

**INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION**

**No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 1 of 34
Contact: Phil Winston**

KEY BULLETIN POINTS: THIS GUIDE OUTLINES THE MINIMUM REQUIREMENTS, FROM THE SYSTEM PROTECTION AND OPERATIONS PERSPECTIVE, FOR THE CONNECTION OF GENERATORS OWNED BY OTHER PARTIES TO THE GEORGIA POWER COMPANY (GPC) SYSTEM.

TABLE OF CONTENTS

1. OBJECTIVES.....3

2. GENERAL POLICY.....3

3. APPLICATION PROCESS.....4

A. PRELIMINARY APPLICATION AND STUDY.....4

B. RESULTS OF PRELIMINARY INTERCONNECTION STUDY.....5

C. FINAL APPLICATION AND STUDY.....5

D. INSTALLATION.....6

E. FINAL APPROVAL.....6

4. POWER FLOW.....6

A. ONE-WAY POWER FLOW.....6

B. TWO-WAY POWER FLOW.....6

5. UTILITY SYSTEM PROTECTION CONCERNS.....8

A. FAULTS.....8

B. AUTOMATIC RECLOSING.....8

C. ISLANDING.....9

6. PROTECTIVE DEVICES.....9

A. RELAYS.....9

B. INSTRUMENT TRANSFORMERS.....10

C. CIRCUIT BREAKERS.....10

D. SINGLE-PHASE DEVICES - FUSES/OIL CIRCUIT RECLOSERS.....10

E. COMMUNICATION CHANNEL.....10

7. NUG RESPONSIBILITIES.....11

A. OPERATING LIMITS.....11

 1. Voltage.....11

 2. Flicker.....11

 3. Frequency.....11

 4. Power Factor.....11

 5. Harmonics.....11

B. ISOLATION TRANSFORMER.....12

C. ENERGIZATION OF GPC EQUIPMENT BY NUG.....12

D. SYNCHRONIZATION OF NON-UTILITY GENERATION.....12

E. DISCONNECT.....13

F. CODES AND REGULATIONS.....13

G. METERING.....13

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION OF NON-UTILITY GENERATION	No. 18-8 Effective: November 1, 1979 Revised: August 22, 1997 Page: 2 of 34 Contact: Phil Winston
---	--

TABLE OF CONTENTS

H. EQUIPMENT MAINTENANCE.....13

 1. *Circuit Breakers*:.....13

 2. *Protective Relays*:.....14

 3. *Control Batteries*:.....14

8. CLASSIFICATION OF INSTALLATIONS WITH NON-UTILITY GENERATION.....15

9. SERVICE CONFIGURATION ISSUES.....26

A. DEDICATED SUBSTATION.....26

B. PADMOUNT TRANSFORMER26

C. NETWORK UNDERGROUND26

D. CLOSED TRANSITION TRANSFER SWITCHES.....27

E. PHOTOVOLTAICS27

10. PRE-PARALLEL REQUIREMENTS AND INSPECTION27

11. OPERATING GUIDELINES.....28

12. REFERENCES29

ATTACHMENTS:

- Preliminary Application
- Final Application
- Statement of Responsibility

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 3 of 34
Contact: Phil Winston

1. OBJECTIVES

This guide outlines the minimum requirements, from the system protection and operations perspective, for the connection of generators owned by other parties to the Georgia Power Company (GPC) system. Such generators can be described by several different names, such as non-utility generator (NUG), independent power producer (IPP), co-generator, or peak shaver. We will refer to all of these as NUGs. Generation is defined as any device producing electrical energy, such as rotating generators driven by steam turbines, internal combustion engines, hydraulic turbines, windmills, etc; photovoltaic or battery arrays with a DC to AC inverter; or any other electric generating device.

This bulletin is intended for use only in those situations where a NUG owner intends to operate generation in parallel with the GPC system. If the generation is intended strictly for emergency operation, open transition peak shaving, or any other type of stand-alone operation where the generation is never tied directly to the GPC system, it is not necessary to follow the procedures listed in this bulletin. If it is not readily apparent whether a NUG will operate in parallel with, as opposed to isolated from, the GPC system, a Protection and Control Engineer should be consulted to determine the proper course of action. Confusion over the parallel/nonparallel classification is common when the situation involves automatic transfer switches. See Section 9D for information on closed-transition transfer switches.

2. GENERAL POLICY

The parallel operation of a NUG with a utility electrical system raises safety and power quality concerns. In addition to protecting his own generator, the NUG owner must adequately address safety and power quality issues which may affect other users attached to the utility system or those who operate the system. In general, NUGs will be permitted to operate in parallel with the GPC system provided they do not have a negative impact on the safe operation of the system or the level of service to other GPC customers. The decision to operate in parallel should be made after consideration of the potential benefits versus the possible adverse consequences.

The requirements stated in this guide are intended to achieve the following:

- Insure the safety of the general public and GPC personnel
- Minimize the possible damage to the property of the general public, GPC, and GPC customers
- Minimize adverse operating conditions on the GPC system
- Permit the NUG owner to operate his generating equipment in parallel with the GPC system in a safe and efficient manner.

In order to achieve these goals, certain protective devices (relays, circuit breakers, etc.) must be installed to promptly disconnect the non-utility generation from the GPC system whenever a fault or abnormality occurs. The determination of what type of protective devices are required depends primarily on three major factors:

- 1) The type and size of the generating equipment
- 2) The location of the NUG on the GPC system
- 3) The manner in which the installation will operate (one-way vs. two-way power flow).

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 4 of 34
Contact: Phil Winston

In addition to the protective devices, certain modifications and/or additions may be required to the GPC system due to the addition of the non-utility generation. **Each request will be handled individually**, and the final determination of the requirements will be made by GPC. GPC will work with the NUG owner to achieve an installation which meets the requirements of both the NUG owner and GPC.

The NUG owner shall bear that portion of the costs resulting from GPC equipment additions or changes that are required to permit parallel operation of the NUG with the GPC system. The NUG owner's contribution shall be determined concurrently with the service or power purchase contract, as provided by GPC policy. Costs incurred by a utility to permit parallel operation of a NUG must be paid by the owner of the NUG, not charged to other customers or the utility share holders.

This guide does not provide information regarding the protection of any NUG facilities. GPC cannot assume any responsibility for protection of the non-utility generating equipment, or of any other portion of the NUG electrical equipment. NUG owners are solely responsible for protecting their equipment from the effects of disturbances on the GPC system.

Technical requirements are largely based on issues discussed at greater length in the references listed at the end of this document. Utility system design and operating policies are usually based on the same underlying principles, but may vary in some details from one company to another. No one should assume that the design of a non-utility generation project from one location can be duplicated for application at another location.

3. APPLICATION PROCESS

In order to process all interconnection requests in an efficient and consistent manner, GPC follows the procedures outlined below.

A. Preliminary Application and Study

The NUG owner should inform GPC of the intent to operate generating equipment in parallel with the GPC system.. A GPC Marketing representative will provide the NUG owner with a copy of this document (INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION OF NON-UTILITY GENERATION). The NUG owner should read this document and perform the following:

1. Complete and sign the "Preliminary Application for Operation of Non-Utility Generation" form (attached).
2. Develop a preliminary one-line electrical diagram of the generating equipment and the facility where it is to be located.
3. Return both items listed above to the GPC Marketing representative.

The Preliminary Application is the first formal step in the two-way exchange of information which is necessary before the successful connection and operation of a NUG can occur. The completed application and one-line diagram will be used by a GPC Protection and Control Engineer to initiate a Preliminary Interconnection Study. Additional details of the proposed facility may be required and will be requested from the NUG owner as needed. The interconnection study will address protective relaying requirements, equipment ownership, equipment upgrades, additional rights-of-way

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 5 of 34
Contact: Phil Winston

acquisitions, and factors introduced by the proposed generation on system operating conditions. In most cases, meetings will be held between GPC representatives and the NUG owner, consulting engineer, contractor, or equipment manufacturer to establish the details of the proposed installation.

The Preliminary Interconnection Study can take several weeks to complete depending on the nature of the project. The application should therefore be submitted as early as possible. An early exchange of information allows time for the resolution of any questions or misunderstandings about system operations, power flow, or protection issues. The NUG owner is also urged not to purchase any equipment or enter into any final purchase agreements until the Preliminary Interconnection Study has been completed.

B. Results of Preliminary Interconnection Study

Upon completion of the Preliminary Interconnection Study, GPC will provide the following to the NUG owner:

1. Details of any modifications required to the GPC system and/or the customer's proposed configuration.
2. A nonbinding estimate of costs to the customer and a preliminary construction schedule for the modifications required to the GPC system.

At this point the NUG owner should determine whether or not to proceed with the installation of the generating equipment. If there are questions or concerns about the Preliminary Interconnection Study, the NUG owner should contact the GPC Marketing representative, who will coordinate any meetings or discussions required.

C. Final Application and Study

If the NUG owner decides to proceed with the installation, he should inform the GPC Marketing representative of that decision, and provide the following items to the representative:

1. A completed "Final Application for Parallel Operation of Non-Utility Generation" (attached).
2. A detailed one-line diagram of the proposed facility.
3. All applicable elementary diagrams.
4. Equipment specifications and details of:
 - Generators which will be in parallel with the utility system
 - Transformers and circuit breakers in the path between the above generation and the utility system
 - Protective relays, current transformers, and voltage transformers in the utility interconnection protective scheme
 - Any other major equipment or special items.

The GPC Marketing representative will coordinate the initiation of a Final Interconnection Study and the establishment of a service contract. Development of the Final Interconnection Study and service contract can take several weeks depending on the nature of the project (excluding final engineering, construction, equipment purchase and delivery, etc.). The NUG owner is therefore requested to provide the above items as soon as practical. The service contract will include details of the

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 6 of 34
Contact: Phil Winston

customer contribution to the cost of modifications required, operational and maintenance requirements, a tentative schedule for any work to be performed, and a tentative date for the NUG interconnection and parallel operation.

D. Installation

After GPC review of the "Final Application for Parallel Operation of Customer-Owned Generation", the NUG owner may proceed with the installation of the generating equipment. Any modifications to the GPC system will be performed concurrently by GPC as determined by the conditions of the service contract. The NUG owner shall inform GPC of any changes in design or scheduling which may occur. Design changes that affect the interconnection must be reviewed and accepted by GPC.

E. Final Approval

Prior to the initial parallel operation of the NUG equipment, final approval must be obtained from GPC and the NUG owner and operator must sign the Statement of Responsibility (attached). Refer to Section 10 for details of the pre-parallel requirements and inspection.

4. POWER FLOW

The decision of the NUG owner on whether or not to export power to the GPC system is central to the design of the intertie protection package. NUG installations can be categorized as either one-way power flow or two-way power flow as described below.

A. One-Way Power Flow

In those cases where the NUG owner does not intend to sell energy to Georgia Power, the flow of power should always be from the GPC system to the NUG facility. This characteristic allows for a relatively simple intertie protection package.

B. Two-Way Power Flow

The NUG owner intends to export power to the GPC system. The available generation is in excess of minimum NUG facility load levels.

1. Technical issues

The utility system protection and control schemes have been designed based on the existing sources of energy to faults on the system. The addition of a generator creates a new source of fault current which must be cleared from the circuit, thus requiring significant changes to those previously existing schemes. Some of the systems requiring modification may be remotely located from the

DISTRIBUTION BULLETIN

GEORGIA POWER COMPANY

<p>INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION OF NON-UTILITY GENERATION</p>	<p>No. 18-8 Effective: November 1, 1979 Revised: August 22, 1997 Page: 7 of 34 Contact: Phil Winston</p>
--	---

NUG site.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 8 of 34
Contact: Phil Winston

When the intertie must allow for power flow from the NUG to the GPC system, intertie protective relaying must be installed which can sense faults while still allowing power flow in both directions. Two-way flow requires a more complex package than that required for one-way flow. The intertie protection package may involve communications circuits to allow remote tripping of GPC or NUG protective devices.

2. Business issues

This document addresses only the technical issues of NUG interconnection. In the case of two-way power flow it is possible that business issues may overlap the technical issues. It is beyond the scope of this document to describe all the possibilities, but it is essential for all parties involved to realize that a two-way power flow interconnection can raise questions regarding contracts, performance, equipment ownership and access, etc. These items must be considered as a part of the technical design of the interconnection.

5. UTILITY SYSTEM PROTECTION CONCERNS

The fundamental goal of any protection system is to detect and isolate faulted components in the power system so as to minimize personnel exposure and equipment damage. This goal must be accomplished in such a way that the remaining intact electrical system continues to function normally. Utility circuits have been designed and constructed with these goals in mind, based on the characteristics of a widespread circuit fed from a single source. When a Non-Utility Generator is added to a circuit, the protection situation changes. The NUG then becomes a contributor to utility system events. It is for this reason that Georgia Power Company requires an interconnection protection package at the NUG tie point. Here are some of the major points of concern of a utility that a prospective NUG owner should be aware of.

A. Faults

When operating in parallel with a utility system, a NUG can be a contributor of fault current to a fault on the utility system. The presence and magnitude of fault current contribution depend on several variables. The design of an interconnection protection package is dependent on those variables, but the end result must be a scheme that disconnects the NUG source from a faulted utility system.

B. Automatic Reclosing

GPC normally applies automatic reclosing after fault clearing on all transmission and overhead distribution lines. Most faults on an overhead utility circuit are temporary, and the reclosing is intended to restore service as quickly as possible. The duration of outages due to temporary faults is most frequently in the range of 0.5 - 3.0 seconds, but varies depending on many factors. The reclosing time for a particular location can be determined during the interconnection study. The NUG owner must insure that the local generation is disconnected from GPC prior to automatic reclosing. The existing automatic reclosing schemes assume that the circuit is dead and do not employ any voltage check, phasing, or synchronization schemes. GPC shall assume no responsibility for damage to NUG equipment due to out-of-phase reclosing.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 9 of 34
Contact: Phil Winston

It is possible to install voltage check schemes at various locations on the GPC system to prevent automatic reclosing in the event that a NUG remains connected to an isolated, unfaulted section of the GPC system. These schemes may also be required on alternate circuits that can supply power to that location. The cost of such modifications would be borne completely by the NUG owner. Such modifications can usually be justified only in the case of large scale projects involving two-way power flow.

C. Islanding

At those installations where generation size is equal to or greater than the NUG site load, the possibility that a portion of the GPC system may become "islanded" must be considered. Islanding is an undesirable situation where a portion of the GPC system, including the NUG and other GPC customers, continues to operate as a power system isolated from the rest of the utility grid. Such a situation could be caused by an automatic operation required to isolate a fault on another part of the system. This condition causes various operating and safety problems and is not tolerable. During the period of isolated operation, other customers in the islanded area could suffer from poor service quality in terms of voltage, frequency, flicker, and harmonic distortion. If the isolated system is still operating when the utility source returns, it is highly likely that the two systems will be out of phase and equipment damage will be the result. GPC shall assume no responsibility for damage to NUG equipment or nearby customers' equipment due to out-of-phase reclosing. The NUG is required to separate from the GPC system when a loss-of-utility situation occurs.

6. PROTECTIVE DEVICES

Various protective devices are required to permit the safe and proper operation of the GPC/NUG interconnection. Determination of the device requirements will be made by GPC during the interconnection studies. GPC shall own, operate and maintain all protective equipment associated with the interconnection to insure that these requirements are met; however, for installations classified as small or extremely small, it may be determined by GPC that certain protective equipment may be owned by the NUG owner. Determination of ownership will be made during the interconnection studies. All protective equipment and settings (if applicable) must be reviewed and accepted by GPC.

A. Relays

Protective relays are required to promptly sense abnormal system conditions and initiate the isolation of the problem area. Protective relays can generally be categorized into two major groups: industrial grade and utility grade. Utility grade relays have a higher degree of reliability and accuracy, and are required in most cases. The use of GPC-approved industrial grade relays may be permitted on generation installations classified as extremely small (rated less than 100 kVA). In cases where GPC has approved NUG ownership of the intertie protection relays, those relays must be grouped in a package which is physically separate from any other relays and controls, and must be labeled as utility intertie protective relays. In most cases the intertie protection relays will be housed in a separate box. Details of the mounting location should be developed during the interconnection study. GPC must review and accept the selection and settings of any relays in the intertie package. GPC does not provide specifications or settings for the relays which protect the generator.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 10 of 34
Contact: Phil Winston

B. Instrument Transformers

Instrument transformers that are used to provide quantities representative of the high voltage power system to the relays are a critical part of the protection package. These current transformers (CTs) and voltage transformers (VTs) are available with different current and voltage ratings and accuracy class ratings. It is important that any current transformers involved in protective schemes are rated as relaying accuracy class devices. The suitability of a given CT selection will be checked during the final study. Revenue metering CTs are generally **not** suitable for protective relaying applications. Switchable contacts, such as those used for panel ammeters, should not be installed in the same CT circuit as protective relays.

C. Circuit Breakers

GPC shall own, maintain, and operate the intertie circuit breaker at all installations where the NUG has been classified as large. The interconnection study shall determine ownership alternatives in other cases. Upgrading or replacement of existing circuit breakers within or outside the area of the interconnection may be required due to the increased fault current levels. Circuit breakers owned by GPC are dedicated to utility protection and operation purposes and will not be used for NUG synchronization.

D. Single-Phase Devices - Fuses/Oil Circuit Reclosers

It may be necessary to replace single-phase devices (line fuses, single-phase automatic circuit reclosers) existing between the GPC source substation and the NUG location with three-phase devices. Replacement would minimize the possibility of single-phasing a NUG's three-phase generator. Single-phase sectionalizing equipment may be installed on the main circuit past the NUG location, or on radial circuits that tap the main circuit between the source substation and the NUG location.

The NUG owner is responsible for protecting NUG equipment from the effects of excessive negative sequence currents or any other effects caused by system imbalance. GPC does not protect the NUG facility from single-phasing conditions.

E. Communication Channel

GPC may require that a communication channel be installed as part of the protective scheme. This channel may consist of power line carrier, pilot wire circuit, fiber optic cable, radio, or other means. The communication channel is required in cases where it is necessary to remotely send a signal to remove the NUG from the GPC system due to a fault or other abnormal conditions which can not be sensed by the protective devices at the NUG location. A second possible need for a communications channel is for monitoring or control purposes. The interconnection study will determine the communication channel requirements.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 11 of 34
Contact: Phil Winston

7. NUG RESPONSIBILITIES

The following requirements apply to all generating equipment operated in parallel with the GPC system. This applies to all three-phase and single-phase generators or inverter installations, as appropriate.

A. Operating Limits

In order to minimize objectionable and adverse operating conditions on the electric service provided to other customers on the GPC system, the NUG shall meet the following operating criteria:

1. Voltage

The NUG shall operate at a level of plus/minus 6.0% of the nominal voltage stated in the service contract. The NUG owner shall provide an automatic means of disconnecting the generating equipment from the GPC system within one second if the voltage cannot be maintained within this tolerance.

2. Flicker

The NUG shall not cause voltage flicker in excess of 2% as measured at the primary side of the dedicated transformer (if present). If a dedicated transformer is not present, voltage flicker shall not exceed 6% as measured at the NUG service equipment. Details of flicker calculations are outlined by GPC Distribution Engineer's Handbook and can be obtained on request.

3. Frequency

The operating frequency of the NUG equipment shall not deviate more than one-half of a hertz from a 60 hertz base. The NUG owner shall provide an automatic method of disconnecting the generating equipment from the GPC system within 0.2 seconds if the frequency can not be maintained within this tolerance.

4. Power Factor

The NUG service, including load and generation, shall have a power factor within the range of 0.85 leading to 0.85 lagging.

5. Harmonics

The NUG equipment shall not introduce excessive distortion to the GPC system's voltage and current waveforms. The harmonic distortion measurements shall be made at the point of interconnection between the NUG and the GPC system and be within the limits specified in the tables below.

<p>INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION OF NON-UTILITY GENERATION</p>	<p>No. 18-8 Effective: November 1, 1979 Revised: August 22, 1997 Page: 12 of 34 Contact: Phil Winston</p>
--	--

a. Current Harmonics

MAXIMUM ALLOWABLE HARMONIC CONTENT (CURRENT)
 (in percent of total current)

Harmonic Order Number (h)

	h < 11	12 < h < 16	17 < h < 23	24 < h < 35	36 < h
ODD	4.0	2.0	1.5	0.6	0.3
EVEN	1.0	0.5	0.38	0.15	0.08

TOTAL CURRENT HARMONIC DISTORTION MAY NOT EXCEED 5.0%

b. Voltage Harmonics

MAXIMUM ALLOWABLE HARMONIC CONTENT (VOLTAGE)
 (in percent)

Maximum Individual Harmonic : 3.0

Maximum Total Harmonic Distortion: 5.0

Note that the values shown are for NUG/GPC interconnection points below 69 kV, and are based upon IEEE 519-1992. If the NUG/GPC interconnection point is at a voltage greater than 69 kV, more stringent tolerances will be required and will be specified by the interconnection studies.

B. Isolation Transformer

In order to provide maximum operating flexibility for the NUG and to minimize possible adverse effects on other GPC customers, a power transformer is usually required between the NUG and GPC-owned equipment. This transformer is usually connected in such a manner as to isolate the zero sequence circuit of the NUG from the zero sequence circuit of the GPC system. The Final Interconnection Study will determine the transformer connection and grounding configuration required, and whether a dedicated GPC-owned transformer will be required to serve a NUG. Upgrading of GPC transformer insulation levels and lightning arrester ratings to a higher voltage may be required due to the addition of a NUG.

C. Energization of GPC Equipment by NUG

The NUG shall not energize a de-energized GPC circuit. The necessary control devices shall be installed by the NUG owner to prevent the energization of a de-energized GPC circuit by the NUG.

D. Synchronization of Non-Utility Generation

Each time a generator is tied to an energized utility system, it must be synchronized with the utility system before the tie breaker is closed. The NUG owner is responsible for the synchronization of the

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 13 of 34
Contact: Phil Winston

NUG to the GPC system. The breaker that is closed to complete the tie must be owned by the NUG owner. GPC equipment will not be used for this purpose.

E. Disconnect

A disconnect device shall be installed to electrically isolate the GPC system from the NUG. This device shall provide a visible air gap between the NUG and the GPC system in order to establish the open break to satisfy safety requirements for maintenance and repair work on the GPC system. This disconnect device shall be readily accessible to, and allow padlocking by, GPC personnel. The disconnect must be designed to allow the application of safety grounds on the GPC side of the disconnect.

F. Codes and Regulations

The requirements set forth by this document are intended to comply with utility regulations issued by State of Georgia and Federal regulatory agencies. It is the responsibility of the NUG owner to comply with applicable local electrical and safety codes. Any inspection or testing by GPC representatives to verify compliance with GPC requirements is solely for the protection of the GPC system.

G. Metering

Modifications to the revenue metering are usually required due to the installation of customer generation. The modifications required are as follows:

- a. Customer does not desire to sell energy to GPC (One-way power flow):
The existing watt-hour meter will be replaced with a meter system capable of measuring appropriate revenue determinants (in this case power delivered to the customer).
- b. Customer desires to sell energy to GPC (Two-way power flow):
The existing watt-hour meter will be replaced with a meter system capable of measuring appropriate revenue determinants (in this case power delivered to the customer and power received from the customer).

H. Equipment Maintenance

Any interconnection protective devices owned by the NUG owner (as determined by the Final Interconnection Study) shall be maintained and tested by qualified personnel. A summary of the type of maintenance and testing required shall be as follows:

1. Circuit Breakers:

- a. Visual Inspection

Visual inspection of bushings for cracks, leaks, discoloration due to heating, etc. Read and record operation counter.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 14 of 34
Contact: Phil Winston

b. Operational Inspection

General inspection of breaker including lubrication of operating mechanism, check oil levels, check bushings, trip test breaker, etc.

c. Major Inspection

All requirements of an operational inspection plus megger test of insulation, mechanical/hydraulic/pneumatic system check, electrical connection checks, oil sample testing, tank removal and inspection of contact alignment, operation and wear, filtration/replacement of oil.

2. Protective Relays:

a. Visual Inspection

All interconnection protective relays should be visually inspected (**not** removed from their case or physically disturbed) for any obvious signs of damage or inoperability. Any indication of relay inoperability shall be reported to GPC immediately and may require the temporary suspension of generation. The operation of any relay targets shall be reported to GPC immediately.

b. Operational Inspection

Relays shall be tested by applying appropriate currents, voltages, or frequencies to verify proper operation. Items to be checked include, but are not limited to:

- Minimum pickup value
- Time delay at specified multiples of minimum pickup
- Phase angle characteristics

All relays are to meet the following tolerances:

Voltage: plus/minus 3%
Current: plus/minus 3%
Time: plus/minus 5%
Frequency: plus/minus 0.2 Hz
Phase angle: plus/minus 3 degrees

3. Control Batteries:

1. Visual Inspection

Visual inspection of all cells for cracked jars, cracked plates, leaking electrolyte, condition of terminal posts, connections and cell electrolyte levels. Add water to cells with low electrolyte levels.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 15 of 34
Contact: Phil Winston

2. Operational Inspection

Testing/Maintenance: Check of electrolyte specific gravity and temperature, voltage of each individual cell and total battery, charging current, etc. Corrections of any abnormal conditions must be made immediately.

The activities described above are to be part of a scheduled cycle of routine maintenance. Copies of all test reports from Operational and Major Inspections must be kept on file at the generator site. GPC maintains the right to verify on demand the calibration and operation of all protective equipment. GPC will periodically contact the NUG owner to obtain copies of the protective relay maintenance records and schedule tests similar to those performed at the time of the pre-parallel inspection (Section 8 of this document) Verification will include tripping of the intertie breaker by the interconnection relays.

Proper maintenance of the protective devices will be a requirement for continued parallel operation of the NUG. GPC reserves the right to open the intertie connection if the maintenance requirements described in this document have not been met.

If GPC is required or requested to do work on the NUG owner's premises, an inspection of the work area may be made by GPC operating personnel. If hazardous working conditions are detected, the NUG owner shall be required to correct the unsafe conditions before GPC will perform the work required.

8. CLASSIFICATION OF INSTALLATIONS WITH NON-UTILITY GENERATION

The classification of a NUG facility will be made by GPC during the Preliminary Interconnection Study. The determination of what type of protective devices are required depends primarily on three major factors:

- 1) The type and size of the NUG equipment
- 2) The location of the NUG on the GPC system
- 3) The manner in which the installation will operate (one-way vs. two-way power flow)

The following guidelines are used to determine the classification of a NUG (the aggregate sum of all sources of generation at one location):

LARGE: Generation is greater than 3 MVA
or
the possibility of "islanding" a portion of the GPC system exists.

SMALL: Generation which is not classified as large or extremely small.

EXTREMELY SMALL: Generation less than 100 kVA

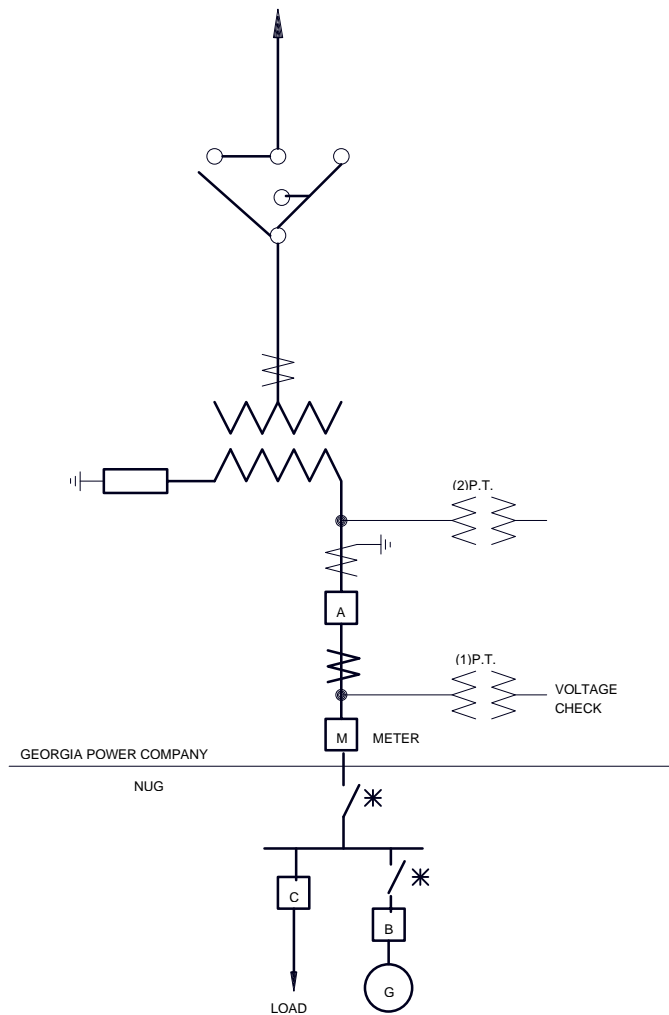
<p>INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION OF NON-UTILITY GENERATION</p>	<p>No. 18-8 Effective: November 1, 1979 Revised: August 22, 1997 Page: 16 of 34 Contact: Phil Winston</p>
--	--

In general, an increased degree of protection is required for large generation installations due to the greater magnitudes of short circuit currents from these installations. These larger installations therefore require more sensitive and faster protection schemes to minimize damage and insure safety. A second consideration for large generation installations is the possibility that a portion of the GPC system may become "islanded", as detailed in Section 5C of this document.

The figures which follow show typical installations for the various combinations of generation size, interconnection location, and manner of operation. It must be emphasized that **these are typical installations only** and **the final installation may vary from the examples shown** due to transformer connections, breaker configurations, etc. **DO NOT USE THESE EXAMPLES AS A CATALOG FROM WHICH TO SELECT A PROTECTION SCHEME.** The exact protective device requirements will be established during the interconnection studies.

Figure No.	Generation Class	Interconnection Location	Power Flow
1	Large	Transmission system	Two-way
2	Large	Transmission system	One-way
3	Large	Distribution system	Two-way
4	Large	Distribution system	One-way
5	Small	Transmission system	Two-way
6	Small	Transmission system	One-way
7	Small	Distribution system	Two-way
8	Small	Distribution system	One-way
9	Extremely Small	Distribution system	One or Two-way

GPC Transmission System (46kV and above)
 Voltage checking may be required at Transmission System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
50/51	Phase Overcurrent
87	Transformer Differential
51G/51N	Ground Overcurrent
63	Transformer Fault Pressure
21	Impedance
121	Impedance
62	Timer for 121
59G	Zero Sequence Overvoltage
59/27	Overvoltage / Undervoltage
81	Over/Underfrequency

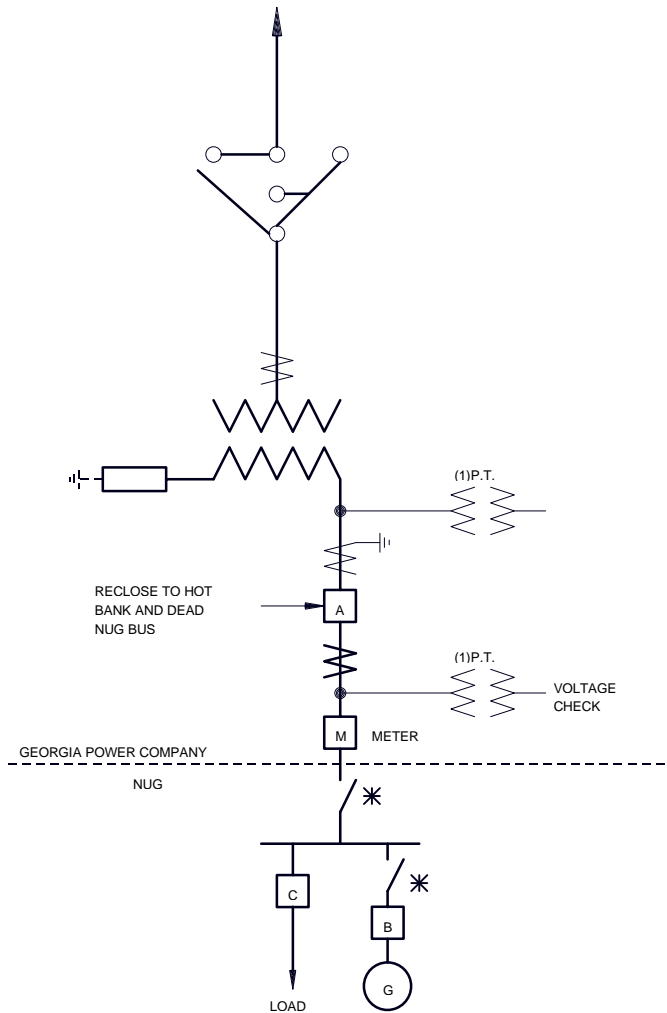
Relays trip Breaker A or both A and transformer high side AIM switch depending on conditions.

Breaker A may reclose only if utility bank is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 1
Large Generation
Typical Transmission Interconnection with Two-Way Power Flow

GPC Transmission System (46kV and above)
 Voltage checking may be required at Transmission System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
50/51	Phase Overcurrent
87	Transformer Differential
51G/51N	Ground Overcurrent
63	Transformer Fault Pressure
32	Reverse Power
62	Timer for 32

Relays trip Breaker A or both A and transformer high side AIM switch depending on conditions.

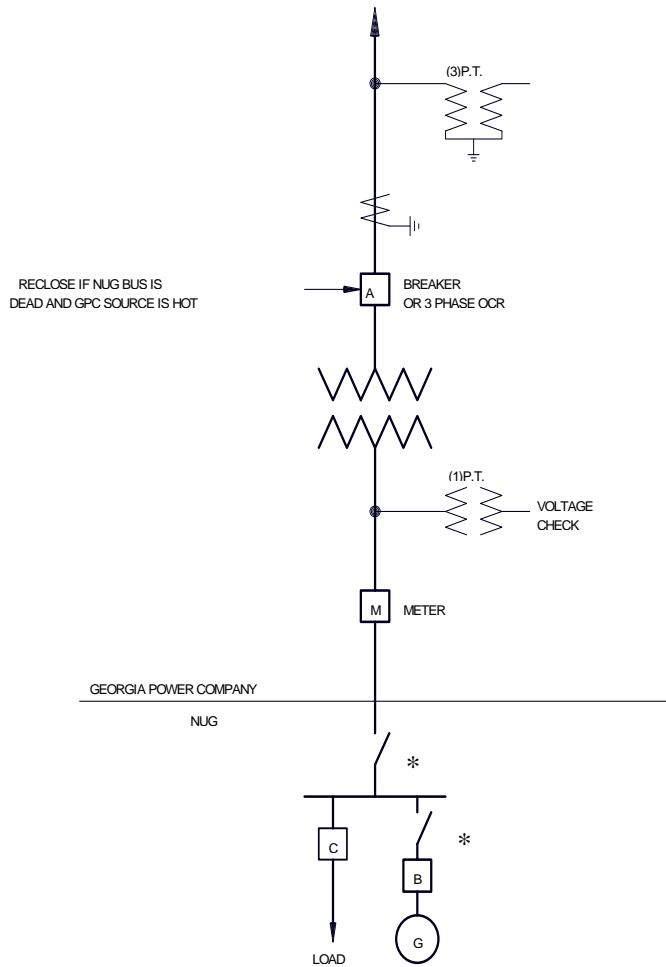
Breaker A may reclose only if utility bank is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 2
Large Generation
Typical Transmission Interconnection with One-Way Power Flow

GPC Distribution System (25kV and below)

Voltage checking may be required at Distribution System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
59/27	Overvoltage / Undervoltage
81	Over/Underfrequency
59G	Zero Sequence Overvoltage
50/51	Phase Overcurrent
50/51N	Ground Overcurrent

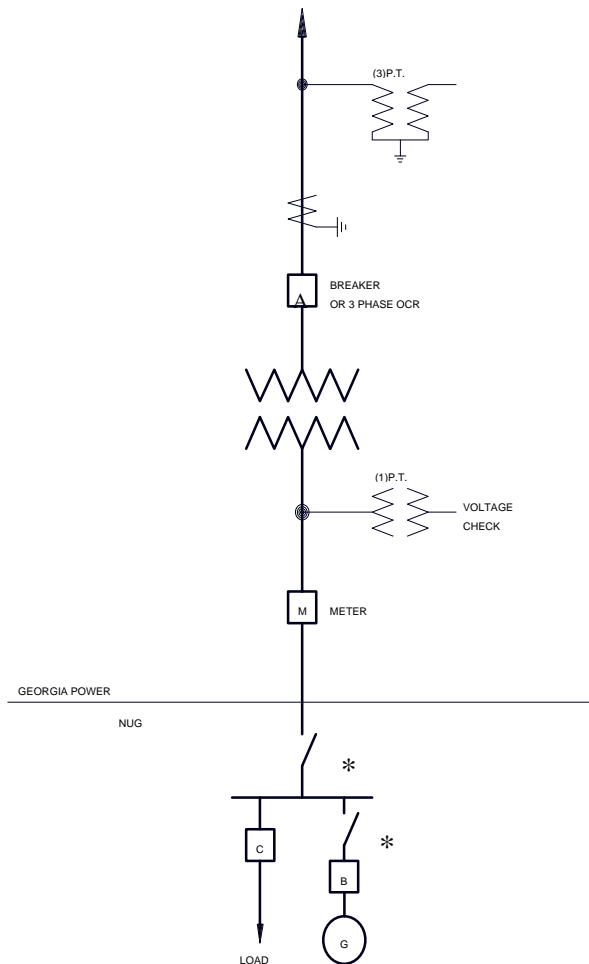
Relays trip Breaker/Recloser A.

Breaker A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 3
Large Generation
Typical Distribution Interconnection with Two-Way Power Flow

GPC Distribution System (25kV and below)
 Voltage checking may be required at Distribution System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
32	Reverse Power
62	Timer for 32
59G	Zero Sequence Overvoltage
50/51	Phase Overcurrent
50/51N	Ground Overcurrent

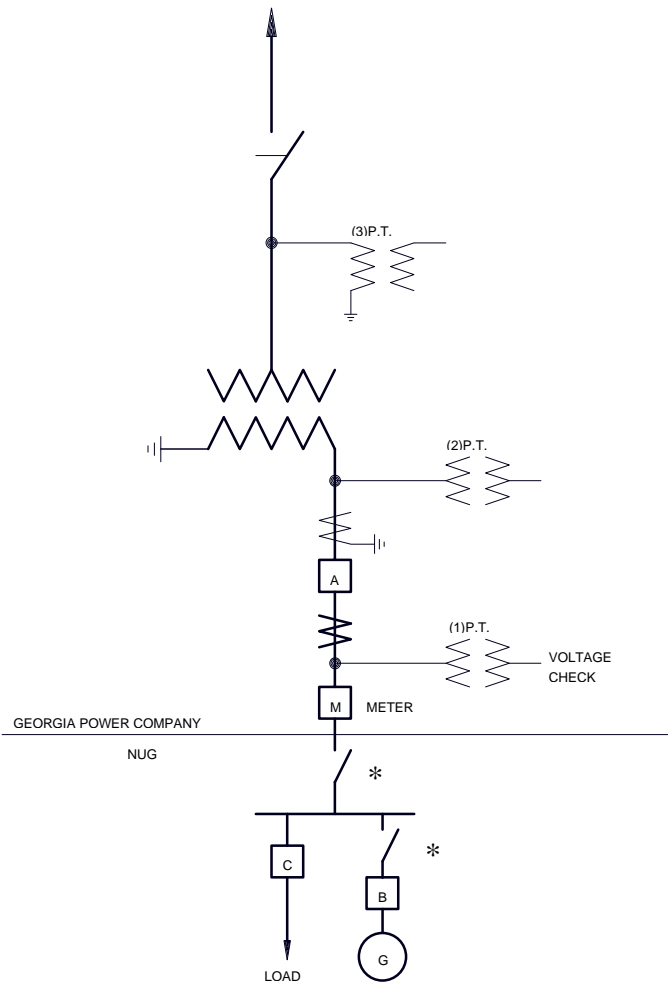
Relays trip Breaker/Recloser A.

Breaker/recloser A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 4
Large Generation
Typical Distribution Interconnection with One-Way Power Flow

GPC Transmission System (46kV and above)
 Voltage checking may be required at Transmission System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
59G	Zero Sequence Overvoltage
59/27	Overtvoltage / Undervoltage
81	Over/Underfrequency
46	Negative Sequence Overcurrent (Current Unbalance)
62	Timer for 46
51	Phase Overcurrent
51N	Ground Overcurrent

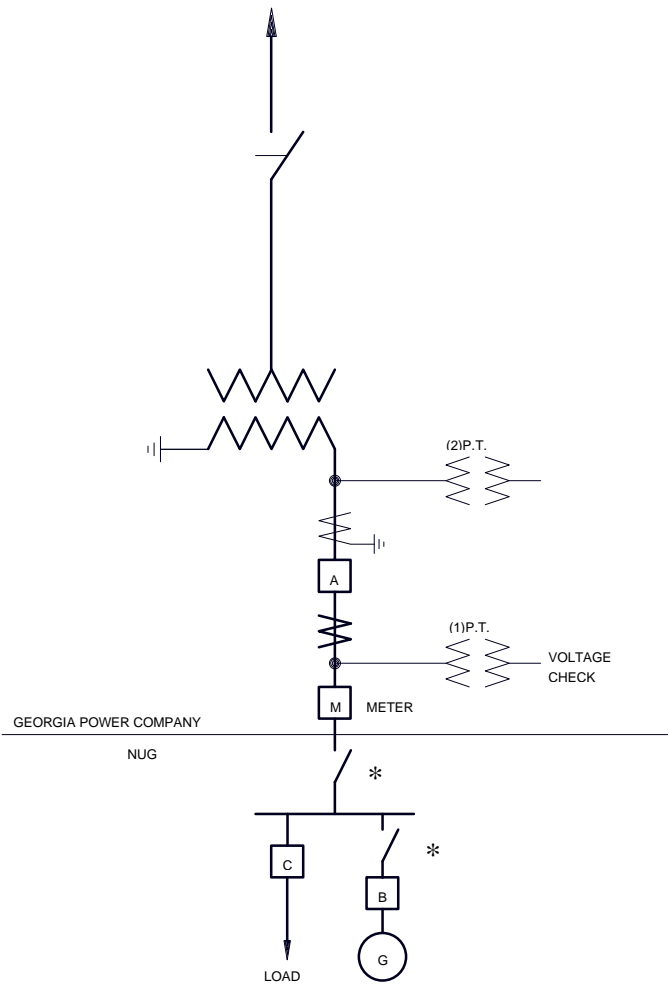
Relays trip Breaker A.

Breaker A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 5
Small Generation
Typical Transmission Interconnection with Two-Way Power Flow

GPC Transmission System (46kV and above)
 Voltage checking may be required at Transmission System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
32	Reverse Power
62	Timer for 32
47	Negative Sequence
	Overtoltage (Voltage Unbalance)
162	Timer for 47
51	Phase Overcurrent
51N	Ground Overcurrent

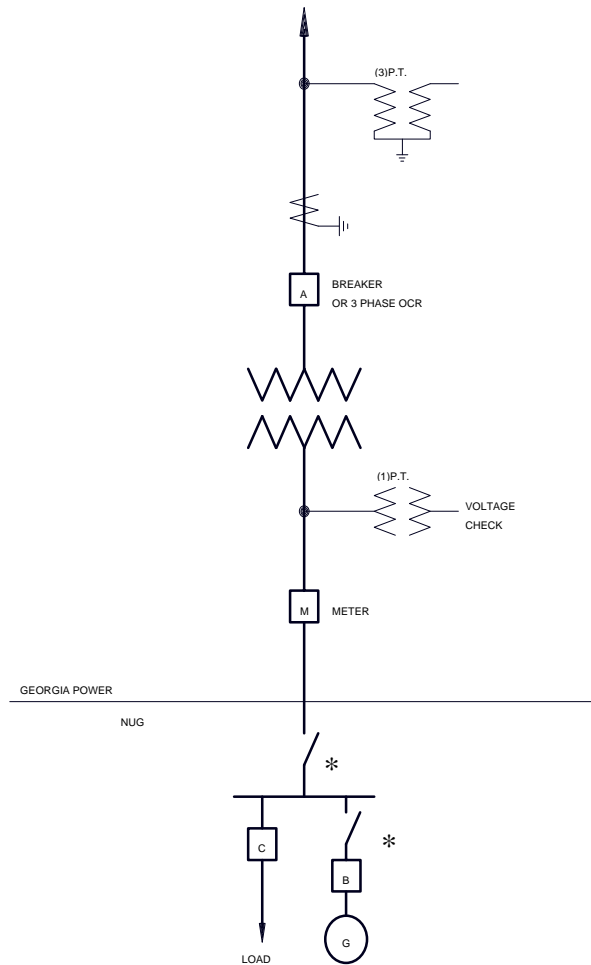
Relays trip Breaker A.

Breaker A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 6
Small Generation
Typical Transmission Interconnection with One-Way Power Flow

GPC Distribution System (25kV and below)
 Voltage checking may be required at Distribution System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
59/27	Overtoltage / Undervoltage
81	Over/Underfrequency
59G	Zero Sequence Overtoltage
50/51	Phase Overcurrent
50/51N	Ground Overcurrent

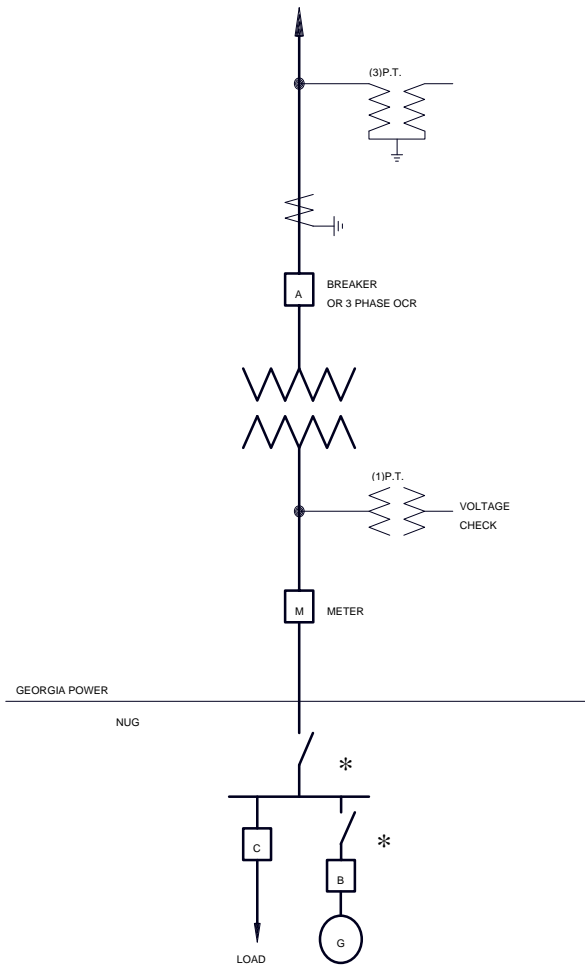
Relays trip Breaker/Recloser A.

Breaker/recloser A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 7
Small Generation
Typical Distribution Interconnection with Two-Way Power Flow

GPC Distribution System (25kV and below)
 Voltage checking may be required at Distribution System source(s).



Relaying in the Georgia Power Company substation may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
32	Reverse Power
62	Timer for 32
59G	Zero Sequence Overvoltage
50/51	Phase Overcurrent
50/51N	Ground Overcurrent

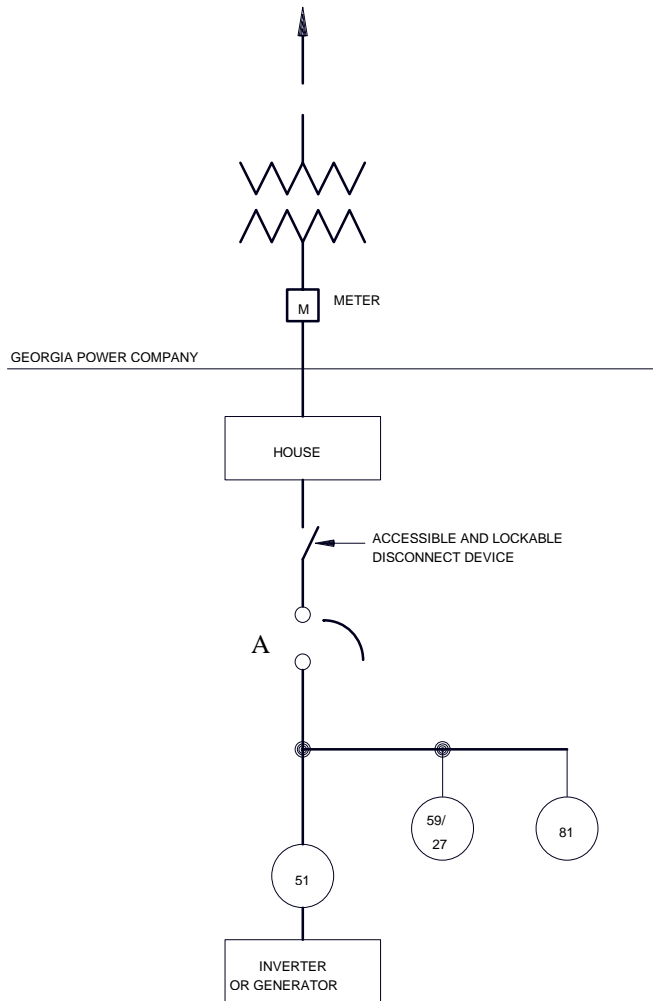
Relays trip Breaker/Recloser A.

Breaker/recloser A may reclose only if utility source is hot and NUG bus is dead.

*Possible locations for accessible and lockable disconnect device.

Figure 8
Small Generation
Typical Distribution Interconnection with One-Way Power Flow

GPC Distribution System (25kV and below)



Relaying at the interconnection may include some or all of the following:

<u>Device No.</u>	<u>Function</u>
51	Phase Overcurrent
59/27	Overvoltage / Undervoltage
81	Over/Underfrequency

Relays trip Breaker A.

**Figure 9
Extremely Small Generation
Typical Distribution Interconnection with One-Way or Two-Way Power Flow**

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 26 of 34
Contact: Phil Winston

9. SERVICE CONFIGURATION ISSUES

The GPC system includes many different voltage levels and equipment configurations. There are also several different types of NUG systems in use. It is difficult to predict every possible set of circumstances which can combine on a particular project to affect the interconnection protection scheme. Some topics do tend to come up repeatedly on certain types of service configurations. This section will address some of the issues that arise for particular classes of service or equipment types.

A. Dedicated Substation

Some locations are connected to the utility system by a dedicated substation that is not shared with any other customers or facilities. This type of facility is usually the most adaptable to the addition of a NUG. The presence of a substation control house, relaying accuracy class instrument transformers, other protection and control schemes, or utility breakers and switches can have quite an impact on the design process. In many cases, GPC can add the necessary relay package to existing facilities.

B. Padmount Transformer

Service to a location by padmount transformer usually brings up two points that should be considered during the design process.

The first issue is location and ownership of the intertie protective relays and instrument transformers. Two possible solutions could be that GPC would install a padmount enclosure or that the NUG owner would install an appropriate enclosure near or inside the facility.

The second issue has to do with the concept of an isolation transformer. Most GPC padmount transformers are grounded wye-grounded wye. This configuration does not isolate the zero-sequence circuit of the NUG from that of GPC, thus allowing the NUG to contribute fault current to phase-to-ground faults on the GPC system and to have a possible harmonic distortion contribution. Some GPC padmount transformers are of a four-legged core design which does effectively isolate the zero-sequence circuits and block harmonic distortion contributions.

C. Network Underground

The network underground system is designed to provide a high level of reliability using multiple transformers in each vault. Each transformer is served from a different source circuit, and the low voltage sides of all the transformers in a vault are tied together on a common bus. A network protector is mounted on each transformer which will trip upon sensing a reverse power condition. The protectors reclose based on voltage and phase relationships across the open contacts of the protectors as opposed to reclosing at a fixed time interval, thus the reclosing time is unpredictable. The increased complexity of a network underground system compared to other distribution systems places additional constraints on local generation. A NUG located on a network underground service must be designed only for one-way power flow because the network system is not capable of distinguishing power export from fault current towards a faulted source cable. Tripping all the protectors in a vault would result in an islanding situation which will also expose the facility to out-of-phase reclosing. NUG systems which are poorly designed or improperly operated can actually cause a reduction in the overall level of reliability.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 27 of 34
Contact: Phil Winston

NUG systems in this environment must be designed to avoid tripping the network protectors under any circumstances. Precise control of generator output magnitude and angle is critical during switching transitions. Peak shaving schemes should be designed to maintain a level of import that is large enough to offset the dropout of a large piece of equipment in the facility. Generally, the smaller the import level is to a facility during NUG operation, the greater the probability is that the protectors will open during an unplanned event. Experience has shown that facilities capable of generating close to 100% of their total load will experience problems. Events have occurred at such installations that have caused some utilities to institute outright bans on generation at network underground facilities.

D. Closed Transition Transfer Switches

Automatic transfer switches are available which keep the time of parallel operation of a NUG with the utility system to a very brief period. The sequence and time period is usually dependent on the proper operation of a control circuit integral to the switch. There is no mechanical interlock in the scheme. GPC requires that a protective relay intertie package be installed when this type of switch is used. The package is usually very basic but it must be reviewed and tested in the same manner as other more complex designs.

E. Photovoltaics

So far, NUG activity on the GPC system has been almost totally comprised of rotating machines. The photovoltaic industry does seem to be maturing and interest in this method of generation is bound to increase as the economic payback picture improves. IEEE now has in the draft and revision process Standard P929, Recommended Practice for Utility Interface of Photovoltaic (PV) Systems. GPC intends to review P929 upon its final publication with the hope of adopting most or all of it as the GPC interconnection standard for PV systems. This approach holds the possibility that small PV systems (under 10kW) will use standardized inverters tested to a UL standard. Larger systems will probably still be custom engineered and have a more complex interconnection.

10. PRE-PARALLEL REQUIREMENTS AND INSPECTION

Prior to the parallel operation of a NUG with the GPC system, all applicable service contracts shall be in place and signed, and all equipment modifications and/or additions shall be complete. Having satisfied these requirements, an inspection shall be performed by GPC test personnel to insure the proper installation and operation of the interconnection protective devices. This inspection applies to both GPC and NUG interconnection equipment. The inspection shall include, but not be limited to:

Verification that the installation is in accordance with the service contract and the Final Interconnection Study.

Verification of the proper operation of the interconnection protective schemes.

Verification that the proper voltages and currents are applied to the interconnection protective relays.

Verification of proper operation and settings of the interconnection protective relays.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 28 of 34
Contact: Phil Winston

Verification of proper voltage and phase rotation.

Trip testing of the breaker(s) tripped by the interconnection relays, preferably under real system conditions.

Upon performance and acceptance of the pre-parallel inspection by GPC personnel, the NUG owner shall be granted approval for operation of the generating equipment in parallel with the GPC system. Neither the inspection nor the granting of approval to operate shall serve to relieve the NUG owner of any liability for injury, death or damage attributable to the negligence of the owner.

11. OPERATING GUIDELINES

The NUG owner shall operate the generating equipment within the guidelines of this document and any special requirements set forth by the service contract. GPC reserves the right to open the intertie circuit breaker or disconnect device for any of the following reasons:

GPC system emergency.

Inspection of a NUG's generating equipment and protective equipment reveals a hazardous condition, or a lack of scheduled maintenance and testing.

Failure of the NUG owner to provide maintenance and testing reports to GPC upon request.

The NUG equipment interferes with other customers or with the operation of the GPC system.

The NUG owner has modified the generating equipment or protective devices without the knowledge or approval of GPC.

Parallel operation of any unapproved NUG equipment.

Personal safety is threatened.

The failure of GPC to open the intertie circuit breaker or disconnect device shall not serve to relieve the NUG owner of any liability for injury, death or damage attributable to the negligence of the NUG owner.

The NUG owner should also be aware that changes to the GPC system, or the addition of other customers with generation in the vicinity, may require modifications to the interconnection protective devices. If such changes are required, the NUG owner may be subject to future charges for these modifications.

INTERCONNECTION REQUIREMENTS AND PARALLEL OPERATION
OF NON-UTILITY GENERATION

No. 18-8
Effective: November 1, 1979
Revised: August 22, 1997
Page: 29 of 34
Contact: Phil Winston

12. REFERENCES

- "National Electrical Safety Code", ANSI C2-1993, Published by The Institute of Electrical and Electronics Engineers, Inc.
- "IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus", ANSI/IEEE C37.90, 1989 (R1994).
- "Guide for Protective Relaying of Utility-Consumer Interconnections", ANSI/IEEE C37.95, 1989 (R1994).
- "IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems", ANSI/IEEE Std. 1001, 1988.
- "IEEE Recommended Practice for Utility Interconnection of Small Wind Energy Conversion Systems", ANSI/IEEE Std. 1021, 1988.
- "Intertie Protection of Consumer-Owned Sources of Generation, 3 MVA or Less", IEEE Publication 88 THO224-6-PWR
- "Reliability Considerations for Integrating Non-Utility Generating Facilities with the Bulk Electric Systems", North American Electric Reliability Council, Princeton, NJ 08540, April 1987.
- Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems** - "Buff Book", ANSI/IEEE Std. 242-1986 (R1991).
- Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications** - "Orange Book", ANSI/IEEE Std. 446-1995.
- The National Electrical Code**, National Fire Protection Association, Quincy, MA, 02269, ANSI/NFPA-70-1996.

13. ATTACHMENTS

- A. Preliminary Application for Operation of Non-Utility Generation
- B. Final Application for Operation of Non-Utility Generation
- C. Statement of Responsibility for Non-Utility Generation connected to the Georgia Power Company System



**Preliminary Application for
Operation of Non-Utility Generation**

WHO SHOULD FILE THIS APPLICATION: *Anyone expressing interest to connect generation on their premises to the Georgia Power Company system. This application should be completed as soon as possible and returned to the GPC Marketing representative in order to begin processing the request.*

INFORMATION: *This application is used by the Georgia Power Company to perform a Preliminary Interconnection Study to determine the interface requirements at the generation service point. The applicant should attempt to fill in as much of the form as possible. The applicant will receive a preliminary estimate for the utility interface requirements that may be used in calculating the overall project requirements.*

OWNER / APPLICANT INFORMATION

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____ Zip Code: _____
 Phone: _____ Representative: _____

PROJECT DESIGN / ENGINEERING

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____ Zip Code: _____
 Phone: _____ Representative: _____

ELECTRICAL CONTRACTOR

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____ Zip Code: _____
 Phone: _____ Representative: _____

GENERATOR DATA

Manufacturer _____ Model: _____
 Type: Synchronous ___ Induction ___ Phases: Single ___ Three ___ Frequency (Hz): _____
 Rated Output: _____ Kilowatt _____ Kilovolt-Ampere
 Rated Power Factor (%): _____ Rated Voltage (Volts): _____ Rated Amperes: _____
 Energy Source (gas, steam, hydro, etc.): _____

ESTIMATED LOAD INFORMATION

The following information will be used to help properly design the GPC-customer interconnection. This information is not intended as a commitment or contract for billing purposes.

Minimum anticipated load (generation not operating)
 _____ (kW) _____ (kVA)

Maximum anticipated load (generation not operating)
 _____ (kW) _____ (kVA)



**Final Application for
Operation of Non-Utility Generation**

WHO SHOULD FILE THIS APPLICATION: *Anyone defined by the GPC Preliminary Interconnection Study as having generation capable of operating in parallel with the Georgia Power Company system. **This application should be completed as soon as possible and returned to the GPC Marketing representative in order to begin final processing.***

INFORMATION: *This application is used by the Georgia Power Company to perform a Final Interconnection Study to determine the required equipment configuration for the GPC/NUG INTERFACE.. The applicant should attempt to fill in as much of the form as possible.*

ADDITIONAL REQUIREMENTS: *Please attach a detailed one-line diagram of the proposed facility, applicable elementary diagrams, specifications and test reports for major equipment (generators, transformers, inverters, circuit breakers, protective relays, etc.), and any other applicable drawings or documents necessary for the proper design of the interconnection.*

Owner / Applicant Information

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____
 Zip Code: _____ Phone: _____
 Representative: _____

Project Design / Engineering

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____
 Zip Code: _____ Phone: _____
 Representative: _____

Electrical Contractor

Company: _____
 Mailing Address: _____
 City: _____ County: _____ State: _____
 Zip Code: _____ Phone: _____
 Representative: _____

Estimated Load Information

The following information will be used to help properly design the GPC-NUG interconnection. This information is not intended as a commitment or contract for billing purposes.

Minimum anticipated load (generation not operating)

_____ (kW) _____
 (kVA)

Maximum anticipated load (generation not operating)

_____ (kW) _____
 (kVA)

Complete all applicable items. Copy this page as required for additional generators.

Synchronous Generator Data

Unit Number _____ Total number of units with listed specifications on site _____
 Manufacturer _____
 Type _____ Date of Manufacture _____
 Serial Number _____ Phases: Single _____ Three _____ R.P.M.: _____
 Rated Output (for one unit) _____ Kilowatts _____ Kilovars _____
 Rated Power Factor (%) _____ Rated Voltage _____ Rated Amperes _____
 Synchronous Reactance (Xd) _____ % on _____ KVA base
 Transient Reactance (X'd) _____ % on _____ KVA base
 Subtransient Reactance (X''d) _____ % on _____ KVA base
 Negative Sequence Reactance(Xs) _____ % on _____ KVA base
 Zero Sequence Reactance (Xo) _____ % on _____ KVA base
 Neutral Grounding Resistor (if applicable) _____
 I²t or K (heating time constant) _____
 Additional information _____

Induction Generator Data

Rotor Resistance (Rr) _____ ohms Stator Resistance (Rs) _____ ohms
 Rotor Reactance (Xr) _____ ohms Stator Reactance (Xs) _____ ohms
 Magnetizing Reactance (Xm) _____ ohms Design Letter _____
 Short Circuit Reactance (Xd'') _____ ohms Frame Size _____
 Reactive Power Required _____ Vars (no load) _____ Vars (full load)
 Additional information _____

Prime Mover Data

Energy Source (hydro, steam, wind, etc.) _____
 Unit Number _____ Type _____
 Manufacturer _____
 Serial Number _____ Date of manufacture _____
 H.P. Rated _____ H.P. Max _____

Generator Transformer Data (transformer between generator and utility)

Generator unit number _____ Date of manufacture _____
 Manufacturer _____
 Serial number _____
 High voltage _____ Volts Connection: _____ delta _____ wye, Neutral grounded? _____
 Low voltage _____ Volts Connection: _____ delta _____ wye, Neutral grounded? _____
 Transformer impedance (Z) _____ % on _____ KVA base
 Transformer Resistance (R) _____ % on _____ KVA base
 Transformer Reactance (X) _____ % on _____ KVA base
 Neutral Grounding Resistor (if applicable) _____

Inverter Data (if applicable)

Manufacturer _____ Model _____
Rated Power Factor (%) _____ Rated Voltage _____ Rated Amperes _____
Inverter Type (ferroresonant, step, pulse-width modulation, etc) _____
Type commutation: forced _____ line _____
Harmonic Distortion: Maximum Single Harmonic (%) _____
Maximum Total Harmonic (%) _____

Note: Attach all available calculations, test reports, and oscillographic prints showing inverter output voltage and current waveforms

Power Circuit Breaker (if applicable)

Manufacturer _____ Model _____
Rated Voltage _____ Rated Amperes (load) _____
Interrupting rating (amperes) _____ BIL Rating _____
Interrupting medium / Insulating medium (vacuum, gas, oil, etc) _____ / _____
Control voltage (closing) _____ (Volts) _____ AC _____ DC
Control voltage (tripping) _____ (Volts) _____ AC _____ DC _____ Battery _____ Capacitor
Close energy _____ Spring _____ Motor _____ Hydraulic _____ Pneumatic Other: _____
Trip energy _____ Spring _____ Motor _____ Hydraulic _____ Pneumatic Other: _____
Bushing Current Transformers _____ (Max. ratio) Relay Accuracy Class _____
Multi ratio? _____ No _____ Yes: (Available taps) _____

Miscellaneous

Signature

The Non-Utility Generation owner agrees to provide Georgia Power Company with any additional information required to complete the interconnection. The NUG owner will operate the equipment within the guidelines set forth by *GPC Power Delivery Bulletin 18-8, Interconnection Requirements and Parallel Operation of Non-Utility Generation.*

Applicant _____

Date _____

To be filled out by GPC Marketing Representative

Marketing Representative _____ Phone _____
Comments / notes: _____

Original of application and notes to Protection & Control Engineering, Copy in Customer Marketing File



**Statement of Responsibility for
Non-Utility Generation connected to
the Georgia Power Company System**

As the operator of a Non-Utility Generator (NUG) electrically connected in parallel to the Georgia Power Company power system, I confirm that I have read and am in agreement with the requirements and responsibilities set forth in Georgia Power Company's Power Delivery Bulletin 18-8. I understand that at no time will I allow the operation of my generator(s) to have a negative impact on the safe operation of the Georgia Power Company system or the level of service to other Georgia Power Company customers.

I accept the responsibility for the periodic calibration and operational testing of the Interface Protective Relaying systems required by Georgia Power Company in Power Delivery Bulletin 18-8. To monitor compliance, Georgia Power Company retains the right to review the test records for the Interface Protective Relaying.

I understand that Georgia Power Company is not responsible or liable for the protection and/or safe operation of my generator(s).

Any change in ownership or operator of this NUG shall be reported to Georgia Power Company in writing, within 30 days of the change. Any change in scope of the NUG installation (such as adding additional generators), which could affect the compliance of Power Delivery Bulletin 18-8, shall be submitted to Georgia Power Company for a review and update of the Interconnection Study.

In the event of non-compliance of these responsibilities, Georgia Power Company may elect to disconnect the NUG from the Georgia Power Company system, until such time as compliance is achieved. Georgia Power Company accepts no liability for consequences associated with non-compliance disconnect.

NUG Facility Name: _____

Address: _____

Generator(s) Identification: _____

NUG Owner: _____

NUG Operator: _____

Operator Signature: _____

Date: _____

Address any changes involving this NUG installation to:

Georgia Power Company
Protection and Control Engineering
Bin 20034
333 Piedmont Ave.
Atlanta, GA 30308