ComEd
Interconnection Guidelines

(For Generators at Transmission Level)

Rev 2: Effective 12/16/2021

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1) INTRODUCTION

a) Purpose & Scope

This document provides guidance applicable to Generator Interconnection Customers (GIC) planning to operate generators greater than 20 MW that will be interconnected to the ComEd system. This guideline is intended to provide standards that apply to various aspects of GIC interface with ComEd. It contains technical standards regarding generator interconnection, relay & protection, SCADA, communication, and metering. It also contains protocols that address generator interconnection arrangements, real estate transactions, facility energization, and post-energization interface associated with such generator interconnections.

This guideline is posted on the PJM website at www.pjm.com. This guideline is also available on the ComEd website at www.comed.com.

b) Definitions

Generator Interconnection Customer (GIC):

An entity that enters the PJM process to interconnect a new generation facility to or to increase the capacity of an existing generation facility interconnected with the ComEd transmission system.

PJM Interconnection L.L.C. (PJM):

PJM is the regional transmission organization that is responsible to plan and operate the ComEd transmission system for the purpose of providing non-discriminatory access to GICs for movement of wholesale energy. PJM manages the generator interconnection process and energy market.

Interconnections & System Studies (ISS):

A ComEd work group that interfaces with PJM, GIC and ComEd internal groups to facilitate generator interconnection.

Transmission System Operation (TSO):

A ComEd work group that operates the electrical grid as the designated authority.

Large Customer Services (LCS):

A ComEd work group that interfaces with GIC at various levels during and after generator interconnection.

Project Management (PM):

A ComEd work group that is responsible for managing the facilities study, design, and construction of the generator interconnection.

2) PJM GENERATOR INTERCONNECTION PROCESS

PJM is responsible for managing the generator interconnection process. The detailed description of this process is provided in PJM Manuals 14A and 14B posted on PJM website. The following steps briefly summarize the PJM process as it applies to ComEd:

a) PJM Queue Number:

PJM assigns a unique queue number to a potential GIC when it enters the PJM interconnection process. The interconnection project is identified by this queue number throughout the life of this generator interconnection.

b) Kickoff Meeting:

PJM schedules a kickoff meeting to review a GIC request for generator interconnection. In the kickoff meeting, PJM provides an overview of the PJM interconnection process. The GIC provides details of its generation facility and the proposed Point-of-Interconnection (POI). ComEd provides its assessment on the feasibility of POI and information on ComEd technical standards. The POI is firmed up in the Kickoff meeting.

c) Interconnection Feasibility Study:

The interconnection feasibility study assesses the feasibility of generator interconnection. PJM performs load flow analyses to identify any reliability criteria violations associated with generation interconnection.

ComEd reviews the results of the load flow analyses and provides the scope and cost of network upgrades needed to mitigate reliability criteria violations. Additionally, ComEd provides the scope and cost of attachment facilities, direct connection network upgrades and non-direct connection network upgrades.

d) System Impact Study:

The system impact study refines the scope and cost of network upgrades.

e) Facilities Study:

The Facilities Study is essentially a preliminary engineering study conducted to document the detailed scope of work and cost estimate for the attachment facilities, direct connection network upgrades, non-direct connection network upgrades and network upgrades. The Facilities Study is performed by ComEd using ComEd and/or contract resources. The GIC is responsible to pay the actual cost of performing the facilities study.

f) Interconnection Service Agreement:

For a FERC jurisdictional and Qualifying Generation Facility (QF), PJM presents the 3-party Interconnection Service Agreement (ISA) to be executed by the GIC, ComEd and PJM.

g) Interconnection Construction Service Agreement:

For a FERC jurisdictional and Qualifying Generation Facility (QF), PJM presents the 3-party Interconnection Construction Service Agreement (ICSA) to be executed by the GIC, ComEd and PJM. The ICSA spells out the construction schedule and responsibilities to complete the generator interconnection.

Once the ICSA is executed, the generator interconnection moves to the design and construction phase.

At this stage, ComEd assigns a specific project manager who interfaces with all stakeholders to complete ComEd's responsibilities to interconnect the GIC.

FOR NON-FERC JURISDICTIONAL GENERATOR INTERCONNECTIONS, THE FOLLOWING TWO STEPS APPLY IN PLACE OF THE STEPS (f) AND (g):

h) Interconnection Agreement:

ComEd presents the 2-party Interconnection Agreement (IA) to be executed by GIC and ComEd, when a generator interconnection is non-FERC jurisdictional. Once the IA is executed, the generator interconnection moves to the design and construction phase.

At this stage, ComEd assigns a specific project manager who interfaces with all stakeholders to complete ComEd responsibilities to interconnect the GIC.

i) Wholesale Market Participation Agreement:

PJM presents the 3-party Wholesale Market Participation Agreement (WMPA) when the generator interconnection is non-FERC jurisdictional. The WMPA is executed among GIC, ComEd and PJM to establish the capacity rights of the GIC in the PJM market.

3) COMED TECHNICAL STANDARDS

The ComEd transmission electric system consists of 765kV, 345kV, and network 138kV lines and substations. The following technical standards would apply to generator interconnections at transmission voltage levels.

3.1) Generator Interconnections at Transmission Voltage Level:

The ComEd transmission system is vital to maintaining system integrity and network reliability of the bulk power system. The generator interconnection to a transmission line bisects that line into two segments. In certain parts of Illinois, multiple generators are in close proximity to each other. The interconnection of multiple generators to a particular transmission line at relatively short distances would bisect that line multiple times leading to excessive segmentation.

Excessive segmentation of transmission lines degrades system integrity and network reliability. A line with excessive segmentation presents various challenges including difficulty in outage planning, communications, increased maintenance costs and increased loss of system continuity.

To reduce transmission line segmentation, generators located in proximity to one another should interconnect to a common substation typically known as 'Generation Hub'. The following guideline should be followed in this regard:

a) A GIC shall not bisect a transmission line at less than 2-mile from an existing or proposed substation. Instead, the GIC should interconnect to the existing or proposed substation.

b) A GIC can bisect a transmission line at less than 2-mile from an existing substation if the existing substation cannot be expanded to interconnect the GIC due to physical limitations.

All new transmission substations shall be designed to a minimum of a breaker-and-a-half configuration to have an appropriate level of reliability and maintenance flexibility.

A new GIC may interconnect to an existing substation or it may interconnect to a new substation that could be expanded in future to a generation hub. The details of these two options are described below:

a) Generator Interconnection to an Existing Substation:

Some of the existing ComEd transmission substations are designed with ring-bus or straight-bus configuration. To interconnect a new generator, the existing substation should be converted into the standard breaker-and-a-half configuration and create a line position for the generator lead line.

However, if the existing substation cannot be converted into the standard breaker-and-a-half configuration due to physical limitations, then the generator interconnection to an existing substation is allowed by connecting to an available bus position in the existing configuration. If no bus position is available, ComEd will investigate expansion of the existing ring or straight bus if it does not violate ComEd design standards and practices. Consideration must be given to the arrangement of lines and generators for reliability and bus loading concerns.

The GIC is responsible to purchase the additional land if needed to expand the existing substation to interconnect the generator lead. The GIC shall transfer the ownership of the additional land to ComEd before ComEd expands the existing substation.

The dead-end structure for the generator lead at the ComEd substation will serve as the point-of-interconnection between ComEd and the GIC.

b) Generator Interconnection to an Existing Nuclear Station:

At existing nuclear stations that use a ring bus design, generator interconnections should include installation of two circuit breakers. One circuit breaker would be installed to expand the ring-bus and create a line position for the new generator lead. The other circuit breaker would be installed on the new generator lead, where practical, to prevent opening the nuclear station ring bus for faults on the new generator lead, as shown in the following Figure-3.1.1.

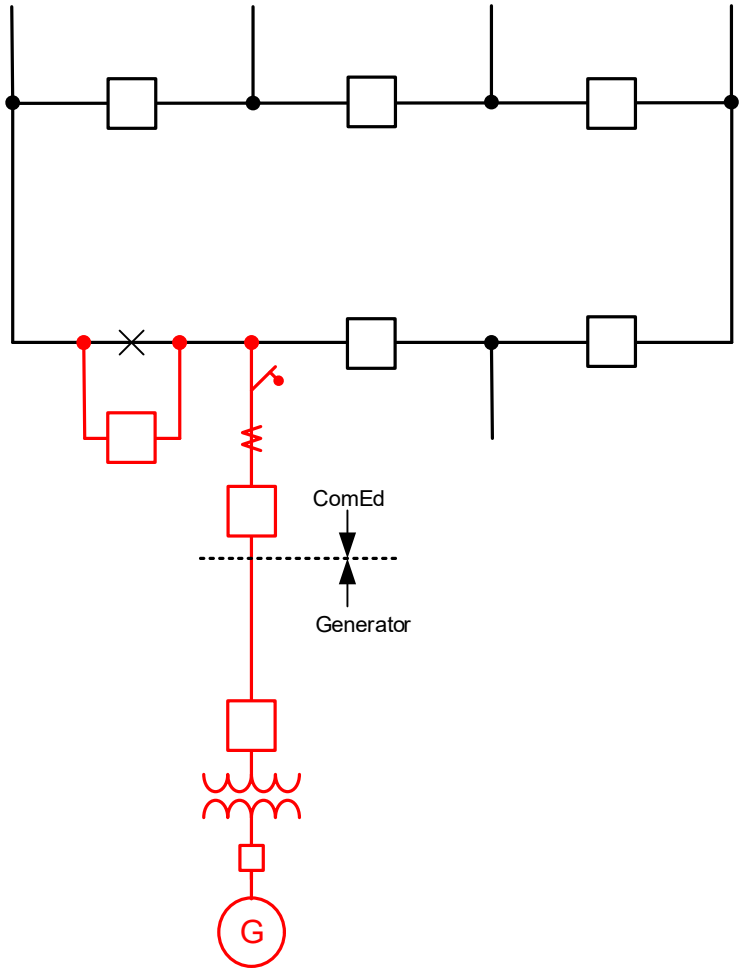


Figure-3.1.1: Generator interconnection to
an existing nuclear station

c) Generator Interconnection at a Generation Hub:

A generation hub is an interconnection substation that is shared by multiple transmission lines and generators. A generation hub employs breaker-and-a-half configuration to facilitate expansion and provide greater operational flexibility. A generation hub is designed to interconnect up to four generators and two transmission lines. The ultimate configuration shall meet ComEd and PJM planning criteria including loss of largest resource.

Many of the ComEd transmission line right of ways have double-circuit transmission lines. The generation hub design has the provision to tie-in both circuits (designated as A and B) of the double-circuit transmission line.

The following figures depict generator interconnection configuration for different scenarios that represent sequential interconnection of a 1st and 2nd generator. The interconnection of 3rd and 4th would depend on the equipment layout at the generation hub and is not covered in this guideline. However, equipment layout of a fully developed generation is also included for reference purposes.

Figure-a: Interconnection of 1st generator at a generation hub (G1 on line-A)

Figure-b: Interconnection of 2nd generator at a generation hub (G1 on line-A & G2 on line-A)

Figure-c: Interconnection of 2nd generator at a generation hub (G1 on line-A & G2 on line-B)

Figure-a: **Interconnection of 1st generator at a generation hub (G1 on line-A)**

For the 1st generator, the scope of interconnection will include installation of three (3) circuit breakers, line tie-in and termination of generator lead in breaker-and-a-half configuration, in addition to any system upgrades identified in PJM studies.

The dead-end structure for the generator lead at the generation hub will serve as the point-of-interconnection between ComEd and the GIC.

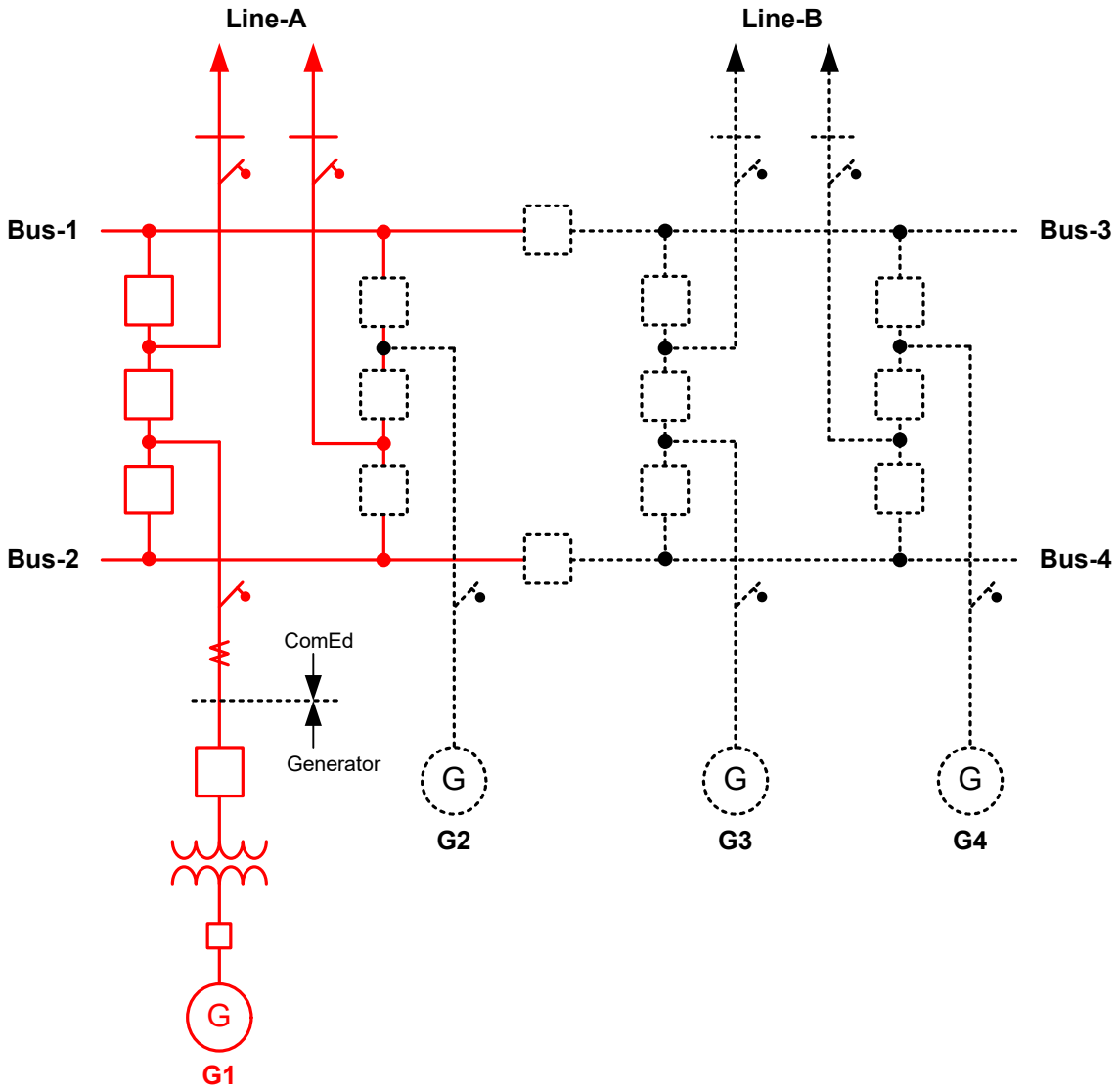


Figure-a: Interconnection of 1st Generator at a Generation Hub (G1 on Line-A)

Figure-b: **<u>Interconnection of 2nd generator at a generation hub (G1 on line-A & G2 on line-A)</u>**

For the 2nd generator, the scope of interconnection will include installation of one (1) circuit breaker to create a bus position for terminating the generator lead. Electrically, this configuration will work as a ring-bus. However, it will have the flexibility to be expanded as a breaker-and-a-half configuration to allow additional interconnections.

The dead-end structure for the generator lead at the generation hub will serve as the point-of-interconnection between ComEd and the GIC.

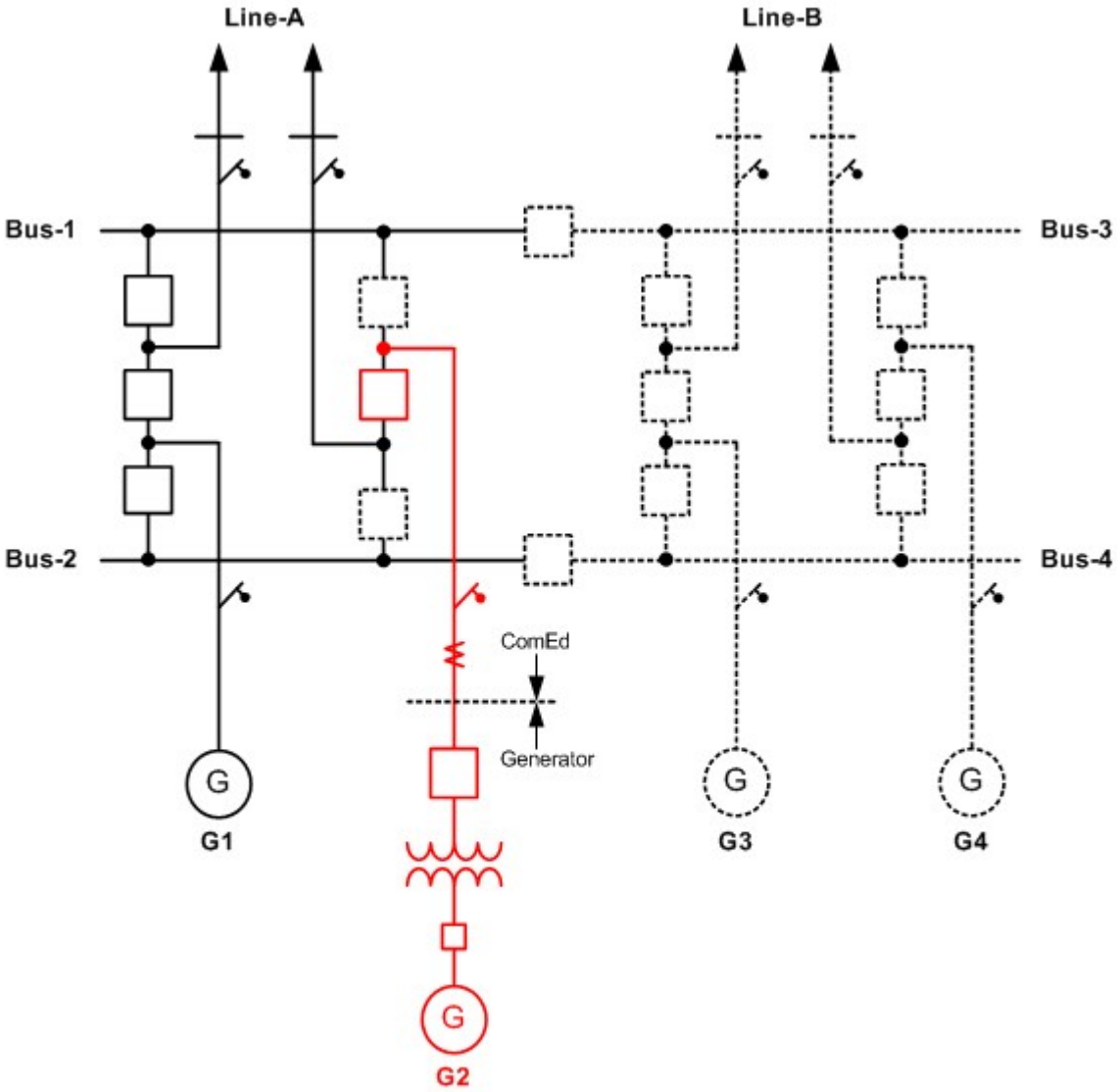


Figure-b: Interconnection of 2nd Generator at a Generation Hub (G1 on Line-A & G2 on Line-A)

Figure-c: **Interconnection of 2nd generator at a generation hub (G1 on line-A & G2 on line-B)**

This scenario applies to a generator that entered the PJM queue intending to interconnect to a different transmission line from the one to which the 1st generator is interconnected.

Under this scenario, the scope of interconnection will include installation of 3 line circuit breakers, 2 bus-tie circuit breakers, line tie-in and termination of generator lead in breaker-and-a-half configuration, in addition to any system upgrades identified in PJM studies. For some interconnections, planning criteria and/or operational considerations may allow use of motor operated disconnect switches instead of bus-tie circuit breakers between buses 1-3 and buses 2-4.

The dead-end structure for the generator lead at the generation hub will serve as the point-of-interconnection between ComEd and the GIC.

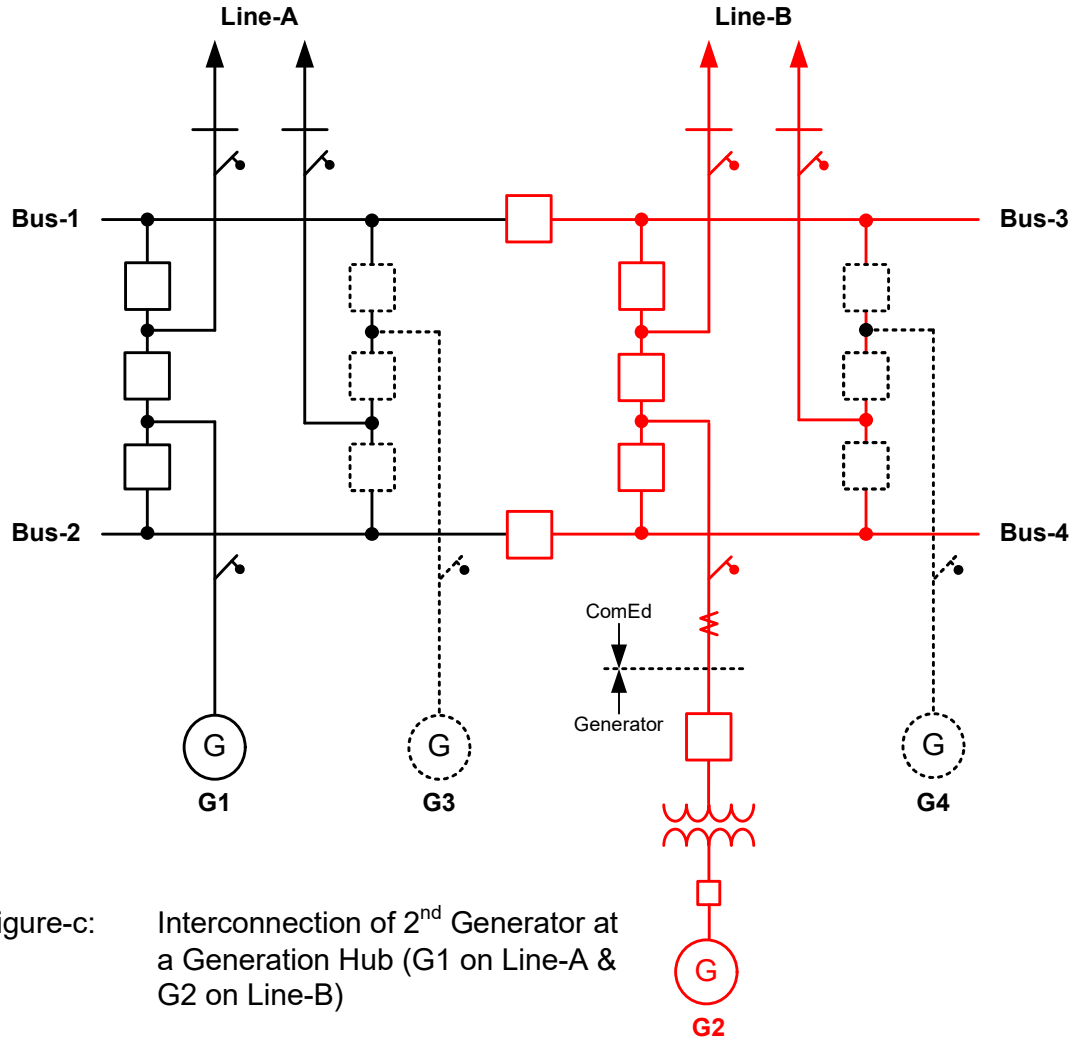


Figure-c: Interconnection of 2nd Generator at a Generation Hub (G1 on Line-A & G2 on Line-B)

d) Generator Interconnection on a Radial Distribution Line:

ComEd has many 138kV radial lines feeding 138kV stepdown distribution transformers. Sometimes, a new GIC picks the radial line for generator interconnection. The following guideline is provided to address this scenario.

ComEd requires two outlet lines for any generator interconnection so that a maintenance outage of one line will not require generator outage. To meet this requirement, a new generator interconnection needs to bisect at least two radial lines. If there is only one radial line available, the generator cannot interconnect unless a new transmission line is built to provide a second outlet for its generation or the radial line is converted into a network line.

4) INTERCONNECTION FACILITIES

The interconnection facilities include all facilities built to interconnect a GIC generating facility to the ComEd transmission network. In most cases, this would include GIC collector substation, generator lead line, and an interconnection substation. The collector substation and generator lead line are GIC-owned interconnection facilities. The interconnection substation is a ComEd-owned interconnection facility. Additionally, network upgrades may be necessary to maintain system adequacy with injection of GIC generation into the electric power system.

The GIC is responsible for all costs to engineer, design, procure, construct and commission all the interconnection facilities and network upgrades. After successful completion of a generator interconnection, ComEd shall own and be responsible to operate and maintain the interconnection substation. The following sections provide guidance on building interconnection facilities and network-upgrades.

4.1) Point-of-Interface between ComEd and GIC Interconnection Facilities

For each interconnection, a dead-end structure is installed within the boundary of the interconnection substation. This dead-end structure is used to connect the generator lead line from the GIC collector substation and serves as the point-of-interface or the point-of-interconnection (POI) between the GIC-owned interconnection facilities and ComEd-owned interconnection facilities, except for Fiber Optic cables.

ComEd shall own and be responsible to maintain the dead-end structure, support structures and insulators. The GIC shall own and be responsible to maintain the incoming generator lead line (wire) and wire lugs. The generator lead line shall enter the substation yard overhead terminating at the dead-end structure, except at urban substations that are predominantly served with underground transmission cables. The GIC cannot install any part of its generator lead underground inside the interconnection substation boundary.

Regarding the Fiber Optic cable, the Fiber Distribution Panel (FDP) and splice box in the ComEd interconnection substation would serve as the point-of-interface or demarcation interface between the GIC and ComEd. The GIC shall own and be responsible to maintain the Fiber Optic cables from the GIC collector substation to the FDP in the interconnection substation. ComEd will own and maintain the FDP panel/rack in the interconnection substation, which will house the customer-owned Fiber cables and Fiber terminations.

4.2) Engineering/ Construction Responsibility of ComEd-Owned Interconnection Facilities & Network-Upgrades

ComEd, as a Transmission Owner, will agree to the following split of responsibilities with the GIC for ComEd-owned interconnection facilities and network upgrades.

4.2.1) Work on Greenfield Site

a) The GIC may elect to build interconnection facilities on greenfield sites such as new substations and transmission lines. Under this option, the GIC will engineer, design, procure, construct and commission greenfield interconnection facilities that will be owned by ComEd. The GIC shall hire ComEd approved contractors and vendors and use ComEd standards/specifications with ComEd oversight and approval.

b) ComEd shall specify the protection system design and provide all settings for protective systems that protect ComEd equipment.

c) ComEd shall engineer, design, procure, construct and commission the line attachments (tie-in work) to the ComEd-owned interconnection facilities on Greenfield sites.

d) The GIC shall coordinate the schedule for its work with ComEd to ensure that its requests for oversight/approval are matched with ComEd resources.

4.2.2) Work within Energized Substation

a) ComEd, having overall responsibility for maintaining reliability of the transmission system, and to avoid the possibility of any negative impact on system reliability and stability, will not mutually agree to allow a GIC to construct and commission the interconnection facilities and network upgrades within energized substations. Please refer to the PJM Open Access Transmission Tariff for further information regarding Option-to-Build options and rights.

b) ComEd shall specify the protection system design and provide all settings for protective systems that protect ComEd equipment.

c) The GIC shall coordinate the schedule for its work with ComEd to ensure that its requests for oversight/approval are matched with ComEd resources.

In exercising option to build for ComEd-owned interconnection facilities, GIC must adhere to Good Utility Practices, the National Electrical Code, the National Electrical Safety Code, North America Electric Reliability Corporation, Reliability First Corporation, PJM standards, ComEd planning criteria and guidelines, and all applicable laws and regulations.

Before proceeding with construction under the option to build, the GIC must furnish six sets of final design documents to ComEd for review and acceptance. The GIC design documents (electrical prints, relay settings, etc.) will be reviewed by ComEd. Project delays due to untimely submittal of complete design

documents are the responsibility of the GIC. These documents must be of good engineering quality and include the following:

- One-line diagram showing the connections between the generator(s) and the ComEd system.
- Three-line diagrams showing current and potential circuits for protective relays.
- Relay tripping and control schematic diagram.
- Instruction books for relays.

Additional engineering meetings may be necessary to discuss the design documents. If changes are necessary, the GIC shall incorporate all changes and corrections and submit six sets of corrected prints to ComEd before proceeding with construction.

4.3) ComEd-Approved Contractors & Vendors

The following guideline is provided on ComEd-approved contractors and vendors that GIC is required to hire to build ComEd-owned interconnection facilities.

- A list of ComEd-approved contractors and vendors is posted on PJM website. Only ComEd Environmental Contractors of Choice should be utilized for environmental portions of the work.

- PJM rules allow the GIC to propose new contactors and vendors that have not been ComEd-approved. ComEd shall evaluate the proposed contractors and vendors using the same process as for any new contractor ComEd would consider for work on its system.

- The proposed contractor shall submit commercial and technical information for evaluation against seven (7) key criteria. The ComEd Supply Organization first evaluates the commercial submittals (financial, insurance and safety record), and if the proposed contractor passes that screening, the Project Manager shall assemble a pre-qualification team for the technical evaluation. The team may include Project Manager, Construction Manager, T&S or Distribution Engineering, Line Organization Management (Ops and Substation Regional Managers) and Testing. The technical reviews may include meetings with the contractor and GIC led by the Project Manager.

- Using the Contractor Pre-Qualification Process, a score is assigned for each of the 7 key criteria. Based on the total score, the contractor is either rejected, approved, or approved with conditions. The Project Manager or Supply representative issues a letter to the contractor with the pre-qualification conclusion, with copy to the GIC and PJM. An additional copy is maintained in the Project Notebook.

4.4) GIC-Owned Interconnection Facilities

The GIC is responsible to engineer, design, procure, construct, commission, operate and maintain GIC-owned interconnection facilities, in accordance with Good Utility Practices, the National Electrical Code, the National Electrical Safety Code, North America Electric Reliability Corporation, Reliability First Corporation, PJM standards and all applicable laws and regulations. This includes installing, setting, and maintaining all protective devices necessary to protect the GIC interconnection facilities.

The GIC is responsible to coordinate with ComEd during the engineering, design, and construction phases of its equipment to ensure coordination of protective relay devices.

ComEd functional relay requirements will be provided to the GIC during the detailed design phase of the project. The information for the specific project will indicate the protective functions for which the GIC is to provide relays and related equipment. The GIC will indicate the specific relay type(s) and range proposed for each function. The GIC must also provide proposed current and potential transformer ratios, connections, and locations as related to the electrical one-line diagram.

The GIC is responsible to install reactive compensation, if needed, at its collector substation to maintain ± 0.95 power factor at the point-of-interface between GIC and ComEd interconnection facilities.

The GIC is responsible for coordinating the design of its own generator step-up electrical facility with PJM and ComEd.

Within one (1) month following the commercial operation of generating unit(s), GIC must provide ComEd with certified documentation demonstrating that "as-built" Customer Facility and GIC-owned interconnection facilities are in accordance with applicable PJM studies and agreements.

5) REAL ESTATE REQUIREMENTS

There are two scenarios with respect to real estate assets and rights necessary for completion of the interconnection and subsequent operation of GIC's project as described below:

a) A generator interconnecting by building a new substation at a new site

In line with PJM Tariff, a Generation Interconnection Customer can choose a location to interconnect. Under this scenario, the GIC would be responsible to purchase or otherwise obtain all necessary and appropriate (i) real property rights (whether in the form of fee simple ownership, a perpetual easement, a perpetual license or other perpetual right) in accordance with all ComEd requirements and (ii) permits and approvals from all applicable governmental authorities and property owners (collectively, the "Property Rights and Permits"), to install the following facilities:

- An appropriately located real estate site that is approximately five (5) acres in size for 138kV interconnection and eight (8) acres in size for 345kV interconnection for the location, construction and operation of the Interconnection Substation (the "Interconnection Substation");
- A line section to tie-in the transmission line to the Interconnection Substation (the "Line Section"); and.
- Transmission line (generator lead) to interconnect GIC's collector substation to the Interconnection Substation.

Upon completion of the construction and installation of the Interconnection Substation and the Line Section, the GIC shall transfer all of the Property Rights and Permits to ComEd, at no cost or expense to ComEd, pursuant to documentation that is acceptable to ComEd together with all of the Property Transfer Documents described below.

d) A generator interconnecting to ~~by expanding~~ an existing substation

Under this scenario, the GIC would be responsible to purchase property or otherwise obtain all Property Rights and Permits to install the following facilities:

- Additional land (if required) to expand a ComEd owned and operated existing substation, and.
- Transmission line (generator lead) to interconnect GIC's collector substation to the existing ComEd Substation.

Upon completion of construction, the GIC is obligated to perform or cause to be performed on the additional land or, if GIC is undertaking no construction, upon acquisition of all Property Rights and Permits for the additional land, GIC shall

transfer all of the Property Rights and Permits to ComEd, at no cost or expense to ComEd, pursuant to documentation that is acceptable to ComEd together with all of the Property Transfer Documents described below.

Real Estate Transaction

The form of transfer documents and the type of real estate transactions will be determined by the type of facility or the required Property Rights and Permits that need to be transferred to ComEd. This transaction may include:

- Conveyance of fee simple ownership in some or all of the real property to ComEd.

- Conveyance of perpetual easements (exclusive and nonexclusive) required for all equipment and facilities associated with the substation and transmission lines including, but not limited to, access, drainage, fiber, and such other overhead and underground facilities as ComEd may reasonably require for the construction, use, maintenance and operation of the generation hub or the interconnection substation.

- Conveyance of perpetual transmission, fiber, and facilities easements (exclusive and nonexclusive) for the purposes of interconnecting the interconnection substation with the ComEd transmission system, including such overhead and underground electrical, fiber, and related communications, transmission and distribution facilities.

In each of the three transaction scenarios outlined above, or any combination thereof, the GIC will be responsible for executing and delivering all documentation requested by ComEd or required by any third party title insurer, surveyor or property owner to transfer the Property Rights and Permits, which may include, without limitation, special warranty deeds, easements, purchase and sale agreements containing representations and warranties acceptable to ComEd, assignments, bills of sale, affidavits, certifications, statements, certifications as to value of improvements, surveys, title policies, and releases, and such other documentation necessary to obtain a title policy in favor of ComEd covering the property rights and interests conveyed (the "Transfer Documents").

To facilitate transfer of property rights and permits, ComEd will provide the form of purchase and sale agreement that will incorporate terms and conditions that reflect ComEd's standard business practices, together with engineering review of proposed GIC facilities that involve ComEd real estate and/or right of way.

Interconnection before Conveyance

If it becomes necessary to interconnect GIC to the ComEd system before the conveyance of property and facilities is complete, Interconnections & System Studies

will require the customer to execute an Operational Control Agreement prior to interconnection.

At a minimum, the operations agreement should include the following requirements:

- The customer's acceptance of full liability for all customer owned equipment
- The customer must meet all applicable NERC requirements for equipment that has not been conveyed
- Prior to conveyance, the customer must provide ComEd with maintenance records for batteries and relays being conveyed

GIC's Scope

It is GIC's responsibility to purchase property, acquire rights and obtain any required permits or zoning for the transmission, distribution and or communication facilities required to interconnect its generation. In addition, the GIC will grant to ComEd such rights and interests as may be reasonably necessary to interconnect the generation facilities and associated network upgrades to the ComEd system.

It is imperative, when the GIC is required by the scope of a project to provide information, that the deliverables itemized below be received by ComEd as soon as possible. This will facilitate a timely review and will allow ComEd to address the real estate aspects of the project in a timely manner.

The GIC is responsible for providing the following:

The following current information covering all interests and rights to be conveyed to ComEd:

1. A title commitment covering all real estate assets to be conveyed to ComEd (whether by deed, easement, assignment or otherwise) (the "Real Property") issued by a title company reasonably acceptable to ComEd (the "Title Commitment").

2. Copies of all documents referenced in all of the exceptions listed in the Title Commitment.

3. Copies of all documents creating the Property Rights and Permits.

4. ALTA/ACSM Land Title Survey of the Real Property.

5. Topographic survey at a contour interval appropriate to the relief and size of the Real Property.

6. Phase I Environmental Assessment Report (Phase 2 if appropriate or necessary as determined by ComEd) and any other environmental reports, notifications and documents associated with or related to the Real Property.

7. Wetland Delineation reports for all of the Real Property.

8. Annexation Agreement(s), zoning changes or other governmental agreements or approvals entered into or proposed with respect to the Real Property.

9. All jurisdictional permits, such as special use and building permits, that have been issued for the project or copies of pending applications that relate to or affect the Real Property.

10. Detailed civil engineering drawings showing the proposed site plan, layout, drainage, access and facilities.

11. At the closing of the conveyance transaction, all original warranties and plans shall be delivered to ComEd.

12. A statement of value of all improvements that have been or will be constructed on the Real Property.

13. An asset map row for the improvements. All of the documentation required by the purchase and sale agreement.

14. Such other information and documentation as ComEd may reasonably require.

Additional information may also be required, depending on project requirements. Requests for such information will be transmitted to the GIC during project development and in connection with ComEd's review of the foregoing documents and materials.

ComEd's Scope

Project Management:

The ComEd Project Manager leads ComEd's real estate process. ComEd Project Management and Engineering, in conjunction with the GIC, develop designs that define what the real estate needs will be and the Real Estate & Facilities group supports that plans execution. The ComEd Project Manager responsibilities include activities such as:

a) Allow a minimum of 6 months for preparation and due diligence. More time in advance may be required depending on the real estate being managed.

b) Periodic meetings, commensurate with the size of the acquisition need to take place. These may be weekly depending on the upcoming project milestones.

c) Establish the date(s) for closing the real estate transaction(s) to meet the overall project schedule.

d) Define the scope of the real estate activities required for the project.

e) Monitor the status of real estate activities to ensure that the process is moving forward and will meet the closing date(s).

f) Provide guidance on technical/operational matters that must be addressed during the real estate process.

g) Monitor the status of real estate activities to ensure that the process is moving forward and will meet the closing date(s)

h) Provide guidance on technical/operational matters that must be addressed during the real estate process

i) Coordinate with internal departments, such as Environmental Services, to ensure that appropriate ComEd processes and requirements are being met

j) Establish a project ID for land transfer and provide Finance the letter of valuation for equipment and property conveyed so it may be added to ComEd's assets

k) Conduct a Final Acceptance walk down with ComEd Team. This includes any other properties or easements acquired by the project under the PJM Option to Build (microwave repeater sites, fiber easements, aux power or transmission line easements, etc.).

l) Provide PJM with required communications prior to land conveyance.

m) Engage Environmental Services Department for the review and approval of environmental permits, etc.

Real Estate:

The Real Estate Department, in conjunction with BSC Legal, executes the tasks involved in the real estate portion of the project with activities such as:

1) Leading the real estate calls to ensure that progress is being made and that issues are being managed.

2) Monitoring and guiding completion of customer due diligence requirements (examples of these are zoning, permits etc.).

3) Negotiating mutually acceptable terms and conditions in the real estate documents required for the project.

4) Coordinating the process for securing internal approval of customer facilities to be located on property in which ComEd has an interest.

5) Guiding customer rights acquisition on behalf of ComEd.

6) Conducting a formal real estate closing to accomplish transfer of property ownership.

7) Developing and maintaining a real estate closing check list. This varies somewhat for each project, to track the status of all documents and other real estate deliverables required by the project.

6) RELAY & PROTECTION REQUIREMENTS

General Need for System Protection in the Presence of Parallel Generation

The components of the transmission system are subject to a variety of natural and man-made hazards; among these are lightning, wind, wildlife, and vandalism. Damaged or short-circuited equipment should be switched out of service as soon as possible to minimize safety hazards, to avoid minimize equipment damage, and to maintain system stability. Generation operated in parallel with the transmission system provides an additional source of energy that must also be disconnected in case of an emergency. It is essential that a suitable system of protection be used to minimize these hazards and to prevent the reduction of quality of service to other transmission customers.

General Effects of Interconnected Generation on System Protection Requirements

The addition of GIC's generation shall not introduce a hazard or adversely affect the quality of service to ComEd customers. Protective equipment must be added to standard ComEd facilities to provide adequate protection of the transmission system. ComEd's protection system designs and requirements are based on years of system operating experience and analysis of events both internal and external to ComEd as well as requirements from the various regulatory organizations. Requirements for additional protective equipment due to interconnected operation will vary depending on the size of the GIC's generation and on the nature of the ComEd local system.

Interconnection Overview

Designs intended for generation interconnections on the ComEd distribution system can be found in the Exelon Energy Delivery's Interconnection Guideline for generators greater than 2MVA and less than or equal to 20MVA.

Protective relaying designs for new interconnections are required to match the most current requirements and standards for protection used on the rest of the ComEd system at the voltage level of the interconnection. The 345 kV and above transmission lines that make up ComEd's transmission system are vital to maintaining system stability, regional stability, and crucial to ensuring the reliable power flow through the service territory. Thus, at ComEd, requirements for equipment connected to or operating at 345kV and above are subject to the most stringent requirements while equipment connected to operating at 138kV or below are subject to somewhat lesser requirements. Although 138kV plays a lesser role in maintaining system stability than 345kV, a majority of ComEd's customers are connected at the 138kV level so protection systems still require a high level of reliability. Some 138kV areas within ComEd's system are subject to nearly the same requirements as 345kV and above due to very high load densities or other reasons. Requirements for 345kV and up and 138kV or below interconnections are described herein for the most encountered configurations. These protection schemes and requirements are guidelines; final requirements are established during the engineering process.

Detailed protection requirements for adding generation to a ComEd transmission line with existing generation must be made on a case-by-case basis. Adding generation to the transmission line may require additional protection at other existing installations.

As a rule, generation that is less than 20 MVA may be connected to the distribution system, generation from 20 to 300 MVA is usually connected to the 138 kV, and generation more than 300 MVA is connected to the 345 kV.

6.1) Protection Requirements of 345kV and above Interconnections:

When connecting to an existing station, the interconnection configuration will follow the configuration at that station (ring bus, straight bus, or breaker and a half (generation hub)) with new breaker/breakers or bus position as required. In some cases, system conditions may require that a generator be connected to an existing line by splitting the line. Typically, a 3-breaker ring configuration is used when splitting a 345kV line.

Three terminal lines are not allowed by ComEd or PJM at 345kV and above voltage (EHV) level.

For some GIC Plant installations, the most appropriate interconnection point to the ComEd system would be directly into the bus at an existing ComEd substation. If the ComEd substation had a ring bus configuration, the GIC interconnection point would have to maintain the integrity of the substation design. This would require the addition of at least one new circuit breaker at the substation. The effect on the substation protection would depend on the site specifics. Protection also would have to be installed on the line to the generator.

Redundancy of protection is required per ComEd standards, NERC Planning Standards, PJM Standards, and/or RFC Standards which specify that no single protection system component failure can cause a fault to remain on the system. Protective relaying systems on the 345 kV and above system shall include two complete schemes, each including primary and back-up protection. Independent current transformers, potential transformer secondaries, and DC source (separate batteries are required at 345kV) will feed each system. The relaying schemes will be complementary in terms of their principle of measurement rather than redundant and be of varying construction to minimize the chance of a common mode failure. The standard medium of system protection communication on the 345kV system is fiber optic-based equipment. The following one-line drawing, and minimum protection scheme design requirements drawings illustrate these concepts for 345kV and above interconnections:

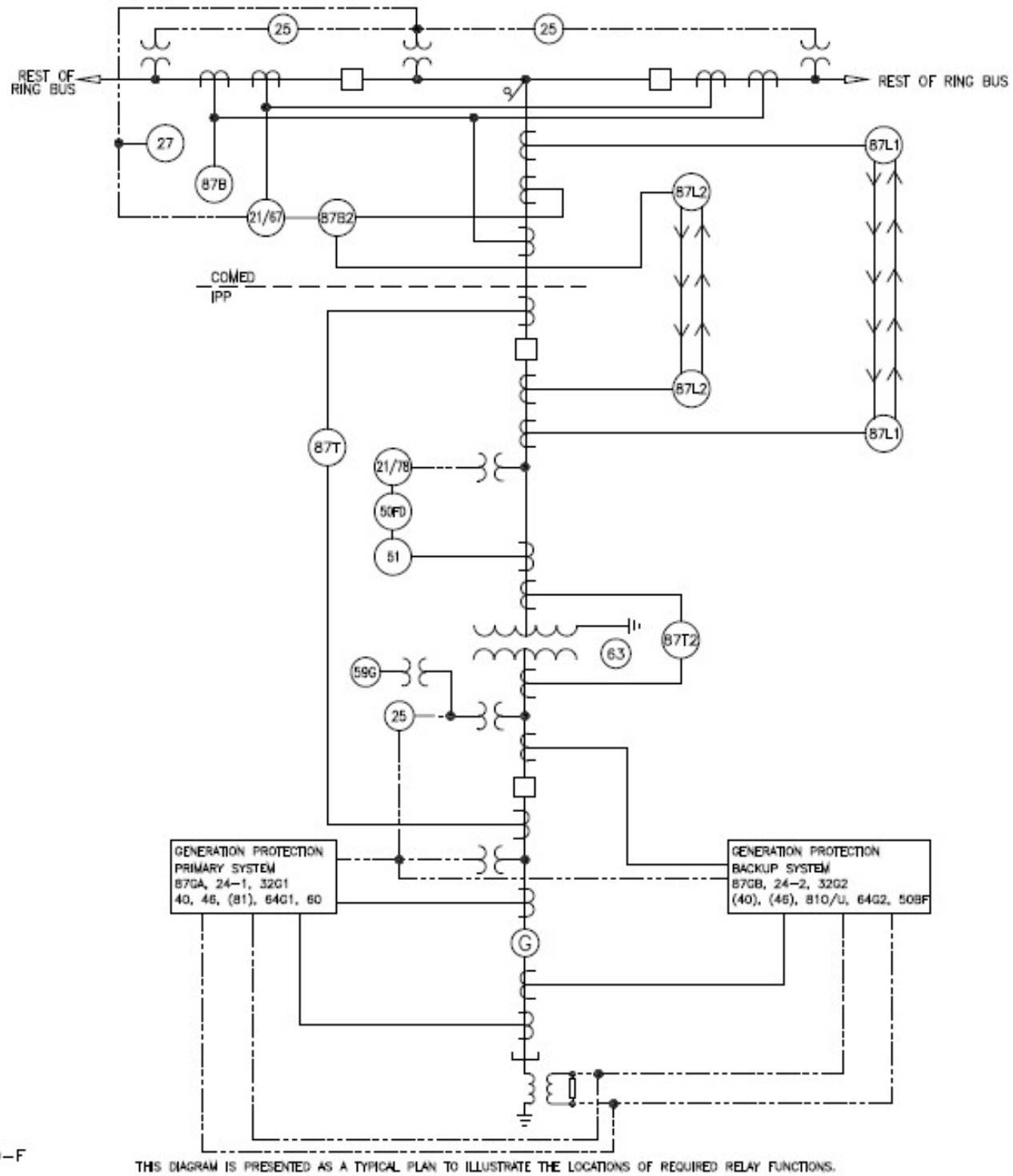
PRELIMINARY RELAY REQUIREMENTS
CUSTOMER OWNED GENERATION PARALLELED WITH COMED

PLAN F

A. A TOTAL GENERATION GREATER THAN OR EQUAL TO 10MVA

——AND——

B. CONNECTED TO 345KV OR 765KV



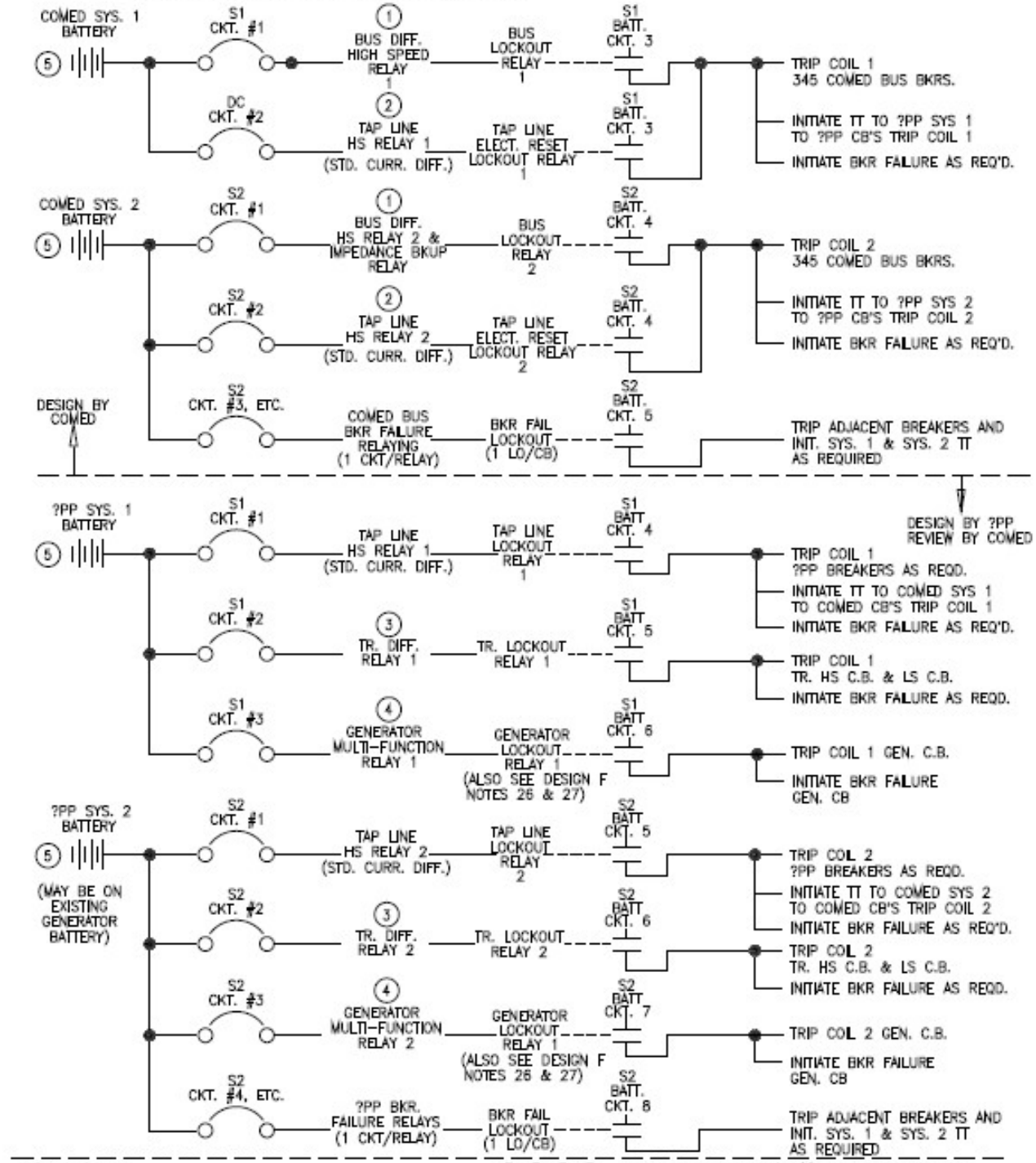
KD–F

THIS DIAGRAM IS PRESENTED AS A TYPICAL PLAN TO ILLUSTRATE THE LOCATIONS OF REQUIRED RELAY FUNCTIONS.

GENERAL MINIMUM PROTECTION SCHEME DESIGN REQUIREMENTS FOR

DESIGN F

2 SEGREGATED HIGH SPEED SCHEMS MUST COVER A FAULT AT ANY LOCATION FOR EHV ?PP'S
SENSING MUST BE SEGREGATED AS WELL FOR TRIPPING



GENERAL NOTES:
- BATTERY/CHARGER ALARM MONITORING IS REQUIRED.
- MICROPROCESSOR RELAY FAILURE ALARM MONITORING IS REQUIRED.

DESIGN F

(1)(2)(3)(4) RELAYS TO BE DIFFERENT MODELS, PREFERABLY BY DIFFERENT MANUFACTURERS.

(5) SEGREGATION OF SYSTEMS BETWEEN TRIP COIL 1 AND TRIP COIL 2 IS RECOMMENDED IF AVAILABLE.

6.2) Protection Requirements of 138kV and below Interconnections:

When connecting to an existing station, the interconnection configuration will follow the configuration at that station (straight bus or ring bus) with a new breaker or bus position. In some cases, system conditions may require that a generator be connected to an existing line by splitting the line. Typically, a three breaker T configuration is used when splitting a 138kV line. Large generators connected to the 69 kV or 138 kV transmission systems may require the use of a ring bus.

Adding a fourth source to a three-terminal line or a third source to a two-terminal line limits the effectiveness of protective relay schemes and reduces system reliability. This type of configuration can limit the amount of power that can be supplied by the weakest source to the line, cause compromises and degradation of line protection, and limit transmission availability to the GIC. Thus, ComEd typically does not allow three terminal line configurations for generator interconnects and the line will be broken into two lines. A three breaker straight or ring bus substation will be installed if connection to an existing ComEd substation is not feasible. New line protection packages are needed for the two new lines created by splitting the existing ComEd line and for the line to the generator.

For some GIC Plant installations, the most appropriate interconnection point to the ComEd system would be directly into the bus at an existing ComEd substation. If the ComEd substation is a ring bus configuration, the GIC interconnection point would have to maintain the integrity of the substation design. This would require the addition of at least one new circuit breaker at the substation. The effect on the substation protection would depend on the site specifics. Protection also would have to be installed on the line to the generator.

Redundancy of protection is required per ComEd standards, NERC Planning Standards, PJM Standards, and/or RFC Standards which specify that no single protection system component failure can cause a fault to remain on the system. ComEd 138kV protection system standards may be greater in some areas of the service territory than shown in the diagrams. The following one-line drawing, and minimum protection scheme design requirements drawings illustrate these concepts for 138kV and below interconnections:

PRELIMINARY RELAY REQUIREMENTS
CUSTOMER OWNED GENERATION PARALLELED WITH COMED

PLAN E

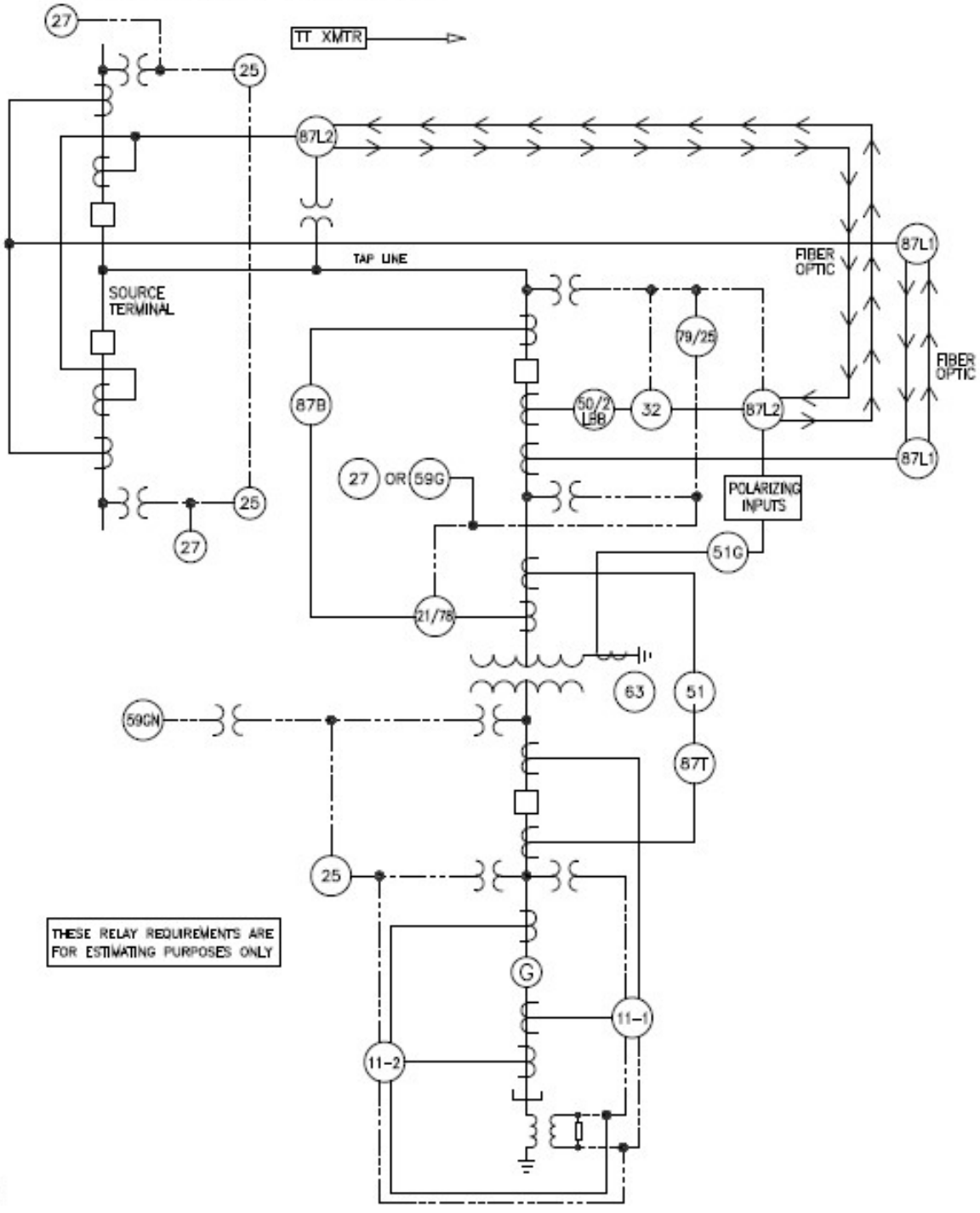
A. A TOTAL GENERATION GREATER THAN 10MVA

——————AND——————

B. CONNECTED TO 69KV OR 138KV

——————AND——————

C. RING BUS OR T-TAP CONNECTION



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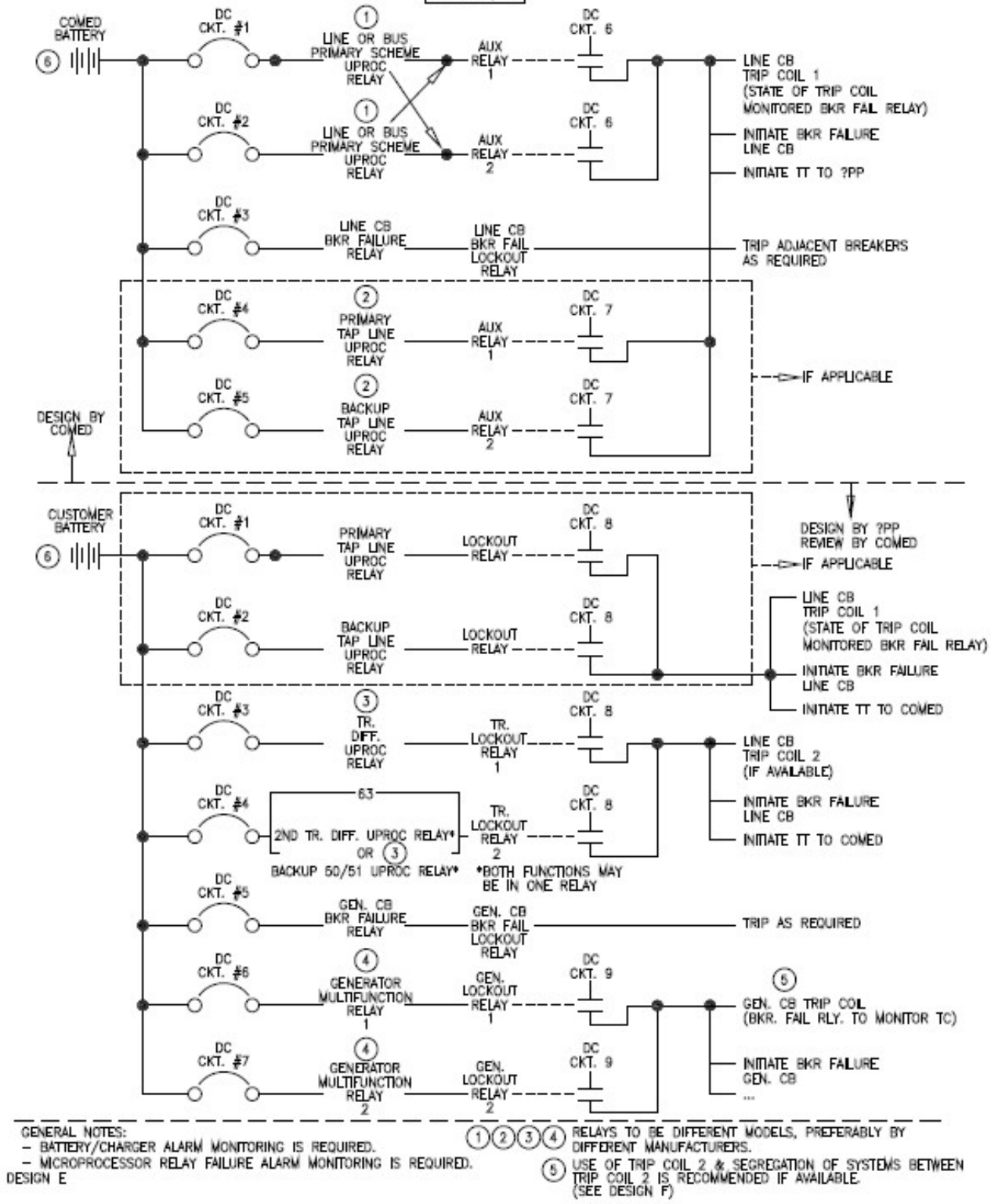
GENERAL MINIMUM PROTECTION SCHEME DESIGN REQUIREMENTS FOR

DESIGN E



GENERAL NOTES:
- BATTERY/CHARGER ALARM MONITORING IS REQUIRED.
- MICROPROCESSOR RELAY FAILURE ALARM MONITORING IS REQUIRED.

DESIGN E

(1)(2)(3)(4) RELAYS TO BE DIFFERENT MODELS, PREFERABLY BY DIFFERENT MANUFACTURERS.

(5) USE OF TRIP COIL 2 & SEGREGATION OF SYSTEMS BETWEEN TRIP COIL 2 IS RECOMMENDED IF AVAILABLE. (SEE DESIGN F)

Review and Approval of GIC Protection System Designs:

ComEd will review and approve the design of all customer owned protection systems that are identified in the 345kV and above and 138kV and below one-line diagrams and minimum design requirement drawings above. ComEd approval is required prior to the start of detailed customer design work.

ComEd will review and approve the settings of protective relays for any intertie tap lines, GSUs, and for any generator setting that must coordinate with the ComEd Transmission System. ComEd approval is required prior to energization of GIC equipment.

Testing of GIC Protection System Designs:

ComEd will witness customer testing of any GIC protection system where the design is required to be reviewed and approved including proper application and testing of relay settings required for coordination with the ComEd transmission system. ComEd's approval of all testing is required prior to energization of GIC equipment.

ComEd requires a high current test (also known as a through-fault test) for any bus or GSU transformer differential schemes prior to energization of these schemes. ComEd will witness this test. ComEd review and approval of the results of this test is required prior to energization of GIC equipment. This test is typically performed just prior to livening.

A witness test list will be provided for a given site and will be the ultimate governing document on what is required. A ComEd tester's time is generally scheduled at least 5 weeks in advance by the Regional Testing Group Work Management department. Testing Group individuals are not scheduled for work until completed and approved prints, and other required documentation, are in hand. GIC representatives shall work with ComEd work management to schedule tester's time for witness testing and review of testing documentation. Four (4) sets of approved blueprints (as built) must be provided to the ComEd testing department. The project delays may be caused by untimely submittal of approved blueprints by the GIC.

Reclosing of ComEd Supply Lines

Most faults on overhead lines are transient. That is, if the line is de-energized promptly, it can be reclosed and returned to service. Examples of such transient faults include momentary tree contact due to wind, and insulator flashover due to lightning. Automatic reclosing of overhead lines is standard industry practice to improve the reliability of supply. In many cases, the line can be de-energized and reclosed within one second, with minimal disruption of service to the GIC.

Effects of Interconnected Generation on Automatic Reclosing

Automatic reclosing on ComEd's transmission lines can potentially damage generating equipment operated in parallel with the T&D system. Severe mechanical stress on the

generating equipment may occur if the line is reclosed while the generator is still connected to the ComEd system. This applies to both synchronous and induction generators. With synchronous generators, damage may occur when they are out of synchronism when the supply is restored; with induction generators, damage may occur if they are operating at a speed higher or lower than normal when reclosed to the system. ComEd will not eliminate automatic reclosing of overhead supply lines because that would severely reduce the reliability of service to other GICs. ComEd will attempt to reclose into a dead line from a non-generating terminal. At 345kV and above, a delayed reclose attempt long enough for a generator to cease oscillation will be applied at the most stable generating terminal of a line with generation at both ends. At 138kV and below, the first reclosing attempt is typically high-speed to maintain reliability to distribution customers and standard distribution substations require this mode. Although unlikely, some 138kV configurations may require direct tripping of connected generation for line faults.

Possible Reclosing Scenarios and GIC Responsibilities

The GIC is responsible for protecting the generating facility's equipment so that automatic or manual reclosing, faults, or other disturbances on the ComEd System do not cause damage to the equipment.

When automatic reclosing may result in equipment damage or a safety hazard, either to the ComEd System or the GIC facilities, ComEd and/or PJM may require that additional protective equipment be installed. This will usually consist of communication and/or control equipment to disconnect the GIC's generator (or to confirm that it is disconnected) before the ComEd transmission line is reclosed.

7) SCADA REQUIREMENTS

Some generators will require continuous telemetry to ComEd's and PJM's operation facilities. These will typically be large generators, generators involved in wholesale transactions or generators that are dispatchable by PJM. Telemetry may be required for one or more of the following reasons:

a) **System Control.** PJM has an obligation to maintain frequency and generation/load balance within its service territory. Changes in the status of large amounts of generation, without real-time telemetry, are detrimental to system control.

b) **Transmission System Operation.** The status of large generators significantly impacts operating decisions. Operators need to know the status of these large generators before performing routine or emergency switching.

c) **Public Safety.** Generators can potentially keep a portion of the electrical grid energized while isolated from the ComEd System. It is critical to detect these situations as soon as they occur so that corrective action can be taken, since the safety of the public and of ComEd workers is at stake.

Generators that meet the following criteria require implementation of telemetry to ComEd's and PJM's control center. Required telemetry is listed below each criterion. If more than one criterion applies to a generator, the telemetry requirements of each criterion must be met.

If the GIC is involved in a Power Purchase Agreement (PPA) or participating in the PJM capacity markets which contains unit specific performance or a unit specific payment structure

- Continuous telemetry required.
- Instantaneous revenue grade MW and MVAR; and cumulative revenue grade MWhr and MVARhr at the generator's step-up transformer high side (or equivalent net output) for each unit.
- Instantaneous revenue grade MW and MVAR; and cumulative revenue grade MWhr and MVARhr at all points of interconnection with ComEd and all points of service from ComEd.

If multiple GIC's generators over a large area with an aggregate generation greater than 40 MW are being centrally controlled

- Continuous telemetry required.
- Aggregate instantaneous MW of all generators.

7.1) General Design Requirements

There are two concerns with telemetry at GIC sites:

- The normal requirements for substation remote supervision and operation
- The unique requirements for GIC service, as emphasized in this document.

PJM requirements

When telemetry is required, as described earlier in this document, the following design will be used.

ComEd SCADA Engineering will specify the SCADA system required. SCADA technology is constantly evolving, so specific devices are not referenced in this document. But the system will typically provide the following 5 basic functions:

1. Monitor status, control, and metering of the ComEd substation and any ComEd equipment.

    a) One or more input/output modules/cards to accommodate any hard-wired alarms, status, and controls

    b) Serial and/or IP data connections to protective IEDs, equipment monitors, revenue meters, etc.

2. Provide substation information to the ComEd SCADA system

    a) A serial or IP data connection to the ComEd SCADA system from the SCADA data concentrator

    b) The data connection can be via a telco circuit, a fiber optic cable, or a radio pathway as specified by ComEd based on availability at the site and ability to meet all ComEd SCADA and security requirements.

3. Provide substation information to onsite personnel

    A utility-grade pc is typically used to act as a substation HMI. The pc will have a serial or IP connection to the SCADA data concentrator to acquire the substation data.

4. Provide ComEd substation information to the GIC

    a) Current practice is to establish a DNP 3.0 serial connection between the ComEd data concentrator and the GIC control system. The GIC will act as the DNP master and poll the ComEd system for any desired information.

b) For larger installations, a fiber optic cable is typically installed between the ComEd and GIC facilities. This DNP connection is most easily accomplished by using a pair of fibers in this cable.

c) The ComEd system will be programmed to only provide information relevant to the GIC connection. This data typically includes the revenue metering data, as well as status of equipment relating to the GIC connection/tap on the ComEd system.

5. Provide ComEd SCADA system with GIC substation information

a) Current practice is to establish a 2nd DNP 3.0 serial connection between ComEd and the GIC. ComEd will now act as the DNP master and poll the GIC on this 2nd DNP connection to gather information about the GIC facility.

b) Like with the first DNP connection, for larger installations a fiber optic cable is typically installed between the ComEd and GIC facilities. This DNP connection is most easily accomplished by using a pair of fibers in this cable.

8) COMMUNICATION REQUIREMENTS

Communications will be required for Relay Protection schemes, SCADA, telemetry, voice/data, Revenue Metering, and other Substation services. The Substation is a harsh environment that will require extraordinary means of construction in order to provide safe, dependable, and reliable service for all required connections.

Relay Requirements

Communications for Relay schemes need to be provided on equipment that meets the same IEEE C.37.90 requirements as the Relays themselves. The type of Communications equipment utilized will vary based on the Transmission voltage level that is being protected. As mentioned in 6.1, the standard medium of system protection communication on the 345kV system is fiber optic-based equipment. For 138kV systems, the standard medium of system protection communication equipment is power line carrier, although fiber optic could be considered. Any other technologies must be reviewed and approved by Com Ed prior to the start of customer design work. This review will occur at the same time the Relay schemes are reviewed.

SCADA/Telemetry/Revenue Metering Requirements

Communications for SCADA/Telemetry/Revenue Metering have slightly less stringent requirements unless they are using the same equipment that the Relay schemes are using. These communications can be made on fiber optic equipment. They can also be provided on leased lines, but all connections to telephone companies will require protection on the phone cabinets for the incoming copper cables. A Ground Potential Rise (GPR) study will be required for any copper cable connections to the phone company. Any other technologies must be reviewed and approved by Com Ed prior to the start of customer design work.

Other Voice/Data Requirements

Communications for other voice/data services, including Plain Old Telephone Service (POTS) lines, Fire Protection, LAN/Internet, etc. also do not have the same stringent requirements as the Relay schemes, unless they are using the same equipment. Any communications provided by leased lines from the phone company will require the same GPR studies as described above in the SCADA Requirements. These communications can be provided over fiber optic-based equipment, with some exceptions:

1) A POTS line intended for voice use cannot be provided over fiber optic-based Com Ed systems due to concerns for the use of “911” calls. So, this must be provided by the phone company.
2) The primary Fire Protection circuit, if required, cannot be provided over a “private network” (i.e., a Com Ed based fiber optic system) per NFPA72. However, if Fire Protection is not required, and is simply being added because it’s

wanted, then this channel can be through SCADA or some other communications means, as approved by Com Ed.

3) Any other technologies must be reviewed and approved by Com Ed prior to the start of customer design work.

9) METERING REQUIREMENTS

The following meters shall be in place, tested and operational before a GIC comes online.

9.1) Revenue Meter

The Revenue Meter measures the wholesale energy output (Hourly compensated net MWH and Hourly compensated net MVARH) of a generator. The Revenue Meter readings provide the basis for financial settlement in PJM market. There are two options to install a Revenue Meter as described below. The GIC can choose the option that suits its needs.

a) Install the Revenue Meter at the Interconnection Substation (ComEd side of POI).

This is the default option if the GIC does not choose one. Under this option:

- ComEd would own the Revenue Meter. ComEd would be responsible to operate, maintain, inspect, and test all metering equipment upon installation and at least once every two years thereafter. The GIC can inspect the testing.
- The GIC can choose to submit the Revenue Meter readings to PJM Power Meter account for financial settlement in PJM market, or else
- The GIC can request ComEd to submit the Revenue Meter readings to the PJM Power Meter account on behalf of the GIC for financial settlement in PJM market.

The following paragraph provides guidance if there are multiple Power Meter accounts for multiple generators behind one POI and GIC requests ComEd to submit the Revenue Meter readings to the PJM Power Meter account on behalf of the GIC:

A generating unit is defined as a set of generators modeled in PJM as a single unit and having a unique PJM Power Meter account. If there is only one generating unit with one PowerMeter account behind POI, ComEd is willing to submit the Revenue Meter readings to PJM Power Meter account. However, if there are multiple generating units with multiple Power Meter accounts behind one POI, one of these generating units must serve as Primary Generator and other generating units would serve as Secondary Generators.

Under this scenario, all Secondary Generators shall install Revenue Meters at their generator terminals on the high side of transformers and submit the readings of their individual Revenue Meters to the respective PJM Power Meter accounts. ComEd will submit residual Revenue Meter data to PJM Power Meter account for the Primary Generator, which will be calculated by

subtracting hourly readings of Secondary Generators from the hourly readings of the Revenue Meter installed at the POI. ComEd will submit corrections only for the Primary Generator if post PJM Power Meter deadline correction/adjustments for the Revenue Meter installed at POI are needed.

b) Install the Revenue Meter at the GIC Collector Substation (GIC side of POI).

This option is implemented if chosen by the GIC. Under this option:

- GIC would own the Revenue Meter. GIC would be responsible to operate, maintain, inspect, and test all metering equipment upon installation and at least once every two years thereafter. ComEd would inspect the testing.
- The Revenue Meter reading would be adjusted for the generator lead line losses.
- GIC would submit the Revenue Meter reading to PJM Power Meter account for financial settlement in PJM market.

9.2) AMI Meter at Transmission Level

The AMI Meter measures the retail energy consumption by the GIC at transmission level. The AMI Meter is installed at the Interconnection Substation on ComEd side of POI.

ComEd owns the AMI Meter and is responsible to operate, maintain, inspect, and test all metering equipment upon installation and at least once every two years thereafter. There are two options for the GIC to purchase retail energy:

- GIC can choose ComEd for retail energy. If so, ComEd bills GIC through a bundled service under Rate BESH and Rider ZSS
- GIC can choose another Retail Energy Supplier (RES). If so, ComEd bills GIC through unbundled retail delivery service under Rate RDS and Rider ZSS
- GIC can choose to self-supply retail energy. In that case, GIC needs to select another Retail Energy Supplier (RES) in the event of going net-negative for the month. If so, ComEd bills GIC through unbundled retail delivery service under Rate RDS and Rider ZSS

9.3) Retail Meter at Distribution Level

The Retail Meter measures the retail energy consumption by the GIC at distribution level. The Retail Meter is installed at the GIC facility at the distribution voltage level.

If GIC facility is located within the ComEd Service Area, ComEd would own and maintain the Retail Meter and bill the GIC using the following options for purchasing retail energy:

- The GIC can choose ComEd for retail energy. If so, ComEd bills GIC through a bundled service under Rate BESH and Rider ZSS
- The GIC can choose another RES. If so, ComEd bills GIC through unbundled retail delivery service under Rate RDS and Rider ZSS

If GIC facility is not located within the ComEd Service Area, the GIC should work with the electric utility of that area for retail energy at distribution level.

9.4) Real Time Power Meter

The GIC is responsible to install a Real Time Power Meter at the high side of its generator transformer to measure real time MW, MVAR and voltage. The GIC is responsible to transmit real time data for its generator to PJM, including but not limited to the following:

- Instantaneous net MW for the generator.
- Instantaneous net MVAR for the generator
- Instantaneous Voltage value.

Additionally, the GIC is responsible to transmit the status of transmission level circuit breakers and Motor Operated Disconnects (MODs) to PJM in real time.

9.5) Tie-Line Meter

External Tie Lines are circuits that connect the PJM Balancing Authority area with an external Balancing Authority area. Internal Tie Lines are circuits that connect the control zones within the PJM Balancing Authority area.

It is PJM protocol to install metering at each end of the External and Internal Tie-Lines, one serving as primary Tie-Line meter and the other serving as secondary or back-up Tie-Line meter.

In situations, where a GIC cuts in the Tie Line to get interconnected, GIC is required to install a Tie-Line meter at the line terminal connecting the non-ComEd substation. The Tie-Line meter will be designated as ‘primary’ or ‘secondary’ depending on the designation of Tie-Line meter located at the non-ComEd substation.