Baltimore Gas and Electric
Transmission Planning Procedure

TAM-I-01

Facility Interconnection Requirements

Revision: 9
# Record of Revision

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# TABLE OF CONTENTS

1.0 Introduction ........................................................................................................................................... 1  
1.1 Purpose and Scope ................................................................................................................................. 1  
1.2 General Process for Transmission and Generator Interconnections ...................................................... 1  
1.3 General Requirements for End-User Interconnections ........................................................................... 1  
2.0 Definitions ............................................................................................................................................... 2  
3.0 Coordination ......................................................................................................................................... 3  
   3.1 Request for Interconnection to the BGE Transmission System .......................................................... 3  
   3.2 Notification of Modification to existing Interconnection Facilities .................................................. 3  
   3.3 Evaluation of Proposed Interconnections ......................................................................................... 4  
4.0 Planning Requirements ............................................................................................................................ 5  
   4.1 BGE Planning Objectives and Methods ............................................................................................. 5  
   4.2 Basic Requirements for Interconnection .......................................................................................... 6  
   4.3 Interconnection Voltage and MW and MVAR Capacity Requirements ............................................. 6  
   4.4 Breaker Interrupt Capability ............................................................................................................ 6  
   4.5 Voltage Control and Power Factor ................................................................................................... 6  
   4.6 Plans to Achieve System Performance ............................................................................................. 7  
5.0 Facility Design and Construction Requirements ..................................................................................... 8  
   5.1 Surge Protection, Insulation, and Insulation Coordination ............................................................... 8  
   5.2 System Protection Design and Coordination .................................................................................... 9  
   5.3 Metering and Telecommunications .................................................................................................. 9  
   5.4 Facility Grounding ........................................................................................................................... 9  
   5.5 Safety & Design Issues .................................................................................................................... 11  
   5.6 Power Quality ................................................................................................................................ 11  
   5.7 Equipment Ratings .......................................................................................................................... 12  
   5.8 Synchronizing of Facilities ............................................................................................................... 13  
6.0 Operation Requirements .......................................................................................................................... 14  
   6.1 Inspection Requirements .................................................................................................................. 14  
   6.2 Coordination of Maintenance .......................................................................................................... 14  
   6.3 Operational Issues (Abnormal frequency and voltages) .................................................................... 15  
   6.4 Communications and Procedures During Normal and Emergency Operating Conditions .................. 16  
7.0 Document Maintenance ........................................................................................................................... 16  
8.0 References ............................................................................................................................................. 17  
   8.1 Developmental References ............................................................................................................... 17  
   8.2 Surge Protection & Insulation Coordination References .................................................................. 17  
   8.3 AC High Voltage Power Circuit Breaker References ...................................................................... 18  
   8.4 Grounding and Safety References ................................................................................................... 18  
   8.5 Operational References .................................................................................................................... 19
1.0 Introduction

1.1 Purpose and Scope

This procedure outlines the BGE specific technical requirements for facilities that interconnect with the BGE Transmission system. Unless otherwise stated, all requirements apply to the interconnection of transmission, generation, and end-user (load serving) facilities to the BGE transmission system.

Many of the technical requirements that BGE imposes on interconnection facilities are the same requirements it applies to other facilities. Due to the number and complexity of BGE’s technical requirements, this document does not attempt to describe them all. Instead, it provides a road map to the applicable requirements.

It should also be noted that due to the complexity of the transmission system, each interconnection request must be studied in detail. Should the results of these studies reveal that the facility requirements described by this document fail to result in a safe, reliable, and expandable configuration, additional requirements may be imposed.

The scope of this procedure is limited to the description of the technical requirements of connecting facilities to the BGE transmission system. It does not address any of the legal, contractual, or liability issues. These issues are normally addressed within the interconnection agreements as defined by the PJM process or the Baltimore Gas and Electric Retail Electric Service Tariff (Reference 8.1.11).

1.2 General Process for Transmission and Generator Interconnections

The interconnection process for transmission and generation is governed by PJM requirements and procedures. Interconnections to BGE facilities are performed in consort with the PJM process. This document is not intended to replace or modify any of the PJM interconnection requirements. Rather it is limited to providing BGE specific technical requirements supplemental to the PJM requirements.

1.3 General Requirements for End-User Interconnections

Interconnections of End-User facilities are governed by the Baltimore Gas and Electric Retail Electric Service Tariff (Reference 8.1.11) which is posted on the BGE Web site at http://www.bge.com/myaccount/billsrates/ratestariffs/electricservice/pages/default.aspx
2.0 Definitions

2.1.1 BGE Transmission System - The system of high voltage facilities, generally 100 kV and above that are within the BGE service area.

2.1.2 BGE Interconnection Facilities - The structures, facilities, equipment, devices, and apparatus owned or leased by, or under contract to BGE which are necessary to interconnect, or to facilitate the interconnection of, the Developer’s facilities to the BGE System.

2.1.3 Developer – A company or group seeking to interconnect with the BGE Transmission System. The developer may be seeking to connect a Generator, Transmission, or End-User (load serving) facilities.

2.1.4 Developer’s Interconnection Facilities - The structures, facilities, equipment, devices, and apparatus NOT owned or leased by, or under contract to BGE which are used to interconnect, and to facilitate the interconnection of the Developer’s facilities to the BGE System.

2.1.5 End-user facility – A facility or facilities connected to the BGE Transmission System for the purpose of serving load.

2.1.6 Generator Developer – A Developer that seeks to interconnect to the BGE System for the purpose of connecting generation to the PJM system.

2.1.7 Good Utility Practice - Any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather is intended to include acceptable practices, methods, or acts generally accepted in the region.

2.1.8 Joint Use Facilities - Equipment which is owned by either BGE or the Developer but are also essential to the operational reliability of the non-owning Party.

2.1.9 Jointly Operated Facility – Joint Use Facilities that are to be operated by either BGE or the Developer for the benefit of the either party.

2.1.10 Point of Interconnection - Each physical point of interconnection where capacity, energy, and ancillary services are transferred between the Developer’s facilities and the BGE System.

2.1.11 Routine Inspection and Maintenance - Any inspection, certification, test and/or work required pursuant to Good Utility Practice on either Party’s property or facilities to ensure (a) reliable substation, transmission, and distribution operations, and (b) transmission and distribution system integrity.
3.0 Coordination

This procedure applies to the interconnection of Generation facilities, Transmission facilities, and End-user facilities.

3.1 Request for Interconnection to the BGE Transmission System

All requests for Generation and Merchant Transmission facility interconnections must be submitted directly to PJM and processed through the PJM Interconnection process. The process by which requests for new Generation and Merchant Transmission Interconnection are submitted to PJM is described in PJM Manual (Reference 8.1.3). This manual summarizes the guidelines, requirements, and procedures for Generation and Transmission interconnection, including Developer actions and PJM actions. BGE evaluates the impact of proposed interconnections as directed by PJM. The internal process by which BGE coordinates and communicates assessments of Transmission and Generator interconnection requests with PJM is defined in sections 5 and 6 of BGE Transmission Planning Procedure TAM-I-02 “Coordination of Plans for New Facilities” (Reference 8.1.2).

End-user facility requests are submitted directly to BGE in accordance with the process described in the Baltimore Gas and Electric Retail Electric Service Tariff (Reference 8.1.11). If clearly requested, all Developer information will remain strictly confidential. BGE will need to update system planning models to reflect the new load and facilities, but these model changes will be communicated with no information that distinguishes it from BGE native load serving facilities. BGE will notify PJM of the modeling changes as soon as feasible. The internal process by which BGE coordinates and communicates assessments of End-user facilities with PJM is defined in section 6 of BGE Transmission Planning Procedure TAM-I-02 “Coordination of Plans for New Facilities” (Reference 8.1.2).

3.2 Notification of Modification to existing Interconnection Facilities

If the Developer plans any additions, modifications, replacements, or improvements to the Developer’s Interconnection Facilities that could reasonably be expected to affect the BGE System or BGE’s Interconnection Facilities, the Developer shall give BGE reasonable notice, but not less than one hundred and eighty (180) calendar days prior written notice thereof. All such additions, modifications, replacements, or improvements shall (i) comply with Good Utility Practice, (ii) be accompanied by appropriate information and operating instructions, and (iii) be subject to review and acceptance by BGE. The review shall be based on Good Utility Practice and acceptance shall not unreasonably be withheld. BGE will make reasonable efforts to notify the Developer within thirty (30) calendar days of receipt of notice of its acceptance of Developer’s planned additions, modifications, replacements, or improvements. All such information will remain strictly confidential unless specifically agreed otherwise by the Developer.

BGE will notify PJM of the change as soon as feasible and coordinate with PJM on the assessment of the proposed changes as described in BGE Procedure TAM-I-02. As specified in TAM-I-02, if the interconnecting Developer so chooses, the entity’s identity will remain confidential. However the Developer’s notification to BGE must clearly indicate this requirement.

BGE will inform the Developer of any additions, modifications, or replacements to the BGE System or BGE’s Interconnection Facilities that are necessary as a result of the changes being
proposed by the Developer. The Developer shall compensate BGE for all reasonable costs associated with modifications to BGE Interconnection Facilities or the BGE System resulting from the proposed change. BGE will make reasonable efforts to provide the Developer with an estimate at least sixty (60) calendar days prior to the initiation of such addition, modification, replacement or improvement.

BGE’s acceptance of the Developer’s plans and specifications for any proposed additions, modifications, replacements, or improvements shall not be construed as: (a) confirmation or endorsement of the design of the Developer’s Facilities, or Company Interconnection Facilities, as applicable; (b) a warranty of safety, durability, or reliability of the Developer’s Facility or BGE Interconnection Facilities, as applicable; or (c) responsibility for strength, details of design, adequacy, or capability of such Facilities, as applicable.

Upon completion of any addition, modification, replacement, or improvement to the Developer’s Facilities that may reasonably be expected to affect the BGE System or the BGE Interconnection Facilities, the Developer shall issue "as-built" drawings of their facilities to BGE no later than ninety (90) calendar days.

Note: Increases in capacity of existing generating facilities are considered New Generation and must be submitted to PJM as described in Section 3.1 above.

3.3 Evaluation of Proposed Interconnections

PJM administers the process for the interconnection of all new generators and new transmission facilities to the PJM Transmission in accordance with PJM Manual (Reference 8.1.3). BGE assists in the evaluation under PJM direction in accordance with their procedures. The process which describes BGE coordination of these evaluations is described in Sections 4 and 5 of BGE Transmission Planning Procedure TAM-I-02 “Coordination of Plans for New Facilities” (Reference 8.1.2).

BGE integrates End-User facilities into the same models as transmission facilities. The evaluation of these facilities is done as an integral part of the PJM RTEP evaluation process as described in PJM Manual (Reference 8.1.4). This applies to requests for Transmission supplies to facilities from the BGE distribution provider, and external developers. The process which describes BGE coordination of evaluations End-user facilities is described in Section 6 of BGE Transmission Planning Procedure TAM-I-02 “Coordination of Plans for New Facilities”.
4.0 Planning Requirements

This section describes the requirements that are generally associated with the planning process. Unless otherwise specified, these requirements apply to the interconnection of generation, transmission, and end-user facilities.

4.1 BGE Planning Objectives and Methods

The BGE planning objectives and methods are described in more detail in the BGE Planning Standards (Reference 8.1.1).

When planning and designing company facilities, BGE takes in account the unique considerations of each project. BGE analyzes performance of potential designs on the Transmission system to determine the best configuration. This analysis accounts for such things as unique configurations elsewhere on the system and anticipated future expansion plans. When outside entities interconnect transmission, generation, or end-user facilities to the BGE system, condition-specific analysis cannot be employed. Therefore, a more conservative approach must be taken and standard design requirements must be implemented.

Since BGE has no control of facilities beyond the point of interconnection, it must employ measures to assure isolation of the BGE system at the interconnection. Care must be taken to prevent disturbances from propagating between the interconnected systems. BGE stations will be designed so that the interconnection’s reliability is maintained for events occurring within the BGE system. Similarly, transmission, load, or generation customers must ensure that disturbances on customer facilities will not result in outages on the BGE system. Generally, for the system interconnections, this includes the addition of redundant protection by both BGE and the interconnecting Developer.

Because of the heightened need for the security of interconnection facilities and the need to protect the BGE system from events on customer facilities, the following additional guidelines apply to such facilities:

- BGE will have control and ownership of all facilities related to a transmission path where power supplies a system or other customers
- System protection must be installed to ensure that disturbances on either interconnected system should not propagate and result in additional facility outages on the other system
- All equipment must be sanctioned by BGE as compliant with its standards if the equipment lies within a BGE substation or it is operated by BGE
- BGE reliability and operability should not be comprised in any way due to equipment not compliant to BGE standards
- Isolation between BGE and the developer’s system should be accomplished at a minimum with a single circuit breaker
- 115kV and 230kV ring interconnections require an additional isolation breaker
- Interconnections with BGE 500kV facilities must be terminated in a breaker-and-a-half or more robust scheme
- A 500kV breaker open for maintenance and a subsequent tie outage should not cause the station to be split into locally isolated sections
4.2 Basic Requirements for Interconnection

In accordance with Section 4.10 of the Consolidated Transmission Owners Agreement Rate Schedule FERC No. 42 (Reference 8.1.9), no party will be permitted to connect to BGE Transmission or distribution facilities without an interconnection agreement that contains provisions for the safe and reliable operation of each interconnection in accordance with Good Utility Practice, and principles, guidelines, and standards of BGE, PJM, ReliabilityFirst, and NERC or comparable requirements of an applicable retail tariff or agreement approved by an appropriate regulatory authority.

4.3 Interconnection Voltage and MW and MVAR Capacity Requirements

A Generator Developer connecting to the BGE Transmission shall supply electricity to the Points of Interconnections at a nominal voltage of 115, 230, or 500kV, with balanced three-phase alternating current produced by generators equipped with automatic voltage regulation and automatic speed control and designed to meet the requirements of NEMA Standard MG 1-22, (1987). BGE does not impose any other specific Voltage, MW or MVAR requirements on Generation facilities.

Points of Interconnections for all transmission facilities connected to the BGE Transmission System shall be at a nominal voltage of 115, 230, or 500kV. BGE does not invoke any additional Voltage, MW and/or MVAR requirements on transmission facilities unless specific interconnection evaluations reveal a need to do so.

Individuals seeking to serve load from the BGE system generally connect to the distribution system. End-User Developers seeking to connect to the BGE transmission system are usually connected to the 115kV system. On rare occasions End-User Developers may be connected to the 230kV system if warranted by non-typical circumstances such as high capacity, high security requirements, or a large potential for load growth. Under no circumstances does BGE allow End-User interconnections to be made directly to the 500kV system. The anticipated MW and MVAR demand of the proposed facility shall be provided by the Developer. BGE will evaluate individual requests to determine the actual voltage or power factor compensation requirements. BGE does not impose any specific MW or MVAR requirement on End-User facilities unless specific interconnection evaluations reveal a need to do so.

4.4 Breaker ‘Duty’ Interrupt Capability

The developer must supply BGE with the applicable fault rating information for all breakers that connect Generation, Transmission or end-user facilities to the BGE system. BGE will analyze each breaker to ensure it is acceptable for the application. Due to current and anticipated fault levels, it is BGE’s practice to utilize breakers with a minimum interrupting capability of 63kA for all 115kV and 230kV new construction.

4.5 Voltage Control and Power Factor

Consistent with Section 4.9.2 of the Specifications for Interconnection Service Agreement as included in Attachment “O” of the PJM Tariff (reference 8.1.8), The developer agrees, as and when so directed by PJM or when so directed by BGE acting on behalf or at the direction of PJM, to operate the Customer Facility to produce reactive power within the design limitations of the Customer Facility pursuant to voltage schedules, reactive power schedules or power factor schedules established by PJM or, as appropriate, BGE. PJM shall maintain oversight over such schedules to ensure that all sources of reactive power in the PJM Region, as applicable, are
treated in an equitable and not unduly discriminatory manner. The Developer agrees that PJM and BGE, acting on behalf or at the direction of PJM, may make changes to the schedules that they respectively establish as necessary to maintain the reliability of the Transmission System.

In addition to PJM requirements BGE imposes the following requirements for Transmission, Generation, and End-user facilities interconnecting to the BGE Transmission system.

The Developer shall operate their facilities in accordance with any voltage schedules prescribed by BGE or the PJM System Operator, as applicable, provided that meeting such voltage schedule would not cause the developer's facilities to operate outside of their respective reactive generating capability or violate any electrical constraints.

The Generator Developer shall normally operate interconnected generation with automatic voltage regulation equipment in service at all times in accordance with Good Utility Practice. The voltage regulation equipment will control voltage at the respective Points of Interconnection consistent with the range of voltages prescribed by BGE, or the PJM System Operator, as applicable.

From time to time, the BGE System Operator or the PJM System Operator may require a Generator to provide reactive power from a developer's facility, or to cause a developer's facility to absorb reactive power from the BGE System. The Developer will use reasonable efforts consistent with Good Utility Practice to comply with such requirement provided that, in either case, such Station or Stations are operating within their respective generating capabilities and not violating any electric constraints to provide the requested services. The Developer shall inform BGE of changes in the Developer's ability to provide the aforementioned services.

The Generation Developer shall notify the BGE System Operator or PJM System Operator, as applicable, if any or all generating units at any developer's facility reach a VAR limit, if there is any deviation from the assigned voltage schedule, or if any automatic voltage regulator is removed from or restored to service.

4.6 Plans to Achieve System Performance

The PJM Regional Transmission Expansion Plan (RTEP) provides as summary of plans to achieve the required system performance throughout the planning horizon. Each year an update to the RTEP is released and posted on the PJM website “http://www.pjm.com/documents/reports/rtep-documents.aspx”. All applicable facilities, including Generation, Transmission, and End-user facilities are accounted for in the development of the RTEP.
5.0 Facility Design and Construction Requirements

This section describes the requirements associated with the design of interconnection facilities. Unless otherwise specified, these requirements apply to the interconnection of generation, transmission, and end-user facilities.

5.1 Surge Protection, Insulation, and Insulation Coordination

Requirements for application in Baltimore Gas and Electric Company transmission class substations are covered in several company specifications Engineering Practices and industry standards The most recent edition of these documents shall be applied for all new facility applications. Applicable industry standards and BGE specifications are listed in sections 8.2 of the References section of this document.

In regards to lightning and switching insulation levels, the following table lists the BIL values applied for each BGE nominal transmission voltage class.

<table>
<thead>
<tr>
<th>BGE Nominal System Voltages (kV) Φ to Φ</th>
<th>Station BIL (kV)</th>
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<td>115</td>
<td>550</td>
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<tr>
<td>230</td>
<td>900</td>
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<tr>
<td>500</td>
<td>1800</td>
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The table above is offered as a guide only. Specific applications may have different surge characteristics resulting in a different BIL value. For each new facility / project, appropriate and competent engineering analyses must be performed to ensure adequate insulation strength is established and maintained in the operation of the facility. Such analyses must include and are not necessarily limited to: 

- transient switching
- lightning
- over-voltages & recovery voltages
- harmonics
- short circuit studies.

For all new applications in substations, BGE requires the use of gap-less metal oxide varister (MOV) type surge arresters. Polymer / Silicon housed MOV’s are preferred over porcelain housing. If porcelain housed arresters are used, metal top type arresters are required for station application. Surge arresters used in connecting to BGE’s electric system must meet the following minimum ratings / requirements:

<table>
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<th>BGE Substation Surge Arrester Minimum Ratings Table</th>
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<td>System Voltage (kV)</td>
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<tr>
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</tr>
<tr>
<td>115</td>
</tr>
<tr>
<td>230</td>
</tr>
<tr>
<td>500</td>
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Note: All arresters are “station class” unless noted otherwise.

Pressure Relief Capability, Energy Rating (kJ/kV MCOV), TOV, and Protective Margins all must be established by engineering calculation and matched to the station and system conditions (present and future engineering estimated) at the proposed facility.
5.2 System Protection Design and Coordination

For all transmission, generation, and end-user facilities interconnecting with the BGE system, the Customer is required to provide protection for all transmission facilities in accordance with the PJM Manual 07, BGE’s Transmission Owners Standards as supplied on the PJM website, and all applicable IEEE C37 standards and guides. Protection facilities must be designed, and the appropriate studies completed to ensure the customer’s protection meets the requirements of the NERC Transmission Planning Standards TPL-001, 002, 003, and 004. All protection system designs must be reviewed and approved by BGE.

BGE prohibits the use of power line carrier or leased lines for protective relay communications on all new transmission facilities. Where modifications are being made to facilities that currently use power line carrier or leased circuits, these communications facilities must be upgraded.

Coordination of protection facilities will be a joint effort between BGE and the Developer, and the process will be documented for audit purposes within the PJM Relay Subcommittee using their Coordination of Shared Facilities database.

5.3 Metering and Telecommunications

For all transmission, generation, and end-user facilities interconnecting with the BGE system, the customer shall install, at their expense, a remote terminal unit (RTU) as specified by BGE for the purpose of remote monitoring and control. BGE shall monitor the status of all transmission breakers and circuits according to BGE standards MTR-1, MTR-2, and REL-15, as posted in the Transmission Owners Standards section of the PJM website. In addition, for generation connected to the transmission system, BGE will monitor the status of the synchronizing circuit breaker, generator frequency, voltage, current, and output kW and output kVAR.

Consistent with Section 8.5 of the Specifications for Interconnection Service Agreement as included in Attachment “O” of the PJM Tariff (Reference 8.1.8), Generation and Merchant Interconnection Developers shall install and maintain satisfactory operating communications with the PJM system dispatcher and with the Interconnected Transmission Owner. The Developer shall provide standard voice line, dedicated voice line, and facsimile communications at its Customer Facility control room through use of the public telephone system. The Developer shall also provide and maintain backup communication links with both PJM and BGE for use during abnormal conditions as specified by BGE and PJM respectively. The Developer shall provide the dedicated data circuit(s) necessary to provide the Developer’s data to PJM and BGE as necessary to conform to Applicable Technical Requirements and Standards.

For End-User interconnections, a telephone line for remote revenue meter reading by BGE shall be provided by the Customer. The telephone line shall consist of a 4/C - two twisted pair - telephone cable in a 3/4” minimum conduit. The telephone cable shall be #24 AWG solid copper, UL type CMP, or better if required by NEC. In addition to the telephone line required for remote revenue metering, it is strongly recommended that the Customer substation be equipped with a telephone to facilitate communication during start-up, switching, or emergencies.

5.4 Facility Grounding

The purpose of this section is to supply grounding requirements and methodology to ensure public and employee safety (BGE, Exelon, Contractor, Third Party, etc.) along with the reliable
operation of Baltimore Gas and Electric's bulk power system. BGE does not differentiate between Generation, Transmission, or End-User facilities in regards to electric substation grounding, and thus this section shall be considered the reference for any type of station connected to the BGE system.

5.4.1 Code References & Internal BGE Documentation

The facility to be attached to the BGE system shall be designed in accordance with the applicable industry and BGE standards. These include, but are not limited to the latest revision of:

(a) IEEE Std. 80, IEEE Guide for Safety in AC Substation Grounding (Reference 8.4.1)
(b) IEEE Std. 81, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Reference 8.4.2)
(c) National Electrical Safety Code – Section 9, Grounding methods for electric supply and communications facilities (Reference 8.4.3)
(d) Internal BGE Standards:
   - GRD-2, Procedures for Obtaining Grounding Measurements (Reference 8.4.4)
   - GRD-3, Substation Ground Systems (Reference 8.4.5)
   - S250, Grounding Details for Substation Structures w/o High Voltage Equipment (Reference 8.4.6)
   - S251, Grounding Details for Substation Steel Structures Supporting High Voltage Equipment w/o Personnel Protective Equipment (Reference 8.4.7)
   - S252, Grounding Details for Substation Steel Structures Supporting High Voltage Equipment and Personnel Protective Equipment (Reference 8.4.8)
   - S254, Grounding System Connection for Security Car Stopper (Reference 8.4.9)

5.4.2 Analysis Software

The software package that BGE uses to analyze the grounding system is CDEGS, produced by Safe Engineering Services of Montreal, Canada. This is a finite element analysis program that analyzes field measurements and transforms the raw data into a soil model to be used while analyzing the actual ground grid design.

5.4.3 Grounding Requirements of Note

Design of any ground system connected to the BGE system is expected to incorporate the recommendations of the internal standard GRD-3. This is specifically important in addressing the impedance of the grid. BGE Substation grounding follows the approaches and recommendations found in accepted industry standards and PJM Technical Requirements.

5.4.4 Methodology

A typical BGE ground study would follow the approach found in the BGE’s GRD-3. The expectation is the same general process would be followed in the design of a connected facility.
5.5 Safety & Design Issues

The purpose of this section is to convey the necessary parameters and methodologies to use as a guide in designing a facility that will be connected to the BGE system. Please note that although these parameters are strongly urged by BGE, the design engineer should consult all applicable industry standards, RTO/ISO requirements, and Governmental requirements for the development of the facility design. It is also desirable for the design firm to use standard engineering practices and good engineering judgment.

5.5.1 Fence Requirements

All requirements for the enclosure of equipment are defined in the National Electrical Safety Code and BGE Engineering Practice EPB-11108. NESC Section 110 states safety clearances for energized parts as well as all acceptable combinations of fence height and barbed wire. On all new installations, BGE installs a minimum seven-foot high fence with an additional foot of barbed wire. This exceeds the NESC requirements, but is desirable as an additional safeguard. An internal BGE standard (EPB 11411 formerly DES-23) requires minimum horizontal distances between energized parts and the exterior fence, and should also be verified by consulting the NESC.

5.5.2 Electrical Clearances

The minimum clearances required for high voltage substation application are based upon BGE Engineering Practice EPB 11411 (formerly DES-23) and NESC section 23, IEEE Std. 1427, IEEE Std. C37-32, and BGE’s Safety Manual. In most cases, BGE’s requirements are more conservative than those in the other guides. Facilities connected to the BGE system are requested to adhere to BGE’s guidelines. Such an approach will help ensure the safe operation of the station and ultimately improve reliability.

5.5.3 Equipment Separation

There is a need to protect critical equipment inside the station, and thus the design should incorporate separation distances for the major pieces of equipment and the control house. This is addressed in IEEE Std. 979 – IEEE Guide for Substation Fire Protection, BGE’s DES-19, and other NFPA guiding documents.

5.5.4 Fire Quenching & Oil Retention Pits

BGE’s pit design follows the approach found in DES-08. Facilities connected to the BGE system are requested to adhere to BGE’s guidelines.

5.6 Power Quality

The Developer will comply with the voltage and reactive limits specified in subsection 4.5 “Voltage Control and Power Factor”, under section 4.0 “Planning Requirements”.

Consistent with Section 4.9.2 of the Specifications for Interconnection Service Agreement as included in Attachment “O” of the PJM Tariff (reference 8.1.8), Interconnection Facilities shall not cause excessive deviations from the power quality criteria set forth in the Applicable Technical Requirements and Standards. BGE extends this requirement to the connection of all Generation, Transmission, and End-user facilities. Additionally, at the point
of interconnection, the customer’s generation must not cause the system harmonics level to exceed IEEE Standard 519 limits.

For End-user facilities, consistent with Section 9.15 of the BGE Retail Electric Service Tariff, before installing motors or miscellaneous equipment, the Developer should consult BGE. It is important that the characteristics of motors, motor-starting equipment, and miscellaneous apparatus such as welders and X-rays, be such as not to impair the quality of service rendered by BGE to any of its Customers. BGE shall in any event be consulted prior to the preparation of plans for the installation of:

(a) a single-phase motor of 3 horsepower and larger.
(b) a three-phase motor of 25 horsepower and larger.
(c) a motor requiring frequent starting.
(d) a synchronous motor.
(e) a single-phase motor on a three-phase service.
(f) group-operated motors started automatically. (Sequence starting may be required.)
(g) certain alternating current equipment such as welders, X-rays, radio transmitters, rectifiers, signal systems and air conditioning.
(h) service at Primary Systems voltages.

BGE reserves the right to make the final decision regarding whether or not the project plan is acceptable.

5.7 Equipment Ratings

All power equipment within BGE facilities or within facilities that interconnect with the BGE system shall be rated to meet or exceed BGE’s requirements for similar equipment as defined in the current revision of BGE “Bulk Electrical System Facility Ratings” Methodology (Reference 8.1.12). The equipment shall conform to all applicable PJM and ANSI/IEEE standards as outlined in the BGE Procedure and Guideline’s document that is appropriate for the equipment under consideration.

Equipment shall be capable of carrying the maximum loading that is determined by BGE in the load flow analysis. Loading in excess of nameplate shall be backed by manufacturer design documentation, and / or PJM equipment loading criteria and /or standard industry practices. Upon request, BGE’s Bulk Electrical System Facility Ratings Methodology will be made available as a reference. The Manager Engineering & Design should be contacted for this document.

All new power circuit breakers applied on BGEs electric system have operating duty cycles as defined in the most up to date standards referenced in section 8.3. Standard operating duty as found in IEEE Standard C37.04 – 1999 (IEEE Standard Rating Structure for High Voltage Circuit Breakers) is required for application on BGE electric system. Where reclosing of a power circuit breaker is required on BGEs electric system, guidelines found in IEEE Standard C37.010 – 1999 (IEEE Application Guide for AC High – Voltage Circuit Breakers Rated On A Symmetrical Current Basis) apply. Older power circuit breakers found on BGE’s electric system may reflect operating capabilities as defined in earlier versions of the same or similar historical standards.
5.8 Synchronizing of Facilities

Regardless of whether the developer connects Generation, Transmission or End-User facilities, all circuit breakers on the BGE transmission system shall be supplied with synchronizing facilities to consist of one of the following types:

- Manual closing using a local sync scope. The manual closing path must be supervised by a sync permissive switch that serves the dual purpose of energizing the sync scope and enabling the breaker close circuit. The sync scope is energized by potential from either side of the open breaker and gives an indication of phase angle between the two voltages. An operator must determine whether the voltages are within prescribed limits for closing the breaker.

- Automatic reclosing by sync check. Where automatic reclosing is applied, a sync check relay must be used in conjunction with the reclosing relay to verify the voltages on either side of the open breaker are within limits. The sync check relay is typically set to allow closing for a static phase angle difference of 40 degrees. In these schemes one end of the line will be pre-determined to “test” the circuit using live bus – dead line logic and the other end will close by sync check. For new inter-tie lines and interconnection facilities where the system frequency on either side of an open breaker may slip, the sync check relay must be able to determine the slip frequency and allow closing only within a pre-determined window.

- SCADA closing. Two paths must be provided for remote closing through the RTU. Normal closing of the breaker from the RTU will be supervised by the sync check relay, but an alternate direct path must be provided to allow closing the breaker under abnormal system conditions.

The parameters for synchronizing a generator to the utility system are generally dictated by the generator manufacturer. Common practice on the BGE system is to close manually through a syncro verifier relay. These devices typically are set to allow closing the generator sync breaker when the slip frequency is less than .05 Hz, the phase angle is within +/- 10 degrees, and the generator voltage is 1 to 1.05 times the bus voltage.
6.0 Operation Requirements

This section describes the requirements associated with the operations of interconnection facilities. Unless otherwise specified, these requirements apply to the interconnection of generation, transmission, and end-user facilities.

6.1 Inspection Requirements

6.1.1 Substation Equipment

The developer is required to perform routine maintenance and testing of all facilities and equipment whose performance may be reasonably expected to affect the reliability of BGE’s facilities and equipment. These inspections are to be made in accordance with Good Utility Practice and must be performed as necessary to ensure the continued interconnection of the facility with BGE’s Transmission System in a safe and reliable manner. This requirement includes primary equipment as well as secondary low voltage control systems.

BGE has the right to observe the testing of any of the Developer’s facilities and equipment whose performance may be reasonably expected to affect the reliability of BGE’s facilities and equipment. The Developer is required to notify BGE in advance and allow BGE to have a representative present during such testing. If BGE observes any deficiencies or defects on, or becomes aware of a lack of scheduled maintenance and testing with any of the Developer’s facilities, BGE will promptly notify the Developer. Upon notification, the developer will be required to make any corrections required in accordance with Good Utility Practice to ensure safe and reliable operation of the equipment.

BGE is willing to provide the Developer the same inspection requirements and considerations that are being requested of the Developer in this section.

6.1.2 Protection System

Commissioning of new protection facilities will be performed by the customer with all tests witnessed by BGE. All commissioning tests on inter-tie lines will be completed in accordance with the PJM Relay Testing Task Force guideline for Interconnection Relay Testing.

Protection on all interconnection transmission protection facilities must be maintained per the PJM Relay Testing and Maintenance Practices document.

6.2 Coordination of Maintenance

As a transmission-owning member of the PJM RTO, BGE has ceded the responsibility of the interconnection of generators to the BGE transmission system to PJM. Similarly, PJM manages the interconnection process for merchant transmission projects. PJM administers the interconnection process and maintains all documentation of the process and all pro forma agreements as posted on the PJM website at: http://www.pjm.com/planning/rtep-development/expansion-plan-process.aspx.
6.2.1 Coordination of Customer Equipment Maintenance

Whenever a customer requires an outage on the BGE equipment to allow for maintenance on customer equipment, the customer will contact BGE to request an outage on the BGE equipment. BGE will follow standard outage requesting procedures that are documented in the BGE Transmission System Operations Manual Section 10 and follow the PJM outage requesting requirements that are documented in PJM M03: Transmission Operations Manual – Section 4: Reportable Transmission Facility Outages.

When switching, BGE follows procedures outlined in the Exelon Utilities Lock Out Tag Out procedure (OP-EU-50003).

6.2.2 Coordination with Customers for BGE Equipment Maintenance

Whenever BGE performs maintenance that would require a customer equipment outage, BGE will contact the customer to coordinate the outage. BGE will follow standard outage requesting procedures that are documented in the BGE Transmission System Operations Manual, Section 10 and follow the PJM outage requesting requirements that are documented in PJM M03: Transmission Operations Manual – Section 4: Reportable Transmission Facility Outages.

When switching, BGE follows procedures outlined in the Exelon Utilities Lock Out Tag Out procedure (OP-EU-50003).

6.3 Operational Issues (Abnormal frequency and voltages)

For the interconnection of generating facilities located within the BGE transmission zone, BGE follows PJM procedures and requirements as outlined in PJM Manual M14A: Introduction to Generation and Transmission Interconnection Process. As a transmission-owning member of the PJM RTO, BGE has ceded the responsibility of the interconnection of generators to the BGE transmission system to PJM. Similarly, PJM manages the interconnection process for merchant transmission projects. PJM administers the interconnection process and maintains all documentation of the process and all pro forma agreements as posted on the PJM website at: http://www.pjm.com/planning/rtip-development/expansion-plan-process.aspx. In addition, the PJM Manuals for the operation of Generation are followed, including, but not limited to the following; M01: Control Center Requirements, M03: Transmission Operations, M11: Scheduling Operations, M12: Dispatching Operations, M13 Emergency Operations, M14A: Introduction to the Generation and Transmission Interconnection Process, M14D: Generator Operational Requirements, M15: Cost Development Guidelines, M17: Capacity Obligations.

For the interconnection of new facilities located within the BGE transmission zone, BGE follows requirements outlined in the BGE Retail Electric Service Tariff, Rider 11. Measured Demand. End-user customer interconnection requirements are contained in the BGE Retail Electric Service Tariff, Sections 1.22, 4.12, 6.2, 9.132, 9.14, and 9.15.

For the operation of transmission and end-user customer facilities, BGE follows procedures outlined in R2.1.16.

The Retail Electric Service Tariff is available on the BGE.com website at; http://www.bge.com/myaccount/billsrates/rate tariffs/electric service/Electric%20Services%20Rates%20and%20Tariffs/TOC_Part_1_2.pdf

Rider 11. Measured Demand is available on the BGE.com website at;
6.4 Communications and Procedures During Normal and Emergency Operating Conditions.

During routine system operations, the BGE Outage Scheduler notifies the customer in advance, and coordinates planned switching operations which will impact the customer’s BGE supply. In addition, the BGE System Operator-TSO notifies the customer prior to performing planned or emergency switching operations which impact the customer's BGE supply. These communications may or may not be in advance of the switching operations depending upon the situation. Communications and notifications associated with the coordination of planned equipment outages are documented in the BGE Transmission System Operations Manual, Section 10 and follow the PJM outage requesting requirements that are documented in PJM M03: Transmission Operations Manual – Section 4: Reportable Transmission Facility Outages.

Contacts are established and maintained for all customer transmission facilities. This contact information is available at the Shift Manager – TSO console. Transmission customers are also provided with BGE TSO Control Room contact information.

7.0 Document Maintenance

Each calendar year BGE Transmission Planning performs a review of this document for technical accuracy and consistency with current version of the following documents:

- NERC Reliability Standards FAC-001 and FAC-002
- PJM Interconnection Process (Manual 14A)
- BGE Transmission Planning Standards
- Any other NERC/RF/PJM/BGE document regarding interconnection of new facilities
- Exelon Utilities Lock Out Tag Out procedure (OP-EU-50003)
8.0 References

8.1 Developmental References

8.1.1 BGE Planning Standards Revision 4
8.1.2 BGE Transmission Planning Procedure TAM-I-02 “Coordination of Plans for New Facilities”; Revision 7
8.1.5 PJM Manual M14C “Generation and Transmission Interconnection Facility Construction”; Revision 08, dated December 20, 2012
8.1.6 PJM Manual M14E “Merchant Transmission Specific Requirements”; Revision 03, dated February 28, 2013
8.1.7 “Amended and Restated Operating Agreement of PJM Interconnection, L.L.C.”; Schedule 6-Regional Transmission Expansion Planning Protocol; Effective Date: 08/08/2014
8.1.8 “PJM Open Access Transmission Tariff”; Effective Date: 08/08/2014.
8.1.9 “Consolidated Transmission Owners Agreement Rate Schedule FERC No. 42”; Effective Date: 06/12/2013.
8.1.10 “Operations Coordination And Interconnection Agreement Between Baltimore Gas And Electric Company And Constellation Power Source Generation, Inc.”; Issued May 7, 2003
8.1.11 “Baltimore Gas and Electric Retail Electric Service Tariff”; filed May 11, 2000
8.1.12 BGE “Bulk Electrical System Facility Ratings” Methodology; Current revision

8.2 Surge Protection & Insulation Coordination References

8.2.1 BGE Specification: SPT-1 Surge Protection and Insulation Coordination for High Voltage Substations. (Latest Edition)
8.2.3 PJM Design and Application of Insulation Coordination and Surge Protection (Latest Edition)
8.2.4 IEEE C62.11: Standard for Metal Oxide Surge Arresters for AC Power Circuits (Latest Edition)
8.2.5 IEEE C62.22: Guide for the Application of Metal Oxide Surge Arresters for AC Systems and supplements (Latest Editions)

8.2.6 PJM Relay Testing Taskforce Guideline for Interconnection Relay Testing

8.2.7 PJM Manual M7 “PJM Protection Standards”; Revision 0, dated November 16, 2011

8.3 AC High Voltage Power Circuit Breaker References


8.3.9 PJM Design & Application of Circuit Breakers (Latest Edition)

8.3.10 IEEE C37.04: Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis-Preferred Ratings and Related Required Capabilities (including all supplements; Latest Editions)

8.3.11 IEEE C37.06: Standard for Switchgear – AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis-Preferred Ratings and Related Required Capabilities (Latest Edition)


8.3.13 IEEE C37.09: Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (includes all supplements; Latest Editions)

8.3.14 IEEE C37.010: Standard Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (Including supplements; Latest Editions)


8.4 Grounding and Safety References

8.4.1 IEEE Std. 80, “IEEE Guide for Safety in AC Substation Grounding”

8.4.2 IEEE Std. 81, “IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System”

8.4.3 National Electrical Safety Code – Section 9, “Grounding methods for electric supply and communications facilities”

8.4.4 BGE Standard GRD-2, “Procedures for Obtaining Grounding Measurements”

8.4.5 BGE Standard GRD-3, “Substation Ground Systems”
8.4.6 BGE Standard S250, “Grounding Details for Substation Structures w/o High Voltage Equipment”

8.4.7 BGE Standard S251, “Grounding Details for Substation Steel Structures Supporting High Voltage Equipment w/o Personnel Protective Equipment”

8.4.8 BGE Standard S252, “Grounding Details for Substation Steel Structures Supporting High Voltage Equipment and Personnel Protective Equipment”

8.4.9 BGE Standard S254, “Grounding System Connection for Security Car Stopper”

8.5 Operational References

8.5.1 BGE Electric System Operations & Planning Department Document BGE-FAC-001-0, “Facility Connection Requirements” Revision 5.