

# **BGE Distributed Generation Interconnection Requirements**

## **GENERAL**

### **Scope**

This standard establishes the criteria for the interconnection of distributed generation on the BGE electrical system.

This standard applies to any electricity generator facility that will be interconnected to an electric distribution system that is owned or operated by an electric company in Maryland and meets the following criteria:

1. The nameplate capacity of the small generator facility is equal to or less than 10 MW (10,000 kW);
2. The small generator facility is designed to operate in parallel (i.e., connected) with BGE's electric distribution system, and;
3. The small generator facility is not subject to the interconnection requirements of PJM Interconnection, LLC (see note below).

*Note: Customers who wish to interconnect their distributed generation to BGE's electrical system with the intent to use all or part of it as a capacity or energy resource in PJM's wholesale energy market, shall first submit an Interconnection Request to the PJM Interconnection, L.L.C. as required by the PJM Open Access Transmission Tariff - Part IV "Generation Interconnections". BGE, being the Transmission Owner, shall support PJM in performing studies to determine impacts on the electrical system. All of PJM's and BGE's requirements shall be included in PJM's Interconnection Service Agreement which requires PJM, BGE and the interconnection customers as signatories.*

For small generator installations that are covered by this guideline there is an expedited Maryland Public Service Commission process for generator interconnection. Effective June 9, 2008, the Maryland Public Service Commission (MD PSC) requires that all Small Generator Interconnection equipment that is/will be connected to BGE's electric utility distribution system be approved by BGE pursuant to the requirements of Section 20.50.09 of the Code of Maryland Regulations.

This standard does not apply to residential or small-scale back-up emergency generators which only start when power is lost (and are never connected to an electric utility distribution system) or if the generator operates in such a way that it is never connected to an electric utility distribution system for more than 100 milliseconds.

Distributed generation may be paralleled to the BGE electric distribution system at the point of common coupling (PCC) as shown in Table 1. The generator shall operate in accordance with the operating nominal line voltage of the BGE interconnection point.

**Table 1: BGE Interconnection Points and Nominal Line Voltages**

BGE's Interconnection Point	Nominal Line Voltage
AC Network	208 volt, 480 volt
AC Radial Distribution System	240 volt
Distribution System	4.16 kV, 13.2 kV
Sub-Transmission System	13.2 kV, 34.5 kV

## **Safety Standards**

BGE may require the customer to disconnect its distributed generator from BGE's electrical system due to system emergencies such as safety concerns, equipment thermal overloads, voltage limitations, etc. For primary voltage connected systems, the customer shall follow BGE's outage scheduling, switching & grounding, and permit & tagging procedures to ensure the safety and integrity of BGE's electrical system.

### Electrical Isolation of Generators

- (1) Small generator facilities shall be capable of being isolated from the BGE distribution system.
- (2) For small generator facilities interconnecting to a primary line, the isolation shall be by means of a lockable, visible-break isolation device accessible by BGE.
- (3) For small generator facilities interconnecting to a secondary line, the isolation shall be by means of a lockable isolation device whose status is clearly indicated and is accessible by BGE.
- (4) The isolation device shall be installed, owned, and maintained by the owner of the small generation facility, and located electrically between the small generation facility and the point of interconnection.
- (5) A draw-out type circuit breaker with a provision for padlocking at the draw-out position satisfies the requirement for an isolation device.

### Use of Lockbox for Access to Isolation Device

- (1) An interconnection customer may elect to provide BGE access to an isolation device that is contained in a building or area that may be unoccupied and locked or not otherwise readily accessible to the utility, by installing a lockbox provided by the utility that shall allow ready access to the isolation device.
- (2) The lockbox shall be in a location that is readily accessible by BGE, and the interconnection customer shall permit the utility to affix a placard in a location of its choosing that provides clear instructions to BGE operating personnel on access to the isolation device.
- (3) In the event the interconnection customer fails to comply with the terms of this section and BGE needs to gain access to the isolation device, BGE may not be held liable for any damages resulting from any necessary BGE action to isolate the small generator.

## **Interconnection Levels**

There are four levels of applications. In general, almost all residential generator applications will be Level 1, but some small industrial and commercial generator applications may also fall under Level 1.

For the most part, Levels 2, 3 and 4 generator applications involve either industrial or commercial applications.

### **Level 1 - <10 kW Expedited Review**

These systems are inverter-based and must be tested to Institute of Electrical and Electronic Engineers (IEEE) and Underwriters Laboratory (UL) standards by a nationally recognized test laboratory. Household photo voltaic systems are an example of the type of small generator equipment that is expected to qualify for Level 1 expedited review.

### **Level 2 - 10 kW to 2 MW Expedited Review**

These systems must use equipment approved by a nationally recognized testing laboratory or must have been previously approved by an electric utility under a study process. Systems in this size range do not have to be inverter-based and are expected to use a variety of technologies including photo voltaics, reciprocating engines, micro turbines, fuel cells, small wind generators, and combined heat and power units. Level 2 procedures also provide for the interconnection of systems less than 50kW to area networks

### **Level 3 - 10 kW to 10 MW Expedited Review**

These systems qualify for expedited review if they use special equipment to ensure they will not export power from the customer premises on to the electric distribution system. The vast majority of small generators that qualify for review under this category are expected to be standby generator facilities that interconnect at distribution system voltages and operate in parallel for more than 100 milliseconds. Net metered small generators are not eligible for a Level 3 review

### **Level 4 – 2 MW to 10 MW Study Process**

These are small generators that do not qualify for expedited review. This level is used where the generators are larger and are expected to use application specific interconnection equipment, requiring more in-depth evaluation of potential impacts on the electric distribution system.

The standards criteria used in technical screens that BGE will apply to interconnection requests for all interconnection requests is the IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems that was approved by the IEEE Standards Board in June 2003, except where there are specific exceptions as described in the Maryland Small Generator Interconnection Rule. These IEEE 1547 standards may be purchased from IEEE from their website at <http://www.ieee.org/web/standards/home/index.html>. The Maryland Small Generator Interconnection Rule can be obtained from the MD Public Service Commission at <http://www.psc.state.md.us/>.

Utility monitoring and control of a small generator facility is only permitted pursuant to the requirements of Section 20.50.09 of the Code of Maryland Regulations if the nameplate rating is greater than 2 MW, unless the customer agrees. In some cases BGE may request that generator applicants with generators with nameplate ratings less than 2 MW also follow additional BGE monitoring and control standards normally required only for generators over 2 MW. In these cases, BGE will bear the additional expense for these requests.

# **BGE Monitoring & Control Requirements for Small Generators > 2 MW**

## **POWER QUALITY AND MONITORING REQUIREMENTS**

Distributed generation shall not adversely affect the service or power quality to other Customers supplied by BGE's electrical system. Specifically, distributed generation shall not cause unwanted interruptions, excessive voltage variations, flicker, or cause distortion of the system voltage or current waves (or both) by injection of excessive harmonics. The voltage variations permitted when a distributed generator is switched on or off shall not exceed similar limits established by BGE for motor starting and capacitor switching. To this end, the distributed generator shall at a minimum comply with the American National Standards Institute C84.1 voltage ratings and the IEEE Standard 519 voltage and harmonic distortion limitations.

BGE may require that a distributed generator be connected to its electrical system through a dedicated transformer or reactor to reduce harmonic and other power quality events from affecting nearby Customers.

Specific power quality requirements for voltage and VAR support are included in the System Stability Requirements section .

## **DISTRIBUTION AUTOMATION EQUIPMENT**

BGE will install distribution automation equipment for monitoring and remote control operation purposes at the Customer's expense. The DA equipment is necessary for BGE to operate its electrical system in a safe, reliable and secure manner. BGE shall monitor the status of the synchronizing circuit breaker and shall monitor generator frequency, voltage, current, and output kW and output kVAR by telemetering the metered values to the BGE Electric Operations Building (EOB). BGE will be allowed to remotely trip the interconnection circuit breakers to isolate the Customer's generator from a high impedance fault on the BGE electrical system in the case of "export" generation. BGE shall furnish and install the distribution automation equipment.

## **VOICE COMMUNICATION REQUIREMENTS**

BGE will require that the distributed generator owner install a telephone line and a dedicated ringdown line between its operating facilities and BGE's Electric Operations Building to allow verbal communications to take place between the Customer's plant operators and BGE's System Operator - Bulk Power.

## **SYSTEM STABILITY REQUIREMENTS**

BGE's electrical system stability requirements are intended to maintain a reliable operating electrical system. These requirements include the need for voltage regulation, volt-ampere reactive (VAR) support and under-frequency protection.

The Customer's generator shall include automatic voltage regulating equipment capable of maintaining power factors in the range of 0.90 lagging to 0.95 leading. The Customer shall also maintain such automatic voltage regulating equipment in service at all times. The voltage regulating equipment shall control voltage at the generator's point of interconnection consistent with the range of voltages from 120

to 125 V using a nominal voltage of 120 V. The voltage regulation should not cause voltage flicker to be greater than 2%.

The Customer's generator shall not produce a total voltage harmonic distortion (THD) that exceeds 5% as measured at the generator's terminals when the generator is not paralleled with the BGE's electrical system. Because harmonic distortion is additive, multiple generators on a feeder may cause unacceptable levels of THD. Therefore, in specific locations the requirement may dictate a lower percentage of THD. In all cases, THD at the point of interconnection shall conform to IEEE Standard 519 –1992.

## **FAULT LEVEL REQUIREMENTS**

BGE shall review pertinent protection schemes that deal with the protection of its electrical system or the interconnection. The design of the generator interconnection shall consider the fault contributions from BGE and Customer generating units to ensure that protective devices on the BGE system including primary service customers are adequately sized for its short circuit capabilities.

## **PROTECTION OF EQUIPMENT REQUIREMENTS**

BGE's equipment protection requirements are intended to define the systems required for the interface between a distributed generator and BGE's electrical system. The protective systems shall be properly designed to protect distributed generators from damage due to faults on BGE's electrical system, and to protect BGE and its Customers from damage due to operation of distributed generators under abnormal conditions. The selection of protective devices and/or functions depends on the generating system being protected. However, regardless of the type of distributed generator, four principles shall be considered:

- Dependability – The protective device shall have a high probability of clearing faults that occur on the electrical system.
- Security – The protective device shall have a low probability of interrupting the feeder/circuit unnecessarily.
- Selectivity – The protective device shall isolate only the faulted area of the electrical system.
- Speed – The protective device shall operate as rapidly as possible, consistent with coordination requirements to minimize damage.

### Required Protection

The Customer shall provide each generator with a multifunction protective relay or discrete relays per Table 2. These requirements include relay systems that are required to protect Customer-owned, paralleled generation from abnormal but necessary operations on BGE's distribution system such as momentary outages and subsequent feeder reclosing operations.

**Table 2: General Protection Requirements**

Protective Function	Set to Detect	Equipment Tripped	Remarks
Definite Time Over and Under Frequency	Separation from the BGE System	Generator Circuit Breaker	May be supervised by interconnection circuit breaker status
Definite Time Over and Under Voltage	Separation from the BGE system	Generator Circuit Breaker	May be controlled by interconnection breaker status
Voltage Controlled or Directional Phase Inverse Time Overcurrent	Phase Faults on the BGE system	Generator Circuit Breaker	
Generator Neutral Time Overcurrent or Generator Neutral Time Overvoltage or Utility System Zero Sequence Time Overvoltage	Ground faults on the BGE system	Generator Circuit Breaker	Selection is dependent on generator and transformer grounding
Negative Sequence Time Overvoltage and/or Negative Sequence Time Overcurrent	BGE Open-Phase conditions	Generator Circuit Breaker	

### Special Protection

Direct transfer trip and/or reverse power protection may be required as described in Table 3 below. Direct transfer trip may be required to coordinate the distributed generator's fault response with BGE's protection scheme especially for fault protection schemes that utilize BGE feeder reclosing or when the connected generating facility needs to remain operable and independent on its own generation following a BGE feeder fault.

**Table 3: Trip Protection Requirements**

Protective Function	Set to Detect	Equipment Tripped	Remarks
Receive Direct Transfer Trip	Circuit opening operation at a remote BGE substation	Interconnection Circuit Breaker	Applicability to be determined by BGE
Reverse Power	Excessive Power Flow from Customer to Utility	Interconnection Circuit Breaker	Applicability to be determined by BGE

### Automatic-Transfer Blocking

For Customer locations where the 4.16 kV, 13.2 kV or 34.5 kV voltage switchgear is equipped with automatic-transfer facilities to restore service upon loss of a BGE feeder, protection should be provided to block this transfer while the generator(s) are paralleled to the system. This eliminates the possibility of an out-of-phase condition, which could damage the generators and/or switchgear.

## Relay Settings

Settings for all protective functions shall be submitted to BGE for approval.

## Protection and Tripping Power Supplies

A DC battery and charger shall supply relays and circuit breaker tripping circuits. Battery voltage shall be continuously monitored and low voltage alarms reported to an attended location at all times when generators are in operation.

***NOTE: BGE Customer Substation Requirements (CSR-6) available on [www.bge.com](http://www.bge.com) provides more detailed information on Equipment Protection Requirements***

## **SWITCHGEAR REQUIREMENTS**

This section is concerned with isolation requirements and paralleling of systems. Isolation switches are addressed above under "Safety Standards." BGE will require that the isolating device have the ability to be controlled on-site and may also request that the isolating device have the capability for remote control operation.

Where a disconnect switch is used, it shall provide visible confirmation of status. Circuit breakers or other interrupting devices at the interface between the generator and BGE's electrical system shall be capable of interrupting maximum available fault current.

For larger units, a redundant circuit breaker may be required for installations that can generate more power than they consume. This requirement is to cover the condition of a stuck breaker. This may not be necessary if a utility grade or high quality circuit breaker is used.