

GUYANA POWER AND LIGHT INCORPORATED



National Grid Code

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Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

1. NATIONAL GRID CODE

1.1 Introduction

The individual sections of the grid code contain the rules and provisions relating specifically to that individual section of the grid code. There are also provisions of a more general application, which need to be included in the grid code to allow the various sections of the grid code to work together. Such provisions are included in these general conditions.

1.2 Objectives

The objectives of the general conditions are as follows

- a) to ensure, insofar as it is possible, that the various sections of the grid code work together for the benefit of GPL and all users; and
- b) to provide a set of principles governing the status and development of the grid code and related issues as approved by regulatory authority.

1.3 Scope of Grid Code and General Conditions

The general conditions and the grid code apply to GPL and to all parties interconnected to the GPL System.

1.4 Grid Code Structure

The GPL National Grid Code is comprised of five (5) distinct codes as follows:

- a) Planning Code
- b) Interconnection Code
- c) Operational Code
- d) Minimum Technical Requirement Code
- e) Metering Code

In this section, a brief introduction for each code is provided. In addition, the correlation and interdependence between these codes is discussed.

1.4.1 Planning Code

The Planning Code defines the criteria and procedures employed by GPL in evaluating the performance of its power system and the reinforcements necessary to maintain reliability. The overarching objective of the Planning Code is to set the minimum planning criteria that will be used as the basis for the expansion of the transmission network to reliably attend current and future loads while taking into account the need to minimize operating costs and capital investments. The Planning Code is a public document known to all parties, it is complemented by the Minimum Technical Requirements in this Code and it is the basis for the studies prescribed by the Interconnection Code.

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1.4.2 Interconnection Code

The Interconnection Code defines the requirements and processes that any Independent Power Producers (IPP) or GPL Generation Projects must comply with to interconnect new (or modified) generation to the GPL System. The information on the procedures, forms, requirements, timelines, fees and pro-forma standardized interconnection contracts are presented, along with the steps required in the interconnection processed.

The Interconnection Code objective is to ensure that the interconnection of the new (or modified) generation is accomplished in a manner that maintains the reliability of the GPL System and is in compliance with GPL Planning Code, the Minimum Technical Requirements and Operations Code. The Interconnection Code also aims for providing standardized and transparent bases for interconnecting new (or modified) generation to the GPL System, including required network upgrades and their cost allocation.

1.4.3 Operational Code

The Operational Code includes the criteria, procedures and information requirements necessary to execute the operational planning, the generation dispatch and coordination supervision and control of integrated operation of the GPL System.

The Operating Code will procure a reliable and safe supply of energy and power demand by using the available resources in the most efficient and economical way. The Operational Code will also define the procedures for the reporting and information exchange between the different entities connected to the GPL System.

The Operational Code takes into consideration that new generation will be added to the system in compliance with the Interconnection Code and in consequence with the Planning Code and Minimum Technical Requirements.

1.4.4 Minimum Technical Requirements Code

The Minimum Technical Requirements (MTRs) Code defines the technical specifications and requirements that must be complied with by any new generation facility that will interconnect to the GPL System. This code is critical for Renewable Generation Facilities (RGFs), since there are specific technical requirements that are required to address RGFs inherent variability, uncertainty, and limited dispatchability. On the other hand, complying with the Minimum Technical Requirements for conventional generation resources is normally less challenging, however they must also comply with the MTRs.

The primary objective of the MTRs is to establish the technical rules, requirements and performance that a generation facility must comply with in relation to their connection to and their operation on the GPL System. The MTRs delineate the required technical and performance requirements that will ensure that generation facilities (conventional and renewable) contribute to continued safe and reliable operation of the GPL System. It complements and it is expected to be used together with the Planning Code.

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1.4.5 Metering Code

All active and reactive power entering or exiting the transmission system and distribution systems shall be metered using one or more metering systems. Electricity delivered to consumer premises shall also be metered. Hence, the Metering Code defines the regulations and technical aspects related to metering within the GPL System. The requirements of this Metering Code are complimentary to the metering and data exchange requirements of agreements between persons to whom this code applies and the Distribution Code.

The objectives of the metering code are to establish the standards to be met in the provision, location, installation, operation and maintenance of metering systems. The code also defines the responsibilities of each person bound by this code in relation to ownership and management of metering systems and meters and the provision, use, and storage of meter data.

1.4.6 Codes Correlation

The individual components of the Grid Code are integral and designed to support and complement one another. As mentioned previously, the Planning Code provides the bases for system expansion and defines the Reliability Criteria that are used in the rest of the Grid Code. For instance, the interconnection studies specified in the Interconnection Code use the Reliability Criteria defined in the Planning Code as a reference for system reliability and security and the Minimum Technical Requirements. The Minimum Technical Requirements Code provides detailed and specific technical specifications and requirements that are also used in the Interconnection Code and Operational Code to ensure that the system is operated and expanded in a safe and reliable manner.

This correlation between the Grid Code components ensures that the standards and procedures are consistent throughout the entire Grid Code and facilitates the enforcement and regulation of these standards. Therefore, this correlation and consistency should be maintained whenever any part of the Grid Code is modified or revised.

1.5 Grid Code Review Panel

GPL shall establish and maintain the grid code Review Panel, which shall be a standing body, constituted;

- a) to generally review, discuss and develop the grid code and its implementation;
- b) to review and discuss suggestions for amendments to the grid code which GPL, the regulatory authority or any user may wish to submit to GPL for consideration from time to time;
- c) to discuss what changes are necessary to the grid code arising out of any unforeseen circumstances referred to it by GPL;

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- d) to review existing Guyana electrical standards relevant to GPL Transmission System and make recommendations to the regulatory authority concerning modifications to existing Guyana electrical standards or proposals for new Guyana electrical standards relevant to GPL transmission system;
- e) to publish recommendations and ensure that user consultation upon such recommendations has occurred through Members; and
- f) to issue guidance in relation to the grid code and its implementation, performance and interpretation when asked to by a user.

The grid code Review Panel shall be governed by a constitution which defines its scope, Membership, duties, and rules of conduct, operation and further development of the grid code as approved by the regulatory authority.

The Panel shall consist of;

- a) Deputy CEO of GPL
- b) Divisional Director – Operations
- c) Divisional Director – Systems Planning and Projects
- d) SEI Representative
- e) PUC Representative
- f) Secretary (or a member functions as the Panel Secretary)

Panel term should be for one year with the option of an automatic renewal of membership.

1.6 Grid Code Revisions

All revisions to the grid code must be reviewed by the grid code Review Panel prior to application to the regulatory authority by the Chairman of the Review Panel. All proposed revisions from users or GPL shall be brought before the grid code Review Panel by the Chairman of the Review Panel for consideration. The Chairman will advise the grid code Review Panel, all users, and GPL of all proposed revisions to the grid code with notice of no less than 10 business days in advance of the next scheduled meeting of the grid code Review Panel.

Following review of a proposed revision by the grid code Review Panel, the Chairman of the panel will apply to the regulatory authority for revision of the grid code based on the grid code Review Panel recommendation. The Chairman, in applying to the regulatory authority, shall also notify each user of the proposed revision and other views expressed by the grid code Review Panel and users so that each user may consider making representations directly to the regulatory authority regarding the proposed revision.

The regulatory authority shall consider the proposed revision, other views, and any further representations and shall determine whether the proposed revision should be made and, if so, whether in the form proposed or in an amended form.

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Having been so directed by the regulatory authority that the revision shall be made, the Review Panel Chairman shall notify each user of the revision at least 10 business days prior to the revision taking effect, and the revision shall take effect (and this grid code shall be deemed to be amended accordingly) from (and including) the date specified in such notification or other such date as directed by the regulatory authority.

1.7 Code Confidentiality

Several parts of the grid code specify the extent of confidentiality, which applies to data supplied by Users to GPL. Unless otherwise specifically stated in the grid code, GPL shall be at liberty to share all data with users likely to be affected by the matters concerned. In all cases, GPL is at liberty, and may be required, to share the data with the regulatory authority.

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Planning Code

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2.6.4 SINGLE CONTINGENCY CONDITIONS FOLLOWING THE LOSS OF A TRANSFORMER 2.11

2.6.5 DOUBLE CONTINGENCY CONDITIONS 2.12

2.6.6 SINGLE OUTAGE FOLLOWED BY A CONTINGENCY..... 2.12

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2.13 SUPPLEMENTARY CONSIDERATIONS 2.16

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2.13.2 SYSTEM PROTECTION AND CONTROLS..... 2.16

Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

2. PLANNING CODE

2.1 Introduction

The Planning Code defines the criteria and procedures employed by GPL in evaluating the need for transmission system to maintain reliability. To maintain reliable operation of the GPL System, it is necessary that all stakeholders observe and subscribe to certain minimum planning criteria. The criteria set forth in this Code constitute the aforementioned minimum planning criteria. Tests outlined herein shall be performed to determine conformance to these minimum criteria; however, GPL recognizes that events more severe than those outlined in these criteria could cause grid separation and other tests may also be required.

The code is structured in 13 sections including:

Section 1: Introduction

Section 2: Objectives

Section 3: Scope

Section 4: Definitions

Section 5: Responsibility

Section 6: Reliability Criteria

Section 7: Voltage Regulation Standards

Section 8: Voltage Swing Criteria

Section 9: Voltage Stability Criteria

Section 10: Damping

Section 11: Frequency Deviations

Section 12: Thermal Loading

Section 13 Supplementary Considerations

2.2 Objectives

The overarching objective of the Planning Code is to set the minimum planning criteria that will be used as the basis for the expansion of the transmission network to reliably attend current and future loads while taking into account the need to minimize operating costs and capital investments.

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2.3 Scope / Applicability

The requirements and use of the Planning Code are applicable as follows:

- a. The transmission system will be planned according to this Code and its Reliability Criteria. Under credible worst-case loading and generation conditions, unless stated otherwise, the system shall be designed to meet or exceed this Code’s Criteria.
- b. The Code applies to:
 - i. The transmission system that includes all 69 kV and above facilities;
 - ii. System generation and the transformation to 13.8 kV; and
 - iii. Other MV levels that GPL uses in the future.
- c. GPL shall forecast future needs of the system users (demands, IPP, and GPL) and create 5, 10 and 20 year long term plans to fulfil these needs while meeting reliability standards as defined in this Code.
- d. GPL shall perform steady state, short circuit, and dynamic analyses appropriately to ensure the reliability of the GPL System and identify appropriate solutions, where necessary.
- e. Although central responsibility of planning lies with GPL, all agents are required to design their facilities so that they support the requirements of this Planning Code.

2.4 Definitions

Accuracy Test: A test to determine the percentage error of any item of a metering system.

Active Energy: The electrical energy produced during a time interval measured in units of watt-hours or standard multiples.

Active Power: The product of voltage and the in-phase component of alternating current measured in units of watts or multiples.

Actual Metering Point: The physical point at which electricity is metered.

Ancillary Services: The services that generation facilities or other users connected to grid may be required to provide from time to time in connection with the security and stability of the DBIS. Those services included but are not limited to: frequency control, reserve margin, voltage regulation, black start capability, etc.

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Benchmark Case: A system model without the Interconnection Project(s) under study. It is considered the reference.

Bi-directional meter: Meter that measures the active energy (kWh) flow in both directions (import and export) and displays both imported and exported energy in separate registers.

Business Day: shall mean Monday through Friday, excluding Holidays.

Calendar Day: shall mean any day including Saturday, Sunday or a Holiday.

Check Meter: A device where required, that duplicates and provides backup to the main meter for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Cluster / Cluster Study: A group of Interconnection Projects that are studied simultaneously in the same FIS due to the time proximity of their applications.

Connection Point: The point on the transmission system to which a user connects its system to the grid.

Connection Site: The physical site belonging to GPL or a user where a connection point is located.

Consequential Load Shed: Load that is dropped as a direct implication of a fault (e.g. a radial line).

Contingency Reserve: is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand, provide by units that are not required to be synchronized.

Conventional Generation: A resource using conventional fuels or water and is fully dispatchable and controllable.

Customer-generator: Any Customer of a DNO that generates electricity on the Customer’s side of the billing meter with renewable energy generation system that is primarily intended to offset part or all of the Customer’s electricity.

Delivery Point: The point at which electricity is delivered.

Demand Control Refers to measures that allow secure a reduction in demand to preserve the integrity of the network operation.

Directly Connected Customers: Any customer that is directly connected to the transmission network.

Dispatch Instructions: Mandatory dispatch orders issue by the System Operator during any operation day.

Distribution Networks Operators: Any user connected to the transmission grid to exchange power and that delivers power through his own network to final customers.

Economic Dispatch: The process to assign the available resources to cover the electric load in merit order.

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Electric Time: The time shown on an electric clock connected to the DBIS.

Emergency Conditions: Abnormal system conditions that require automatic or manual actions to prevent or limit loss of transmission and distribution facilities or generation capacity that could adversely affect the reliability of the transmission network.

Emergency Instructions: A dispatch instruction issued by GPL that may require an action or response that is outside the limits declared in the day ahead dispatch for a generation unit and issue to prevent or limit an emergency condition.

Facility aggregated power MW capacity: It is the basis to determine the requirements associated with real and reactive power capability. This capacity is usually defined as gross capacity (i.e. the aggregated capacity of all generation) but the developer shall also provide a maximum net capacity to be delivered at the POI. It is of particular importance of Wind Turbine Generation (WTG) facilities or PV; called here Renewable Generating Facilities (RGF).

Feasibility Study: A preliminary system impact study as presented in this code.

Firm Loads: Loads that require continuous electric service from GPL and should not be interrupted except in extreme conditions to preserve the integrity of the system.

FIS Study Scope Agreement: A binding document defining the basis for the FIS.

Frequency Excursions: System frequency deviation from nominal frequency as a result of contingencies or load-generation imbalance.

Frequency Sensitive Mode: The operation of a generation unit that will result in active power output changing automatically in response to changes in the DBIS frequency.

Full Interconnection Study (FIS): A detailed system impact study as presented in this code.

Full Interconnection Study Request (FISR): A letter from IC notifying GPL to proceed with the Full Interconnection Study for the Interconnection Project identified in the letter.

Generation Owner: Independent Power Producers (IPP), Large Customers and/or GPL that own a Generation Resource as defined in this code.

Generation Resource: Any device capable of injecting active power into GPL System regardless of technology; conventional generation, renewable generation or any type of storage devices. Generation Resources inject into the grid 5 MW (net after auxiliary services) or more if the POI is at 69 kV or 1.5 MW for POI at the 13.8 kV level.

Generating Resource, Generation Facility, or Generating Facility: See Generation Resource.

Good Utility Practice: Acting in good faith to perform obligations in accordance with international good practices in the electricity sector. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted.

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GPL: Guyana Power and Light, provider of Transmission and Interconnection Services, owner and operator of the GPL System, and has central responsibility of planning the System.

GPL Operators: Personnel at the Energy Control Centre in charge of providing dispatch instructions to generation, monitoring the system performance, open and reconnect transmission facilities for normal operation or during emergency procedures and system restoration.

GPL System: All interconnect transmission and distribution facilities owned by GPL. Currently consists of the Demerara Berbice Interconnected System (DBIS)

GPL Transmission System: Facilities at 69 kV or above, used by GPL to interconnect generating resources to the distribution system MV system. Includes the transformation to MV (13.8 kV) level.

Hourly Economic Dispatch Program: The program output for each of the generation units in all the hours of the day generated by the Economic Dispatch.

Instation: Equipment located within GPL’s premises that receive and stores metering data from Outstations.

Interconnecting Customer’s System Impact Responsibility: Consists of the overloads or voltage violations that the Interconnection Project is likely to produce or aggravate in the system and that until corrected limit the capacity that the Interconnection Project can inject into the system. This limit can be zero. IC may or may not have financial responsibility on the cost of the associated reinforcements.

Interconnection Customer (IC): Party seeking interconnection service from GPL. Can be and Independent Power Producer, a Cogenerators or GPL itself operating as a resource owner.

Interconnection Project: The New Generation Resource or Generation Resource change seeking interconnection to GPL System.

Internally Interconnected Party: An entity located in Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

International Interconnected Party: An entity located outside Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

Interruptible Loads: Loads that have contractual conditions that allow interrupting their service during emergency conditions or for economic considerations. This is also called Load acting as a Resource.

Long term: A one to five years period for operational planning. The long term has been initially set up to 1 year.

Main Meter: The primary meter for measuring and recording electrical quantities.

Major Customers: Customers with annual peak load demand higher than 1 MW.

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Measurement Transformers: Voltage and/or current transformers or combinations of those, used in metering systems.

Medium Term: A 4 weeks period for operational planning.

Merit Order: an order for ranking available generation facilities which shall optimize the DBIS economy, security, stability and reliability and that shall be determined by GPL.

Meter: A device for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Meter Certificate: The statement issued by GPL confirming that a meter or metering system complies with the requirements of the metering code.

Meter Owner: The person responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of meters.

Meter Register: A device associated with a meter, from which it is possible to obtain a visual reading of the quantities that have passed the meter.

Meter Registration System: A system that uniquely identifies the meter and users associated with the meter and contains pertinent data relating to the meter as required by the metering code.

Meter Service Provider: A person that provides to a meter owner meter services such as the installation, commissioning, operation, maintenance, and general servicing of metering systems.

Metering: The activity of measuring and recording units of active power, active energy, reactive power, reactive energy or other electrical quantities using a metering system or a meter.

Metering System: The group of equipments including meters, measurement transformers, metering protection and isolation equipment, including alarms, circuitry, associated data storage and data communications equipment that are part of the active energy, reactive energy and demand measuring equipment at or relating to a connection site.

Minimum Technical Requirements (MTR): A set of requirements that any new generating resource needs to comply with to safely interconnect and not degrade the reliability of the system.

Net Metering: A methodology under which electrical energy generated by a customer-generator and delivered to the DNO facilities as measured by an appropriate device to offset electric energy supply by the DNO to the customer-generator during the applicable billing period. Net Metering is not designed to be an income generating mechanism and the supplier will not have to make monetary payments to customer-generators.

Non Consequential Load Shed: Load that needs to be shed to alleviate an overload or remediate a severe voltage violation.

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Non Disclosure Agreement (NDA): A binding document limiting the information that the parties may disclose to third parties and the conditions according to which this disclose can be made.

Operating Margin: The amount of reserve available over and above that required to meet the expected demand. It includes the contingency and operating reserves.

Operating Reserve: The amount of reserve to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). It includes the primary and secondary regulation and the tertiary response.

Operating Parameters: The onsite technical capabilities, flexibilities and limitations of a generation unit, that need to be declared for the day ahead dispatch.

Operational Test: a test carried out to acquire information in respect of a plant under pre-determined system conditions.

Outstation: On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an Instation or SCADA system or downloading to a local interrogation unit on request. When used with metering systems the outstation will store data from a meter(s) and may perform some processing of data.

Performance Standards: Define acceptable response to normal or contingency events and are measured in voltage magnitude or voltage change, thermal loading, stability or voltage swing limits and damping.

Photovoltaic Generation (PVG) Facility: Photovoltaic Facility has several photovoltaic arrays with solar panels connected to individual inverters and step-up transformers. The PVG transformers will step-up voltages from a typical 200-volt level to a typical 13.8 kV to 34.5 kV collector. A PVG may have several collectors that will connect to the Collector Bus. The Collector Bus is connected to the low side of the transmission step-up transformer(s), that changes the voltage to 13.8 kV, 69 kV or higher. Photovoltaic facilities output is a function of the site itself and the tracking system employed, with production that varies depending on whether tracking is used or not. PVG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

Plant: Any apparatus, equipment or appliance used for, or for purposes connected with, the generation, transmission, dispatch, distribution or supply of electricity.

Point of Interconnection (POI): A physical point in the System where ownership changes from the IC to GPL. Facilities towards the generator from the POI belong and are maintained by the IC, facilities from the POI to the GPL System are owned, maintained and operated by GPL.

Power Factor (PF): Ratio of the active power delivered by a generator or consumed by a load to the total apparent power delivered by the same generator or consumed by the same load. Over excited, lagging or positive PF corresponds to the condition of the generator

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injecting reactive power. Under excited, leading or negative power factor corresponds to the condition of the generator absorbing reactive power.

Project: See Interconnection Project

Primary Regulation: The real time variation in the power delivery of the generator in response to changes in the system frequency.

Reactive Energy: The integral with respect to Reactive Power, measured in units of voltampere reactive hours (Varh) and standard multiples.

Reactive Power: The product of alternating voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive (vars) and standard multiples.

Reliability Criteria: Define the acceptable operating limits for normal (N-0), as well as for various single and double contingency conditions such as: N-1, N-1-1, and N-2. Steady state, transient, and dynamic aspects are considered in determining reliability criteria for each type of contingency.

Remedial Action Scheme (RAS): A protective device that trips generation or load upon the occurrence of defined events to prevent overloads or voltage violations.

Resource: See Generation Resource.

Running Orders: Indicative dispatch instructions issue by the system operator as part of the day ahead generation dispatch.

Schedule Day: The 24 hours period starting at midnight of the day concerned.

Secondary Regulation: The automatic or manual adjustment to the power delivery by the generators to re-establish the generation – load balance.

Short Term: A 24 hours period for operational planning.

Significant Incident: An incident that GPL has determined that shall be defined as significant in the context of reporting.

Site Investigations: Test conducted in relation to plant and operation procedures at generation facilities sites to monitor and assess the characteristics of the plant.

System: See GPL System.

System Operator: Guyana Power & Light Incorporated.

System Protection Facilities: Shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tertiary Respond: This is component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets.

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Transfer Distribution Factor: A fraction of the generation injection increase that flows over a defined element or flow gate (groups of elements) when balanced against the swing bus or sink area.

Unidirectional Meter: A meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction

User: Any entity different than GPL that is connected to transmission network and uses it to receive or delivery electricity.

Utility Scale Generating Facility: See Generating Resource.

Wind Power Facility: A Wind Turbine Generating facility (WTG) typically will have several Wind Turbine Generators (WTGs) connected to individual WTG step-up transformers. The WTG transformers will step-up voltages from a typical 600-volt level to a typical 13.8 kV or 34.5 kV collector. A WTG facility may have several collectors that will connect to the Main Collector Substation. The Main Collector Substation typically has a step-up transformer(s) that change the voltage to the transmission voltage (69 kV and above). The step-up transformer is connected to the POI through one or more lines, unless the transformer connects directly to the POI. WTG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

2.5 Responsibility

The Planning Code is fundamental to setting the minimum planning criteria that will be used as the basis for the expansion of the transmission network to ensure reliability. This section presents the responsibilities of each Party in ensuring that this objective is met:

- a. GPL is responsible for the planning studies and compiling the information provided by parties.
- b. The Interconnection Customers (ICs) are responsible for providing generator model and data as required for planning.
- c. Large Customers are responsible for providing updated information on the load connected and any “behind the fence” generation. This information does not include emergency generators that are not intended to be connected in parallel with GPL System at any time.

2.6 Reliability Criteria

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The Reliability Criteria is a central component of this Planning Code as it defines the acceptable operating performance of the system under normal and several contingency conditions.

- a. Normal conditions represent the system intact or N-0 operating conditions without any disturbances or unplanned outages.
- b. Contingency conditions represent the system operating conditions following the occurrence of a single or double outage (N-1, N-1-1, or N-2).

Reliability criteria for these various conditions are discussed in the subsequence subsections.

2.6.1 Normal Conditions

These condition levels represent normal system operations with no contingencies and all facilities in service. These condition levels will be referred to as the N-0 condition.

Under normal conditions, the system shall be able to supply all firm loads with no non-consequential load shed. All equipment must operate within its applicable ratings, and voltages must be within their applicable ratings as described in this Code and the system must be stable with no cascading outages.

For standard system planning, peak loading conditions are considered and no scheduled maintenances (e.g. planned outages) shall be considered. For Operational Planning, the normal conditions will include scheduled maintenance to ensure that the network operations do not result in normal condition violations.

The target loading for N-0 conditions shall be 75% of the normal rating of transmission lines and of the ONAN rating of transformers with ONAF capability.

2.6.2 Single Contingency Conditions

These condition levels are referred to as N-1 events, which occur due to a single element being out, such as the outage of a generator, a transmission circuit, or a transformer. Each element in a structure is distinct, and as such, if a single tower has two elements out due to a

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breaker failure, it would fall under double contingency conditions (addressed below) and not N-1.

The acceptable impact on the system shall be the same as for N-0 with the difference that the “applicable ratings” will be the emergency ratings, if applicable.

No non-consequential load shed of firm loads is allowed.

The opening of the faulted transmission element shall allow no greater than 5 MW of consequential load shed. The remaining load shall have loop service and not be affected by the fault.

2.6.3 Single Contingency Conditions Following the Loss of a Generator

These condition levels, referred to as N-G-1, occur when the network has adjusted to the most critical generator being out of service and then the single contingency happens. The same analysis as N-1 above is performed with the added objective of guaranteeing safe operation during extended outages of generators.

The single contingency that happens includes the trip of generation, so the simultaneous loss of the two most critical units shall also be studied.

The acceptable impact on the system shall be the same as single contingency conditions (N-1).

2.6.4 Single Contingency Conditions Following the Loss of a Transformer

These condition levels occur when the network has each transformer in the system taken out one at a time and then the single contingency occurs. These conditions apply to transmission transformers that connect 69 kV to a higher voltage (230 kV) and not distribution transformers down to 13.8 kV.

The acceptable impact on the system shall be the same as single contingency conditions (N-1).

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2.6.5 Double Contingency Conditions

These condition levels occur when an unplanned outage of two elements in the system happens simultaneously and is referred to as N-2. These events include outages due to the loss of two circuits sharing the same structure or simultaneous loss of two elements due to a breaker failure.

Double contingency also includes the loss of all transmission facilities that share the same right of way.

Although the loss of firm load is acceptable in the form of remedial load shedding or non-consequential load shed, there shall be no system collapse due to cascading.

If analysis shows the potential for system collapse, GPL shall document the potential vulnerability of the system and shall take it into consideration as the system expands and in the design of restoration procedures.

2.6.6 Single Outage Followed by a Contingency

These condition levels are a generalization of the generator and transformer outages from the subsections above to include all transmission facilities in the first outage. That is, the system experiences one contingency followed by system adjustments and then the occurrence of another contingency. These conditions are referred to as N-1-1.

Under these conditions, load and firm transmission curtailment are acceptable to maintain system integrity.

The analysis shall identify islanding of parts of the system and/or collapse and GPL shall consider them as the system expands to ensure that there is enough system redundancy to survive these types of events.

2.6.7 Consequential and Non-Consequential Load Shed

Load shed falls under two categories:

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- a. Consequential load shed is load shed due to direct implication of the fault (e.g. a radial line).
- b. Non-Consequential load shed is load shed to alleviate an overload.

Aside for when initiated by protection schemes, load shed shall not be permitted for N-1 events. However, load shed shall be acceptable for N-2 and N-1-1 events.

2.7 Voltage Regulation Standards

In conducting the planning analysis, GPL shall consider the voltage magnitude to be within adequate voltage limits if:

- a. For normal conditions, there is a +/-5% deviation from nominal; and
- b. For emergency conditions, there is a +/-10% deviation from nominal, post contingency.

Regardless of the kV base, these voltage limits shall apply to all substations.

The +/-10% emergency voltage deviation limit shall apply to post contingency conditions before taps are adjusted, but after the effect of fast reactive devices (shunts). Following tap adjustments (either manual or automatic), the intermediate voltage limit shall meet the limits in the table below.

Acceptable Post Contingency Voltages

Parameter and Reference Point	Time Period		
	Post Transient (Up to 30s)	Post Auto Control (30 sec to 5 min)	Post Manual Control (Steady State)
Voltage Deviation from Steady State at Point of Delivery Low Voltage Bus	+/- 10%	+/- 7% (note 1)	+/- 5% (note 2)

Notes:

- 1- This requirement shall apply only for those buses that have automatic voltage control, otherwise the Post-Transient +/- 10% criterion applies.

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- 2- This requirement shall apply only for those buses that have manual / SCADA controlled on-load tap changers, presumes that all adjustments in the network (manual and automatic) are implemented.

At the generator terminal levels, the voltage shall be maintained within +/- 5% at all times to prevent trips due to auxiliary systems or the Volt/Hz relays during low frequency events. Additionally, for generation protection, the limits of 110% of nominal voltage shall not exceed 1 second and the limit of 90% of nominal voltage shall not exceed 10 seconds.

2.8 Voltage Swing Criteria

The Voltage Swing criteria shall ensure that new generation or loads connected to weak points, which require voltage support, will not transiently affect voltage recovery with sluggish voltage recovery events. Such events shall be avoided to prevent generators or interconnected loads to trip.

In planning analysis, all bus voltages shall recover to above 80% within 2 seconds of fault clearance, and to 90% within 10 seconds of fault clearance. Additionally, to ensure that generator protection does not trip, transient voltage shall not exceed 120% nominal.

2.9 Voltage Stability Criteria

In conducting the planning analysis, GPL shall ensure that voltage stability margin is sufficient to maintain post-transient voltage stability under the following conditions:

- a. A 5% increase in load above expected peak supplied from the remote resource being studied for single element out (N-1) conditions;
- b. A 2.5% increase in load above expected peak supplied from the remote resource being studied for two elements out (N-2 or N-1-1) conditions.

2.10 Damping

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In conducting planning analysis, GPL shall ensure that power oscillation within the range of 0.2 Hz to 2 Hz decays with a minimum 3% damping ratio for any operating condition in the Reliability Criteria (Section 2.6)

The damping criterion is defined in terms of the power oscillation Damping Factor (DF) determined in terms of the Successive Positive Peak Ratio (SPPR), which in turn is calculated directly from the rotor angle or alternatively the rotor speed. The SPPR is the ratio of the next peak of the rotor angle (or rotor speed) to the previous peak and should be less than one (1) for a damped event. The damping factor (DF) is calculated as $1 - SPPR$

2.11 Frequency Deviations

In conducting planning analysis, GPL shall ensure that frequency deviations meet the following performance standards:

- a. Frequency shall not drop below 57.7 Hz; and
- b. Frequency shall not exceed 63.0 Hz.

To prevent frequency drops, a load shedding procedure shall be in place where 50% of the connected load is shed at a frequency of 58.0 Hz

2.12 Thermal Loading

In conducting planning analysis, GPL shall use two ratings during load flow simulations:

- a. Rate A for normal conditions; and
- b. Rate B for emergency (contingency) conditions.

GPL shall determine the normal and emergency ratings based on the design capacity of the equipment and adjusted to reflect actual local and equipment conditions. GPL may elect to use only one rating for those situations where the safe use of a higher rating cannot be confirmed.

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2.13 Supplementary Considerations

2.13.1 Considerations of System Dispatch

GPL has six (6) power generation plants with a total installed capacity of 144.8 MW of which 139.49 MW is available capacity. In conducting planning analysis, GPL shall dispatch generation with the following:

- a. Generation shall be dispatched according to the forecast merit order for the period of study. For non-dispatchable generation, such as wind, the worst conditions, whether minimum or maximum seasonal output, shall be used.
- b. For N-G-1 contingencies, system shall be readjusted after re-dispatching the remaining generation according to the forecast merit order with the most critical generator out of service.

Other events, such as multiple outages, shall be assessed with all generation available and dispatched according to the forecast merit orders with some generation as Must Run to alleviate the overloads and expected production for renewable.

2.13.2 System Protection and Controls

GPL shall incorporate the following system protection and control features in to their planning:

- a. Remedial Action Schemes (RAS) shall be designed for specific foreseen events and shed load or generation to preserve system integrity. Such operational issues include changes in load or retirement of generation
- b. Automatic reclosing systems shall be used to improve system reliability.
- c. Single Pole Trip and Reclose (SPT&R) shall be used for certain system lines to enhance reliability for non-three phase faults.

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Interconnection Code

ABBREVIATIONS: III

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Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

3. INTERCONNECTION CODE

3.1 Introduction

The Interconnection Code defines the requirements and processes that any Independent Power Producers (IPP) or GPL Generation Projects must comply with to interconnect new (or modified) generation to the GPL System.

The information on the procedures, forms, requirements, timelines, fees and pro-forma standardized interconnection contracts is presented along with the steps required in the interconnection process. These interconnection steps include: (1) Interconnection Request Filing, (2) Technical Feasibility Study / Security Screening, (3) Full Interconnection Study including Steady State, Protection – Short Circuit and Stability, (4) Determination of Reinforcements and Financial Responsibility Allocation, (5) Facilities Study, (6) Interconnection Agreement, (7) Compliance with Operational Standards and Codes, and (8) Inspection and Commissioning.

The code is structured in 13 sections:

Section 1: Introduction

Section 2: Objectives

Section 3: Scope

Section 4: Definitions

Section 5: Responsibility

Section 6: Generation Interconnection Application

Section 7: System Impact Studies

Section 8: Facility Study

Section 9: Final Study Report and Subsequent Actions

Section 10: Cost Allocation

Section 11: Generation Interconnection Agreement (GIA)

Section 12: Queue Management

Section 13 : Generation Interconnection Application (GIAp) Fees

3.2 Objectives

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The objectives of the Interconnection Code are to:

- a. Ensure that the interconnection of the new (or modified) generation is accomplished in a manner that maintains the reliability of the GPL System and is in compliance with GPL Planning Code, the Minimum Technical Requirements and Operations Code;
- b. Determine the facilities required to interconnect new (or modified) generation to the GPL System, including any reinforcements to comply with the objective above (a);
- c. Provide transparency in the communications between Interconnection Customers (Independent Power Producers or GPL Generation Projects) with GPL as a transmission service provider;
- d. Clearly define the procedures for filing an interconnection request, basis for studies, timelines, fees and cost allocation between GPL and the Interconnection Customers (IC) and the basis of the Interconnection Agreement;
- e. Ensure that GPL has accurate initial data about the proposed Generation Resource as necessary for planning purposes;
- f. Ensure that GPL has the best available information on future capacity additions for use in identifying, forecasting, and analyzing both short and long-term GPL capabilities, demands, and reserves; and
- g. Define the procedures for Code Reviews to reflect the changing conditions of the power system.

3.3 Scope / Applicability

The requirements of the Interconnection Code are applicable to the following:

- a. Any entity proposing a new Generation Resource, regardless of ownership (GPL or a third party) and technology (conventional, cogeneration, renewable, or storage), with an aggregate

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power output (gross Generation Resource output minus auxiliary Load directly related to the Generation Resource) exceeding 1.5 MW up to (but not including) 5 MW for POI at 13.8 kV or 5 MW or greater for POI at 69 kV or above; or

- b. Resource entities that are seeking to:
- i. Change an existing Generation Resource that will increase the Generation Resource's connected capacity, including refurbishing/repowering, to exceeding 1.5 MW up to (but not including) 5 MW for POI at 13.8 kV or 5 MW or greater of POI at 69 kV or above; or
 - ii. Change the Point of Interconnection of a Generation Resource exceeding 1.5 MW up to (but not including) 5 MW for POI at 13.8 kV or 5 MW or greater for POI at 69 kV or above.

Any Generation Resource with capacity of 5 MW or greater will have a POI at 69 kV or above.

3.4 Definitions

Accuracy Test: A test to determine the percentage error of any item of a metering system.

Active Energy: The electrical energy produced during a time interval measured in units of watt-hours or standard multiples.

Active Power: The product of voltage and the in-phase component of alternating current measured in units of watts or multiples.

Actual Metering Point: The physical point at which electricity is metered.

Ancillary Services: The services that generation facilities or other users connected to grid may be required to provide from time to time in connection with the security and stability of the DBIS. Those services included but are not limited to: frequency control, reserve margin, voltage regulation, black start capability, etc.

Benchmark Case: A system model without the Interconnection Project(s) under study. It is considered the reference.

Bi-directional meter: Meter that measures the active energy (kWh) flow in both directions (import and export) and displays both imported and exported energy in separate registers.

Business Day: shall mean Monday through Friday, excluding Holidays.

Calendar Day: shall mean any day including Saturday, Sunday or a Holiday.

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Check Meter: A device where required, that duplicates and provides backup to the main meter for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Cluster / Cluster Study: A group of Interconnection Projects that are studied simultaneously in the same FIS due to the time proximity of their applications.

Connection Point: The point on the transmission system to which a user connects its system to the grid.

Connection Site: The physical site belonging to GPL or a user where a connection point is located.

Consequential Load Shed: Load that is dropped as a direct implication of a fault (e.g. a radial line).

Contingency Reserve: is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand, provide by units that are not required to be synchronized.

Conventional Generation: A resource using conventional fuels or water and is fully dispatchable and controllable.

Customer-generator: Any Customer of a DNO that generates electricity on the Customer's side of the billing meter with renewable energy generation system that is primarily intended to offset part or all of the Customer's electricity.

Delivery Point: The point at which electricity is delivered.

Demand Control Refers to measures that allow secure a reduction in demand to preserve the integrity of the network operation.

Directly Connected Customers: Any customer that is directly connected to the transmission network.

Dispatch Instructions: Mandatory dispatch orders issue by the System Operator during any operation day.

Distribution Networks Operators: Any user connected to the transmission grid to exchange power and that delivers power through his own network to final customers.

Economic Dispatch: The process to assign the available resources to cover the electric load in merit order.

Electric Time: The time shown on an electric clock connected to the DBIS.

Emergency Conditions: Abnormal system conditions that require automatic or manual actions to prevent or limit loss of transmission and distribution facilities or generation capacity that could adversely affect the reliability of the transmission network.

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Emergency Instructions: A dispatch instruction issued by GPL that may require an action or response that is outside the limits declared in the day ahead dispatch for a generation unit and issue to prevent or limit an emergency condition.

Facility aggregated power MW capacity: It is the basis to determine the requirements associated with real and reactive power capability. This capacity is usually defined as gross capacity (i.e. the aggregated capacity of all generation) but the developer shall also provide a maximum net capacity to be delivered at the POI. It is of particular importance of Wind Turbine Generation (WTG) facilities or PV; called here Renewable Generating Facilities (RGF).

Feasibility Study: A preliminary system impact study as presented in this code.

Firm Loads: Loads that require continuous electric service from GPL and should not be interrupted except in extreme conditions to preserve the integrity of the system.

FIS Study Scope Agreement: A binding document defining the basis for the FIS.

Frequency Excursions: System frequency deviation from nominal frequency as a result of contingencies or load-generation imbalance.

Frequency Sensitive Mode: The operation of a generation unit that will result in active power output changing automatically in response to changes in the DBIS frequency.

Full Interconnection Study (FIS): A detailed system impact study as presented in this code.

Full Interconnection Study Request (FISR): A letter from IC notifying GPL to proceed with the Full Interconnection Study for the Interconnection Project identified in the letter.

Generation Owner: Independent Power Producers (IPP), Large Customers and/or GPL that own a Generation Resource as defined in this code.

Generation Resource: Any device capable of injecting active power into GPL System regardless of technology; conventional generation, renewable generation or any type of storage devices. Generation Resources inject into the grid 5 MW (net after auxiliary services) or more if the POI is at 69 kV or 1.5 MW for POI at the 13.8 kV level.

Generating Resource, Generation Facility, or Generating Facility: See Generation Resource.

Good Utility Practice: Acting in good faith to perform obligations in accordance with international good practices in the electricity sector. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted.

GPL: Guyana Power and Light, provider of Transmission and Interconnection Services, owner and operator of the GPL System, and has central responsibility of planning the System.

GPL Operators: Personnel at the Energy Control Centre in charge of providing dispatch instructions to generation, monitoring the system performance, open and reconnect

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transmission facilities for normal operation or during emergency procedures and system restoration.

GPL System: All interconnect transmission and distribution facilities owned by GPL. Currently consists of the Demerara Berbice Interconnected System (DBIS)

GPL Transmission System: Facilities at 69 kV or above, used by GPL to interconnect generating resources to the distribution system MV system. Includes the transformation to MV (13.8 kV) level.

Hourly Economic Dispatch Program: The program output for each of the generation units in all the hours of the day generated by the Economic Dispatch.

Instation: Equipment located within GPL's premises that receive and stores metering data from Outstations.

Interconnecting Customer's System Impact Responsibility: Consists of the overloads or voltage violations that the Interconnection Project is likely to produce or aggravate in the system and that until corrected limit the capacity that the Interconnection Project can inject into the system. This limit can be zero. IC may or may not have financial responsibility on the cost of the associated reinforcements.

Interconnection Customer (IC): Party seeking interconnection service from GPL. Can be and Independent Power Producer, a Cogenerators or GPL itself operating as a resource owner.

Interconnection Project: The New Generation Resource or Generation Resource change seeking interconnection to GPL System.

Internally Interconnected Party: An entity located in Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

International Interconnected Party: An entity located outside Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

Interruptible Loads: Loads that have contractual conditions that allow interrupting their service during emergency conditions or for economic considerations. This is also called Load acting as a Resource.

Long term: A one to five years period for operational planning. The long term has been initially set up to 1 year.

Main Meter: The primary meter for measuring and recording electrical quantities.

Major Customers: Customers with annual peak load demand higher than 1 MW.

Measurement Transformers: Voltage and/or current transformers or combinations of those, used in metering systems.

Medium Term: A 4 weeks period for operational planning.

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Merit Order: an order for ranking available generation facilities which shall optimize the DBIS economy, security, stability and reliability and that shall be determined by GPL.

Meter: A device for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Meter Certificate: The statement issued by GPL confirming that a meter or metering system complies with the requirements of the metering code.

Meter Owner: The person responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of meters.

Meter Register: A device associated with a meter, from which it is possible to obtain a visual reading of the quantities that have passed the meter.

Meter Registration System: A system that uniquely identifies the meter and users associated with the meter and contains pertinent data relating to the meter as required by the metering code.

Meter Service Provider: A person that provides to a meter owner meter services such as the installation, commissioning, operation, maintenance, and general servicing of metering systems.

Metering: The activity of measuring and recording units of active power, active energy, reactive power, reactive energy or other electrical quantities using a metering system or a meter.

Metering System: The group of equipments including meters, measurement transformers, metering protection and isolation equipment, including alarms, circuitry, associated data storage and data communications equipment that are part of the active energy, reactive energy and demand measuring equipment at or relating to a connection site.

Minimum Technical Requirements (MTR): A set of requirements that any new generating resource needs to comply with to safely interconnect and not degrade the reliability of the system.

Net Metering: A methodology under which electrical energy generated by a customer-generator and delivered to the DNO facilities as measured by an appropriate device to offset electric energy supply by the DNO to the customer-generator during the applicable billing period. Net Metering is not designed to be an income generating mechanism and the supplier will not have to make monetary payments to customer-generators.

Non Consequential Load Shed: Load that needs to be shed to alleviate an overload or remediate a severe voltage violation.

Non Disclosure Agreement (NDA): A bidding document limiting the information that the parties may disclose to third parties and the conditions according to which this disclose can be made.

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Operating Margin: The amount of reserve available over and above that required to meet the expected demand. It includes the contingency and operating reserves.

Operating Reserve: The amount of reserve to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). It includes the primary and secondary regulation and the tertiary response.

Operating Parameters: The onsite technical capabilities, flexibilities and limitations of a generation unit, that need to be declared for the day ahead dispatch.

Operational Test: a test carried out to acquire information in respect of a plant under pre-determined system conditions.

Outstation: On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an Instation or SCADA system or downloading to a local interrogation unit on request. When used with metering systems the outstation will store data from a meter(s) and may perform some processing of data.

Performance Standards: Define acceptable response to normal or contingency events and are measured in voltage magnitude or voltage change, thermal loading, stability or voltage swing limits and damping.

Photovoltaic Generation (PVG) Facility: Photovoltaic Facility has several photovoltaic arrays with solar panels connected to individual inverters and step-up transformers. The PVG transformers will step-up voltages from a typical 200-volt level to a typical 13.8 kV to 34.5 kV collector. A PVG may have several collectors that will connect to the Collector Bus. The Collector Bus is connected to the low side of the transmission step-up transformer(s), that changes the voltage to 13.8 kV, 69 kV or higher. Photovoltaic facilities output is a function of the site itself and the tracking system employed, with production that varies depending on whether tracking is used or not. PVG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

Plant: Any apparatus, equipment or appliance used for, or for purposes connected with, the generation, transmission, dispatch, distribution or supply of electricity.

Point of Interconnection (POI): A physical point in the System where ownership changes from the IC to GPL. Facilities towards the generator from the POI belong and are maintained by the IC, facilities from the POI to the GPL System are owned, maintained and operated by GPL.

Power Factor (PF): Ratio of the active power delivered by a generator or consumed by a load to the total apparent power delivered by the same generator or consumed by the same load. Over excited, lagging or positive PF corresponds to the condition of the generator injecting reactive power. Under excited, leading or negative power factor corresponds to the condition of the generator absorbing reactive power.

Project: See Interconnection Project

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Primary Regulation: The real time variation in the power delivery of the generator in response to changes in the system frequency.

Reactive Energy: The integral with respect to Reactive Power, measured in units of voltampere reactive hours (Varh) and standard multiples.

Reactive Power: The product of alternating voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive (vars) and standard multiples.

Reliability Criteria: Define the acceptable operating limits for normal (N-0), as well as for various single and double contingency conditions such as: N-1, N-1-1, and N-2. Steady state, transient, and dynamic aspects are considered in determining reliability criteria for each type of contingency.

Remedial Action Scheme (RAS): A protective device that trips generation or load upon the occurrence of defined events to prevent overloads or voltage violations.

Resource: See Generation Resource.

Running Orders: Indicative dispatch instructions issue by the system operator as part of the day ahead generation dispatch.

Schedule Day: The 24 hours period starting at midnight of the day concerned.

Secondary Regulation: The automatic or manual adjustment to the power delivery by the generators to re-establish the generation – load balance.

Short Term: A 24 hours period for operational planning.

Significant Incident: An incident that GPL has determined that shall be defined as significant in the context of reporting.

Site Investigations: Test conducted in relation to plant and operation procedures at generation facilities sites to monitor and assess the characteristics of the plant.

System: See GPL System.

System Operator: Guyana Power & Light Incorporated.

System Protection Facilities: Shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tertiary Respond: This is component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets.

Transfer Distribution Factor: A fraction of the generation injection increase that flows over a defined element or flow gate (groups of elements) when balanced against the swing bus or sink area.

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Unidirectional Meter: A meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction

User: Any entity different than GPL that is connected to transmission network and uses it to receive or delivery electricity.

Utility Scale Generating Facility: See Generating Resource.

Wind Power Facility: A Wind Turbine Generating facility (WTG) typically will have several Wind Turbine Generators (WTGs) connected to individual WTG step-up transformers. The WTG transformers will step-up voltages from a typical 600-volt level to a typical 13.8 kV or 34.5 kV collector. A WTG facility may have several collectors that will connect to the Main Collector Substation. The Main Collector Substation typically has a step-up transformer(s) that change the voltage to the transmission voltage (69 kV and above). The step-up transformer is connected to the POI through one or more lines, unless the transformer connects directly to the POI. WTG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

3.5 Responsibility

The Interconnection Code is fundamental to ensure that GPL System reliability and integrity is maintained as new generation is interconnected. This section presents the responsibilities of each Party in ensuring that this objective is met:

- a. The IC is responsible for providing generator model(s) and other associated technical data relating to the proposed facility, and for adhering to timelines specified in this Grid Code. The IC is also responsible for studying and installing protective Facilities to protect its equipment, and installing Facilities as identified by GPL if required to protect GPL's system from hazards created by the proposed Generation Resource.
- b. GPL is responsible for coordinating all studies, identifying potential reliability risks to the transmission system, and reviewing the proposed Generation Resource design for compliance with the MTR and operational standards established in this Grid Code.
- c. GPL is responsible for conducting and reviewing the interconnection studies described in this Grid Interconnection Code Section 3.7
- d. GPL is responsible for identifying special conditions that may apply to a particular project and coordinate its mitigation. This may include the use of Remedial Action Schemes (RAS) to temporarily address reliability concerns ahead of the commissioning of network reinforcements and allowing an interconnection service.

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3.6 Generation Interconnection Application (GIAp)

This section of the code specifies the forms to be sent to GPL to initiate the interconnection process.

At this stage, the IC shall identify a request for a new (or modified) generation interconnection (the Interconnection Project) by submitting a Generation Interconnection Application (GIAp) to GPL. The GIAP is reviewed by GPL for completeness and the project is initiated.

A GPL project coordinator is assigned who will be the facilitator of the interconnection process and GPL point of contact for the IC for the life cycle of the project.

The Generation Interconnection Application (GIAp) shall be accompanied by the applicable fees as defined in GPL Website (<http://www.gplinc.net/GI/Fees>). These fees are defined per MW of interconnection capacity, with a minimum and a maximum specified on GPL Website.

GPL shall apply the deposit toward the cost of the applicable Interconnection Study or Studies.

The Interconnection Customer shall submit a separate GIAP for each site and may submit multiple GIAPs for a single site. An interconnection request to evaluate one site at two different voltage levels shall be treated as two separate interconnection requests. The Interconnection Customer must submit a deposit for each GIAP even when more than one request is submitted for a single site.

The expected In-Service Date of the new Generating Resource or increase in capacity of the existing Generating Resource, shall not exceed five (5) years from the date the interconnection request is received by GPL, unless the Interconnection Customer demonstrates that engineering, permitting, and construction of the new Generating Facility or an increase in capacity of the existing Generating Facility will take longer than this period. The In-Service Date may exceed the specified date in the Interconnection Request received by GPL by a longer period if the Interconnection Customer and GPL so agree, such agreement not to be unreasonably withheld.

The IC shall use in its application the Generation Interconnection Application Form found in Appendix A. This form provides basic information on the IC and the project.

The GIAP shall be accompanied by the Project Dataset. This is the information required for the interconnection studies. Initially may contain approximate data to be confirmed prior the Full Interconnection Study.

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The Interconnection Project Dataset (IPDS) shall include at least:

- a) Proposed Point of Interconnection (POI), including substation or if applicable line to be tapped, and voltage level. Also an alternative POI can be provided for the feasibility study.
- b) Unit(s) Name(s) and new capacity MW on site conditions.
- c) Reactive Capability; Qmax / Qmin and nominal power factor.
- d) Step up transformer to the POI voltage including ratings, reactances and taps if applicable.

The minimum information above will allow the interconnection request to move to the feasibility stage only.

The IC shall use the forms in Appendix B and their supporting spreadsheets for providing the Project Dataset.

Non Disclosure Agreement (NDA): IC shall sign a Non Disclosure Agreement limiting the information that it shall be able to disclose to third parties.

IC shall send the GIAP, signed NDA and the IPDS to GPL to the address published in its Website under (<http://www.gplinc.net/GI/NDA>) and pay the applicable fees as defined in (<http://www.gplinc.net/GI/Fees>) according to the instructions contained in the same site.

GPL shall review the GIAP and IPDS and respond to the customer within 10 business days, acknowledging a completed GIAP or identifying deficiencies. If there are deficiencies in the information, the IC must provide any requested additional data within 15 business days from the notification of these deficiencies.

Once the GIAP is deemed complete, GPL shall issue notification to IC assigning a unique Interconnection Project Number in the form of:

YY-XXXX,

where YY is the current year and XXXX is a sequential number or combination of a letter followed by numbers.

The notification will also identify GPL interconnection project coordinator and identifying any information deficiencies that need to be cured before the project can proceed to the Full Interconnection Study phase.

Interconnection Customer can provide updates to the IPDS as they become available, provided that all required information for the Full Interconnection Study (FIS) is provided before the study can start. Once the FIS is started changes are limited to factors that do not

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substantially affect the results. In case of significant changes (for example increase in capacity or change of POI), GPL will notify IC of the need to restart the process.

3.7 System Impact Studies

The sections below define and detail the required studies to interconnect new (or modified) generation to the GPL System. The studies will assess the project's impact on the system.

3.7.1 Feasibility Study / Security Screening

For each Generation Interconnection Application, a steady-state Feasibility Study shall be conducted by GPL which will include power-flow and transfer studies to assess potential power injection limitations based on the proposed POI by the Interconnecting Customer (IC). The Feasibility Study is a high level review of the project and generally may include a number of preliminary assumptions. The IC shall also be permitted to propose alternative POIs to be considered in the Feasibility Study.

The results of the Feasibility Study will provide an indication of the level at which the proposed Generation Resource can expect to operate simultaneously with the existing and expected new Generation Resources in the area, including those that have signed Interconnection Agreements, before significant transmission additions or enhancements may be required.

The Feasibility Study shall begin only after the follow conditions are met:

- a. The Generation Interconnection Application, found in Appendix A, is submitted and accepted by GPL as complete;
- b. The Interconnection Project Dataset (IPDS) , as defined in Appendix B, is submitted and accepted by GPL as complete for the feasibility phase; and
- c. The Feasibility Study Fee is received in full by GPL as per the instructions in GPL Website (<http://www.gplinc.net/GI/Fees>)

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Upon completion of the Feasibility Study, GPL shall provide the IC with a non-binding informational report indicating potential requirements for future transmission additions or enhancement to accommodate the proposed new (or modified) generation to the GPL System. This report will inform the IC about any additional transmission improvements estimated to be required for the continued security and reliability of the GPL System. This report does not imply any commitment by GPL to recommend or construct these transmission additions or enhancements.

3.7.2 Full Interconnection Study (FIS)

3.7.2.1 Full Interconnection Study Overview

The FIS consists of steady-state, dynamic and short-circuit, facility studies, along with other relevant studies deemed necessary for the objective of assessing whether additional transmission facilities are needed to reliably interconnect the new (or modified) Generation Resource to the GPL System.

The FIS is not intended to determine the deliverability of power from the proposed Generation Resource to any particular load or the facilities required to ensure that the proposed Generation Resource does not experience any transmission-related curtailment.

When the Generation Interconnection Application queue has more than one request, GPL shall proceed with a Cluster Study and the FIS will consider all projects in the Cluster (see Section 3.12 on Queue Management). This FIS results shall be made available to all ICs participating in the Cluster Study. When the queue has only one project, the FIS will consider only that project.

Along with the existing power plants, GPL shall include all projects with signed interconnection agreements (IA) as pre-existing for the FIS.

If changes to the GPL System occur after the FIS report is completed, but before the IC signs the Interconnection Agreement, GPL reserves the right to update the final FIS report to reflect those changes. Such changes may include, but are not limited to, a newly signed Interconnection Agreement.

The FIS shall be carried out under stressed conditions on the transmission system and as such the dispatch of facilities and load conditions will be as follows:

- a) All proposed generation under study shall be dispatched at its maximum capacity along with other plants in the same area also dispatched at maximum capacity.
- b) The load conditions shall be chosen to maximize the use of the transmission system in the area where the project is located. This may require certain areas, such as near the

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Interconnection Project's site, to have light loads, whereas other areas, far from the project site, to have peak loads.

The FIS shall include not only the in-service year of the project but also the long term assessment, five years out, of the system impact for ensuring optimal transmission additions or enhancements. The Cost Allocation (see Section 3.10) shall determine how different high cost investments are taken into consideration.

The interconnection requests can be for an Energy Resource Interconnection Service (ERIS) or Network Resource Interconnection Service (NRIS). ERIS refers to curtailable service and the project has access to transmission as available and can ask to reduce output in case of contingencies, maintenance or dispatching considerations. NRIS allows the project to dispatch its full capacity once the reinforcements identified in the study are in place.

When considering the need for system upgrades before the interconnection service can be provided, the nature of the service (ERIS or NRIS) shall be considered as detailed in section 3.7.3)

3.7.2.2 Full Interconnection Study Procedure

The IC can request a FIS at any time after GPL deems the initial Generation Interconnection Application complete and may request an FIS before the completion of the Feasibility/Security Screening Study. Requesting both studies at the same time may shorten the overall time to complete the interconnection process due to overlap of work on both studies.

Within 180 days of the date when GPL provided the IC with the Feasibility Study results described in Section 3.7.1, the IC must file the request for the Full Interconnection Study Request (FISR), along with the applicable fees as defined in GPL Website (<http://www.gplinc.net/GI/Fees>) and proof of site control. If the FISR is not received within 180 days the Generation Interconnection Application will be considered withdrawn.

GPL will begin initiation and coordination of the FIS only after receiving the Full Interconnection Study Request from the IC.

After the expiration of the 180 day period, an IC must submit a new Generation Interconnection Application for a Feasibility Study and must again pay the appropriate fee. The IC will also be required to submit any updates or changes in the project's data to GPL.

Within five (5) Business Days of receiving notice to proceed with an FIS and with all requirements fulfilled, GPL will schedule a FIS Scope Meeting. At the FIS scope meeting,

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- a) The IC will present the proposed Generation Interconnection Application and GPL will review the results of the Feasibility Study;
- b) GPL shall define whether the project will be assessed independently or within a Cluster Study;
- c) GPL and IC shall agree if a Facilities Study will be included as part of the FIS and adjust the fees appropriately.
- d) GPL will facilitate a review of the Project Data received and the IC shall confirm validity of data. If any data requires updating, the IC will provide the date when all Project Data will be finalized;
- e) GPL will facilitate a general discussion of the preliminary study scope of work for the FIS and the study timeline; and
- f) GPL shall disclose any additional special studies required to fully assess the project’s impact to the system.

The IC and GPL must reach an agreement on the FIS scope within 60 Calendar Days of the FIS scope meeting and have this summarized in the FIS Scope Agreement. The FIS Scope Agreement (FISSA) must include all assumptions, timetables, study cost estimates and payment schedules, and the determination of all requirements for interconnection.

The FISSA must include all studies required by this section. The agreement shall also include the scenarios and base cases that will be used in the studies along with the years for study and dispatch conditions. The communication protocols relevant to the project shall be documented in the agreement. Additionally, the locations where short-circuit fault duty will be identified, calculated, and documented in the study shall be included in the agreement. The IC and GPL shall consider the Feasibility Study and other preliminary studies and documents provided by the IC when developing the FISSA.

The IC and GPL may divide the FIS into distinct study phases, each requiring IC approval to proceed (e.g. steady state and stability).

If the IC and GPL cannot agree to the FIS study scope within the 60-day period, GPL may choose to grant an extension. If after the extension there is no successful agreement, mediation by the Public Utility Commission will be attempted. If mediation is unsuccessful, GPL will consider whether the IC’s Generation Interconnection Agreement should be terminated. If the request is terminated, the IC will be required to file a new Generation Interconnection Application and pay all appropriate fee(s) for any new generation project.

Upon completion and execution of the FIS Scope Agreement GPL will include the Interconnection Project in the Cluster FIS or individual FIS as identified in the FISSA.

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Upon completion of the FIS, GPL provides the System Impact Study Report (SISR) detailing the results of the study and reinforcements necessary for full interconnection service as well as any limitations before these reinforcements are in place. This report may include critical energy infrastructure information and shall be protected under the IC Non Disclose Agreement.

GPL shall submit the dynamic and transient stability analysis as separate documents from the remainder of the System Impact Study Report.

GPL and the IC shall review and accept the System Impact Study Report no later than hundred and fifty (150) Calendar Days after execution of the FIS Scope Agreement.

IC shall file with GPL its agreement with the SISR results and desire to proceed with the Facilities Study (Facility Study Order to Proceed Letter), unless it was included as part of the FIS as agreed in the FIS Scoping meeting.

3.7.2.3 Full Interconnection Study Elements

The FIS consists of a series of distinct study elements that will be stated in the FIS Study Scope Agreement. The primary purpose of the FIS is to determine the most effective and efficient manner in which to achieve the proposed Generation Interconnection Application while continuing to maintain the reliability of the GPL System by ensuring compliance with all applicable guides, reliability standards as defined in this Grid Code, GPL's Planning and Operating Guides and Good Utility Practice. The scenarios and base cases being used for these studies to determine potential transmission limitations will be documented in the FIS study.

The FIS process includes developing and analyzing steady state, short circuit and dynamic stability models of the existing and proposed GPL System to determine the impact of the proposed interconnection as detailed below.

GPL will also examine normal transmission operations as well as potentially adverse, or contingency, conditions in order to identify and analyze the reliability and effectiveness of various interconnection design alternatives in alleviating or mitigating any undesirable performance of the interconnection under a variety of operating conditions. The study shall include analysis demonstrating the adequate reliability of any temporary interconnection configurations if applicable.

In comparing interconnection alternatives, GPL will consider such information as interconnection cost and construction schedule, impact to short and long-range reliability, operational flexibility, and compatibility with future transmission plans.

GPL may consider interconnection alternatives not suggested by the IC.

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3.7.2.4 Steady-State Analysis

The steady-state interconnection study base case shall be created from the most recently approved GPL base cases for the year of interconnection. GPL may adjust the base cases by removing any future facility for which funding / commitment has not been finalized.

For Cluster Studies, the steady-state model shall include all Generation Interconnection Applications determined to be within the cluster. Additionally, GPL reserves the right to add other future generation that it deems likely to also be online in the interconnection year or future years. All included generation shall be indicated in the FIS Scope Agreement.

The steady-state interconnection study shall be conducted in accordance with the Planning Code. Any additional facilities that may be necessary to ensure that expected system performance conforms to the reliability standards in this Planning Code for the normal and contingency conditions will be clearly identified in the report for this part of the FIS.

The steady-state interconnection study shall include the proposed in-service year with the Project (or Cluster) in service (Project / Cluster Case) and without the Project (or Cluster) in service (the Benchmark Case). As indicated earlier, GPL shall also include a future (five years out) case to identify long term impacts and optimality of reinforcements.

If the steady-state interconnection study identifies problems, such as overloads or voltage violations, with the Project (or Cluster) in service and a threshold on responsibility is met (Section 3.10 Allocation of Responsibility), an additional study of alternative solutions shall be carried out. This study shall include a steady-state power flow, with contingency analysis, for the proposed in-service year and various alternative reinforcement solutions. Preliminary costing for the various solutions shall be determined for screening and a reinforcement solution shall be selected.

A steady-state voltage stability analysis, with the proposed reinforcement solution for the project expected in-service year, shall be performed. A Q/V analysis at critical buses for selected contingencies shall be carried out. The critical buses and contingencies shall be identified during previous studies and can be confirmed with activities such as PSS@E RANK.

If there are facilities that cannot be completed in time to accommodate the Commercial Operations Date of the generation plant(s), they will be identified and reported to the affected IC(s) along with any likely interim limitations of generation output that may result.

Loss-of-generation analyses shall assume that the lost generation will be replaced from all remaining Generation Resources in proportion to their nominal capacity and not solely from the swing bus (i.e., inertial response), and shall consider the generation limit of each Generation Resource.

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3.7.2.5 System Protection (Short-Circuit) Analysis

GPL shall calculate available short-circuit fault duty in locations identified in the FIS Scope Agreement.

If any of the required transmission system improvements associated with the Generation Interconnection Application result in violations of GPL's short circuit criteria, GPL shall plan and provide facilities to address such violations.

GPL will determine the maximum available fault currents at the interconnection substation for determining switching device interrupting capabilities and protective relay settings.

3.7.2.6 Dynamic and Transient Stability (Angular Stability, Voltage Stability, Small Signal Stability)

GPL shall perform transient stability studies to confirm compliance with the Planning Code reliability standards and confirm compliance with the Minimum Technical Requirements.

If GPL decides not to conduct these studies, GPL must provide documented justification in lieu of the study report.

When performing such studies, all existing or publicly committed Generation Resource in the area of the study will normally be represented at full net output, although some generation might be modeled at full gross output (including auxiliary load). Any resulting increase in generation will be balanced as addressed in the FIS Scope Agreement; i.e. identification of sinks for the increased generation.

Stability study base cases shall be formed from the latest available approved GPL base cases and approved Dynamics database. The initial transmission configuration in the area of study included in a stability study base case shall be identical to that used in the steady-state studies of the same period. Any previously identified transmission improvements that will not be in service prior to the Commercial Operations Date of the proposed Generation Resource shall not be included in the stability study base case.

Transient stability studies shall be conducted following the guidelines and principles of the Planning Code and shall analyze the performance of the proposed Generation Resource or Cluster in terms of angular stability, voltage stability, voltage dips and excessive frequency excursions. Additional studies may include small signal stability in case of oscillations and PSS tuning required. Proposed analyses shall be identified and defined in the FIS Scope Agreement.

All stability studies shall be performed in accordance with the reliability standards in the Planning Code, and the results shall identify any additional facilities or action(s) necessary to ensure reliable operation and conformance with that standard.

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3.7.2.7 Long Term Dynamic Stability

For Generation Interconnection Applications that are deemed to include renewable resources which will produce large and fast generation ramps in the system, GPL shall assess the long term stability.

These studies shall identify the adequacy of GPL's regulating reserves and generation ramping capability to manage these ramps and of the Automatic Generation Control (when installed) to bring the frequency back to nominal.

3.7.3 Interconnecting Customer (IC)'s System Impact Responsibility

If the FIS identifies overloads or voltage violations the Interconnection Project responsibility for these overloads and voltage violations will be determined as follows:

- a. If thermal overloads are found in the system with the Project (or Cluster) in service, then these overloads shall be considered the responsibility of the Project (or Cluster) if :
 - i. The Project Outage Transfer Distribution Factor (OTDF) on the overloaded facility is greater than 2% unless the IC is seeking Energy Resource Interconnection Service (ERIS) in which case the OTDF must be greater than 20%; or
 - ii. The loading change of the facility, defined as the difference in loading with respect to the facility applicable rating (Rating A or B) between the Benchmark case without the Project and the Project case with the Project in-service, is greater than 5%.
 - iii. For Base Case overloads introduced by the Project or Cluster in place a Transfer Distribution Factor (TDF) of 2% will be used regardless of the project seeking ERIS or NRIS
- b. If a facility is marginally overloaded in the Benchmark Case and the Project (or Cluster) increases the overload by more than 5%, GPL shall assign partial responsibility.
- c. The Project (or Cluster) shall not be responsible for network issues that are not related to the Project. In particular, if the facility is nearing overload (e.g., 99%) in the Benchmark Case and the Project case is slightly overload (e.g., 101%).
- d. Voltage violation responsibility will be assessed by comparing voltage changes between the Project Case and the Benchmark case. Responsibility will be identified if the project produces a voltage change greater than or equal to 1% and brings the voltage into violation range.
- e. For a Cluster Study, all Projects in the Cluster shall share the responsible for the reinforcements identified in the FIS. Each individual Project's responsible shall be proportion to their contribution to the total OTDF on the overloaded facility.

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- f. The financial responsibility, if any, on the reinforcements shall be specified in the Facility Study and based on the Cost Allocation defined in this Code (Section 3.10).

3.8 Facility Study

The Facility Study shall provide complete details and estimated cost of the facility requirements for the direct interconnection of the proposed Generation Resource project to the system.

If system reinforcements are identified as necessary to safely interconnect the Generation Resource(s), the complete details and costs of these investments shall also be included in the Facility Study.

The Facility Study Report shall include Basic Engineering and cost estimates (+20/-10 percent range of accuracy), construction milestones estimates for all direct interconnection-related transmission and substation facilities proposed to be installed in accordance with the findings and recommendations of the FIS.

The Facility Study shall specify and estimate the cost of the equipment, engineering, procurement, and construction work in accordance with applicable ANSI/IEEE standards, GPL Constructions standards, as modified from time to time, and Good Utility Practice.

The Facility Study Report shall also identify the electrical switching configuration of the connection equipment, including, without limitation: the transformer, switchgear, meters, and other station equipment; the nature and estimated cost of any of the GPL's system expansion or upgrades necessary to accomplish the interconnection; GPL shall use existing studies to the extent practicable in performing the Facility Study.

The Facility Study shall define the financial responsibility of the IC in accordance with the Cost Allocation in this Code (Section 3.10). The financial responsibility shall be incorporated as conditions in the Interconnection Agreement.

GPL may perform any additional studies required for the completion of the Facilities Study and completes, if required, stakeholder consultation with land owners and municipalities in the area of the proposed development. If there are changes/additions to the Interconnection Project that affects the FIS, additional simulations to address these changes shall be carried out by GPL. These changes shall be related to a better definition of the Project facilities and important changes such as material movements of the Point of Interconnection (POI) are not allowed. GPL shall use Reasonable Efforts to complete the additional studies no later than sixty (60) Calendar Days after receiving Facility Study Order to Proceed Letter and the requested changes.

3.8.1 Facility Study Procedure

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The Facilities Study can be part of the FIS if agreed during the FIS Scoping meeting with the aim of expediting the studies.

Upon completion of the system studies in the FIS, the IC will instruct GPL to proceed with the Facility Study by filing the “Facility Study Order to Proceed Letter” and provide any missing information on the Interconnection Project Dataset as necessary for the Facility Study as well as an initial payment to cover the estimated study costs to be incurred by GPL based on the rates and guidelines on its website (<http://www.gplinc.net/GI/Fees>). The additional information includes the detailed data required for system design; i.e. major equipment specifications, physical layout, protection details, communications, etc.

The Facility Study results shall be provided as either a separate report or included as a section of the FIS is so agreed in the FIS Scoping Meeting.

If upon completion of the study there is a shortfall to cover actual study cost, IC will make a supplementary payment to cover them and if there is a surplus GPL will refund the IC.

3.9 Final Study Report and Subsequent Actions

GPL will present a preliminary report of its findings and recommendations for each of the study elements of the FIS and the Facility Study to the IC.

Any questions, comments, proposed revisions, or clarifications by the IC shall be made in writing to GPL within ten Business Days after the issuance of each study report, which may cover one or more study elements.

After considering the information received from the IC, the study element(s) report will be deemed complete and GPL shall provide a final report to the IC.

The IC shall provide final documentation to GPL certifying their progress to construction including environmental permits and stakeholder consultation (if applicable).

IC shall enter into an agreement with GPL (Customer Contribution in Aid of Construction Agreement) in which the IC agrees to its financial responsibility as identified in the Facility Study according to the rules in Section 3.10 and to post a banking guarantee (Letter of Credit) to cover its allocation of system reinforcements costs.

Should the IC wish to proceed with the proposed Generation Interconnection Application, the IC must execute the Generation Interconnection Agreement (Section 3.11) with GPL within

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180 days following the completion of the FIS (includes all major study element reports) and the Facility Study.

The Customer Contribution in Aid of Construction must become part of the contract as well.

If during the time after the FIS and the Facility Study is completed, and before the Generation Interconnection Agreement is executed, changes occur that substantially differ from the assumptions used for the FIS, GPL shall determine the impact of the changes on the results of the FIS. All Generation Resource changes to be submitted to GPL using the same forms as in the initial submission for a change comparison. GPL will make appropriate modifications to the FIS/Facility Study and this may imply reinitiating the process and payment of applicable re-study fees.

3.10 Cost Allocation

This section defines the rules and procedures to be used to assign financial responsibility to the IC. This financial responsibility shall be included in an agreement, which is the “Customer Contribution in Aid of Construction Agreement” and shall be part of the Generation Interconnection Agreement.

The cost allocation is designed with consideration to the following:

- a) The IC and GPL shall have a Power Purchase Agreement (PPA) in place. All of the IC’s costs associated with the interconnection shall be part of payments under the PPA. Thus the cost allocation seeks to maintain the integrity of the cost allocation procedures for GPL rate making between generation, transmission, distribution and commercialization services. Also this allocation ensures that i) IC funds the investments as part of the development of the Interconnection Project and ii) payments to cover this investments follow the same contractual conditions as the electric power delivered by the IC
- b) Create a mechanism by which the responsibility of transmission reinforcements that can be used by other transmission users (GPL and other IPPs) but are initially funded by the Interconnection Customer (IC) can be properly allocated and IC compensated.
- c) Create a procedure by which IC can provide financing and if agreed build system reinforcements that although responsibility of GPL are necessary for IC’s Project interconnection.

3.10.1 Nature of Transmission Reinforcements

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The cost allocation is a function of the type of transmission reinforcements. These reinforcements are identified in the FIS and Facility Study and will fall under the following four project categories:

- I. Transmission reinforcements not a part of GPL's short or long term plans and identified for the sole purpose of facilitating the connection of the IC's generator with the GPL System (e.g., expansions to an existing substation, a new substation or radial lines to the IC's Project location).
- II. Transmission reinforcements not a part of GPL's short or long term plans and identified as necessary for the IC's interconnection and implemented at lower voltage level (e.g. 13.8 kV and transformation to 69 kV). Such projects should have local impact and could potentially benefit other ICs.
- III. Transmission reinforcements not a part of GPL's short or long term plans and identified as necessary for the IC's interconnection and implemented in the bulk transmission system (69 kV and above). Such projects will add flexibility and capacity to the transmission grid once in service.
- IV. Transmission reinforcements that are a part of GPL's short or long term plans and identified as necessary for the IC's interconnection and improve reliability of the network and bring economic efficiency across the GPL System. These projects will address future reliability concerns, i.e. correction of voltage violations and/or overloads that would appear independently of the IC, or improve the system efficiency with benefit to cost ratios greater than one (e.g. reduction in operating costs and losses are greater than the carrying value of the investments).

3.10.2 Cost Allocation Breakdown

The Cost Allocations for the four Transmission Reinforcement projects identified are as follows:

3.10.2.1 Project Category I

These are transmission reinforcement projects created for the sole purpose of facilitating the connection of the IC's generator with GPL's system.

These projects shall be identified in the Customer Contribution in Aid of Construction Agreement as entirely to be funded by the IC.

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IC shall post bank guarantees to cover all cost to be incurred by GPL in the development of these category I projects as identified in the Customer Contribution in Aid of Construction Agreement. IC shall pay GPL all cost actually incurred.

IC can enter into an EPC agreement with GPL by which IC will construct the required facilities under GPL supervision and as per governing standards, i.e. ANSI/IEEE and NESC.

If within five (5) years a new Generation Interconnection Application Generation Resource make use of the Category I facilities funded by the original IC's, the owners of the new Generation Resource shall compensate the original IC proportionally for the use of the facilities. The cost allocation shall be made using proportional participation on the loading of facilities.

The original IC and GPL shall keep records of the investments made, GPL shall monitor the prospective loading facilities as defined in the FIS and determine the reallocation of costs to make sure that such compensation is made and that the generation cost properly reflects the necessary investments.

3.10.2.2 Project Category II

These are the transmission reinforcements identified as necessary for the IC's interconnection and implementation at lower voltage level (e.g. 13.8 kV and transformation to 69 kV). These costs shall be fully funded by the IC (or ICs in the Cluster proportionally to the OTDF of the overloaded facility).

These projects shall be identified in the Customer Contribution in Aid of Construction Agreement as entirely to be funded by the IC (or ICs in the Cluster proportionally to the projects capacity and TDF of the overloaded facility).

IC shall post bank guarantees to cover all cost to be incurred by GPL in the development of these category II projects as identified in the Customer Contribution in Aid of Construction Agreement. IC shall pay GPL all cost actually incurred or its aliquot in case of cluster studies.

If within five (5) years, a new Generation Interconnection Application occur in the area and require the reinforcements, the new IC shall compensate the original IC(s) proportional to their use of the facilities as determined by the project's capacity and TDF.

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The original IC and GPL shall keep records of the investments made, GPL shall monitor the prospective loading facilities as defined in the FIS and determine the reallocation of costs to make sure that such compensation is made and that the generation cost properly reflects the necessary investments.

3.10.2.3 Project Category III

These are transmission reinforcements identified as necessary for the IC's interconnection and implementation in the bulk transmission system (69 kV and above). These Project Category III reinforcements shall have cost allocation in the Customer Contribution in Aid of Construction Agreement based on the following:

- a) If the reinforcement project is part of the system connecting two or more of GPL bulk substations (69 kV or above), GPL shall require the IC(s) to finance up to 100% of the interconnection costs. GPL shall repay the investment with interest (rate posted on GPL Website <http://www.gplinc.net/GI>) within 10 years by use of an "adder" to the PPA. IC shall post a bank guarantee for all GPL expected costs identified in the facilities study,
- b) For voltage lines 69 kV or above and/or substations that are not part of the existing GPL System, the interconnection costs shall be fully funded by the IC(s). In the future, if GPL connects to this subsystem and integrates it into its existing system, then GPL shall proportionally compensate the IC for the value of the project facilities used at that future time to ensure proper allocation of costs between generation and transmission. The compensation shall be done by use of an "adder" to the PPA.
- c) If the reinforcements are less than US\$1,000,000 or represent less than a 5% of the IC's new Generation Resource project costs, the IC shall be responsible for full funding without GPL compensation as in (a) above.
- d) If within five (5) years, a new Generation Interconnection Application occur in the area and require the reinforcements, the new IC shall compensate the original IC(s) proportional to their capacity and TDF. The original IC and GPL shall keep records of the investments made, GPL shall monitor the prospective loading facilities as defined in the FIS and determine the reallocation of costs to make sure that such compensation is made and that the generation cost properly reflects the necessary investments.

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3.10.2.4 Project Category IV

Transmission reinforcements that are a part of GPL's short or long term plans shall be entirely funded by GPL. However, under the following two conditions, the IC shall be required to contribute up to 100% of the total reinforcements cost:

- a) The IC's generation is advancing the plans/need for such reinforcements.
- b) GPL does not have the funds to meet the timeline for reinforcements required by the IC.

Under both conditions, GPL shall repay the contribution with interest within 10 years by use of an "adder" to the PPA.

3.11 Generator Interconnection Agreement (GIA)

If the Interconnecting Customer (IC) decides to proceed with the construction and completion of the proposed generation project and interconnection within the 180-day period following the completion of the Full Interconnection Study (FIS) and Facility Study, it shall execute the Generation Interconnection Agreement (GIA) with GPL which will include the Customer Contribution in Aid of Construction Agreement with GPL as well. A template of the GIA can be found in Appendix C.

Before a GIA is signed, all studies included in the FIS scope must be completed and the Customer Contribution in Aid of Construction Agreement must be in place. In the event the IC and GPL agree to sign a GIA prior to the completion of all studies included in the FIS scope, the GIA will be considered preliminary and not effective until the studies are finalized and the relevant Customer Contribution in Aid of Construction Agreement is in place. The IC and GPL must meet and maintain compliance with all Reliability Standards, Protocols, and the requirements of this Code.

Banking guarantees in accordance with the Customer Contribution in Aid of Construction Agreement shall to be posted within ten (10) days of the GIA execution or the project will be considered withdrawn and the GIA terminated.

It is critical that the GIA clearly delineates the responsibility of the IC to comply with all requirements of the Grid Code and the authorization of GPL to enforce it. If at any time GPL determines that Generation Resource may violate operational standards established in this Grid Code, GPL shall refuse synchronization until the affected IC can demonstrate that the Generation Resource is in compliance with this Grid Code.

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If at any time before initial synchronization of a Generation Resource, GPL reasonably determines that the Resource may violate operational standards established in the Protocols, this Grid Code, and other binding documents, GPL may require the affected IC to demonstrate to GPL's reasonable satisfaction that the Generation Resource can comply with these standards before the Generation Resource is permitted to synchronize. GPL may refuse to allow synchronization of a Generation Resource if the IC cannot demonstrate that the Generation Resource can comply with these standards.

3.12 Queue Management

This section defines the rules and procedures to be used to manage the queue of interconnection requests received by GPL.

- a. GPL shall perform one Cluster FIS per year. All Generation Interconnection Applications received by the date specified on GPL Website (<http://www.gplinc.net/GI>) shall be considered in the Cluster and eligible for the FIS.
- b. The deadline date will be announced by GPL on its Website (<http://www.gplinc.net/GI>) with at least six (6) months prior notice.
- c. A Generation Interconnection Application may be submitted at any time before the deadline date. However, a Cluster FIS shall only commence once the deadline has passed.
- d. If a large volume adding in total more than 20 MW of requests is received or an IC has a generator greater than 15 MW, a Cluster study shall begin at an earlier date once an agreement between the IC(s) and GPL has been reached for an "Independent Study.
- e. Any IC subsequently part of that year's scheduled Cluster FIS shall be considered in the Facility Study and Cost Allocation, when applicable, to ensure proper cost sharing of facilities.

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3.13 Generation Interconnection Application (GIAP) Fees

One of the Interconnection Code objectives is to clearly define the procedures for filing an interconnection request, basis for studies, timelines, fees and cost allocation between GPL and the Interconnection Customers (IC). Although the interconnection fees are discussed in each of the relevant sections of the code, in this subsection the fees are summarized for ease of reference.

3.13.1 Feasibility Study Fees

- The Generation Interconnection Application (GIAP) shall be accompanied by the applicable fees as defined on GPL Website (<http://www.gplinc.net/GI/Fees>).
- These fees are defined per MW of interconnection capacity, with a minimum and a maximum specified on GPL Website.
- GPL shall apply the deposit toward the cost of the applicable Interconnection Study or Studies.
- The Interconnection Customer shall submit a separate GIAP for each site and may submit multiple GIAPs for a single site (e.g. for different voltage level connection).
- The Interconnection Customer must submit a deposit for each GIAP even when more than one request is submitted for a single site.
- The Feasibility Study shall begin only after the Feasibility Study Fee is received in full by GPL as per the instructions on GPL Website (<http://www.gplinc.net/GI/Fees>), that is only after the initial deposit plus any additional payments (if necessary) cover the cost of the feasibility study as posted on the website..

3.13.2 Full Interconnection Study Fees

- Within 180 days of the date when GPL provided the IC with the Feasibility Study results, the IC must file the request for the Full Interconnection Study Request (FISR), along with the applicable fees as defined in GPL Website (<http://www.gplinc.net/GI/Fees>), and proof of site control.
- If Site Control cannot be provided at this time, the Interconnection Customer shall post an additional deposit of as indicated on GPL Website (<http://www.gplinc.net/GI/Fees>). This deposit is reimbursable upon demonstration of Site Control or withdrawal of Interconnection Request. If Site Control is not demonstrated before 10 days after the start of the Full Interconnection Study, the deposit will become non reimbursable.
- At the FIS Scope Meeting (Section 3.7.2.2), GPL and IC shall agree if a Facilities Study will be included as part of the FIS and adjust the fees appropriately.

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If during the time after the FIS and the Facility Study are completed, and before the Generation Interconnection Agreement is executed, changes occur that substantially differ from the assumptions used for the FIS, GPL shall determine the impact of the changes on the results of the FIS. All Generation Resource changes to be submitted to GPL using the same forms as in the initial submission for a change comparison. GPL will make appropriate modifications to the FIS/Facility Study and this may imply reinitiating the process and payment of applicable re-study fees.

3.13.3 Facility Study Cost

Upon completion of the system studies in the FIS, the IC will instruct GPL to proceed with the Facility Study by filing the “Facility Study Order to Proceed Letter”, unless these studies were agreed to be included as part of the FIS. Under either case, before the facility study starts GPL shall provide a budget for the study with the expected cost determined using the rates and conditions published on GPL’s website (<http://www.gplinc.net/GI/Fees>). IC shall make an initial payment to cover these estimated costs of the Facilities Study. If upon completion of the study there is a shortfall to cover actual study cost, IC will make a supplementary payment to cover them and if there is a surplus GPL will refund the IC.

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3.14 APPENDIX A: Generation Interconnection Application

Generation Interconnection Application

This Generation Interconnection Application (GIAP) is required when proposing a Point of Delivery (POD) to Guyana Power and Light (GPL) where new transmission facilities are required to permit the proposed connection project. Once the GIAP has been submitted, GPL will review the GIAP. Once complete, GPL will assign a project name and project number and the project will follow the Interconnection Code for connection to GPL.

APPLICANT INFORMATION

Legal Corporate Name: _____

Project Name: _____

Contact Mailing Address: _____

Contact Phone Number: _____ Contact Fax Number: _____

Primary Contact for matters relating to this Interconnection Request:

Name: _____

Title: _____

Phone Number: _____

Internet Mail Address: _____

Secondary Contact (if applicable) for matters relating to this Interconnection Request:

Name: _____

Title: _____

Phone Number: _____

Internet Mail Address: _____

FACILITY INFORMATION

Proposed Facility Name: _____ (subject to GPL approval)

Facility Description _____

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Facility Location:

Substation closest to facility (if known): _ _____

PROJECT INFORMATION

IS THIS A CHANGE TO AN EXISTING FACILITY?

Yes No

If yes, what is the existing Point of Service (POS) name?

- e. Requested Capacity: _____MW (do not include existing contract capacity)
- f. Requested connection to transmission system (i.e. in-service) date*: _____(yyyy-mm-dd)
- g. If commissioning for the requested capacity will be staged:
- h. Stage 1: _____MW
- i. Requested connection to transmission system (i.e. in-service) date*: _(yyyy-mm-dd)
- j. Stage 2: _____MW
- k. Requested connection to transmission system (i.e. in-service) date*: _(yyyy-mm-dd)
- l. Stage 3: _____MW
- m. Requested connection to transmission system (i.e. in-service) date*: _(yyyy-mm-dd)
- n. Requested commissioning period (maximum 90 days): _____ days
- o. Auxiliary or start-up power requirements: _____ MW
- p. Anticipated facility generation capacity factor: _____ %
- q. Generation type: _____ (i.e. Reciprocating Engines, wind, PV, steam, etc.)

****APPLICANT TO PROVIDE THEIR BEST ESTIMATE OF THE DATE BY WHEN THEY WOULD LIKE TO HAVE SYSTEM ACCESS. A MUTUALLY DEVELOPED TARGET IN-SERVICE DATE WILL BE ESTABLISHED.***

Additional Information Required with the Application

- e) An explanatory letter that indicates the scope of the project and capacity
- f) Two copies of the Site Plan including the location of the Project.
- g) Diagram illustrating the installation of the Generation System up to the proposed POI.
- h) Single-line protection diagram.

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- i) Interconnection Customer must demonstrate to GPL’s satisfaction Site Control for the intended generating facilities by ownership, leasehold in or right to develop. If Site Control cannot be provided at this time the Interconnection Customer shall post an additional deposit of as indicated on GPL <http://www.gplinc.net/GI>. This deposit is reimbursable upon demonstration of Site Control or withdrawal of Interconnection Request. If Site Control is not demonstrated before 10 days after the start of the Full Interconnection Study, the deposit will become non reimbursable.
- j) Feasibility Study Fees

The Requestor requests to be qualified for the interconnection request in accordance with the Tariff established by Guyana Light and Power (GPL) and based on the information provided on this form. The Requestor acknowledges that this document represents a request only and is not a contract between itself and GPL.

Signed: _____ Date: _____

Name: _____

Title: _____

Note: Substantial revisions to the Project Information provided may require the Requestor to submit a new Interconnection Request based on the revised information. “Substantial revisions” include, but are not limited to, changes in facility location, in-service date timing, electrical capacity or characteristics of the requested connection.

Please submit the completed application to:

Guyana Light and Power, Inc
Address:
Postal Code:
Attention: Customer Connections

Email: customer.connections@gpl.com

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3.15 APPENDIX B: Interconnection Project Data Set (IPDS)

Interconnection Project Dataset (IPDS)

The Generation Interconnection Applicant (Interconnection Customer) shall use the forms contained in the excel spreadsheet GPL Generation Forms.xlsx that can be downloaded from GPL website <http://www.gplinc.net/GI> and submitted together with the form below as per the instruction in the website.

APPLICANT INFORMATION

Legal Corporate Name: _____

Project Name: _____

Contact Mailing Address: _____

Contact Phone Number: _____ Contact Fax Number: _____

Primary Contact for matters relating to this Interconnection Request:

Name: _____

Title: _____

Phone Number: _____

Internet Mail Address: _____

Secondary Contact (if applicable) for matters relating to this Interconnection Request:

Name: _____

Title: _____

Phone Number: _____

Internet Mail Address: _____

FACILITY INFORMATION

Proposed Facility Name: _____ (subject to GPL approval)

Project Interconnection Number (if assigned): _____

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The completed Interconnection Project Data Set is in the file _____ sent along this document Please submit the completed dataset to or upload to website .

Guyana Light and Power, Inc
Address:
Postal Code:
Attention: Customer Connections

Email: customer.connections@gpl.com

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3.16 APPENDIX C: SAMPLE GENERATOR INTERCONNECTION AGREEMENT (GIA)

THIS GENERATOR INTERCONNECTION AGREEMENT (“GIA”) is made and entered into this ____ day of _____ 20__, by and between _____, a _____ organized and existing under the laws of _____ (“Interconnection Customer” with a Generating Facility), and **Guyana Power & Light (GPL)**, a public corporation registered under _____, represented in this act by its _____, engineer -----, of legal age, married, and resident of _____, hereinafter referred to as "GPL". Interconnection Customer and GPL each may be referred to as a “Party,” or collectively as the “Parties.”

RECITALS

WHEREAS, GPL owns, operates and has functional control of the operations of the Transmission System, as defined herein, is responsible for providing Transmission Service and Interconnection Service on the transmission facilities under its control, and may therefore be required to construct certain Interconnection Facilities and Network Upgrades, as set forth in this GIA; and

WHEREAS, Interconnection Customer intends to own, lease and/or control and operate the Generating Facility identified as a Generating Facility in Appendix A to this GIA; and

WHEREAS, Interconnection Customer, and GPL have agreed to enter into this GIA, for the purpose of interconnecting the Generating Facility with the Transmission System;

NOW, THEREFORE, in consideration of and subject to the mutual covenants contained herein, it is agreed:

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ARTICLE 1. DEFINITIONS

When used in this GIA, terms with initial capitalization that are not defined in Article 1 shall have the meanings specified in the Article in which they are used. Those capitalized terms used in this GIA that are not otherwise defined in this GIA have the meaning set forth in the “Independent Power Producer Interconnection Regulation of GPL”

Adverse System Impact shall mean the negative effects due to technical or operational limits on conductors or equipment being exceeded that may compromise the safety and reliability of the electric system.

Affiliate shall mean, with respect to a corporation, partnership or other entity, each such other corporation, partnership or other entity that directly or indirectly, through one or more intermediaries, controls, is controlled by, or is under common control with, such corporation, partnership or other entity.

Ancillary Services shall mean those services that are necessary to support the transmission of capacity and energy from resources to loads while maintaining reliable operation of the Transmission System in accordance with Good Utility Practice.

Applicable Laws and Regulations shall mean all duly promulgated applicable national, state and local laws, regulations, rules, ordinances, codes, decrees, judgments, directives, or judicial or administrative orders, permits and other duly authorized actions of any Governmental Authority having jurisdiction over the Parties, their respective facilities and/or the respective services they provide.

Applicable Reliability Standards shall mean Reliability Standards as adopted by GPL and included in the Grid Code.

Base Case shall mean the base case power flow, short circuit, and stability databases used for the Interconnection Studies by GPL or Interconnection Customer.

Breach shall mean the failure of a Party to perform or observe any material term or condition of this GIA.

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Breaching Party shall mean a Party that is in Breach of this GIA.

Business Day shall mean Monday through Friday, excluding Holidays.

Calendar Day shall mean any day including Saturday, Sunday or a Holiday.

Critical Energy Infrastructure Information (CEII); information related to the power system and its interconnected components that could potentially be used to identify vulnerabilities.

Competent Authority shall mean any regulatory body enabled by Law to regulate any of the functions of parties or activities in this contract.

Commercial Operation shall mean the status of a Generating Facility that has commenced generating electricity for sale, excluding electricity generated during Trial Operation.

Commercial Operation Date (COD) of a unit shall mean the date on which the Generating Facility commences Commercial Operation as agreed to by the Parties pursuant to Appendix E to this GIA.

Common Use Upgrade (CUU) shall mean an Interconnection Facility, Network Upgrade, System Protection Facility, or any other classified addition, alteration, or improvement on the Transmission System or the transmission system of an Affected System, not classified under Attachment FF as a Baseline Reliability Project, Market Efficiency Project, or Multi-Value Project, that is needed for the interconnection of multiple Interconnection Customers' Generating Facilities and which is the shared responsibility of such Interconnection Customers.

Confidential Information shall mean any proprietary or commercially or competitively sensitive information, trade secret or information regarding a plan, specification, pattern, procedure, design, device, list, concept, policy or compilation relating to the present or planned business of a Party, or any other information as specified in Article 22, which is designated as confidential by the Party supplying the information, whether conveyed orally, electronically, in writing, through inspection, or otherwise, that is received by another Party.

Default shall mean the failure of a Breaching Party to cure its Breach in accordance with Article 17 of this GIA.

Definitive Planning Phase Queue Position shall mean the order of a valid Interconnection Request, relative to all other pending valid Interconnection Requests, in the Definitive Planning Phase. The Definitive Planning Phase Queue Position is established based upon the date Interconnection Customer satisfies all of the requirements of Section 8.2 to enter the Definitive Planning Phase.

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Demonstrated Capability shall mean the continuous net real power output that the Generating Facility is required to demonstrate in compliance with Applicable Reliability Standards.

Dispute Resolution shall mean the procedure for resolution of a dispute between or among the Parties in which they will first attempt to resolve the dispute on an informal basis.

Distribution Upgrades shall mean the additions, modifications, and upgrades to the Distribution System at or beyond the Point of Interconnection to facilitate interconnection of the Generating Facility and render the delivery service necessary to affect Interconnection Customer's wholesale sale of electricity in interstate commerce. Distribution Upgrades do not include Interconnection Facilities.

Effective Date shall mean the date on which this GIA becomes effective upon execution by the Parties subject to acceptance by the Commission, or if filed unexecuted, upon the date specified by the Commission.

Emergency Condition shall mean a condition or situation: (1) that in the reasonable judgment of the Party making the claim is imminently likely to endanger, or is contributing to the endangerment of, life, property, or public health and safety; or (2) that, in the case of either GPL, is imminently likely (as determined in a non-discriminatory manner) to cause a material adverse effect on the security of, or damage to the Transmission System, GPL's Interconnection Facilities or the electric systems of others to which the Transmission System is directly connected; or (3) that, in the case of Interconnection Customer, is imminently likely (as determined in a non-discriminatory manner) to cause a material adverse effect on the security of, or damage to, the Generating Facility or Interconnection Customer's Interconnection Facilities. System restoration and blackstart shall be considered Emergency Conditions; provided that Interconnection Customer is not obligated by this GIA to possess blackstart capability. Any condition or situation that results from lack of sufficient generating capacity to meet load requirements or that results solely from economic conditions shall not constitute an Emergency Condition, unless one of the enumerated conditions or situations identified in this definition also exists.

Engineering & Procurement (E&P) Agreement shall mean an agreement that authorizes GPL to begin engineering and procurement of long lead-time items necessary for the establishment of the interconnection in order to advance the implementation of the Interconnection Request.

Environmental Law shall mean Applicable Laws or Regulations relating to pollution or protection of the environment or natural resources.

Holiday shall mean a national holiday in Guyana.

Force Majeure shall mean any act of God, labor disturbance, act of the public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A Force Majeure

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event does not include an act of negligence or intentional wrongdoing by the Party claiming Force Majeure.

Generating Facility shall mean Interconnection Customer's device(s) for the production of electricity identified in the Interconnection Request, but shall not include the Interconnection Customer's Interconnection Facilities.

Generating Facility Capacity shall mean the net capacity of the Generating Facility and the aggregate net capacity of the Generating Facility where it includes multiple energy production devices.

Generator Interconnection Agreement (GIA) shall mean the form of interconnection agreement, set forth herein.

Generator Interconnection Procedures (GIP) shall mean the interconnection procedures set forth in GPL Grid Code."

Generator Upgrades shall mean the additions, modifications, and upgrades to the electric system of an existing generating facility or of a higher queued Generating Facility at or beyond the Point of Interconnection to facilitate interconnection of the Generating Facility and render the Transmission Service necessary to affect Interconnection Customer's wholesale sale of electricity in interstate commerce.

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

Governmental Authority shall mean any National, state, local or other governmental regulatory or administrative agency, court, commission, department, board, or other governmental subdivision, legislature, rulemaking board, tribunal, or other governmental Authority having jurisdiction over the Parties, their respective facilities, or the respective services they provide, and exercising or entitled to exercise any administrative, executive, police, or taxing; provided, however, that such term does not include Interconnection Customer, GPL, or any Affiliate thereof.

Group Study(ies) shall mean the process whereby more than one Interconnection Request is studied together, instead of serially, for the purpose of conducting one or more of the required Studies.

Hazardous Substances shall mean any chemicals, materials or substances defined as or included in the definition of "hazardous substances," "hazardous wastes," "hazardous materials,"

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“hazardous constituents,” “restricted hazardous materials,” “extremely hazardous substances,” “toxic substances,” “radioactive substances,” “contaminants,” “pollutants,” “toxic pollutants” or words of similar meaning and regulatory effect under any applicable Environmental Law, or any other chemical, material or substance, exposure to which is prohibited, limited or regulated by any applicable Environmental Law.

Initial Queue Position shall mean the order of a valid Interconnection Request, relative to all other pending valid Interconnection Requests. The Initial Queue Position is established based upon the date and time of receipt of the valid Interconnection Request by GPL.

Initial Synchronization Date shall mean the date upon which the Generating Facility is initially synchronized and upon which Trial Operation begins.

In-Service Date (ISD) shall mean the date upon which Interconnection Customer reasonably expects it will be ready to begin use of GPL’s Interconnection Facilities to obtain backfeed power.

Interconnection Customer shall mean any entity, including GPL, GPL or any of the Affiliates or subsidiaries of either, that proposes to interconnect its Generating Facility with the Transmission System.

Interconnection Customer’s Interconnection Facilities (ICIF) shall mean all facilities and equipment, as identified in Appendix A of this GIA, that are located between the Generating Facility and the Point of Change of Ownership, including any modification, addition, or upgrades to such facilities and equipment necessary to physically and electrically interconnect the Generating Facility to the Transmission System or Distribution System, as applicable. Interconnection Customer’s Interconnection Facilities are sole use facilities.

Interconnection Facilities shall mean GPL’s Interconnection Facilities and the Interconnection Customer's Interconnection Facilities. Collectively, Interconnection Facilities include all facilities and equipment between the Generating Facility and the Point of Interconnection, including any modification, additions or upgrades that are necessary to physically and electrically interconnect the Generating Facility to the Transmission System. Interconnection Facilities shall not include Distribution Upgrades, Generator Upgrades, Stand Alone Network Upgrades or Network Upgrades.

Interconnection Facilities Study shall mean a study conducted by GPL, or its agent, for Interconnection Customer to determine a list of facilities (including GPL’s Interconnection Facilities, System Protection Facilities, and if such upgrades have been determined, Network Upgrades, Distribution Upgrades, Generator Upgrades, Common Use Upgrades, and upgrades on Affected Systems, as identified in the Interconnection System Impact Study), the cost of those facilities, and the time required to interconnect the Generating Facility with the Transmission System.

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Interconnection Facilities Study Agreement shall mean the form of agreement contained in Appendix 4 of the Generator Interconnection Procedures for conducting the Interconnection Facilities Study.

Interconnection Feasibility Study shall mean a preliminary evaluation of the system impact of interconnecting the Generating Facility to the Transmission System.

Interconnection Request shall mean an Interconnection Customer's request, in the form of Appendix 1 to the Generator Interconnection Procedures, to interconnect a new Generating Facility, or to increase the capacity of, or make a Material Modification to the operating characteristics of, an existing Generating Facility that is interconnected with the Transmission System.

Interconnection Service shall mean the service provided by GPL associated with interconnecting the Generating Facility to the Transmission System and enabling it to receive electric energy and capacity from the Generating Facility at the Point of Interconnection, pursuant to the terms of this GIA.

Interconnection Study (or Study) shall mean any of the studies described in the GPL Grid Code.

Interconnection Study Agreement shall mean the form of agreement contained in GPL Grid Code.

Interconnection System Impact Study shall mean an engineering study that evaluates the impact of the proposed interconnection on the safety and reliability of Transmission System. The study shall identify and detail the system impacts that would result if the Generating Facility were interconnected without project modifications or system modifications, focusing on the Adverse System Impacts identified in the Interconnection Feasibility Study, or to study potential impacts, including but not limited to those identified in the Scoping Meeting as described in the GPL Grid Code.

Loss shall mean any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demand, suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the other Party's performance, or non-performance of its obligations under this GIA on behalf of the indemnifying Party, except in cases of gross negligence or intentional wrongdoing, by the indemnified party.

Material Modification shall mean those modifications that have a material impact on the cost or timing of any Interconnection Request with a later queue priority date.

Metering Equipment shall mean all metering equipment installed or to be installed at the Generating Facility pursuant to this GIA at the metering points, including but not limited to instrument transformers, MWh-meters, data acquisition equipment, transducers, remote terminal unit, communications equipment, phone lines, and fiber optics.

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Network Resource Interconnection Service (NR Interconnection Service) shall mean an Interconnection Service that allows GPL to integrate Generating Facility with the Transmission System in the same manner as for any Generating Facility being designated as a Network Resource.

Network Upgrades shall mean the additions, modifications, and upgrades to the Transmission System required at or beyond the point at which the Interconnection Facilities connect to the Transmission System or Distribution System, as applicable, to accommodate the interconnection of the Generating Facility to the Transmission System.

Notice of Dispute shall mean a written notice of a dispute or claim that arises out of or in connection with this GIA or its performance.

Operating Horizon Study shall mean an Interconnection System Impact Study that includes in service transmission and generation for an identified timeframe to determine either the available injection capacity of an Interconnection Request or Interconnection Facilities and/or Transmission System changes required for the requested Interconnection Service.

Party or Parties shall mean GPL and the Interconnection Customer.

Planning Horizon Study shall mean an Interconnection System Impact Study that includes a future year study to determine either the available injection capacity of an Interconnection Request or Interconnection Facilities and/or Transmission System changes required for the requested Interconnection Service.

Point of Change of Ownership (PCO) shall mean the point, as set forth in Appendix A of the Generator Interconnection Agreement, where the Interconnection Customer's Interconnection Facilities connect to GPL's Interconnection Facilities.

Point of Interconnection (POI) shall mean the point, as set forth in Appendix A of the GIA, where the Interconnection Facilities connect to the Transmission System.

Scoping Meeting shall mean the meeting between representatives of Interconnection Customer and GPL conducted for the purpose of discussing alternative interconnection options, to exchange information including any transmission data and earlier study evaluations that would be reasonably expected to impact such interconnection options, to analyze such information, and to determine the potential feasible Points of Interconnection.

Shared Network Upgrade shall mean a Network Upgrade or Common Use Upgrade that is funded by an Interconnection Customer(s) and also benefits other Interconnection Customer(s) that are later identified as beneficiaries.

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Site Control shall mean documentation reasonably demonstrating: (1) ownership of, a leasehold interest in, or a right to develop a site for the purpose of constructing the Generating Facility and when applicable (i.e. when Interconnection Customer is providing the site for the TOIFs and Network Upgrades at the POI) the Interconnection Facilities, and; (2) an option to purchase or acquire a leasehold site for such purpose; or (3) an exclusivity or other business relationship between Interconnection Customer and the entity having the right to sell, lease or grant Interconnection Customer the right to possess or occupy a site for such purpose. Such documentation must include a reasonable determination of sufficient land area to support the size and type of Generating Facility proposed. Such documentation must include a reasonable determination of sufficient land area to support the size and type of Generating Facility proposed.

Special Protection System (SPS) shall mean an automatic protection system or remedial action scheme designed to detect abnormal or predetermined system conditions, and take corrective actions other than and/or in addition to the isolation of faulted components, to maintain system reliability. Such action may include changes in demand (MW and MVAR), energy (MWh and MVARh), or system configuration to maintain system stability, acceptable voltage, or power flows. An SPS does not include (a) underfrequency or undervoltage load shedding, (b) fault conditions that must be isolated, (c) out-of-step relaying not designed as an integral part of an SPS, or (d) Transmission Control Devices.

Stand Alone Network Upgrades shall mean Network Upgrades that an Interconnection Customer may construct without affecting day-to-day operations of the Transmission System during their construction. GPL and Interconnection Customer must agree as to what constitutes Stand Alone Network Upgrades and identify them in Appendix A to this GIA.

System Protection Facilities shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Transmission Control Devices shall mean a generally accepted transmission device that is planned and designed to provide dynamic control of electric system quantities, and are usually employed as solutions to specific system performance issues. Examples of such devices include fast valving, high response exciters, high voltage DC links, active or real power flow control and reactive compensation devices using power electronics (e.g., unified power flow controllers), static VAR compensators, thyristor controlled series capacitors, braking resistors, and in some cases mechanically-switched capacitors and reactors. In general, such systems are not considered to be Special Protection Systems.

GPL's Interconnection Facilities (TOIF) shall mean all facilities and equipment owned by GPL from the Point of Change of Ownership to the Point of Interconnection as identified in

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Appendix A to this GIA, including any modifications, additions or upgrades to such facilities and equipment. GPL's Interconnection Facilities are sole use facilities and shall not include Distribution Upgrades, Generator Upgrades, Stand Alone Network Upgrades or Network Upgrades.

Transmission System shall mean the facilities owned by GPL and controlled or operated by GPL that are used to provide Transmission Service.

Trial Operation shall mean the period during which Interconnection Customer is engaged in on-site test operations and commissioning of the Generating Facility prior to Commercial Operation.

ARTICLE 2. EFFECTIVE DATE, TERM AND TERMINATION

2.1 Effective Date. This GIA shall become effective upon execution by the Parties.

2.2 Term of Agreement. Subject to the provisions of Article 2.3, this GIA shall remain in effect for a period of _____ years from the Effective Date and shall be automatically renewed for each successive one-year period thereafter on the anniversary of the Effective Date.

2.3 Termination Procedures. This GIA may be terminated as follows:

2.3.1 Written Notice. This GIA may be terminated by Interconnection Customer after giving GPL ninety (90) Calendar Days advance written notice or by GPL if the Generating Facility or a portion of the Generating Facility fails to achieve Commercial Operation for three (3) consecutive years following the Commercial Operation Date, or has ceased Commercial Operation for three (3) consecutive years, beginning with the last date of Commercial Operation for the Generating Facility, after giving Interconnection Customer ninety (90) Calendar Days advance written notice. Where only a portion of the Generating Facility fails to achieve Commercial Operation for three (3) consecutive years following the Commercial Operation Date, GPL may only terminate that portion of the GIA. The Generating Facility will not be deemed to have ceased Commercial Operation for purposes of this Article 2.3.1 if Interconnection Customer can document that it has taken other significant steps to maintain or restore operational readiness of the Generating Facility for the purpose of returning the Generating Facility to Commercial Operation as soon as possible.

2.3.2 Default. Any Party may terminate this GIA in accordance with Article 17.

2.3.3 Notwithstanding Articles 2.3.1 and 2.3.2, no termination shall become effective until the Parties have complied with all Applicable Laws and Regulations applicable to such termination.

2.4 Termination Costs. If a Party elects to terminate this GIA pursuant to Article 2.3 above, each Party shall pay all costs incurred for which that Party is responsible (including any

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cancellation costs relating to orders or contracts for Interconnection Facilities, applicable upgrades, and related equipment) or charges assessed by the other Parties, as of the date of the other Parties' receipt of such notice of termination, under this GIA. In the event of termination by a Party, the Parties shall use commercially Reasonable Efforts to mitigate the costs, damages and charges arising as a consequence of termination. Upon termination of this GIA, unless otherwise ordered or approved by the Competent Authority.

2.4.1 With respect to any portion of GPL's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades, Generator Upgrades, and if so determined and made a part of this GIA, upgrades on Affected Systems, that have not yet been constructed or installed, GPL shall to the extent possible and to the extent of Interconnection Customer's written notice under Article 2.3.1, cancel any pending orders of, or return, any materials or equipment for, or contracts for construction of, such facilities; provided that in the event Interconnection Customer elects not to authorize such cancellation, Interconnection Customer shall assume all payment obligations with respect to such materials, equipment, and contracts, and GPL shall deliver such material and equipment, and, if necessary, assign such contracts, to Interconnection Customer as soon as practicable, at Interconnection Customer's expense. To the extent that Interconnection Customer has already paid GPL for any or all such costs of materials or equipment not taken by Interconnection Customer, GPL shall promptly refund such amounts to Interconnection Customer, less any costs, including penalties incurred by GPL to cancel any pending orders of or return such materials, equipment, or contracts.

If an Interconnection Customer terminates this GIA, it shall be responsible for all costs incurred in association with that Interconnection Customer's interconnection, including any cancellation costs relating to orders or contracts for Interconnection Facilities and equipment, and other expenses including any upgrades or related equipment for which GPL has incurred expenses and has not been reimbursed by Interconnection Customer.

2.4.2 GPL may, at its option, retain any portion of such materials, equipment, or facilities that Interconnection Customer chooses not to accept delivery of, in which case GPL shall be responsible for all costs associated with procuring such materials, equipment, or facilities. If GPL does not so elect, then Interconnection Customer shall be responsible for such costs.

2.4.3 With respect to any portion of the Interconnection Facilities, and any other facilities already installed or constructed pursuant to the terms of this GIA, Interconnection Customer shall be responsible for all costs associated with the removal, relocation, reconfiguration or other disposition or retirement of such materials, equipment, or facilities, and such other expenses actually incurred by GPL necessary to return the Transmission, Distribution or Generator System, as applicable, to safe and reliable operation.

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2.5 Disconnection. Upon termination of this GIA, the Parties will take all appropriate steps to disconnect the Generating Facility from the Transmission or Distribution System, as applicable. All costs required to effectuate such disconnection shall be borne by the terminating Party, unless such termination resulted from the non-terminating Party's Default of this GIA or such non-terminating Party otherwise is responsible for these costs under this GIA.

2.6 Survival. This GIA shall continue in effect after termination to the extent necessary to provide for final billings and payments and for costs incurred hereunder, including billings and payments pursuant to this GIA; to permit the determination and enforcement of liability and indemnification obligations arising from acts or events that occurred while this GIA was in effect; and to permit each Party to have access to the lands of the other Party pursuant to this GIA or other applicable agreements, to disconnect, remove or salvage its own facilities and equipment.

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ARTICLE 3.

(reserved)

ARTICLE 4. SCOPE OF SERVICE**4.1. Network Resource Interconnection Service (NR Interconnection Service).**

4.1.2 The Product. GPL must conduct the necessary studies and construct the facilities identified in Appendix A of this GIA, subject to the approval of Governmental Authorities, needed to integrate the Generating Facility in the same manner as for any Generating Facility being designated as a Network Resource.

4.1.2 Transmission Delivery Service Implications. NR Interconnection Service allows the Generating Facility to be designated by GPL as a Network Resource, up to the Generating Facility's full output, on the same basis as existing Network Resources that are interconnected to the Transmission or Distribution System, as applicable, and to be studied as a Network Resource on the assumption that such a designation will occur. NR shall be dispatched by GPL to supply its load. A Generating Facility receiving NR Interconnection Service shall be used to provide Ancillary Services in accordance with the Grid Code.

Once an Interconnection Customer satisfies the requirements for obtaining NR Interconnection Service, any future Transmission Service request for delivery from the Generating Facility within the Transmission System of any amount of capacity and/or energy, up to the amount initially studied, will not require that any additional studies be performed or that any further upgrades associated with such Generating Facility be undertaken, regardless of whether such Generating Facility is ever designated by GPL as a Network Resource and regardless of changes in ownership of the Generating Facility.

4.2 Provision of Service. GPL shall provide Interconnection Service for the Generating Facility at the Point of Interconnection.

4.3 Performance Standards. Each Party shall perform all of its obligations under this GIA in accordance with Applicable Laws and Regulations, Applicable Reliability Standards, and Good Utility Practice. To the extent a Party is required or prevented or limited in taking any action by such regulations and standards, or if the obligations of any Party may become limited by a change in Applicable Laws and Regulations, Applicable Reliability Standards, and Good Utility Practice after the execution of this GIA, that Party shall not

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be deemed to be in Breach of this GIA for its compliance therewith. The Party so limited shall notify the other Party whereupon GPL shall amend this GIA in concurrence with the other Party and submit the amendment to the Commission for approval.

4.5 Interconnection Customer Provided Services. The services provided by Interconnection Customer under this GIA are set forth in Article 9.6 and Article 13.4.1.

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**ARTICLE 5. INTERCONNECTION FACILITIES ENGINEERING, PROCUREMENT,
AND CONSTRUCTION**

This section of the contract refers to the construction of interconnection facilities; we provide the main clauses in this Article of the contract.

5.1 Options. Unless otherwise mutually agreed to between the Parties, Interconnection Customer shall select: 1) the In-Service Date, Initial Synchronization Date, and Commercial Operation Date based on a reasonable construction schedule that will allow sufficient time for design, construction, equipment procurement, and permit acquisition of Transmission System equipment or right-of-way; and 2) either Standard Option or Alternate Option set forth below for completion of the GPL's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades and Generator Upgrades, as applicable, and set forth in Appendix A, and such dates and selected option shall be set forth in the Appendix A. The dates and selected option shall be subject to the acceptance of GPL taking into account the type of construction to be employed and the regulatory requirements of Governmental Authority.

5.1.1 Standard Option. GPL shall design, procure, and construct the GPL's Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades, and Generator Upgrades using reasonable efforts to complete the GPL Interconnection Facilities, Network Upgrades, System Protection Facilities, Distribution Upgrades and Generator Upgrades by the dates set forth in Appendix B, Milestones, subject to the receipt of all approvals required from Governmental Authorities and the receipt of all land rights necessary to commence construction of such facilities, and such other permits or authorizations as may be required. GPL shall not be required to undertake any action which is inconsistent with its standard safety practices, its material and equipment specifications, its design criteria and construction procedures, its labor agreements, Applicable Laws and Regulations and Good Utility Practice. In the event GPL expects that it will not be able to complete its scope of work by the specified dates, GPL shall promptly provide written notice to Interconnection Customer and GPL and shall undertake reasonable efforts to meet the earliest dates thereafter.

5.1.2 Option to Build. If the dates designated by Interconnection Customer are not acceptable to GPL to complete the GPL's Interconnection Facilities or Stand Alone Network Upgrades, GPL shall so notify Interconnection Customer within thirty (30) Calendar Days, and unless the Parties agree otherwise, Interconnection Customer

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shall have the option to assume responsibility for the design, procurement and construction of the GPL's Interconnection Facilities and Stand Alone Network Upgrades by the dates originally designated by Interconnection Customer. The Parties must agree as to what constitutes Stand Alone Network Upgrades and identify such Stand Alone Network Upgrades in Appendix A.

Except for Stand Alone Network Upgrades, Interconnection Customer shall have no right to construct Network Upgrades under this option.

5.1.3 Negotiated Option. If Interconnection Customer elects not to exercise its option under Article 5.1.2, Option to Build, Interconnection Customer shall so notify GPL within thirty (30) Calendar Days, and the Parties shall in good faith attempt to negotiate terms and conditions (including revision of the specified dates and liquidated damages, the provision of incentives or the procurement and construction of a portion of the GPL's Interconnection Facilities and Stand Alone Network Upgrades by Interconnection Customer) pursuant to which GPL is responsible for the design, procurement and construction of the GPL's Interconnection Facilities and Network Upgrades. If the Parties are unable to reach agreement on such terms and conditions, GPL shall assume responsibility for the design, procurement and construction of the GPL's Interconnection Facilities and Network Upgrades pursuant to 5.1.1, Standard Option.

5.2 General Conditions Applicable to Option to Build.

Defines the conditions that Interconnection Customer needs to meet to design and construct the facilities. Basically to follow GPL standards, the Grid Code, and ANSI/IEEE standards.

5.3 Liquidated Damages.

This section defines the payments in case of delays not due to force majeure, if applicable and to be drafted as needed.

5.4 Power System Stabilizers. Interconnection Customer shall procure, install, maintain and operate power system stabilizers in accordance with the guidelines and procedures in the Grid Code. GPL reserves the right to reasonably establish minimum acceptable settings for any installed power system stabilizers, subject to

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the design and operating limitations of the Generating Facility. If the Generating Facility's power system stabilizers are removed from service or are not capable of automatic operation, Interconnection Customer shall immediately notify the GPL's system operator, or its designated representative. This paragraph applies only to synchronous generators.

- 5.5 Equipment Procurement.** If responsibility for construction of the GPL's Interconnection Facilities, Network Upgrades and/or Distribution Upgrades is to be borne by GPL, then GPL shall commence design of the GPL's Interconnection Facilities, Network Upgrades and/or Distribution Upgrades, and procure necessary equipment as soon as practicable, unless the Parties otherwise agree in writing.
- 5.6 Construction Commencement.** GPL shall commence construction of the GPL's Interconnection Facilities, Network Upgrades, GPL's System Protection Facilities, Distribution Upgrades, and Generator Upgrades for which it is responsible as soon as practicable.
- 5.7 Work Progress.** GPL and Interconnection Customer will keep each other advised periodically as to the progress of their respective design, procurement and construction efforts.
- 5.8 Information Exchange.** As soon as reasonably practicable after the Effective Date, the Parties shall exchange information regarding the design and compatibility of the Interconnection Facilities and compatibility of the Interconnection Facilities with the Transmission System or Distribution System, as applicable, and shall work diligently and in good faith to make any necessary design changes
- 5.9 Limited Operation.** If any of the GPL's Interconnection Facilities, Network Upgrades, or GPL's System Protection Facilities, Distribution Upgrades or Generator Upgrades are not reasonably expected to be completed prior to the Commercial Operation Date of the Generating Facility, GPL shall, upon the request and at the expense of Interconnection Customer, perform operating studies on a timely basis to determine the extent to which the Generating Facility and the Interconnection Customer's Interconnection Facilities may operate prior to the completion of the GPL's Interconnection Facilities, Network Upgrades, GPL's System Protection Facilities, Distribution Upgrades or Generator Upgrades consistent with Applicable Laws and Regulations, Applicable Reliability Standards, the Grid Code, Good Utility Practice, and this GIA. GPL shall permit Interconnection Customer to operate the Generating Facility and the

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Interconnection Customer's Interconnection Facilities in accordance with the results of such studies; provided, however, such studies reveal that such operation may occur without detriment to the Transmission System as then configured and in accordance with the safety requirements of GPL and any Governmental Authority.

The maximum permissible output of the Generating Facility will be updated on a quarterly basis if the Network Upgrades necessary for the interconnection of the Generating Facility pursuant to this GIA are not in service within six (6) months following the Commercial Operation Date of the Generating Facility as specified in Appendix B of this GIA. These quarterly studies will be performed using the same methodology set forth in Section 11.5 of the GIP. These quarterly updates will end when all Network Upgrades necessary for the interconnection of the Generating Facility pursuant to this GIA are in service.

5.10 Interconnection Customer's Interconnection Facilities. Interconnection Customer shall, at its expense, design, procure, construct, own and install the ICIF, as set forth in Appendix A.

5.11 GPL's Interconnection Facilities Construction. The GPL's Interconnection Facilities shall be designed and constructed in accordance with Good Utility Practice. Upon request, within one hundred twenty (120) Calendar Days after the Commercial Operation Date, unless the Parties agree on another mutually acceptable deadline, GPL shall deliver to Interconnection Customer the "as-built" drawings, information and documents for the GPL's Interconnection Facilities specified in Appendix C to this GIA. Such drawings, information and documents shall be deemed Confidential Information.

5.12 Access Rights.

5.13 Lands of Other Property Owners.

5.14 Permits.

5.15 Early Construction of Base Case Facilities.

5.16 Suspension.

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5.17 Taxes.

5.18 Tax Status

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5.19 Modification.

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ARTICLE 6. TESTING AND INSPECTION

6.1 Pre-Commercial Operation Date Testing and Modifications.

Prior to the Commercial Operation Date, GPL shall test the Interconnection Facilities, Network Upgrades, System Protection Facilities and Distribution Upgrades, and Interconnection Customer shall test each electric production device at the Generating Facility, Interconnection Customer's System Protection Facilities and the Interconnection Customer's Interconnection Facilities to ensure their safe and reliable operation. Similar testing may be required after initial operation. GPL and Interconnection Customer shall make any modifications to their respective facilities that are found to be necessary as a result of such testing. Interconnection Customer shall bear the cost of all such testing and modifications. Interconnection Customer shall generate test energy at the Generating Facility only if it has arranged for the delivery of such test energy.

6.2 Post-Commercial Operation Date Testing and Modifications. Each Party shall at its own expense perform routine inspection and testing of its facilities and equipment in accordance with Good Utility Practice as may be necessary to ensure the continued interconnection of the Generating Facility with the Transmission or Distribution System, as applicable, in a safe and reliable manner. Each Party shall have the right, upon advance written notice, to require reasonable additional testing of the Interconnection Facilities, at the requesting Party's expense, as may be in accordance with Good Utility Practice.

6.3 Right to Observe Testing. Each Party shall notify the other Parties in advance of its performance of tests of its Interconnection Facilities. The other Parties shall each have the right, at its own expense, to observe such testing.

6.4 Right to Inspect. Each Party shall have the right, but shall have no obligation to: (i) observe GPL's and Interconnection Customer's tests and/or inspection of any of their respective System Protection Facilities and other protective equipment, including power system stabilizers; (ii) review the settings of the System Protection Facilities and other protective equipment; and (iii) review the maintenance records relative to the Interconnection Facilities, the System Protection Facilities and other protective equipment. A Party may exercise these rights from time to time as it deems necessary upon reasonable notice to the other Party. The exercise or non-exercise by a Party of any such rights shall not be construed as an endorsement or confirmation of any element or condition of the Interconnection Facilities or the System Protection Facilities or other protective equipment or the operation thereof, or as a warranty as to the fitness, safety, desirability, or reliability of same. Any information that a Party obtains through the exercise of any of its rights under this Article 6.4 shall be deemed to be Confidential Information and treated pursuant to Article 22 of this GIA.

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ARTICLE 7. METERING

7.1 General. Unless otherwise agreed by the Parties, GPL, at its election, or otherwise Interconnection Customer, shall install Metering Equipment (the “Metering Party”) at the Point of Interconnection prior to any operation of the Generating Facility and GPL, at its election, or otherwise Interconnection Customer shall own, operate, test and maintain such Metering Equipment. Power flows to and from the Generating Facility shall be measured at or, at the Metering Party’s option, compensated to, the Point of Interconnection. The Metering Party shall provide metering quantities, in analog and/or digital form, to the other Parties upon request. Interconnection Customer shall bear all reasonable documented costs associated with the purchase, installation, operation, testing and maintenance of the Metering Equipment.

7.2 Check Meters. Interconnection Customer, at its option and expense, may install and operate, on its premises and on its side of the Point of Interconnection, one or more check meters to check the Metering Equipment owned by the Metering Party. Such check meters shall be for check purposes only and shall not be used for the measurement of power flows for purposes of this GIA, except as provided in Article 7.4 below. The check meters shall be subject at all reasonable times to inspection and examination by GPL, or their designees. The installation, operation and maintenance thereof shall be performed entirely by Interconnection Customer in accordance with Good Utility Practice.

7.3 Standards. The Metering Party shall install, calibrate, and test revenue quality Metering Equipment in accordance with applicable GPL standards as defined in the Metering Code.

7.4 Testing of Metering Equipment. The Metering Party shall inspect and test Metering Equipment upon installation and at least once every two (2) years thereafter. If requested to do so by a Party, the Metering Party shall, at the requesting Party’s expense, inspect or test Metering Equipment more frequently than every two (2) years. The Metering Party shall give reasonable notice to the other Party of the time when any inspection or test shall take place, and the other Party may have representatives present at the test or inspection. If at any time Metering Equipment is found to be inaccurate or defective, it shall be adjusted, repaired or replaced at Interconnection Customer's expense, in order to provide accurate metering, unless the inaccuracy or defect is due to the Metering Party’s failure to maintain, then the Metering Party shall pay. If Metering Equipment fails to register, or if the measurement made by Metering Equipment during a test varies by more than two percent (2%) from the measurement made by the standard meter used in the test, the Metering Party shall adjust the measurements by correcting all measurements for the period during which Metering Equipment was in error by using Interconnection Customer’s check meters, if installed. If no such check meters are installed or if the period cannot be reasonably ascertained, the adjustment shall be for the period

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immediately preceding the test of the Metering Equipment equal to one-half the time from the date of the previous test of the Metering Equipment.

7.5 Metering Data. At Interconnection Customer's expense, the metered data shall be telemetered to one or more locations designated by GPL and one or more locations designated by Interconnection Customer. Such telemetered data shall be used, under normal operating conditions, as the official measurement of the amount of energy delivered from the Generating Facility to the Point of Interconnection.

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ARTICLE 8. COMMUNICATIONS

8.1 Interconnection Customer Obligations. Interconnection Customer shall maintain satisfactory operating communications with GPL's Transmission System dispatcher or representative designated by GPL. Interconnection Customer shall provide standard voice line, dedicated voice line and facsimile communications at its Generating Facility control room or central dispatch facility through use of either the public telephone system, or a voice communications system that does not rely on the public telephone system. Interconnection Customer shall also provide the dedicated data circuit(s) necessary to provide Interconnection Customer data to GPL as set forth in Appendix D, Security Arrangements Details. The data circuit(s) shall extend from the Generating Facility to the location(s) specified by GPL. Any required maintenance of such communications equipment shall be performed by and at the cost of Interconnection Customer. Operational communications shall be activated and maintained under, but not be limited to, the following events: system paralleling or separation, scheduled and unscheduled shutdowns, equipment clearances, and hourly and daily load data.

Interconnection Customer shall install communication and control equipment such that the Generating Facility can receive and respond to the appropriate dispatch signals while operating under the Grid Code. Where applicable, the requirements of the communication and control equipment will be enumerated in Appendix C to this GIA.

8.2 Remote Terminal Unit (RTU). Prior to the Initial Synchronization Date of the Generating Facility, a remote terminal unit, or equivalent data collection and transfer equipment acceptable to both Parties, shall be installed by Interconnection Customer, or by GPL at Interconnection Customer's expense, to gather accumulated and instantaneous data to be telemetered to the location(s) designated by GPL through use of a dedicated point-to-point data circuit(s) as indicated in Article 8.1. The communication protocol for the data circuit(s) shall be specified by GPL. Instantaneous bi-directional analog real power and reactive power flow information must be telemetered directly to the location(s) specified by GPL.

Each Party will promptly advise the other Parties if it detects or otherwise learns of any metering, telemetry or communications equipment errors or malfunctions that require the attention and/or correction. The Party owning such equipment shall correct such error or malfunction as soon as reasonably feasible.

8.3 No Annexation. Any and all equipment placed on the premises of a Party shall be and remain the property of the Party providing such equipment regardless of the mode and manner of annexation or attachment to real property, unless otherwise mutually agreed by the Parties.

ARTICLE 9. OPERATIONS

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- 9.1 General.** Each Party shall comply with the Applicable Reliability Standards and GPL Grid Code. Each Party shall provide to any Party all information that may reasonably be required by that Party to comply with Applicable Laws and Regulations and Applicable Reliability Standards.
- 9.3 GPL Obligations.** GPL shall cause the Transmission to be operated, maintained and controlled in a safe and reliable manner in accordance with this GIA. GPL, or its designee, may provide operating instructions to Interconnection Customer consistent with this GIA and the Grid Code and, if applicable, GPL's operating protocols and procedures as they may change from time to time. GPL will consider changes to its operating protocols and procedures proposed by Interconnection Customer.
- 9.4 Interconnection Customer.** Interconnection Customer shall at its own expense operate, maintain and control the Generating Facility and the Interconnection Customer's Interconnection Facilities in a safe and reliable manner and in accordance with this GIA. The Generating Facility must be operated in accordance with the operating limits, if any, in the Interconnection Facilities Study and specified in Appendix C of this GIA. Interconnection Customer shall operate the Generating Facility and the Interconnection Customer's Interconnection Facilities in accordance with all applicable requirements of GPL, as such requirements are set forth in Appendix C, Interconnection Details, of this GIA. Appendix C, Interconnection Details, will be modified to reflect changes to the requirements as they may change from time to time. Any Party may request that a Party provide copies of the requirements set forth in Appendix C, Interconnection Details, of this GIA.
- 9.5 Start-Up and Synchronization.** Consistent with the Parties' mutually acceptable procedures, Interconnection Customer is responsible for the proper synchronization of the Generating Facility to the Transmission or Distribution System, as applicable.
- 9.6 Reactive Power.**

9.6.1 Power Factor Design Criteria. Interconnection Customer shall design the Generating Facility to be capable of maintaining a composite power delivery at continuous rated power output at the Point of Interconnection at all power factors over XX leading to YY lagging.

The Generating Facility shall be capable of continuous dynamic operation throughout the power factor design range as measured at the Point of Interconnection. Such operation shall account for the net effect of all energy production devices on the Interconnection Customer's side of the Point of Interconnection. .

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9.6.2 Voltage Schedules. Once Interconnection Customer has synchronized the Generating Facility with the Transmission System, GPL shall require Interconnection Customer to operate the Generating Facility to produce or absorb reactive power within the design limitations of the Generating Facility set forth in Article 9.6.1 (Power Factor Design Criteria), to maintain the output voltage or power factor at the Point of Interconnection as specified by GPL. GPL's voltage schedules shall treat all sources of reactive power in its system in an equitable and not unduly discriminatory manner. GPL shall exercise Reasonable Efforts to provide Interconnection Customer with such schedules at least one (1) Calendar Day in advance, and may make changes to such schedules as necessary to maintain the reliability of the Transmission or Distribution System as applicable. Interconnection Customer shall operate the Generating Facility to maintain the specified output voltage or power factor at the Point of Interconnection within the design limitations of the Generating Facility set forth in Article 9.6.1 (Power Factor Design Criteria). If Interconnection Customer is unable to maintain the specified voltage or power factor, it shall promptly notify GPL's system operator, or its designated representative.

9.6.2.1 Governors and Regulators. Whenever the Generating Facility is operated in parallel with the Transmission or Distribution System as applicable and the speed governors (if installed on the generating unit pursuant to Good Utility Practice) and voltage regulators are capable of operation, Interconnection Customer shall operate the Generating Facility with its speed governors and voltage regulators in automatic operation. If the Generating Facility's speed governors and voltage regulators are not capable of such automatic operation, Interconnection Customer shall immediately notify GPL's system operator, or its designated representative, and ensure that such Generating Facility's reactive power production or absorption (measured in MVARs) are within the design capability of the Generating Facility's generating unit(s) and steady state stability limits. Interconnection Customer shall not cause its Generating Facility to disconnect automatically or instantaneously from the Transmission or Distribution System, as applicable, or trip any generating unit comprising the Generating Facility for an under or over frequency condition unless the abnormal frequency condition persists for a time period beyond the limits set forth in the GPL Grid Code.

9.6.4 Minimum Technical Requirements (MTR). Generating Facility shall comply with the MTR included in the Grid Code at the time of signature of this contract.

9.7 Outages and Interruptions.

9.7.1 Outages.

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9.7.1.1 Outage Coordination. Interconnection Customer and GPL may each in accordance with Good Utility Practice in coordination with the other Party remove from service any of its respective Interconnection Facilities, System Protection Facilities, Network Upgrades, System Protection Facilities or Distribution Upgrades that may impact the other Party's facilities as necessary to perform maintenance or testing or to install or replace equipment. Absent an Emergency Condition, the Party scheduling a removal of such facility(ies) from service will use Reasonable Efforts to notify one another and schedule such removal on a date and time mutually acceptable to the Parties. In all circumstances, any Party planning to remove such facility(ies) from service shall use Reasonable Efforts to minimize the effect on the other Parties of such removal.

9.7.1.2 Outage Schedules. GPL shall post scheduled outages of transmission facilities on a secure area of its website or other secure accessible medium. Interconnection Customer shall submit its planned maintenance schedules for the Generating Facility to GPL for a minimum of a rolling twenty-four (24) month period in accordance with GPL's procedures. Interconnection Customer shall update its planned maintenance schedules as necessary. GPL may request Interconnection Customer to reschedule its maintenance as necessary to maintain the reliability of the Transmission System; provided, however, adequacy of generation supply shall not be a criterion in determining Transmission System reliability.

9.7.1.3 Outage Restoration. If an outage on either the Interconnection Customer's or GPL's Interconnection Facilities, Network Upgrades, System Protection Facilities or Distribution Upgrades adversely affects a Party's operations or facilities, the Party that owns or controls the facility that is out of service shall use Reasonable Efforts to promptly restore such facility(ies) to a normal operating condition consistent with the nature of the outage. The Party that owns or controls the facility that is out of service shall provide the other Parties, to the extent such information is known, information on the nature of the Emergency Condition, an estimated time of restoration, and any corrective actions required. Initial verbal notice shall be followed up as soon as practicable with written notice to the other Parties explaining the nature of the outage.

9.7.2 Interruption of Service. If required by Good Utility Practice to do so, GPL may require Interconnection Customer to interrupt or reduce deliveries of electricity if such delivery of electricity could adversely affect GPL's ability to perform such activities as are necessary to safely and reliably operate and maintain the

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Transmission System. The following provisions shall apply to any interruption or reduction permitted under this Article 9.7.2:

- 9.7.2.1** The interruption or reduction shall continue only for so long as reasonably necessary under Good Utility Practice;
- 9.7.2.2** Any such interruption or reduction shall be made on an equitable, non-discriminatory basis with respect to all generating facilities directly connected to the Transmission or Distribution System, as applicable;
- 9.7.2.3** When the interruption or reduction must be made under circumstances which do not allow for advance notice, GPL shall notify Interconnection Customer by telephone as soon as practicable of the reasons for the curtailment, interruption, or reduction, and, if known, its expected duration. Telephone notification shall be followed by written notification as soon as practicable;
- 9.7.2.4** Except during the existence of an Emergency Condition, when the interruption or reduction can be scheduled without advance notice, GPL shall notify Interconnection Customer in advance regarding the timing of such scheduling and further notify Interconnection Customer of the expected duration. GPL shall coordinate with Interconnection Customer using Good Utility Practice to schedule the interruption or reduction during periods of least impact to Interconnection Customer, GPL;
- 9.7.2.5** The Parties shall cooperate and coordinate with each other to the extent necessary in order to restore the Generating Facility, Interconnection Facilities, and the Transmission or Distribution System, as applicable to their normal operating state, consistent with system conditions and Good Utility Practice.

9.7.3 Under-Frequency and Over Frequency Conditions. The Transmission System is designed to automatically activate a load-shed program in the event of an under-frequency system disturbance. Interconnection Customer shall implement under-frequency and over-frequency relay set points for the Generating Facility as required by GPL standards to ensure “ride through” capability of the Transmission System. Generating Facility response to frequency deviations of pre-determined magnitudes, both under-frequency and over-frequency deviations, shall be studied and coordinated with GPL in accordance with the Grid Code. The term "ride through" as used herein shall mean the ability of a Generating Facility to stay connected to and synchronized with the Transmission System during system disturbances within a range of under-frequency and over-frequency conditions, in accordance with Good Utility Practice.

9.7.4 System Protection and Other Control Requirements.

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- 9.7.4.1 System Protection Facilities.** Interconnection Customer shall, at its expense, install, operate and maintain its System Protection Facilities as a part of the Generating Facility or the Interconnection Customer's Interconnection Facilities. GPL shall install at Interconnection Customer's expense any GPL's System Protection Facilities that may be required on GPL's Interconnection Facilities or GPL's transmission or distribution facilities as a result of the interconnection of the Generating Facility and the Interconnection Customer's Interconnection Facilities.
- 9.7.4.2** Interconnection Customer's and GPL's System Protection Facilities shall be designed in accordance with Good Utility Practice.
- 9.7.4.3** Each Party shall be responsible for protection of its facilities consistent with Good Utility Practice.
- 9.7.4.4** Each Party's protective relay design shall incorporate the necessary test switches to perform the tests required in Article 6. The required test switches will be placed such that they allow operation of lockout relays while preventing breaker failure schemes from operating and causing unnecessary breaker operations and/or the tripping of the Generating Facility.
- 9.7.4.5** Each Party will test, operate and maintain their respective System Protection Facilities in accordance with Good Utility Practice.
- 9.7.4.6** Prior to the In-Service Date, and again prior to the Commercial Operation Date, Interconnection Customer or GPL, or their respective agents, shall perform a complete calibration test and functional trip test of the System Protection Facilities. At intervals suggested by Good Utility Practice and following any apparent malfunction of the System Protection Facilities, Interconnection Customer or GPL shall each perform both calibration and functional trip tests of their respective System Protection Facilities. These tests do not require the tripping of any in-service generating unit. These tests do, however, require that all protective relays and lockout contacts be activated.
- 9.7.5 Requirements for Protection.** In compliance with Good Utility Practice, Interconnection Customer shall provide, install, own, and maintain relays, circuit breakers and all other devices necessary to remove any fault contribution of the Generating Facility to any short circuit occurring on the Transmission or Distribution System, as applicable, not otherwise isolated by Transmission Owner's equipment, such that the removal of the fault contribution shall be coordinated with the protective requirements of the Transmission or Distribution System, as applicable. Such protective equipment shall include, without

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limitation, a disconnecting device or switch with load-interrupting capability located between the Generating Facility and the Transmission or Distribution System, as applicable, at a site selected upon mutual agreement (not to be unreasonably withheld, conditioned or delayed) of the Parties. Interconnection Customer shall be responsible for protection of the Generating Facility and Interconnection Customer's other equipment from such conditions as negative sequence currents, over- or under-frequency, sudden load rejection, over- or under-voltage, and generator loss-of-field. Interconnection Customer shall be solely responsible to disconnect the Generating Facility and Interconnection Customer's other equipment if conditions on the Transmission or Distribution System, as applicable, could adversely affect the Generating Facility.

9.7.6 Power Quality. Neither Party's facilities shall cause excessive voltage flicker nor introduce excessive distortion to the sinusoidal voltage or current waves as defined by ANSI Standard C84.1-1989, in accordance with IEEE Standard 519, the Grid Code or any applicable superseding electric industry standard. In the event of a conflict between ANSI Standard, and any applicable superseding electric industry standard, the applicable superseding electric industry standard shall control.

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9.8 Switching and Tagging Rules. Prior to the Initial Synchronization Date, each Party shall provide the other Parties a copy of its switching and tagging rules that are applicable to the other Parties' activities. Such switching and tagging rules shall be developed on a non-discriminatory basis. The Parties shall comply with applicable switching and tagging rules, as amended from time to time, in obtaining clearances for work or for switching operations on equipment.

9.10 Disturbance Analysis Data Exchange. The Parties will cooperate with one another in the analysis of disturbances to either the Generating Facility or the Transmission System by gathering and providing access to any information relating to any disturbance, including information from oscillography, protective relay targets, breaker operations and sequence of events records, and any disturbance information required by Good Utility Practice.

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ARTICLE 10. MAINTENANCE

- 10.1 GPL Obligations.** GPL shall maintain GPL's Interconnection Facilities in a safe and reliable manner and in accordance with this GIA and all Applicable Laws and Regulations.
- 10.2 Interconnection Customer Obligations.** Interconnection Customer shall maintain the Generating Facility and the Interconnection Customer's Interconnection Facilities in a safe and reliable manner and in accordance with this GIA and all Applicable Laws and Regulations.
- 10.3 Coordination.** The Parties shall confer regularly to coordinate the planning, scheduling and performance of preventive and corrective maintenance on the Generating Facility and the Interconnection Facilities.
- 10.4 Secondary Systems.** Each Party shall cooperate with the other in the inspection, maintenance, and testing of control or power circuits that operate below 600 volts, AC or DC, including, but not limited to, any hardware, control or protective devices, cables, conductors, electric raceways, secondary equipment panels, transducers, batteries, chargers, and voltage and current transformers that directly affect the operation of a Party's facilities and equipment which may reasonably be expected to impact another Party. Each Party shall provide advance notice to the other Parties before undertaking any work on such circuits, especially on electrical circuits involving circuit breaker trip and close contacts, current transformers, or potential transformers.
- 10.5 Operating and Maintenance Expenses.** Subject to the provisions herein addressing the use of facilities by others, and except for operations and maintenance expenses associated with modifications made for providing Interconnection Service or Transmission Service to a non-Party and such non-Party pays for such expenses, Interconnection Customer shall be responsible for all reasonable expenses including overheads, associated with: (1) owning, operating, maintaining, repairing, and replacing Interconnection Customer's Interconnection Facilities; and (2) operation, maintenance, repair and replacement of GPL's Interconnection Facilities to the extent required by GPL on a comparable basis.

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ARTICLE 11. PERFORMANCE OBLIGATION

11.1 Interconnection Customer's Interconnection Facilities. Interconnection Customer shall design, procure, construct, install, own and/or control the Interconnection Customer's Interconnection Facilities described in Appendix A at its sole expense.

11.2 GPL's Interconnection Facilities. GPL shall design, procure, construct, install, own and/or control GPL's Interconnection Facilities described in Appendix A at the sole expense of Interconnection Customer.

11.3 Network Upgrades, System Protection Facilities and Distribution Upgrades. GPL shall design, procure, construct, install, and own the Network Upgrades, GPL's System Protection Facilities and Distribution Upgrades described in Appendix A. Interconnection Customer shall be responsible for all costs related to Distribution Upgrades and/or Generator Upgrades. Such facilities shall be solely funded by Interconnection Customer.

11.3.1 Contingencies Affecting Network Upgrades, System Protection Facilities and Distribution Upgrades. Network Upgrades, System Protection Facilities and Distribution Upgrades that are required to accommodate the Generating Facility may be modified because (1) a higher queued interconnection request withdrew or was deemed to have withdrawn, (2) the interconnection agreement associated with a higher queued interconnection request was terminated prior to the project's In-Service Date, (3) the Commercial Operation Date for a higher queued interconnection request is delayed, or the project itself is delayed (including due to suspension) such that facilities required to accommodate lower queued projects or the project itself may be altered, (4) the queue position is reinstated for a higher-queued interconnection request whose queue position was subject to dispute resolution, (5) changes occur in GPL equipment design standards or reliability criteria giving rise to the need for restudy, (6) the facilities required to accommodate a higher queued Interconnection Request were modified constituting a Material Modification pursuant to Section 4.4 of the GIP, (7) a GIA with an effective date prior to this GIA is terminated. The higher queued Interconnection Requests that could impact the Network Upgrades, System Protection Facilities and Distribution Upgrades required to accommodate the Generating Facility, and possible Modifications that may result from the above listed events affecting the higher queued Interconnection Requests, to the extent such modifications are reasonably known and can be determined, and estimates of the costs associated with such required Network Upgrades, System Protection Facilities and Distribution Upgrades, are provided in Appendix A.

11.3.2 Agreement to Restudy. Interconnection Customer agrees to enter into an Interconnection Study Agreement, if at any time before the Network Upgrades, System Protection Facilities and/or Distribution Upgrades associated with

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higher queued Interconnection Requests with GIA in effect prior to this GIA are completed, GPL determines restudy is required because one of the contingencies in Article 11.3.1 occurred, and provides notice to Interconnection Customer. Any restudy shall be performed, as applicable, in accordance with Sections 6.3, 7.4 and 8.5 of the GIP. The Parties agree to amend Appendix A to this GIA in accordance with Article 30.10 to reflect the results of any restudy required under this Article 11.3.2.

11.3.3 Agreement to Fund Shared Network Upgrades. Interconnection Customer agrees to fund Shared Network Upgrades, as determined by GPL and the Grid Code. Where applicable, payments to fund Shared Network Upgrade(s) that are made to GPL by Interconnection Customer will be disbursed by GPL to the appropriate entities that funded the Shared Network Upgrades in accordance with the Grid Code. In the event that Interconnection Customer fails to meet its obligation to fund Shared Network Upgrades, GPL shall not be responsible for the Interconnection Customer's funding obligation.

11.4 PPA Adders

This section of the contract defines the conditions for repayment to Interconnection Customers for the advanced funds for network upgrades; that is the investments made by Interconnection Customer on behalf of GPL.

It typically has the following sections

11.4.1 Repayment of Amounts Advanced for Network Upgrades. Interconnection Customer shall be entitled to a cash repayment by GPL(s) and the Affected System Owner(s) that own the Network Upgrades, of the amount paid respectively to GPL and Affected System Operator, if any, for the Network Upgrades, as provided under the Grid Code and including any tax gross-up or other tax-related payments associated with the repayable portion of the Network Upgrades as an adder to the PPA contract. Any repayment shall include interest. Interest shall not accrue during periods in which Interconnection Customer has suspended construction pursuant to Article 11 or the Network Upgrades have been determined not to be needed pursuant to this Article 11.4.1. Interconnection Customer may assign such repayment rights to any person.

Customer and GPL may adopt any alternative payment schedule that is mutually agreeable so long as GPL take one of the following actions no later than five (5) years from the Commercial Operation Date: (1) return to Interconnection Customer any amounts advanced for Network Upgrades not previously repaid, or (2) declare in writing that GPL will continue to provide payments to Interconnection Customer as an adder to the PPA contract, or develop an alternative schedule that is mutually agreeable and provides for the return of all amounts advanced for Network Upgrades not previously repaid;

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however, full reimbursement shall not extend beyond twenty (20) years from the Commercial Operation Date.

If the Generating Facility is installed in phases, the amount eligible for refund as each phase achieves Commercial Operation will be reduced by the proportional amount of generation capacity not yet installed. However, all facilities in Appendix A other than the Generating Facility shall be built without consideration for the phasing of the Generating Facility as though the entire Generating Facility will be placed in Commercial Operation for the full output or increased output of the Generating Facility constructed by Interconnection Customer under this GIA.

If the Generating Facility fails to achieve Commercial Operation, but it or another generating facility is later constructed and makes use of the Network Upgrades, GPL shall at that time reimburse Interconnection Customer for the remaining applicable amounts that may be refundable that were advanced for the Network Upgrades on their respective systems as described above. Before any such reimbursement can occur, Interconnection Customer, or the entity that ultimately constructs the Generating Facility, if different, is responsible for identifying the entity to which the reimbursement must be made.

11.5 Initial Payment. Interconnection Customer shall elect (and provide its election to GPL within five (5) days of the commencement of negotiation of the GIA pursuant to Section 11.2 of the GIP) to make either 1) an initial payment equal to twenty (20) percent of the total cost of Network Upgrades, GPL Interconnection Facilities, GPL’s System Protection Facilities, Distribution Upgrades and/or Generator Upgrades (if the In-Service Date is less than or equal to five (5) years of the initial payment date); or 2) an initial payment equal to ten (10) percent of the total cost of Network Upgrades, GPL Interconnection Facilities, GPL’s System Protection Facilities, Distribution Upgrades and/or Generator Upgrades (if the In-Service Date exceeds the initial payment date by more than five (5) years); or 3) the total cost of Network Upgrades, GPL Interconnection Facilities, GPL’s System Protection Facilities, Distribution Upgrades and/or Generator Upgrades in the form of security pursuant to Article 11.6. The initial payment shall be provided to GPL by Interconnection Customer pursuant to this Article 11.5 within thirty (30) days of the execution of the GIA by all Parties, or b) thirty (30) days of the filing if the GIA is filed unexecuted and the initial payment is not being protested by Interconnection Customer.

11.6 Provision of Security. Unless otherwise provided in Appendix B, at least thirty (30) Calendar Days prior to the commencement of the design, procurement, installation, or construction of a discrete portion of an element, not otherwise funded under Article 11.5, of GPL’s Interconnection Facilities, GPL’s System Protection Facilities, Network Upgrades, Distribution Upgrades or Stand-Alone Network Upgrades, or at the request of GPL if regulatory approvals are required for the construction of such facilities, Interconnection Customer shall provide GPL, at Interconnection Customer's selection, a guarantee, a surety bond, letter of credit or other form of security that is reasonably acceptable to GPL and is consistent with the Uniform Commercial Code of the jurisdiction identified in Article 14.2.1. Such security for payment shall be in an amount

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sufficient to cover the applicable costs and cost commitments, in addition to those funded under Article 11.5, required of the Party responsible for building the facilities pursuant to the construction schedule developed in Appendix B for designing, engineering, seeking regulatory approval from any Governmental Authority, constructing, procuring and installing the applicable portion of GPL's Interconnection Facilities, GPL's System Protection Facilities, Network Upgrades, Distribution Upgrades or Stand-Alone Network Upgrades and shall be reduced on a dollar-for-dollar basis for payments made to GPL for these purposes.

In addition:

- 11.6.1** The guarantee must be made by an entity that meets the creditworthiness requirements of GPL, and contain terms and conditions that guarantee payment of any amount that may be due from Interconnection Customer, up to an agreed-to maximum amount.
- 11.6.2** The letter of credit must be issued by a financial institution reasonably acceptable to GPL and must specify a reasonable expiration date.
- 11.6.3** The surety bond must be issued by an insurer reasonably acceptable to GPL and must specify a reasonable expiration date.
- 11.6.4** If the Shared Network Upgrade is not in service, Interconnection Customer will provide, as applicable, an Irrevocable Letter of Credit to fund any Shared Network Upgrade pursuant to Attachment FF of the Tariff. The Irrevocable Letter of Credit shall be in an amount sufficient to cover the Interconnection Customer's share of the applicable costs and cost commitments associated with the Shared Network Upgrades. GPL may periodically adjust the Interconnection Customer's share of the applicable costs and cost commitment of Shared Network Upgrades and may require Interconnection Customer to adjust the amount of the Irrevocable Letter of Credit accordingly.

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ARTICLE 12. INVOICE

12.1 General. Each Party shall submit to the other Party, on a monthly basis, invoices of amounts due, if any, for the preceding month. Each invoice shall state the month to which the invoice applies and fully describe the services and equipment provided. The Parties may discharge mutual debts and payment obligations due and owing to each other on the same date through netting, in which case all amounts a Party owes to the other Party under this GIA, including interest payments or credits, shall be netted so that only the net amount remaining due shall be paid by the owing Party.

12.2 Final Invoice. Within six (6) months after completion of the construction of GPL's Interconnection Facilities, GPL's System Protection Facilities, Distribution Upgrades and the Network Upgrades, GPL shall provide an invoice of the final cost of the construction of GPL's Interconnection Facilities, GPL's System Protection Facilities, Distribution Upgrades and the Network Upgrades and shall set forth such costs in sufficient detail to enable Interconnection Customer to compare the actual costs with the estimates and to ascertain deviations, if any, from the cost estimates. GPL shall refund, with interest to Interconnection Customer any amount by which the actual payment by Interconnection Customer for estimated costs exceeds the actual costs of construction within thirty (30) Calendar Days of the issuance of such final construction invoice.

12.3 Payment. Invoices shall be rendered to the paying Party at the address specified in Appendix F. The Party receiving the invoice shall pay the invoice within thirty (30) Calendar Days of receipt. All payments shall be made in immediately available funds payable to the other Party, or by wire transfer to a bank named and account designated by the invoicing Party. Payment of invoices by a Party will not constitute a waiver of any rights or claims that Party may have under this GIA.

12.4 Disputes. In the event of a billing dispute among the Parties, GPL shall continue to provide Interconnection Service under this GIA as long as Interconnection Customer: (i) continues to make all payments not in dispute; and (ii) pays to GPL or into an independent escrow account the portion of the invoice in dispute, pending resolution of such dispute. If Interconnection Customer fails to meet these two requirements for continuation of service, then GPL may or, at GPL's request upon Interconnection Customer's failure to pay, GPL, shall provide notice to Interconnection Customer of a Default pursuant to Article 17. Within thirty (30) Calendar Days after the resolution of the dispute, the Party that owes money to another Party shall pay the amount due with interest.

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ARTICLE 13. EMERGENCIES

13.1 Obligations. Each Party shall comply with the Emergency Condition procedures of GPL, and Applicable Laws and Regulations.

13.2 Notice. GPL shall notify the other Party promptly when it becomes aware of an Emergency Condition that affects GPL's Interconnection Facilities or the Transmission or Distribution System, as applicable, that may reasonably be expected to affect Interconnection Customer's operation of the Generating Facility or the Interconnection Customer's Interconnection Facilities.

Interconnection Customer shall notify GPL promptly when it becomes aware of an Emergency Condition that affects the Generating Facility or the Interconnection Customer's Interconnection Facilities that may reasonably be expected to affect the Transmission or Distribution System, as applicable, or GPL's Interconnection Facilities.

To the extent information is known, the notification shall describe the Emergency Condition, the extent of the damage or deficiency, the expected effect on the operation of Interconnection Customer's or GPL's or GPL's facilities and operations, its anticipated duration and the corrective action taken and/or to be taken. The initial notice shall be followed as soon as practicable with written notice.

13.3 Immediate Action. Unless, in a Party's reasonable judgment, immediate action is required, the Party exercising such judgment shall notify and obtain the consent of the other Parties, such consent to not be unreasonably withheld, prior to performing any manual switching operations at the Generating Facility or the Interconnection Customer's Interconnection Facilities in response to an Emergency Condition either declared by GPL or otherwise regarding the Transmission or Distribution System, as applicable.

13.4 GPL Rights

13.4.1 General. GPL may take whatever actions or inactions with regard to the Transmission System or GPL's Interconnection Facilities it deems necessary during an Emergency Condition in order to (i) preserve public health and safety, (ii) preserve the reliability of the Transmission System or GPL's Interconnection Facilities, (iii) limit or prevent damage, and (iv) expedite restoration of service.

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GPL shall use Reasonable Efforts to minimize the effect of such actions or inactions on the Generating Facility or the Interconnection Customer's Interconnection Facilities. GPL may, on the basis of technical considerations, require the Generating Facility to mitigate an Emergency Condition by taking actions necessary and limited in scope to remedy the Emergency Condition, including, but not limited to, directing Interconnection Customer to shut-down, start-up, increase or decrease the real or reactive power output of the Generating Facility; implementing a reduction or disconnection pursuant to Article 13.4.2; directing Interconnection Customer to assist with blackstart (if available) or restoration efforts; or altering the outage schedules of the Generating Facility and the Interconnection Customer's Interconnection Facilities. Interconnection Customer shall comply with all of GPL's or GPL's operating instructions concerning Generating Facility real power and reactive power output within the manufacturer's design limitations of the Generating Facility's equipment that is in service and physically available for operation at the time, in compliance with Applicable Laws and Regulations.

13.4.2 Reduction and Disconnection. GPL may reduce Interconnection Service or disconnect the Generating Facility or the Interconnection Customer's Interconnection Facilities, when such reduction or disconnection is necessary under Good Utility Practice due to Emergency Conditions. These rights are separate and distinct from any right of curtailment of GPL pursuant to the Tariff. When GPL can schedule the reduction or disconnection in advance, GPL shall notify Interconnection Customer of the reasons, timing and expected duration of the reduction or disconnection. GPL shall coordinate with Interconnection Customer and GPL using Good Utility Practice to schedule the reduction or disconnection during periods of least impact to Interconnection Customer, GPL. Any reduction or disconnection shall continue only for so long as reasonably necessary pursuant to Good Utility Practice. The Parties shall cooperate with each other to restore the Generating Facility, the Interconnection Facilities, and the Transmission System to their normal operating state as soon as practicable consistent with Good Utility Practice.

13.5 Interconnection Customer Rights. Consistent with Good Utility Practice and this GIA and the GIP, Interconnection Customer may take whatever actions or inactions with regard to the Generating Facility or the Interconnection Customer's Interconnection Facilities during an Emergency Condition in order to (i) preserve public health and safety, (ii) preserve the reliability of the Generating Facility or the Interconnection Customer's Interconnection Facilities, (iii) limit or prevent damage, and (iv) expedite restoration of service. Interconnection Customer shall use Reasonable Efforts to minimize the effect of such actions or inactions on the Transmission System and GPL's Interconnection Facilities. GPL shall use Reasonable Efforts to assist Interconnection Customer in such actions.

13.6 Limited Liability. Except as otherwise provided in Article 11.6 of this GIA, no Party shall be liable to any other for any action it takes in responding to an Emergency Condition so long as such action is made in good faith and is consistent with Good Utility Practice.

13.7 Audit. In accordance with Article 25.3, any Party may audit the performance of another Party when that Party declared an Emergency Condition.

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ARTICLE 14. REGULATORY REQUIREMENTS AND GOVERNING LAW

14.1 Regulatory Requirements. Each Party's obligations under this GIA shall be subject to its receipt of any required approval or certificate from one or more Governmental Authorities in the form and substance satisfactory to the applying Party, or the Party making any required filings with, or providing notice to, such Governmental Authorities, and the expiration of any time period associated therewith. Each Party shall in good faith seek, and if necessary assist the other Party and use its Reasonable Efforts to obtain such other approvals.

14.2 Governing Law.

14.2.1 The validity, interpretation and performance of this GIA and each of its provisions shall be governed by the laws of Guyana.

14.2.2 This GIA is subject to all Applicable Laws and Regulations.

14.2.3 Each Party expressly reserves the right to seek changes in, appeal, or otherwise contest any laws, orders, rules, or regulations of a Governmental Authority.

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ARTICLE 15. NOTICES

15.1 General. Unless otherwise provided in this GIA, any notice, demand or request required or permitted to be given by any Party to the other Parties and any instrument required or permitted to be tendered or delivered by a Party in writing to the other Parties shall be effective when delivered and may be so given, tendered or delivered, by recognized national courier, or by depositing the same with the Guyana Post Office Corp with postage paid, for delivery by certified or registered mail, addressed to the Party, or personally delivered to the Party, at the address set out in Appendix F, Addresses for Delivery of Notices and Billings.

Either Party may change the notice information in this GIA by giving five (5) Business Days written notice prior to the effective date of the change.

15.2 Billings and Payments. Billings and payments shall be sent to the addresses set out in Appendix F.

15.3 Alternative Forms of Notice. Any notice or request required or permitted to be given by any Party to the other and not required by this GIA to be given in writing may be so given by telephone, facsimile or email to the telephone numbers and email addresses set out in Appendix F.

15.4 Operations and Maintenance Notice. Each Party shall notify the other Parties in writing of the identity of the person(s) that it designates as the point(s) of contact with respect to the implementation of Articles 9 and 10.

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ARTICLE 16. FORCE MAJEURE**16.1 Force Majeure.**

16.1.1 Economic hardship is not considered a Force Majeure event.

16.1.2 A Party shall not be considered to be in Default with respect to any obligation hereunder, (including obligations under Article 4 and 5), other than the obligation to pay money when due, if prevented from fulfilling such obligation by Force Majeure. A Party unable to fulfill any obligation hereunder (other than an obligation to pay money when due) by reason of Force Majeure shall give notice and the full particulars of such Force Majeure to the other Parties in writing or by telephone as soon as reasonably possible after the occurrence of the cause relied upon. Telephone, facsimile or email notices given pursuant to this Article shall be confirmed in writing as soon as reasonably possible and shall specifically state full particulars of the Force Majeure, the time and date when the Force Majeure occurred and when the Force Majeure is reasonably expected to cease. The Party affected shall exercise Reasonable Efforts to remove such disability with reasonable dispatch, but shall not be required to accede or agree to any provision not satisfactory to it in order to settle and terminate a strike or other labor disturbance.

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ARTICLE 17. DEFAULT

17.1 Default

17.1.1 General. No Default shall exist where such failure to discharge an obligation (other than the payment of money) is the result of Force Majeure as defined in this GIA or the result of an act or omission of another Party. Upon a Breach, the non-Breaching Party or Parties shall give written notice of such Breach to the Breaching Party with a copy to the other Party if one Party gives notice of such Breach. Except as provided in Article 17.1.2, the Breaching Party shall have thirty (30) Calendar Days from receipt of the Breach notice within which to cure such Breach; provided however, if such Breach is not capable of cure within thirty (30) Calendar Days, the Breaching Party shall commence such cure within thirty (30) Calendar Days after notice and continuously and diligently complete such cure within ninety (90) Calendar Days from receipt of the Breach notice; and, if cured within such time, the Breach specified in such notice shall cease to exist.

17.1.2 Termination. If a Breach is not cured as provided in this Article, or if a Breach is not capable of being cured within the period provided for herein, the non-Breaching Party or Parties shall terminate this GIA, subject to Article 2.3.2 of this GIA, by written notice to the Breaching Party, with a copy to the other Party if one Party gives notice of termination, and be relieved of any further obligation hereunder and, whether or not that Party(ies) terminates this GIA, to recover from the Breaching Party all amounts due hereunder, plus all other damages and remedies to which it is (they are) entitled at law or in equity. The provisions of this Article will survive termination of this GIA.

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ARTICLE 18. LIMITATION OF LIABILITY, INDEMNITY, CONSEQUENTIAL DAMAGES AND INSURANCE

18.1 Limitation of Liability. A Party shall not be liable to another Party or to any third party or other person for any damages arising out of actions under this GIA, including, but not limited to, any act or omission that results in an interruption, deficiency or imperfection of Interconnection Service, except as provided in this Tariff. The provisions set forth in the Tariff shall be additionally applicable to any Party acting in good faith to implement or comply with its obligations under this GIA, regardless of whether the obligation is preceded by a specific directive.

18.2 Indemnity. To the extent permitted by law, an Indemnifying Party shall at all times indemnify, defend and hold the other Parties harmless from Loss.

18.2.1 Indemnified Party. If an Indemnified Party is entitled to indemnification under this Article 18 as a result of a claim by a non-Party, and the Indemnifying Party fails, after notice and reasonable opportunity to proceed under Article 18.2, to assume the defense of such claim, such Indemnified Party may at the expense of the Indemnifying Party contest, settle or consent to the entry of any judgment with respect to, or pay in full, such claim.

18.2.2 Indemnifying Party. If an Indemnifying Party is obligated to indemnify and hold any Indemnified Party harmless under this Article 18, the amount owing to the Indemnified Party shall be the amount of such Indemnified Party's actual Loss, net of any insurance or other recovery.

18.2.3 Indemnity Procedures. Promptly after receipt by an Indemnified Party of any claim or notice of the commencement of any action or administrative or legal proceeding or investigation as to which the indemnity provided for in Article 18.2 may apply, the Indemnified Party shall notify the Indemnifying Party of such fact. Any failure of or delay in such notification shall not affect a Party's indemnification obligation unless such failure or delay is materially prejudicial to the Indemnifying Party.

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The Indemnifying Party shall have the right to assume the defense thereof with counsel designated by such Indemnifying Party and reasonably satisfactory to the Indemnified Party. If the defendants in any such action include one or more Indemnified Parties and the Indemnifying Party and if the Indemnified Party reasonably concludes that there may be legal defenses available to it and/or other Indemnified Parties which are different from or additional to those available to the Indemnifying Party, the Indemnified Party shall have the right to select separate counsel to assert such legal defenses and to otherwise participate in the defense of such action on its own behalf. In such instances, the Indemnifying Party shall only be required to pay the fees and expenses of one additional attorney to represent an Indemnified Party or Indemnified Parties having such differing or additional legal defenses.

The Indemnified Party shall be entitled, at its expense, to participate in any such action, suit or proceeding, the defense of which has been assumed by the Indemnifying Party. Notwithstanding the foregoing, the Indemnifying Party (i) shall not be entitled to assume and control the defense of any such action, suit or proceedings if and to the extent that, in the opinion of the Indemnified Party and its counsel, such action, suit or proceeding involves the potential imposition of criminal liability on the Indemnified Party, or there exists a conflict or adversity of interest between the Indemnified Party and the Indemnifying Party, in such event the Indemnifying Party shall pay the reasonable expenses of the Indemnified Party, and (ii) shall not settle or consent to the entry of any judgment in any action, suit or proceeding without the consent of the Indemnified Party, which shall not be reasonably withheld, conditioned or delayed.

18.3 Consequential Damages. In no event shall either Party be liable under any provision of this GIA for any losses, damages, costs or expenses for any special, indirect, incidental, consequential, or punitive damages, including but not limited to loss of profit or revenue, loss of the use of equipment, cost of capital, cost of temporary equipment or services, whether based in whole or in part in contract, in tort, including negligence, strict liability, or any other theory of liability; provided; however, that damages for which a Party may be liable to the other Party under another agreement will not be considered to be special, indirect, incidental, or consequential damages hereunder.

18.4 Insurance. GPL and Interconnection Customer shall, at their own expense, maintain in force throughout the period of this GIA pursuant to 18.4.9, and until released by the other Party, the following minimum insurance coverages, with insurers authorized to do business or an approved surplus lines carrier in the state where the Point of Interconnection is located:

18.4.1 Employers' Liability and Workers' Compensation Insurance providing statutory benefits in accordance with the laws and regulations of the state in which the Point of Interconnection is located.

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- 18.4.2** Commercial General Liability Insurance including premises and operations, personal injury, broad form property damage, broad form blanket contractual liability coverage (including coverage for the contractual indemnification) products and completed operations coverage, coverage for explosion, collapse and underground hazards, independent contractors coverage, coverage for pollution to the extent normally available and punitive damages to the extent normally available and a cross liability endorsement, with minimum limits of X Million Dollars (\$1,000,000) per occurrence/One Million Dollars (\$1,000,000) aggregate combined single limit for personal injury, bodily injury, including death and property damage.
- 18.4.3** Comprehensive Automobile Liability Insurance, for coverage of owned and non-owned and hired vehicles, trailers or semi-trailers licensed for travel on public roads, with a minimum combined single limit of One Million Dollars (\$1,000,000) each occurrence for bodily injury, including death, and property damage.
- 18.4.4** Excess Public Liability Insurance over and above the Employer's Liability, Commercial General Liability and Comprehensive Automobile Liability Insurance coverage, with a minimum combined single limit of Twenty Million Dollars (\$20,000,000) per occurrence/Twenty Million Dollars (\$20,000,000) aggregate.
- 18.4.5** The Commercial General Liability Insurance, Comprehensive Automobile Insurance and Excess Public Liability Insurance policies shall name the other Parties, their parents, associated and Affiliate companies and their respective directors, officers, agents, servants and employees ("Other Party Group") as additional insured. All policies shall contain provisions whereby the insurers waive all rights of subrogation in accordance with the provisions of this GIA against the Other Party Groups and provide thirty (30) Calendar Days' advance written notice to the Other Party Groups prior to anniversary date of cancellation or any material change in coverage or condition.
- 18.4.6** The Commercial General Liability Insurance, Comprehensive Automobile Liability Insurance and Excess Public Liability Insurance policies shall contain provisions that specify that the policies are primary and shall apply to such extent without consideration for other policies separately carried and shall state that each insured is provided coverage as though a separate policy had been issued to each, except the insurer's liability shall not be increased beyond the amount for which the insurer would have been liable had only one insured been covered. Each Party shall be responsible for its respective deductibles or retentions.
- 18.4.7** The Commercial General Liability Insurance, Comprehensive Automobile Liability Insurance and Excess Public Liability Insurance policies, if written on

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a Claims First Made Basis, shall be maintained in full force and effect for two (2) years after termination of this GIA, which coverage may be in the form of tail coverage or extended reporting period coverage if agreed by GPL and Interconnection Customer.

18.4.8 The requirements contained herein as to the types and limits of all insurance to be maintained by GPL and Interconnection Customer are not intended to and shall not in any manner, limit or qualify the liabilities and obligations assumed by GPL and Interconnection Customer under this GIA.

18.4.9 As of the date set forth in Appendix B, Milestones, and as soon as practicable after the end of each fiscal year or at the renewal of the insurance policy and in any event within ninety (90) Calendar Days thereafter, Interconnection Customer and GPL shall provide the other Party with certification of all insurance required in this GIA, executed by each insurer or by an authorized representative of each insurer.

18.4.10 Notwithstanding the foregoing, GPL or Interconnection Customer may self-insure to meet the minimum insurance requirements of Articles 18.4.1 through 18.4.8, to the extent it maintains a self-insurance program; provided that, GPL's or Interconnection Customer's senior secured debt is rated at investment grade, or better, by Standard & Poor's and that its self-insurance program meets minimum insurance requirements under Articles 18.4.1 through 18.4.8. For any period of time that a GPL's or Interconnection Customer's senior secured debt is unrated by Standard & Poor's or is rated at less than investment grade by Standard & Poor's, such Party shall comply with the insurance requirements applicable to it under Articles 18.4.1 through 18.4.9. In the event that GPL or Interconnection Customer is permitted to self-insure pursuant to this article, it shall notify the other Party that it meets the requirements to self-insure and that its self-insurance program meets the minimum insurance requirements in a manner consistent with that specified in Article 18.4.9.

18.4.11 GPL and Interconnection Customer agree to report to each other in writing as soon as practical all accidents or occurrences resulting in injuries to any person, including death, and any property damage arising out of this GIA

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ARTICLE 19. ASSIGNMENT

19.1 Assignment. This GIA may be assigned by any Party only with the written consent of the other Parties; provided that a Party may assign this GIA without the consent of the other Parties to any Affiliate of the assigning Party with an equal or greater credit rating and with the legal GPL and operational ability to satisfy the obligations of the assigning Party under this GIA; and provided further that Interconnection Customer shall have the right to assign this GIA, without the consent of either GPL, for collateral security purposes to aid in providing financing for the Generating Facility, provided that Interconnection Customer will promptly notify GPL of any such assignment. Any financing arrangement entered into by Interconnection Customer pursuant to this Article will provide that prior to or upon the exercise of the secured party's, trustee's or mortgagee's assignment rights pursuant to said arrangement, the secured creditor, the trustee or mortgagee will notify GPL of the date and particulars of any such exercise of assignment right(s), including providing GPL with proof that it meets the requirements of Article 11.5 and 18.4. Any attempted assignment that violates this Article is void and ineffective. Any assignment under this GIA shall not relieve a Party of its obligations, nor shall a Party's obligations be enlarged, in whole or in part, by reason thereof. Where required, consent to assignment will not be unreasonably withheld, conditioned or delayed.

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ARTICLE 20. SEVERABILITY

20.1 Severability. If any provision in this GIA is finally determined to be invalid, void or unenforceable by any court or other Governmental Authority having jurisdiction, such determination shall not invalidate, void or make unenforceable any other provision, agreement or covenant of this GIA; provided that if Interconnection Customer (or any non-Party, but only if such non-Party is not acting at the direction of either GPL) seeks and obtains such a final determination with respect to any provision of the Alternate Option (Article 5.1.2), or the Negotiated Option (Article 5.1.4), then none of these provisions shall thereafter have any force or effect and the Parties' rights and obligations shall be governed solely by the Standard Option (Article 5.1.1).

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ARTICLE 21. COMPARABILITY

21.1 Comparability. The Parties will comply with all applicable comparability and code of conduct laws, rules and regulations including such laws, rules and regulations of Governmental Authorities establishing standards of conduct, as amended from time to time.

ARTICLE 22. CONFIDENTIALITY

22.1 Confidentiality. Confidential Information shall include, without limitation, all information relating to a Party's technology, research and development, business affairs, and pricing, and any information supplied by a Party to another Party prior to the execution of this GIA. Information is Confidential Information only if it is clearly designated or marked in writing as confidential on the face of the document, or, if the information is conveyed orally or by inspection, if the Party providing the information orally informs the Party receiving the information that the information is confidential. The Parties shall maintain as confidential any information that is provided and identified by a Party as Critical Energy Infrastructure Information (CEII). Such confidentiality will be maintained in accordance with this Article 22.

If requested by the receiving Party, the disclosing Party shall provide in writing, the basis for asserting that the information referred to in this Article warrants confidential treatment, and the requesting Party may disclose such writing to the appropriate Governmental Authority. Each Party shall be responsible for the costs associated with affording confidential treatment to its information.

22.1.1 Term. During the term of this GIA, and for a period of three (3) years after the expiration or termination of this GIA, except as otherwise provided in this Article 22 or with regard to CEII, each Party shall hold in confidence and shall not disclose to any person Confidential Information. CEII shall be treated in accordance with Commission policy and regulations.

22.1.2 Scope. Confidential Information shall not include information that the receiving Party can demonstrate: (1) is generally available to the public other than as a result of a disclosure by the receiving Party; (2) was in the lawful possession of the receiving Party on a non-confidential basis before receiving it from the disclosing Party; (3) was supplied to the receiving Party without restriction by a non-Party, who, to the knowledge of the receiving Party after due inquiry, was under no obligation to the disclosing Party to keep such information confidential; (4) was independently developed by the receiving Party without reference to Confidential Information of the disclosing Party; (5) is, or becomes, publicly known, through no wrongful act or omission of the receiving Party or Breach of this GIA; or (6) is required, in accordance with Article

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22.1.7 of this GIA, Order of Disclosure, to be disclosed by any Governmental Authority or is otherwise required to be disclosed by law or subpoena, or is necessary in any legal proceeding establishing rights and obligations under this GIA. Information designated as Confidential Information will no longer be deemed confidential if the Party that designated the information as confidential notifies the receiving Party that it no longer is confidential.

22.1.3 Release of Confidential Information. No Party shall release or disclose Confidential Information to any other person, except to its Affiliates (limited by the Standards of Conduct requirements), subcontractors, employees, agents, consultants, or to non-parties who may be or are considering providing financing to or equity participation with Interconnection Customer, or to potential purchasers or assignees of Interconnection Customer, on a need-to-know basis in connection with this GIA, unless such person has first been advised of the confidentiality provisions of this Article 22 and has agreed to comply with such provisions. Notwithstanding the foregoing, a Party providing Confidential Information to any person shall remain primarily responsible for any release of Confidential Information in contravention of this Article 22.

22.1.4 Rights. Each Party retains all rights, title, and interest in the Confidential Information that it discloses to the receiving Party. The disclosure by a Party to the receiving Party of Confidential Information shall not be deemed a waiver by the disclosing Party or any other person or entity of the right to protect the Confidential Information from public disclosure.

22.1.5 No Warranties. By providing Confidential Information, no Party makes any warranties or representations as to its accuracy or completeness. In addition, by supplying Confidential Information, no Party obligates itself to provide any particular information or Confidential Information to another Party nor to enter into any further agreements or proceed with any other relationship or joint venture.

22.1.6 Standard of Care. Each Party shall use at least the same standard of care to protect Confidential Information it receives as it uses to protect its own Confidential Information from unauthorized disclosure, publication or dissemination. Each Party may use Confidential Information solely to fulfill its obligations to another Party under this GIA or its regulatory requirements.

22.1.7 Order of Disclosure. If a court or a Government Authority or entity with the right, power, and apparent GPL to do so requests or requires any Party, by subpoena, oral deposition, interrogatories, requests for production of documents, administrative order, or otherwise, to disclose Confidential Information, that Party shall provide the disclosing Party with prompt notice of such request(s) or requirement(s) so that the disclosing Party may seek an appropriate protective order or waive compliance with the terms of this GIA.

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Notwithstanding the absence of a protective order or waiver, the Party may disclose such Confidential Information which, in the opinion of its counsel, the Party is legally compelled to disclose. Each Party will use Reasonable Efforts to obtain reliable assurance that confidential treatment will be accorded any Confidential Information so furnished.

22.1.8 Termination of Agreement. Upon termination of this GIA for any reason, each Party shall, within ten (10) Calendar Days of receipt of a written request from another Party, use Reasonable Efforts to destroy, erase, or delete (with such destruction, erasure, and deletion certified in writing to the requesting Party) or return to the requesting Party, without retaining copies thereof, any and all written or electronic Confidential Information received from the requesting Party, except that each Party may keep one copy for archival purposes, provided that the obligation to treat it as Confidential Information in accordance with this Article 22 shall survive such termination.

22.1.9 Remedies. The Parties agree that monetary damages would be inadequate to compensate a Party for another Party's Breach of its obligations under this Article 22. Each Party accordingly agrees that the disclosing Party shall be entitled to equitable relief, by way of injunction or otherwise, if the receiving Party Breaches or threatens to Breach its obligations under this Article 22, which equitable relief shall be granted without bond or proof of damages, and the Breaching Party shall not plead in defense that there would be an adequate remedy at law. Such remedy shall not be deemed an exclusive remedy for the Breach of this Article 22, but shall be in addition to all other remedies available at law or in equity. The Parties further acknowledge and agree that the covenants contained herein are necessary for the protection of legitimate business interests and are reasonable in scope. No Party, however, shall be liable for indirect, incidental, or consequential or punitive damages of any nature or kind resulting from or arising in connection with this Article 22.

22.1.10 Disclosure to Competent Authority. Notwithstanding anything in this Article 22 to the contrary, if Competent Authority or its staff, during the course of an investigation or otherwise, requests information from a Party that is otherwise required to be maintained in confidence pursuant to this GIA, the Party shall provide the requested information to Competent Authority or its staff, within the time provided for in the request for information. In providing the information to Competent Authority or its staff, the Party must, consistent with the request that the information be treated as confidential and non-public by Competent Authority and its staff and that the information be withheld from public disclosure. Parties are prohibited from notifying the other Parties to this GIA prior to the release of the Confidential Information to Competent Authority or its staff. The Party shall notify the other Parties to this GIA when it is notified by Competent Authority or its staff that a request to release Confidential Information has been received by Competent Authority, at which time any of the Parties may respond before such information would be made

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public. Requests from a state regulatory body conducting a confidential investigation shall be treated in a similar manner if consistent with the applicable state rules and regulations.

22.1.11 Subject to the exception in Article 22.1.10, any information that a disclosing Party claims is competitively sensitive, commercial or financial information under this GIA shall not be disclosed by the receiving Party to any person not employed or retained by the receiving Party, except to the extent disclosure is (i) required by law; (ii) reasonably deemed by the receiving Party to be required to be disclosed in connection with a dispute between or among the Parties, or the defense of litigation or dispute; (iii) otherwise permitted by consent of the disclosing Party, such consent not to be unreasonably withheld; or (iv) necessary to fulfill its obligations under this GIA. The Party asserting confidentiality shall notify the receiving Party in writing of the information that Party claims is confidential. Prior to any disclosures of that Party's Confidential Information under this subparagraph, or if any non-Party or Governmental Authority makes any request or demand for any of the information described in this subparagraph, the Party who received the Confidential Information from the disclosing Party agrees to promptly notify the disclosing Party in writing and agrees to assert confidentiality and cooperate with the disclosing Party in seeking to protect the Confidential Information from public disclosure by confidentiality agreement, protective order or other reasonable measures.

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ARTICLE 23. ENVIRONMENTAL RELEASES

23.1 Each Party shall notify the other Parties, first orally and then in writing, of the release of any Hazardous Substances, any asbestos or lead abatement activities, or any type of remediation activities related to the Generating Facility or the Interconnection Facilities, each of which may reasonably be expected to affect another Party. The notifying Party shall: (i) provide the notice as soon as practicable, provided such Party makes a good faith effort to provide the notice no later than twenty-four (24) hours after such Party becomes aware of the occurrence; and (ii) promptly furnish to the other Parties copies of any publicly available reports filed with any Governmental Authorities addressing such events.

ARTICLE 24. INFORMATION REQUIREMENTS

24.1 Information Acquisition. GPL and Interconnection Customer shall submit specific information regarding the electrical characteristics of their respective facilities to each other as described below and in accordance with Applicable Reliability Standards.

24.2 Information Submission by GPL The initial information submission by GPL to Interconnection Customer, shall occur no later than one hundred eighty (180) Calendar Days prior to Trial Operation and shall include Transmission or Distribution System information, as applicable and available, necessary to allow Interconnection Customer to select equipment and meet any system protection and stability requirements, unless otherwise mutually agreed to by the Parties. On a monthly basis, GPL shall provide Interconnection Customer a status report on the construction and installation of GPL's Interconnection Facilities, GPL's System Protection Facilities, Distribution Upgrades and Network Upgrades, including, but not limited to, the following information: (1) progress to date; (2) a description of the activities since the last report (3) a description of the action items for the next period; and (4) the delivery status of equipment ordered.

24.3 Updated Information Submission by Interconnection Customer. The updated information submission by Interconnection Customer to GPL, including manufacturer information, shall occur no later than one hundred eighty (180) Calendar Days prior to the Trial Operation. Interconnection Customer shall submit to GPL a completed copy of the Generating Facility data requirements contained in Appendix 1 to the GIP. It shall also include any additional information provided to GPL for the Interconnection Feasibility Study and Interconnection Facilities Study. Information in this submission shall be the most current Generating Facility design or expected performance data. Information submitted for stability models shall be compatible with GPL standard models. If there is no compatible model, Interconnection Customer will work with a consultant mutually agreed to by GPL and Interconnection Customer to develop and supply a standard model and associated information. If the Interconnection Customer's data is materially different from what was originally

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provided to GPL pursuant to the Interconnection Study Agreement between GPL and Interconnection Customer, then GPL will conduct appropriate studies to determine the impact on the Transmission System based on the actual data submitted pursuant to this Article 24.3. Interconnection Customer shall not begin Trial Operation until such studies are completed.

24.4 Information Supplementation. Prior to the Commercial Operation Date, the Parties shall supplement their information submissions described above in this Article 24 with any and all “as-built” Generating Facility information or “as-tested” performance information that differs from the initial submissions or, alternatively, written confirmation that no such differences exist. Interconnection Customer shall conduct tests on the Generating Facility as required by Good Utility Practice, such as an open circuit “step voltage” test on the Generating Facility to verify proper operation of the Generating Facility's automatic voltage regulator.

Unless otherwise agreed, the test conditions shall include: (1) Generating Facility at synchronous speed; (2) automatic voltage regulator on and in voltage control mode; and (3) a five percent (5 %) change in Generating Facility terminal voltage initiated by a change in the voltage regulators reference voltage. Interconnection Customer shall provide validated test recordings showing the responses in Generating Facility terminal and field voltages. In the event that direct recordings of these voltages is impractical, recordings of other voltages or currents that mirror the response of the Generating Facility's terminal or field voltage are acceptable if information necessary to translate these alternate quantities to actual Generating Facility terminal or field voltages is provided. Generating Facility testing shall be conducted and results provided to GPL for each individual generating unit in a station.

Subsequent to the Operation Date, Interconnection Customer shall provide GPL any information changes due to equipment replacement, repair, or adjustment. GPL shall provide Interconnection Customer, with copy to GPL, any information changes due to equipment replacement, repair or adjustment in the directly connected substation or any adjacent GPL substation that may affect the Interconnection Customer's Interconnection Facilities equipment ratings, protection or operating requirements. The Parties shall provide such information no later than thirty (30) Calendar Days after the date of the equipment replacement, repair or adjustment.

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ARTICLE 25. INFORMATION ACCESS AND AUDIT RIGHTS

- 25.1 Information Access.** Each Party (the “disclosing Party”) shall make available to the other Parties information that is in the possession of the disclosing Party and is necessary in order for the other Parties to: (i) verify the costs incurred by the disclosing Party for which another Party is responsible under this GIA; and (ii) carry out its obligations and responsibilities under this GIA. The Parties shall not use such information for purposes other than those set forth in this Article 25.1 and to enforce their rights under this GIA.
- 25.2 Reporting of Non-Force Majeure Events.** A Party (the “notifying Party”) shall notify the other Parties when the notifying Party becomes aware of its inability to comply with the provisions of this GIA for a reason other than a Force Majeure event. The Parties agree to cooperate with each other and provide necessary information regarding such inability to comply, including the date, duration, reason for the inability to comply, and corrective actions taken or planned to be taken with respect to such inability to comply. Notwithstanding the foregoing, notification, cooperation or information provided under this Article shall not entitle any Party receiving such notification to allege a cause for anticipatory breach of this GIA.
- 25.3 Audit Rights.** Subject to the requirements of confidentiality under Article 22 of this GIA, each Party shall have the right, during normal business hours, and upon prior reasonable notice to the other Parties, to audit at its own expense the other Parties’ accounts and records pertaining to the Parties’ performance or the Parties’ satisfaction of obligations under this GIA. Such audit rights shall include audits of the other Parties’ costs, calculation of invoiced amounts, GPL’s efforts to allocate responsibility for the provision of reactive support to the Transmission or Distribution System, as applicable, GPL’s efforts to allocate responsibility for interruption or reduction of generation, and each Party’s actions in an Emergency Condition. Any audit authorized by this Article shall be performed at the offices where such accounts and records are maintained and shall be limited to those portions of such accounts and records that relate to each Party’s performance and satisfaction of obligations under this GIA. Each Party shall keep such accounts and records for a period equivalent to the audit rights periods described in Article 25.4.
- 25.4 Audit Rights Periods.**
- 25.4.1 Audit Rights Period for Construction-Related Accounts and Records.** Accounts and records related to the design, engineering, procurement, and construction of GPL’s Interconnection Facilities, GPL’s System Protection Facilities, Distribution Upgrades and Network Upgrades shall be subject to audit for a period of twenty-four (24) months following GPL’s issuance of a final invoice in accordance with Article 12.2.

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25.4.2 Audit Rights Period for All Other Accounts and Records. Accounts and records related to a Party's performance or satisfaction of all obligations under this GIA other than those described in Article 25.4.1 shall be subject to audit as follows: (i) for an audit relating to cost obligations, the applicable audit rights period shall be twenty-four (24) months after the auditing Party's receipt of an invoice giving rise to such cost obligations; and (ii) for an audit relating to all other obligations, the applicable audit rights period shall be twenty-four (24) months after the event for which the audit is sought.

25.5 Audit Results. If an audit by a Party determines that an overpayment or an underpayment has occurred, a notice of such overpayment or underpayment shall be given to the Party or from whom the overpayment or underpayment is owed together with those records from the audit which support such determination.

ARTICLE 26. SUBCONTRACTORS

26.1 General. Nothing in this GIA shall prevent a Party from utilizing the services of any subcontractor as it deems appropriate to perform its obligations under this GIA; provided, however, that each Party shall require its subcontractors to comply with all applicable terms and conditions of this GIA in providing such services and each Party shall remain primarily liable to the other Parties for the performance of such subcontractor.

26.2 Responsibility of Principal. The creation of any subcontract relationship shall not relieve the hiring Party of any of its obligations under this GIA. The hiring Party shall be fully responsible to the other Parties for the acts or omissions of any subcontractor the hiring Party hires as if no subcontract had been made; provided, however, that in no event shall GPL be liable for the actions or inactions of Interconnection Customer or its subcontractors with respect to obligations of Interconnection Customer under Article 5 of this GIA. Any applicable obligation imposed by this GIA upon the hiring Party shall be equally binding upon, and shall be construed as having application to, any subcontractor of such Party.

26.3 No Limitation by Insurance. The obligations under this Article 26 will not be limited in any way by any limitation of subcontractor's insurance.

ARTICLE 27. DISPUTES

27.1 Submission. In the event any Party has a dispute, or asserts a claim, that arises out of or in connection with this GIA or its performance, such Party (the "disputing Party") shall provide the other Parties with written notice of the dispute or claim ("Notice of Dispute"). Such dispute or claim shall be referred to a designated senior representative of each Party for resolution on an informal basis as promptly as practicable after receipt of

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the Notice of Dispute by the non-disputing Parties. In the event the designated representatives are unable to resolve the claim or dispute through unassisted or assisted negotiations within thirty (30) Calendar Days of the non-disputing Parties' receipt of the Notice of Dispute, such claim or dispute shall be submitted for resolution in accordance with the dispute resolution procedures of the Tariff.

ARTICLE 28. REPRESENTATIONS, WARRANTIES AND COVENANTS

28.1 General. Each Party makes the following representations, warranties and covenants:

28.1.1 Good Standing. Such Party is duly organized, validly existing and in good standing under the laws of the state in which it is organized, formed, or incorporated, as applicable; that it is qualified to do business in the location or locations in which the Generating Facility, Interconnection Facilities and Network Upgrades owned by such Party, as applicable, are located; and that it has the corporate power and authority to own its properties, to carry on its business as now being conducted and to enter into this GIA and carry out the transactions contemplated hereby and perform and carry out all covenants and obligations on its part to be performed under and pursuant to this GIA.

28.1.2 Authority. Such Party has the right, power and Authority to enter into this GIA, to become a Party hereto and to perform its obligations hereunder. This GIA is a legal, valid and binding obligation of such Party, enforceable against such Party in accordance with its terms, except as the enforceability thereof may be limited by applicable bankruptcy, insolvency, reorganization or other similar laws affecting creditors' rights generally and by general equitable principles (regardless of whether enforceability is sought in a proceeding in equity or at law).

28.1.3 No Conflict. The execution, delivery and performance of this GIA does not violate or conflict with the organizational or formation documents, or bylaws or operating agreement, of such Party, or any judgment, license, permit, order, material agreement or instrument applicable to or binding upon such Party or any of its assets.

28.1.4 Consent and Approval. Such Party has sought or obtained, or, in accordance with this GIA will seek or obtain, each consent, approval, authorization, order, or acceptance by any Governmental Authority in connection with the execution, delivery and performance of this GIA, and it will provide to any Governmental Authority notice of any actions under this GIA that are required by Applicable Laws and Regulations.

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ARTICLE 29. {RESERVED}**ARTICLE 30. MISCELLANEOUS**

30.1 Binding Effect. This GIA and the rights and obligations hereof, shall be binding upon and shall inure to the benefit of the successors and assigns of the Parties hereto.

30.1.1 Reversion. If offered pursuant to an Agency Agreement under which this GIA is executed by GPL as agent for the relevant GPL, in the event that the relevant Agency Agreement terminates, any Service offered by GPL under this GIA shall revert to the relevant GPL shall be released from all obligations and responsibilities under this GIA.

30.2 Conflicts. In the event of a conflict between the body of this GIA and any attachment, appendices or exhibits hereto, the terms and provisions of the body of this GIA shall prevail and be deemed the final intent of the Parties.

30.3 Rules of Interpretation. This GIA, unless a clear contrary intention appears, shall be construed and interpreted as follows: (1) the singular number includes the plural number and vice versa; (2) reference to any person includes such person's successors and assigns but, in the case of a Party, only if such successors and assigns are permitted by this GIA, and reference to a person in a particular capacity excludes such person in any other capacity or individually; (3) reference to any agreement (including this GIA), document, instrument or tariff means such agreement, document, instrument, or tariff as amended or modified and in effect from time to time in accordance with the terms thereof and, if applicable, the terms hereof; (4) reference to any Applicable Laws and Regulations means such Applicable Laws and Regulations as amended, modified, codified, or reenacted, in whole or in part, and in effect from time to time, including, if applicable, rules and regulations promulgated thereunder; (5) unless expressly stated otherwise, reference to any Article, Section or Appendix means such Article of this GIA or such Appendix to this GIA, or such Section to the GIP or such Appendix to the GIP, as the case may be; (6) "hereunder", "hereof", "herein", "hereto" and words of similar import shall be deemed references to this GIA as a whole and not to any particular Article or other provision hereof or thereof; (7) "including" (and with correlative meaning "include") means including without limiting the generality of any description preceding such term; and (8) relative to the determination of any period of time, "from" means "from and including", "to" means "to but excluding" and "through" means "through and including".

30.4 Entire Agreement. This GIA, including all Appendices and attachments hereto, constitutes the entire agreement between the Parties with reference to the subject matter hereof, and supersedes all prior and contemporaneous understandings or agreements, oral or written,

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between the Parties with respect to the subject matter of this GIA. There are no other agreements, representations, warranties, or covenants, which constitute any part of the consideration for, or any condition to, any Party's compliance with its obligations under this GIA

30.5 No Third Party Beneficiaries. This GIA is not intended to and does not create rights, remedies, or benefits of any character whatsoever in favor of any persons, corporations, associations, or entities other than the Parties, and the obligations herein assumed are solely for the use and benefit of the Parties, their successors in interest and, where permitted, their assigns.

30.6 Waiver. The failure of a Party to this GIA to insist, on any occasion, upon strict performance of any provision of this GIA will not be considered a waiver of any obligation, right, or duty of, or imposed upon, such Party.

Any waiver at any time by any Party of its rights with respect to this GIA shall not be deemed a continuing waiver or a waiver with respect to any other failure to comply with any other obligation, right, duty of this GIA. Termination or Default of this GIA for any reason by Interconnection Customer shall not constitute a waiver of the Interconnection Customer's legal rights to obtain Interconnection Service from GPL. Any waiver of this GIA shall, if requested, be provided in writing.

30.7 Headings. The descriptive headings of the various Articles of this GIA have been inserted for convenience of reference only and are of no significance in the interpretation or construction of this GIA.

30.8 Multiple Counterparts. This GIA may be executed in two or more counterparts, each of which is deemed an original but all constitute one and the same instrument.

30.9 Amendment. The Parties may by mutual agreement amend this GIA by a written instrument duly executed by all of the Parties.

30.10 Modification by the Parties. The Parties may by mutual agreement amend the Appendices to this GIA by a written instrument duly executed by all of the Parties. Such amendment shall become effective and a part of this GIA upon satisfaction of all Applicable Laws and Regulations.

30.11 No Partnership. This GIA shall not be interpreted or construed to create an association, joint venture, agency relationship, or partnership among or between the Parties or to impose any partnership obligation or partnership liability upon any Party. No Party shall have any right, power or GPL to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Parties.

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IN WITNESS WHEREOF, the Parties have executed this GIA in multiple originals; each of which shall constitute and be an original GIA among the Parties.

GPL .

By:

Name:

Title:

[Insert name of Interconnection Customer]

By:

Name:

Title:

Project No. _____

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TYPICAL APPENDICES TO GIA

Appendix A Interconnection Facilities, Network Upgrades, System Protection Facilities,
Generator Upgrades and Distribution Upgrades

Appendix B Milestones

Appendix B-1 Pre-Certification Generation Test Notification Form

Appendix C Interconnection Details

Appendix D Security Arrangements Details

Appendix E Commercial Operation Date

Appendix F Addresses for Delivery of Notices and Billings

Appendix G Interconnection Requirements for a PV or Wind Farm

Appendix H Interconnection Requirements for Provisional GIA

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GUYANA POWER AND LIGHT INCORPORATED



Operational Code

ABBREVIATIONS: V

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Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

4. OPERATIONAL CODE

4.1 Introduction

The Operational Code includes the criteria, procedures and information requirements necessary to execute the operational planning, the generation dispatch and coordination supervision and control of integrated operation of the GPL System.

The Operating Code will procure a reliable and safe supply of energy and power demand by using the available resources in the most efficient and economical way.

The code is structured in 9 sections including:

Section 1: Introduction

Section 2: Objectives

Section 3: Scope

Section 4: Definitions

Section 5: Operational Planning

Section 6: Operations Scheduling, Coordination, Control and Supervision

Section 7: Operations Reports

Section 8: Data Requirements

Section 9: Testing and Monitoring

4.2 Objectives

The Operational Code objectives are:

- a) Establish procedures and criteria for:
 - i. Demand Forecasting
 - ii. Long Term, Medium Term and Short Term Operational Planning
 - iii. Reserve Margins
 - iv. Demand Control
 - v. Power System Restoration
 - vi. Safety Coordination

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- vii. Generation Dispatch
 - viii. Real Time Operation Coordination
 - ix. Frequency Control
 - x. Voltage Control
 - xi. Testing and Monitoring
- b) Define the procedures for the information exchange, between the different entities connect to the GPL grid, including:
- i. Operational Planning Reports
 - ii. Real Time Operation Reports
 - iii. Operational Planning Data
 - iv. Real Time Operational Data

4.3 Scope

The Operational Codes applies to the following entities:

- a. GPL Inc.
- b. Distribution Networks Operators
- c. Any power generation facility connected to the grid
- d. Directly Connected Customers
- e. Internally Interconnected Parties
- f. International Interconnected Parties

4.4 Definitions

Accuracy Test: A test to determine the percentage error of any item of a metering system.

Active Energy: The electrical energy produced during a time interval measured in units of watt-hours or standard multiples.

Active Power: The product of voltage and the in-phase component of alternating current measured in units of watts or multiples.

Actual Metering Point: The physical point at which electricity is metered.

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Ancillary Services: The services that generation facilities or other users connected to grid may be required to provide from time to time in connection with the security and stability of the DBIS. Those services included but are not limited to: frequency control, reserve margin, voltage regulation, black start capability, etc.

Benchmark Case: A system model without the Interconnection Project(s) under study. It is considered the reference.

Bi-directional meter: Meter that measures the active energy (kWh) flow in both directions (import and export) and displays both imported and exported energy in separate registers.

Business Day: shall mean Monday through Friday, excluding Holidays.

Calendar Day: shall mean any day including Saturday, Sunday or a Holiday.

Check Meter: A device where required, that duplicates and provides backup to the main meter for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Cluster / Cluster Study: A group of Interconnection Projects that are studied simultaneously in the same FIS due to the time proximity of their applications.

Connection Point: The point on the transmission system to which a user connects its system to the grid.

Connection Site: The physical site belonging to GPL or a user where a connection point is located.

Consequential Load Shed: Load that is dropped as a direct implication of a fault (e.g. a radial line).

Contingency Reserve: is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand, provide by units that are not required to be synchronized.

Conventional Generation: A resource using conventional fuels or water and is fully dispatchable and controllable.

Customer-generator: Any Customer of a DNO that generates electricity on the Customer's side of the billing meter with renewable energy generation system that is primarily intended to offset part or all of the Customer's electricity.

Delivery Point: The point at which electricity is delivered.

Demand Control Refers to measures that allow secure a reduction in demand to preserve the integrity of the network operation.

Directly Connected Customers: Any customer that is directly connected to the transmission network.

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Dispatch Instructions: Mandatory dispatch orders issue by the System Operator during any operation day.

Distribution Networks Operators: Any user connected to the transmission grid to exchange power and that delivers power through his own network to final customers.

Economic Dispatch: The process to assign the available resources to cover the electric load in merit order.

Electric Time: The time shown on an electric clock connected to the DBIS.

Emergency Conditions: Abnormal system conditions that require automatic or manual actions to prevent or limit loss of transmission and distribution facilities or generation capacity that could adversely affect the reliability of the transmission network.

Emergency Instructions: A dispatch instruction issued by GPL that may require an action or response that is outside the limits declared in the day ahead dispatch for a generation unit and issue to prevent or limit an emergency condition.

Facility aggregated power MW capacity: It is the basis to determine the requirements associated with real and reactive power capability. This capacity is usually defined as gross capacity (i.e. the aggregated capacity of all generation) but the developer shall also provide a maximum net capacity to be delivered at the POI. It is of particular importance of Wind Turbine Generation (WTG) facilities or PV; called here Renewable Generating Facilities (RGF).

Feasibility Study: A preliminary system impact study as presented in this code.

Firm Loads: Loads that require continuous electric service from GPL and should not be interrupted except in extreme conditions to preserve the integrity of the system.

FIS Study Scope Agreement: A binding document defining the basis for the FIS.

Frequency Excursions: System frequency deviation from nominal frequency as a result of contingencies or load-generation imbalance.

Frequency Sensitive Mode: The operation of a generation unit that will result in active power output changing automatically in response to changes in the DBIS frequency.

Full Interconnection Study (FIS): A detailed system impact study as presented in this code.

Full Interconnection Study Request (FISR): A letter from IC notifying GPL to proceed with the Full Interconnection Study for the Interconnection Project identified in the letter.

Generation Owner: Independent Power Producers (IPP), Large Customers and/or GPL that own a Generation Resource as defined in this code.

Generation Resource: Any device capable of injecting active power into GPL System regardless of technology; conventional generation, renewable generation or any type of

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storage devices. Generation Resources inject into the grid 5 MW (net after auxiliary services) or more if the POI is at 69 kV or 1.5 MW for POI at the 13.8 kV level.

Generating Resource, Generation Facility, or Generating Facility: See Generation Resource.

Good Utility Practice: Acting in good faith to perform obligations in accordance with international good practices in the electricity sector. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted.

GPL: Guyana Power and Light, provider of Transmission and Interconnection Services, owner and operator of the GPL System, and has central responsibility of planning the System.

GPL Operators: Personnel at the Energy Control Centre in charge of providing dispatch instructions to generation, monitoring the system performance, open and reconnect transmission facilities for normal operation or during emergency procedures and system restoration.

GPL System: All interconnect transmission and distribution facilities owned by GPL. Currently consists of the Demerara Berbice Interconnected System (DBIS)

GPL Transmission System: Facilities at 69 kV or above, used by GPL to interconnect generating resources to the distribution system MV system. Includes the transformation to MV (13.8 kV) level.

Hourly Economic Dispatch Program: The program output for each of the generation units in all the hours of the day generated by the Economic Dispatch.

Instation: Equipment located within GPL's premises that receive and stores metering data from Outstations.

Interconnecting Customer's System Impact Responsibility: Consists of the overloads or voltage violations that the Interconnection Project is likely to produce or aggravate in the system and that until corrected limit the capacity that the Interconnection Project can inject into the system. This limit can be zero. IC may or may not have financial responsibility on the cost of the associated reinforcements.

Interconnection Customer (IC): Party seeking interconnection service from GPL. Can be and Independent Power Producer, a Cogenerators or GPL itself operating as a resource owner.

Interconnection Project: The New Generation Resource or Generation Resource change seeking interconnection to GPL System.

Internally Interconnected Party: An entity located in Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

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International Interconnected Party: An entity located outside Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

Interruptible Loads: Loads that have contractual conditions that allow interrupting their service during emergency conditions or for economic considerations. This is also called Load acting as a Resource.

Long term: A one to five years period for operational planning. The long term has been initially set up to 1 year.

Main Meter: The primary meter for measuring and recording electrical quantities.

Major Customers: Customers with annual peak load demand higher than 1 MW.

Measurement Transformers: Voltage and/or current transformers or combinations of those, used in metering systems.

Medium Term: A 4 weeks period for operational planning.

Merit Order: an order for ranking available generation facilities which shall optimize the DBIS economy, security, stability and reliability and that shall be determined by GPL.

Meter: A device for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Meter Certificate: The statement issued by GPL confirming that a meter or metering system complies with the requirements of the metering code.

Meter Owner: The person responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of meters.

Meter Register: A device associated with a meter, from which it is possible to obtain a visual reading of the quantities that have passed the meter.

Meter Registration System: A system that uniquely identifies the meter and users associated with the meter and contains pertinent data relating to the meter as required by the metering code.

Meter Service Provider: A person that provides to a meter owner meter services such as the installation, commissioning, operation, maintenance, and general servicing of metering systems.

Metering: The activity of measuring and recording units of active power, active energy, reactive power, reactive energy or other electrical quantities using a metering system or a meter.

Metering System: The group of equipments including meters, measurement transformers, metering protection and isolation equipment, including alarms, circuitry, associated data storage and data communications equipment that are part of the active energy, reactive energy and demand measuring equipment at or relating to a connection site.

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Minimum Technical Requirements (MTR): A set of requirements that any new generating resource needs to comply with to safely interconnect and not degrade the reliability of the system.

Net Metering: A methodology under which electrical energy generated by a customer-generator and delivered to the DNO facilities as measured by an appropriate device to offset electric energy supply by the DNO to the customer-generator during the applicable billing period. Net Metering is not designed to be an income generating mechanism and the supplier will not have to make monetary payments to customer-generators.

Non Consequential Load Shed: Load that needs to be shed to alleviate an overload or remediate a severe voltage violation.

Non Disclosure Agreement (NDA): A binding document limiting the information that the parties may disclose to third parties and the conditions according to which this disclose can be made.

Operating Margin: The amount of reserve available over and above that required to meet the expected demand. It includes the contingency and operating reserves.

Operating Reserve: The amount of reserve to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). It includes the primary and secondary regulation and the tertiary response.

Operating Parameters: The onsite technical capabilities, flexibilities and limitations of a generation unit, that need to be declared for the day ahead dispatch.

Operational Test: a test carried out to acquire information in respect of a plant under pre-determined system conditions.

Outstation: On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an Instation or SCADA system or downloading to a local interrogation unit on request. When used with metering systems the outstation will store data from a meter(s) and may perform some processing of data.

Performance Standards: Define acceptable response to normal or contingency events and are measured in voltage magnitude or voltage change, thermal loading, stability or voltage swing limits and damping.

Photovoltaic Generation (PVG) Facility: Photovoltaic Facility has several photovoltaic arrays with solar panels connected to individual inverters and step-up transformers. The PVG transformers will step-up voltages from a typical 200-volt level to a typical 13.8 kV to 34.5 kV collector. A PVG may have several collectors that will connect to the Collector Bus. The Collector Bus is connected to the low side of the transmission step-up transformer(s), that changes the voltage to 13.8 kV, 69 kV or higher. Photovoltaic facilities output is a function of the site itself and the tracking system employed, with production that varies depending on

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whether tracking is used or not. PVG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

Plant: Any apparatus, equipment or appliance used for, or for purposes connected with, the generation, transmission, dispatch, distribution or supply of electricity.

Point of Interconnection (POI): A physical point in the System where ownership changes from the IC to GPL. Facilities towards the generator from the POI belong and are maintained by the IC, facilities from the POI to the GPL System are owned, maintained and operated by GPL.

Power Factor (PF): Ratio of the active power delivered by a generator or consumed by a load to the total apparent power delivered by the same generator or consumed by the same load. Over excited, lagging or positive PF corresponds to the condition of the generator injecting reactive power. Under excited, leading or negative power factor corresponds to the condition of the generator absorbing reactive power.

Project: See Interconnection Project

Primary Regulation: The real time variation in the power delivery of the generator in response to changes in the system frequency.

Reactive Energy: The integral with respect to Reactive Power, measured in units of voltampere reactive hours (Varh) and standard multiples.

Reactive Power: The product of alternating voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive (vars) and standard multiples.

Reliability Criteria: Define the acceptable operating limits for normal (N-0), as well as for various single and double contingency conditions such as: N-1, N-1-1, and N-2. Steady state, transient, and dynamic aspects are considered in determining reliability criteria for each type of contingency.

Remedial Action Scheme (RAS): A protective device that trips generation or load upon the occurrence of defined events to prevent overloads or voltage violations.

Resource: See Generation Resource.

Running Orders: Indicative dispatch instructions issue by the system operator as part of the day ahead generation dispatch.

Schedule Day: The 24 hours period starting at midnight of the day concerned.

Secondary Regulation: The automatic or manual adjustment to the power delivery by the generators to re-establish the generation – load balance.

Short Term: A 24 hours period for operational planning.

Significant Incident: An incident that GPL has determined that shall be defined as significant in the context of reporting.

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Site Investigations: Test conducted in relation to plant and operation procedures at generation facilities sites to monitor and assess the characteristics of the plant.

System: See GPL System.

System Operator: Guyana Power & Light Incorporated.

System Protection Facilities: Shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tertiary Respond: This is component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets.

Transfer Distribution Factor: A fraction of the generation injection increase that flows over a defined element or flow gate (groups of elements) when balanced against the swing bus or sink area.

Unidirectional Meter: A meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction

User: Any entity different than GPL that is connected to transmission network and uses it to receive or delivery electricity.

Utility Scale Generating Facility: See Generating Resource.

Wind Power Facility: A Wind Turbine Generating facility (WTG) typically will have several Wind Turbine Generators (WTGs) connected to individual WTG step-up transformers. The WTG transformers will step-up voltages from a typical 600-volt level to a typical 13.8 kV or 34.5 kV collector. A WTG facility may have several collectors that will connect to the Main Collector Substation. The Main Collector Substation typically has a step-up transformer(s) that change the voltage to the transmission voltage (69 kV and above). The step-up transformer is connected to the POI through one or more lines, unless the transformer connects directly to the POI. WTG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

4.5 Operational Planning

4.5.1 Demand Forecasting

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This section includes the rules and procedures to generate the demand forecast that will be used during the operational planning. All the demands must be estimated at the generation level and therefore must include all losses in the distribution and transmission networks.

The demand forecasting is required for:

- Short term operational planning: hourly forecast of the required active and reactive demand for the day ahead.
- Medium term operational planning: weekly forecast of energy and peak load are required to generate a weekly load duration curve.
- Long term operational planning: monthly forecast of energy and peak load are required to generate a monthly load duration curve.

The forecast for any of the above periods must be based on the analysis of historical records of hourly peak active and reactive demand for similar period of the year. The analysis must generate typical load profiles or load duration curves on a daily, weekly and monthly basis for a whole calendar year. GPL must update the load profile analysis at least once a year.

The load forecast must be available:

- Short term: by 12 PM before the day of dispatch.
- Medium term: every week on Monday for the next four weeks.
- Long term: 5 working calendar days before the end of the month.

4.5.2 Long Term Operational Planning

The long term planning can go from one year (1) up to five (5) years. The higher the component of hydroelectric generation with regulating reservoirs, the longer should be the period. Hydroelectric plants with large reservoirs can regulate water inflows for several years in order to manage the lack of water in dry years with the additional water in wet years. For this reason, when this kind of generation resources are available, long planning period are required to optimize the use of the available water.

The initial long term operational planning period is set to one (1) year. In the future when hydroelectric plants become available in Guyana this timeframe must be reviewed and updated.

Data required: demand forecast, losses forecast, hydrology data (if hydroelectric plants are or become available in the planning period), generation units historical available capacity, forced outage rate and heat rate, fuel costs, O&M costs, maintenance program, retirements and/or expansions programs and transmission constraints. In the case of renewable like wind or solar power an estimate of the monthly generated energy is required.

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A long term optimized indicative generation dispatch is developed in order to minimize production costs and to use in the best possible way the available hydroelectric and other renewable resources. Network simulations are required to verify losses and network constraints. The dispatch goal is to obtain the best combination of conventional and renewable generation that will warrant the long term supply at minimum cost.

The dispatch is done on a monthly basis using the estimated load duration curves but the resources and optimization must be achieved in the whole long term planning period.

Schedule maintenance outages for transmission lines, substation equipment and generation units shall be initially defined as part of the whole optimization process.

The long term plan needs to be updated by the end of every month.

4.5.3 Medium Term Operational Planning

The medium term operational planning covers a period of 4 weeks and needs to be updated at the end of every week. This is an indicative planning.

Includes a medium term optimized generation dispatch considering the recommendations of the long term planning for the use of the available hydroelectric or renewable resources and update information for the month ahead regarding , demand forecast, losses forecast, renewable generation data, other generation units data, fuel costs, O&M costs and maintenance programs.

The goal and methodology are similar to the one described for the long term operational planning but in this case the dispatch is done using the weekly load duration curve with the target of optimizing the cost in the four weeks period.

Network simulations are required to verify losses and network constraints.

Maintenance plans can be adjusted during the medium term period but the impact over the long term planning must be verified before a decision is made.

4.5.4 Short Term Operational Planning

The short term operational planning is the day ahead economic dispatch and potential hourly re-dispatches as describe in section 4.6 of this code. The day ahead dispatch is a mandatory operational planning.

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4.5.5 Reserve Margins

The operating margin is the amount of reserve (provided by Production Facilities or by demand control) available over and above that required to meet the expected demand. It is required to limit and then correct frequency deviations that may occur due to an imbalance between total generation capacity output and demand. The operating margin includes:

Contingency Reserve is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand. It is provided by generation sets that are not required to be synchronized but which must be held available to synchronize within a defined timescale.

Operating Reserve is to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). The operating reserve must be capable of providing response in three phases:

Primary Response

The automatic increase in active power output of a generation set or a decrease in the demand for active power in response to a fall in the frequency of the total system. The response must be fully available within 5 seconds from the time of the frequency fall.

Secondary Response

The automatic or manual increase in active power output of a generation set or a decrease in the demand for active power in response to a fall in the frequency of the total system. The response must be fully available within 30 seconds from the time of the frequency fall.

Tertiary Response

This is a component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets. Economic dispatch is also generally included in tertiary response.

Contingency and operating reserves provide protection against uncertainties in the availability of generation sets and/or demand forecasts.

GPL shall determine the amount of contingency reserve required for each hour as part of the operational planning procedure, taking due consideration factors like:

- Generation units historic availability and performance
- Available information about the risk of trip of generator included in the day ahead dispatch
- Demand forecast uncertainties
- Available information about potential transmission contingencies

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GPL shall determine the amount of Operating Reserve required for each hour as part of the operational planning procedure, taking due consideration factors like:

- The power output of the largest generation sources connected to the grid
- The predicted frequency drop due to the lost of any of the previous largest generation sources
- The amount of demand control that can be implemented to control frequency
- Significant events that may trigger the need for additional Operating Reserve
- The costs of providing operating reserve
- Weather or other conditions that may affect the generation output or that can create contingencies in the transmission network

GPL will instruct power producers of the extent to which they are obliged to make their generation units available to contribute towards contingency reserve and operating reserve with the required levels of response. Power producers shall have their units available to provide the required reserve under the term established by GPL.

4.5.6 Demand Control

The term “Demand Control” refers to measures that allow secure a reduction in demand in situations of insufficient generation capacity or where severe operating difficulties pose a threat to the stability of the total system.

Demand Control is implemented in a number of ways, including;

- Consumer demand side management agreements; can have an economic and a planning component (Demand acting as a resource),
- Emergency manual demand shedding;
- Planned rotational demand shedding; and
- Demand shedding by automatic under-frequency relays or under-voltage relays.

GPL may enter into demand side management agreements with customers directly connected to the transmission network. The agreements should specify the willingness of the customers to voluntarily reduce their load at a certain time of the day or certain periods of the year.

GPL must have predefined procedures to implement emergency manual demand shedding or planned rotational demand shedding. These procedures must be developed during the long term planning stages and must be reviewed every year.

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The procedures should clearly establish the required steps to implement demand shedding and the amount and location of the demand to be shed and the frequency level that trigger the action.

Networks operator must know the procedures and should be trained to implement them without delay or hesitation.

During demand control, scheduling and dispatch in accordance with the merit order may cease and will not be re-implemented until GPL so decides.

4.5.7 Power System Restoration

A total system shutdown or partial system shutdown can have widespread implications for electricity supply and it is imperative to have arrangements in place to deal with such situations. It is also important that users are aware of the procedures, and cooperate fully in the implementation of the procedures to return the Grid to normal operating conditions.

GPL shall develop a system normalization strategy to be implemented in emergency conditions such as total system shutdown or a partial system shutdown and other major system incidents. The overall objectives of the system normalization strategy shall be as follows:

- Restoration of the Grid and associated demand in the shortest possible time.
- Re-synchronization of parts of Grid which have become out of synchronism with each other; and
- Provide for effective communication routes and arrangements to enable the system normalization.

The system normalization procedures should include:

- The definition of the responsibilities of the different agents involve in the system restoration.
- A black start procedure; including location of black start sources, creation of “cranking paths” to generation resources that do not have black start capability.
- Formation of electric islands and re-synchronization procedures.

The system normalization will provide detailed instructions for the implementation of:

- Notification to users of the total of partial shutdown and that GPL intends to implement a normalization procedure.
- Identification of power islands.

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- Step by step integration of the power islands into large sub-systems to return the transmission network to normal operating conditions.

System normalization procedures will be developed and maintained by GPL in consultation with other users as appropriate. Procedures shall be reviewed at least yearly to adapt them to changes in the system.

4.5.8 Safety Coordination

All the agents connected to the grid must operate in accordance with approved safety rules, in order to ensure safe working conditions for personnel working on or in close proximity to grid electrical plant and for personnel who may have to work or use grid electrical plant at an interface. The objective is to allow work and/or testing on the grid or HV plant that is directly connected to the Grid to be carried out safely.

All agents connected to the grid must know and follow the rules of the latest version of GPL's Occupational Safety and Health Handbook as well as other Handbook(s) as provided by specific manufacturer(s)/supplier(s).

GPL must make this document available to all the agents and must notify promptly about any updates and changes.

4.6 Operations, Scheduling, Coordination, Control and Supervision

4.6.1 Generation Dispatch

The generation dispatch or scheduling depends on the level and pattern of the total system demand, the location of the generation sources versus the load center, the cost and operation margins of the generation units and current configuration and availability of the transmission network.

This section of the code sets out data and methodology to facilitate the production of the generation dispatch.

By the 10th hour of any given day, power producers shall notify GPL, in writing the following data:

- Availability notice of each generation unit for the next day
- Changes in the operating parameters of each unit for the next day. If no changes are reported the previous submitted operation parameters will apply.

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- c. Other relevant scheduling and dispatch data that may affect the likely output of the generation sets

By the 10th hour of any given day, System Operation Engineer shall document and notify other agents in writing the following data:

- a. System constraints that may affect the dispatch for the next day
 b. The requirements for maintaining voltage within prescribed limits and reactive power reserves for the next day

By the 10th hours of any given day, major customers shall notify GPL in writing the following data:

- a. Hourly demand forecast for the next day

In case of failure to submit any of the data mentioned above, GPL will first try to contact the entity that fails to provide the data to check if the data was sent and not received. If this is the case the data shall be resent immediately.

In the event that data is not received by the 12:00 hours, GPL shall use the latest data provided. In the case of major customer demand forecast GPL shall use data from a similar date of the previous week.

In any time of the day before the schedule day any user becomes aware about changes in the provided data, it shall promptly notify GPL in writing.

For the following schedule day, GPL will compile two merit order schedules. Each schedule will list the generation sets in descending order of incremental cost using information from the operating parameters supplied by the power producers, the requirements of the Grid Code regarding operating reserve, frequency control, ancillary services, and other factors. The two schedules to be compiled by GPL are as follows:

- The first schedule will be the 'Unconstrained Schedule', which will be compiled assuming that there were no Grid constraints, either through inherent physical limitations on the total system or because of outages on the Grid;
- The second schedule will be the 'Constrained Schedule' which will be compiled taking into account the inherent physical limitations of the Grid and all known

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outages and constraints on the total system and connected production facilities for the schedule day.

- Both schedules shall consider the optimal hydroelectric power production plan defined in the long and medium term operational plans plus the actual conditions on the reservoir levels and water inflows.
- Both schedules shall consider the optimal use of other renewable sources like solar or wind farms.

In the case that two generation units have similar costs, GPL will dispatch first the unit that will provide the highest reduction in the overall total system costs.

Using the constrained schedule, by the 16th hour on the date before the schedule date, GPL shall submit provisional running orders to all the generation sources indicating the planned loading pattern of each unit for the schedule day. These running orders are indicative and are provided as guide of the expected output from the generation units. They are not dispatch instructions.

4.6.2 Real Time Coordination

The objective is to setup procedures for the issuance of dispatch instructions to meet demand requirements at minimum cost, taking account of operational constraints while maintaining the integrity of total system security and the quality of electricity supply.

Dispatch Instructions relating to the schedule day shall be issued at any time during the period beginning immediately after the issue of the generation schedule in respect of that schedule day.

A dispatch Instruction given may require a change in the active power output of a generation set, a change in the reactive power output or voltage target for the AVR of a generation set, a change to the mode of operation or an instruction to provide an ancillary service by a specific generation set.

In summary instructions may include adjustments to:

- Increase / decrease in active power
- The reserve margin
- Reactive power output / Target voltage levels
- Frequency sensitive mode change
- Ancillary services

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In order to release a dispatch instructions GPL shall review the constrained schedule, the declared availability of each generation units and any generation unit relevant data other relevant related with the dispatch instructions to be released.

For a dispatch instruction to be valid it must observe the limits of availability, ancillary services capability and operational parameters declare to GPL during the day ahead generation dispatch. Generation unit operators must immediately contact GPL if the instruction is not valid. GPL will take immediate steps to amend the dispatch instruction.

If problem arises during the implementation of a dispatch instruction, the generation unit operator shall notified GPL without delay.

Each power producer will comply with all valid dispatch correctly given by GPL within the range and time frame declared in the operational parameters of each unit.

To preserve the grid integrity under emergency conditions GPL may issue emergency instructions. The power producers will use reasonable efforts to comply with these instructions without prejudice to the safety of the plant or persons.

4.6.3 Frequency Control

The objective is to clarify the frequency control procedures required to maintain the security and quality of electricity supply from the DBIS and (as far as possible) to maintain the electric time in accordance with the limits specified in this code. These procedures include:

- Operation in frequency sensitive mode: frequency sensitive mode is the generic description whereby the active power output of a generation set will change automatically in response to changes in the system frequency. This also permits the generation set to operate in accordance with an instruction to provide primary response and/or secondary Response.
- Demand control and
- Dispatch of generation sets

GPL will issue dispatch instructions to regulate the frequency of the DBIS to meet the requirements of frequency control. Generating plants operating in frequency sensitive mode are required to operate taking into account the target frequency notified by the system operator. GPL will give a 15 minute notice of variation of the target frequency.

GPL shall issue instructions to minimize the duration of any low frequency conditions. Instructions will be given to power producers to synchronize available generation and maximize generation set output while maintaining some reserve capacity to manage frequency control.

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GPL shall also issue instructions to arrange demand control to reduce demand to match available generation output and in order to restore the frequency of the total system to within the normal set point range.

Under high frequency conditions the system operator will issue dispatch instructions to reduce the generation output including the trip of appropriate generation sets.

The network frequency objective is 60 Hz and its variation range under normal conditions shall be between values defined in this code and for a system like GPL's shall be between 59.4 Hz and 60.6 Hz. Under emergency conditions frequency range can be extended for an expanded range typically between 58.2 Hz and 61.5 Hz, for a time period no longer than 1000 seconds. Values between 63 Hz and 57 Hz are permitted but for a period not longer than 2 seconds for the upper limit and 3 seconds for the lower limit. Frequency can drop up to 57.7 Hz for a period of time up to 300 seconds. Automatic load shedding should exist for the lower frequency ranges.

The previous recommend range is only applicable in the case that not combustion turbines generators are connected to the network. If future expansions require the interconnection of combustion turbines to the grid then, the following changes must be implemented:

- Normal Range: no changes
- Emergency Range: frequency can be between 58.4 Hz and 61.5 Hz for a period no longer than 540 seconds
- Additional Range:
 - Frequency can go down to 57 Hz for a period no longer than 0.75 seconds and then needs to be increased to 57.3 Hz for another 7.5 seconds. After that frequency must be recovered up to 57.8 Hz for a period no longer than 30 seconds.
 - Frequency can go up to 61.7 Hz for a period not longer than 30 seconds.

GPL shall make efforts to maintain the electric time to within plus or minus 30 seconds of Guyana official time by specifying changes to the target frequency as part of the dispatch instructions. GPL shall be responsible for monitoring and recording the electric time error using the format described in section 5.8.2 Real Time Operational Data.

4.6.4 Voltage Control

To ensure adequate system voltage profiles and that reactive power reserves are maintained under normal and fault conditions a range of voltage control instructions will be utilized.

Voltage regulation requires both active and reactive power flows across the Grid to be carefully controlled. The physical characteristics of the Plant of the Grid also give rise to the

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generation and absorption of reactive power. Reactive Power flows across the system can give rise to substantial voltage differences and it is therefore necessary to maintain reactive power balances between sources of capacity and demand on a “zonal” basis.

Voltages at different points on the DBIS are determined by the local sources of demand and capacity, by the prevailing network configuration and by the reactive power flows across the network. The voltages at different points on the DBIS thus form a “voltage profile”.

The management of voltage requires control of reactive power and this can be provided by generators, or by means of synchronous or static compensators and switchable capacitors/reactors.

The system operator will monitor the voltage profile and will generate operating instructions to adjust the available sources of reactive power within the specified minimum technical requirements. All generation units shall comply with the instructions unless the requirements are beyond their declared reactive power capability. In this case GPL should be notified promptly and shall modify the operating instructions to comply with generation unit declared capability.

The network nominal voltages are 69 kV and 13.8 kV and its variation range under normal conditions should be between 95% and 105% nominal. Under emergency conditions voltages variations can be extended to a range between 90% and 110% for a period of time no longer than 1/2 hours to give time for operators to adjust transformer taps.

4.7 Operations Reports

This section describes the reports that need to be provided and the time frame to do so during the planning and real time operational stages.

4.7.1 Operational Planning Reports

GPL shall provide the following operational planning reports in the indicated time frame:

- **Long term planning report:** update and release at the end of each month covering the next 12 months period.
- **Medium term planning report:** update and release at the end of each week covering the next 4 weeks period.
- **Short term planning report:** release daily with the day ahead generation schedule

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4.7.2 Real Time Operation Reports

GPL shall provide the following real time operation reports in the indicated time frame:

- **Daily Operation Report:** release daily with information of the actual generation dispatch and indicating any differences or re-dispatch against the day ahead generation schedule.
- **Incidents Notification:** GPL and users shall issue notifications of incidents on their respective systems that have had or may have implications for the Grid or a user's system. Incident notifications must be issued promptly. Notifications and responses to notifications may be made by telephone but must be confirmed in writing using facsimile transmission or other electronic means as agreed with GPL, within 5 minutes. Incidents notifications shall be issued for the following:
 - Where a plant has been operated in excess of its rated capability and presented a hazard to the plant infrastructures and persons;
 - the activation of any alarm or indication of any abnormal operating condition;
 - adverse weather conditions being experienced;
 - breakdown of, faults on or temporary changes in the capabilities of plant;
 - breakdown of or faults on control, communication and metering equipment; and
 - increased risk of inadvertent operation of protection.
- **Significant Incident Reporting:** GPL may determine that an incident reported by it or a user shall be classified as a significant incident. GPL shall promptly notify all potentially affected users by telephone that such a determination has been made and that procedures governing significant incident reporting are to be followed. Significant incidents will include, as a minimum all of the following:
 - manual or automatic tripping of system circuits, and plant;
 - voltage excursions outside normal operating limits;
 - frequency excursions outside normal operating limits;
 - system instability;
 - overloading (i.e., loading in excess of the rated capacity) of system circuits, and plant; and

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- breeches of safety rules or procedures that resulted in danger or injury to members of the public or employees or their representatives.

GPL or the user must produce a preliminary written significant incident report within 2 hours of receiving notification that GPL has determined an incident to be a significant incident. GPL or the user must produce a full written significant incident report within 1 business day of receiving notification that GPL has determined an incident to be a significant incident.

GPL shall maintain an indexed record of all incidents.

GPL shall review each significant incident report to determine if there has been a non compliance with the Grid Code. By the end of each month GPL shall produce a report with a summary of the significant incidents during the month. The report shall emphasize any lack of compliance with the grid code and areas where there may be a need to modify the Grid Code.

The Grid Code Review Panel shall make recommendations at any time including proposed modifications to the Grid Code arising from the analysis of the significant incidents.

4.8 Data Requirements

This section describes the data that need to be provided and the formats to be used to do so during the planning and real time operational stages. Data formats are available in the excel file: GPL Operational Code Formats.xls.

4.8.1 Operational Planning Data

- Load forecast data for the long, medium and short term planning:
 - Short Term:
 - Format LFST01: User Daily Load Profile and Demand Control
 - Format LFST02: Consolidated Load Profile
 - Medium Term:
 - Format LFMT01: Medium Term Operational Planning Load Forecast
 - Long Term:
 - Format LFLT01: Long Term Operational Planning Load Forecast
- Network losses forecast:
 - Short Term:

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- Format LFST02: Consolidated Load Profile
 - Medium and long term network losses must included in the system peak load provided in LFMT01 and LFLT01
- Hydrology data and forecast
 - Medium Term:
 - Format OPMT01: Generation Plant Medium Term Operation Planning Data.
 - Long Term
 - Format OPLT01: Generation Plant Long Term Operation Planning Data.
- Renewable data and forecast
 - Same formats as hydrology data
- Generation unit force outage rates
 - Same formats as hydrology data
- O&M and fuel costs
 - Same formats as hydrology data
- Maintenance programs
 - Same formats as hydrology data
- Schedule retirements or expansions (generation)
 - Same formats as hydrology data
- Network constraints, expansion, retirements
 - Medium Term
 - Format OPMT02: Transmission Network Medium Term Operation Planning Data.
 - Long Term
 - Format OPLT02: Transmission Network Long Term Operation Planning Data.
- Available demand control data
 - Short Term:
 - Format LFST01: User Daily Load Profile and Demand Control
- Generation units availability
 - Format OPST01: Generation Plant Hourly Availability
- Generation units operating parameters
 - Format OPST02: Generation Plant Operating Parameters
- Reactive power capabilities and resources
 - Format OPST03: Reactive Power Capability

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4.8.2 Real Time Operation Data

All the real time operation data must be reported using the format RTIR01 Real Time Operation Incident Report. Real time operational data includes but are not limited to:

- Unavailability or power production reduction in any of the dispatched generation units
- Availability of additional generation considered not available in the day ahead planning
- Incidents in the network that could change the transmission constraints
- Changes in the load due to failures or disconnections
- Loading levels in the different components of the network and generation units that exceed normal operating conditions.

The system frequency must be reported and monitoring using the format RTIR02 System Frequency Monitoring.

The electric time variation must be reported and monitoring using the format RTIR03 Electric Time Monitoring.

4.9 Testing and Monitoring

This section sets out the authorization required and the procedures to be followed by the system operator to conduct operational tests or site investigations involving plant that is connected to or part of the Grid.

The objectives are to ensure that these tests and investigations are authorized by GPL and are carried out with appropriate procedures to avoid unnecessary risks and cost to Grid operations.

The provisions includes in this section applies to:

- Monitoring of:
 - Dispatch units against their declared parameters.
 - Compliance with the frequency response.
 - Provision of ancillary services.
 - Compliance with any provision of the Grid Code

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- Test on:
 - Reactive power capability including AVR model validation.
 - Frequency sensitive operation including governor model validation.
 - Fast start capability.
 - Black start capability.
 - Generation scheduling and dispatch parameters testing.

GPL authorization is required to conduct any test or site investigations by a user or a third party. Test request shall be submitted to GPL at least 8 weeks before the date of the proposed test. The request shall include:

- A description of the proposed test;
- the proposed time and duration;
- the reason for the proposed test;
- an indication of potential effects if the test is cancelled or delayed;
- an indication of the dispatch instructions required to facilitate the test and
- details of any operational switching required to facilitate the test.

GPL shall evaluate the request and within two (2) weeks notify it the test is approved, rejected or if additional information is required.

GPL shall consider the following aspects for the evaluation of test request:

- The impact on the grid security and stability.
- the impact on the grid economics.
- the impact on other users.
- the potential effects on the continuity and quality of service of electricity supply.

If GPL does not approve a test, it should explain the reasons for its rejection. GPL should work with the test proposer in the required changes to the test request to secure its approval.

For any approval test request, GPL will designate a representative that will supervise the test planning, execution and the evaluation of the test results.

GPL as the system operator may also conduct operational test and site investigations. GPL will commit to keep the frequency, scope and impact of the test to the minimum necessary.

GPL shall give eight (8) weeks notice and provided sufficient information to enable the affected user (s) to assess any potential risk(s) on their system(s). The user(s) shall notify any concerns to GPL within two (2) weeks of receiving the test notice.

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Minimum Technical Requirements

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Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

5. MINIMUM TECHNICAL REQUIREMENTS

5.1 Introduction

This section of the Grid Code specifies the Minimum Technical Requirements (MTRs) which must be complied with by any new generation facility that will interconnect to GPL's system either owned by GPL directly or a third party as can be the case of Independent Power Producers (IPP) or a GPL's customer that owns a Generation Resource that will be connected to the system and is equal or exceeds the sizes indicated in the Interconnection Code.

For conventional generation, meeting the Minimum Technical Requirements is normally not an issue, as conventional generators are usually capable of: voltage support, up/down frequency regulation, and fully dispatchable and controllable.

These generators include thermal generation (e.g. reciprocating engines, gas turbines, steam turbine driven generation) and hydroelectric power generators.

For Renewable Generation Facilities (RGFs), there are specific technical requirements that are required to address RGFs inherent variability, uncertainty, and limited dispatchability.

The MTRs Code is structured in 5 sections including:

Section 1: Introduction

Section 2: Objectives

Section 3: Scope

Section 4: Definitions

Section 5: Minimum Technical Requirements

5.2 Objectives

The primary objective of the MTRs is to establish the technical rules, requirements and performance that a generation facility must comply with in relation to their connection to and their operation on the GPL System. The MTRs delineate the required technical and performance requirements that will ensure that generation facilities (conventional and renewable) contribute to continued safe and reliable operation of the GPL System.

The MTRs are not intended to be a design specification for generation facilities and the technical requirements specified herein are subjected to change as the industry evolves.

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5.3 Scope / Applicability

The MTRs are applicable as follows:

- a. Apply to all Utility Scale Power Generation Resource, regardless of ownership (GPL or a third party) and technology (conventional, cogeneration, renewable, or storage), with an aggregate power output (gross Generation Resource output minus auxiliary load directly related to the Generation Resource) exceeding 1.5 MW up to (but not including) 5 MW for POI at 13.8 kV or 5 MW or greater for POI at 69 kV or above.
 - i. All Generation Owners, which include Independent Power Producers (IPP), Large Customers, and GPL are required to ensure that the generating facilities they own and fall under the category above, comply with the MTRs and are verified via commissioning tests, periodic tests and/or manufacturer guaranteed data.
 - ii. All Power Generation Owners will be required to provide mathematical models and detailed single line diagrams of their generating facilities that fall under the category above will be used to verify compliance with the MTRs during the necessary interconnection studies.

5.4 Definitions

Accuracy Test: A test to determine the percentage error of any item of a metering system.

Active Energy: The electrical energy produced during a time interval measured in units of watt-hours or standard multiples.

Active Power: The product of voltage and the in-phase component of alternating current measured in units of watts or multiples.

Actual Metering Point: The physical point at which electricity is metered.

Ancillary Services: The services that generation facilities or other users connected to grid may be required to provide from time to time in connection with the security and stability of the DBIS. Those services included but are not limited to: frequency control, reserve margin, voltage regulation, black start capability, etc.

Benchmark Case: A system model without the Interconnection Project(s) under study. It is considered the reference.

Bi-directional meter: Meter that measures the active energy (kWh) flow in both directions (import and export) and displays both imported and exported energy in separate registers.

Business Day: shall mean Monday through Friday, excluding Holidays.

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Calendar Day: shall mean any day including Saturday, Sunday or a Holiday.

Check Meter: A device where required, that duplicates and provides backup to the main meter for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Cluster / Cluster Study: A group of Interconnection Projects that are studied simultaneously in the same FIS due to the time proximity of their applications.

Connection Point: The point on the transmission system to which a user connects its system to the grid.

Connection Site: The physical site belonging to GPL or a user where a connection point is located.

Consequential Load Shed: Load that is dropped as a direct implication of a fault (e.g. a radial line).

Contingency Reserve: is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand, provide by units that are not required to be synchronized.

Conventional Generation: A resource using conventional fuels or water and is fully dispatchable and controllable.

Customer-generator: Any Customer of a DNO that generates electricity on the Customer's side of the billing meter with renewable energy generation system that is primarily intended to offset part or all of the Customer's electricity.

Delivery Point: The point at which electricity is delivered.

Demand Control Refers to measures that allow secure a reduction in demand to preserve the integrity of the network operation.

Directly Connected Customers: Any customer that is directly connected to the transmission network.

Dispatch Instructions: Mandatory dispatch orders issue by the System Operator during any operation day.

Distribution Networks Operators: Any user connected to the transmission grid to exchange power and that delivers power through his own network to final customers.

Economic Dispatch: The process to assign the available resources to cover the electric load in merit order.

Electric Time: The time shown on an electric clock connected to the DBIS.

Emergency Conditions: Abnormal system conditions that require automatic or manual actions to prevent or limit loss of transmission and distribution facilities or generation capacity that could adversely affect the reliability of the transmission network.

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Emergency Instructions: A dispatch instruction issued by GPL that may require an action or response that is outside the limits declared in the day ahead dispatch for a generation unit and issue to prevent or limit an emergency condition.

Facility aggregated power MW capacity: It is the basis to determine the requirements associated with real and reactive power capability. This capacity is usually defined as gross capacity (i.e. the aggregated capacity of all generation) but the developer shall also provide a maximum net capacity to be delivered at the POI. It is of particular importance of Wind Turbine Generation (WTG) facilities or PV; called here Renewable Generating Facilities (RGF).

Feasibility Study: A preliminary system impact study as presented in this code.

Firm Loads: Loads that require continuous electric service from GPL and should not be interrupted except in extreme conditions to preserve the integrity of the system.

FIS Study Scope Agreement: A binding document defining the basis for the FIS.

Frequency Excursions: System frequency deviation from nominal frequency as a result of contingencies or load-generation imbalance.

Frequency Sensitive Mode: The operation of a generation unit that will result in active power output changing automatically in response to changes in the DBIS frequency.

Full Interconnection Study (FIS): A detailed system impact study as presented in this code.

Full Interconnection Study Request (FISR): A letter from IC notifying GPL to proceed with the Full Interconnection Study for the Interconnection Project identified in the letter.

Generation Owner: Independent Power Producers (IPP), Large Customers and/or GPL that own a Generation Resource as defined in this code.

Generation Resource: Any device capable of injecting active power into GPL System regardless of technology; conventional generation, renewable generation or any type of storage devices. Generation Resources inject into the grid 5 MW (net after auxiliary services) or more if the POI is at 69 kV or 1.5 MW for POI at the 13.8 kV level.

Generating Resource, Generation Facility, or Generating Facility: See Generation Resource.

Good Utility Practice: Acting in good faith to perform obligations in accordance with international good practices in the electricity sector. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted.

GPL: Guyana Power and Light, provider of Transmission and Interconnection Services, owner and operator of the GPL System, and has central responsibility of planning the System.

GPL Operators: Personnel at the Energy Control Centre in charge of providing dispatch instructions to generation, monitoring the system performance, open and reconnect

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transmission facilities for normal operation or during emergency procedures and system restoration.

GPL System: All interconnect transmission and distribution facilities owned by GPL. Currently consists of the Demerara Berbice Interconnected System (DBIS)

GPL Transmission System: Facilities at 69 kV or above, used by GPL to interconnect generating resources to the distribution system MV system. Includes the transformation to MV (13.8 kV) level.

Hourly Economic Dispatch Program: The program output for each of the generation units in all the hours of the day generated by the Economic Dispatch.

Instation: Equipment located within GPL's premises that receive and stores metering data from Outstations.

Interconnecting Customer's System Impact Responsibility: Consists of the overloads or voltage violations that the Interconnection Project is likely to produce or aggravate in the system and that until corrected limit the capacity that the Interconnection Project can inject into the system. This limit can be zero. IC may or may not have financial responsibility on the cost of the associated reinforcements.

Interconnection Customer (IC): Party seeking interconnection service from GPL. Can be and Independent Power Producer, a Cogenerators or GPL itself operating as a resource owner.

Interconnection Project: The New Generation Resource or Generation Resource change seeking interconnection to GPL System.

Internally Interconnected Party: An entity located in Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

International Interconnected Party: An entity located outside Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

Interruptible Loads: Loads that have contractual conditions that allow interrupting their service during emergency conditions or for economic considerations. This is also called Load acting as a Resource.

Long term: A one to five years period for operational planning. The long term has been initially set up to 1 year.

Main Meter: The primary meter for measuring and recording electrical quantities.

Major Customers: Customers with annual peak load demand higher than 1 MW.

Measurement Transformers: Voltage and/or current transformers or combinations of those, used in metering systems.

Medium Term: A 4 weeks period for operational planning.

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Merit Order: an order for ranking available generation facilities which shall optimize the DBIS economy, security, stability and reliability and that shall be determined by GPL.

Meter: A device for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Meter Certificate: The statement issued by GPL confirming that a meter or metering system complies with the requirements of the metering code.

Meter Owner: The person responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of meters.

Meter Register: A device associated with a meter, from which it is possible to obtain a visual reading of the quantities that have passed the meter.

Meter Registration System: A system that uniquely identifies the meter and users associated with the meter and contains pertinent data relating to the meter as required by the metering code.

Meter Service Provider: A person that provides to a meter owner meter services such as the installation, commissioning, operation, maintenance, and general servicing of metering systems.

Metering: The activity of measuring and recording units of active power, active energy, reactive power, reactive energy or other electrical quantities using a metering system or a meter.

Metering System: The group of equipments including meters, measurement transformers, metering protection and isolation equipment, including alarms, circuitry, associated data storage and data communications equipment that are part of the active energy, reactive energy and demand measuring equipment at or relating to a connection site.

Minimum Technical Requirements (MTR): A set of requirements that any new generating resource needs to comply with to safely interconnect and not degrade the reliability of the system.

Net Metering: A methodology under which electrical energy generated by a customer-generator and delivered to the DNO facilities as measured by an appropriate device to offset electric energy supply by the DNO to the customer-generator during the applicable billing period. Net Metering is not designed to be an income generating mechanism and the supplier will not have to make monetary payments to customer-generators.

Non Consequential Load Shed: Load that needs to be shed to alleviate an overload or remediate a severe voltage violation.

Non Disclosure Agreement (NDA): A binding document limiting the information that the parties may disclose to third parties and the conditions according to which this disclose can be made.

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Operating Margin: The amount of reserve available over and above that required to meet the expected demand. It includes the contingency and operating reserves.

Operating Reserve: The amount of reserve to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). It includes the primary and secondary regulation and the tertiary response.

Operating Parameters: The onsite technical capabilities, flexibilities and limitations of a generation unit, that need to be declared for the day ahead dispatch.

Operational Test: a test carried out to acquire information in respect of a plant under pre-determined system conditions.

Outstation: On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an Instation or SCADA system or downloading to a local interrogation unit on request. When used with metering systems the outstation will store data from a meter(s) and may perform some processing of data.

Performance Standards: Define acceptable response to normal or contingency events and are measured in voltage magnitude or voltage change, thermal loading, stability or voltage swing limits and damping.

Photovoltaic Generation (PVG) Facility: Photovoltaic Facility has several photovoltaic arrays with solar panels connected to individual inverters and step-up transformers. The PVG transformers will step-up voltages from a typical 200-volt level to a typical 13.8 kV to 34.5 kV collector. A PVG may have several collectors that will connect to the Collector Bus. The Collector Bus is connected to the low side of the transmission step-up transformer(s), that changes the voltage to 13.8 kV, 69 kV or higher. Photovoltaic facilities output is a function of the site itself and the tracking system employed, with production that varies depending on whether tracking is used or not. PVG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

Plant: Any apparatus, equipment or appliance used for, or for purposes connected with, the generation, transmission, dispatch, distribution or supply of electricity.

Point of Interconnection (POI): A physical point in the System where ownership changes from the IC to GPL. Facilities towards the generator from the POI belong and are maintained by the IC, facilities from the POI to the GPL System are owned, maintained and operated by GPL.

Power Factor (PF): Ratio of the active power delivered by a generator or consumed by a load to the total apparent power delivered by the same generator or consumed by the same load. Over excited, lagging or positive PF corresponds to the condition of the generator injecting reactive power. Under excited, leading or negative power factor corresponds to the condition of the generator absorbing reactive power.

Project: See Interconnection Project

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Primary Regulation: The real time variation in the power delivery of the generator in response to changes in the system frequency.

Reactive Energy: The integral with respect to Reactive Power, measured in units of voltampere reactive hours (Varh) and standard multiples.

Reactive Power: The product of alternating voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive (vars) and standard multiples.

Reliability Criteria: Define the acceptable operating limits for normal (N-0), as well as for various single and double contingency conditions such as: N-1, N-1-1, and N-2. Steady state, transient, and dynamic aspects are considered in determining reliability criteria for each type of contingency.

Remedial Action Scheme (RAS): A protective device that trips generation or load upon the occurrence of defined events to prevent overloads or voltage violations.

Resource: See Generation Resource.

Running Orders: Indicative dispatch instructions issue by the system operator as part of the day ahead generation dispatch.

Schedule Day: The 24 hours period starting at midnight of the day concerned.

Secondary Regulation: The automatic or manual adjustment to the power delivery by the generators to re-establish the generation – load balance.

Short Term: A 24 hours period for operational planning.

Significant Incident: An incident that GPL has determined that shall be defined as significant in the context of reporting.

Site Investigations: Test conducted in relation to plant and operation procedures at generation facilities sites to monitor and assess the characteristics of the plant.

System: See GPL System.

System Operator: Guyana Power & Light Incorporated.

System Protection Facilities: Shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tertiary Respond: This is component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets.

Transfer Distribution Factor: A fraction of the generation injection increase that flows over a defined element or flow gate (groups of elements) when balanced against the swing bus or sink area.

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Unidirectional Meter: A meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction

User: Any entity different than GPL that is connected to transmission network and uses it to receive or delivery electricity.

Utility Scale Generating Facility: See Generating Resource.

Wind Power Facility: A Wind Turbine Generating facility (WTG) typically will have several Wind Turbine Generators (WTGs) connected to individual WTG step-up transformers. The WTG transformers will step-up voltages from a typical 600-volt level to a typical 13.8 kV or 34.5 kV collector. A WTG facility may have several collectors that will connect to the Main Collector Substation. The Main Collector Substation typically has a step-up transformer(s) that change the voltage to the transmission voltage (69 kV and above). The step-up transformer is connected to the POI through one or more lines, unless the transformer connects directly to the POI. WTG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

5.5 Minimum Technical Requirements

This section presents the MTRs as 14 requirement categories:

5.5.1 Voltage Ride-Through

The Voltage Ride-Through requirement defines the no-trip zone in which the generating facility is required to stay connected to the system. This requirement ensures that the plant will remain connected during voltage dips or post-transient voltage swells resulting from normally cleared transmission faults on any phase or combination of phases at or beyond the Point of Interconnection within a “prescribed no-trip zone”.

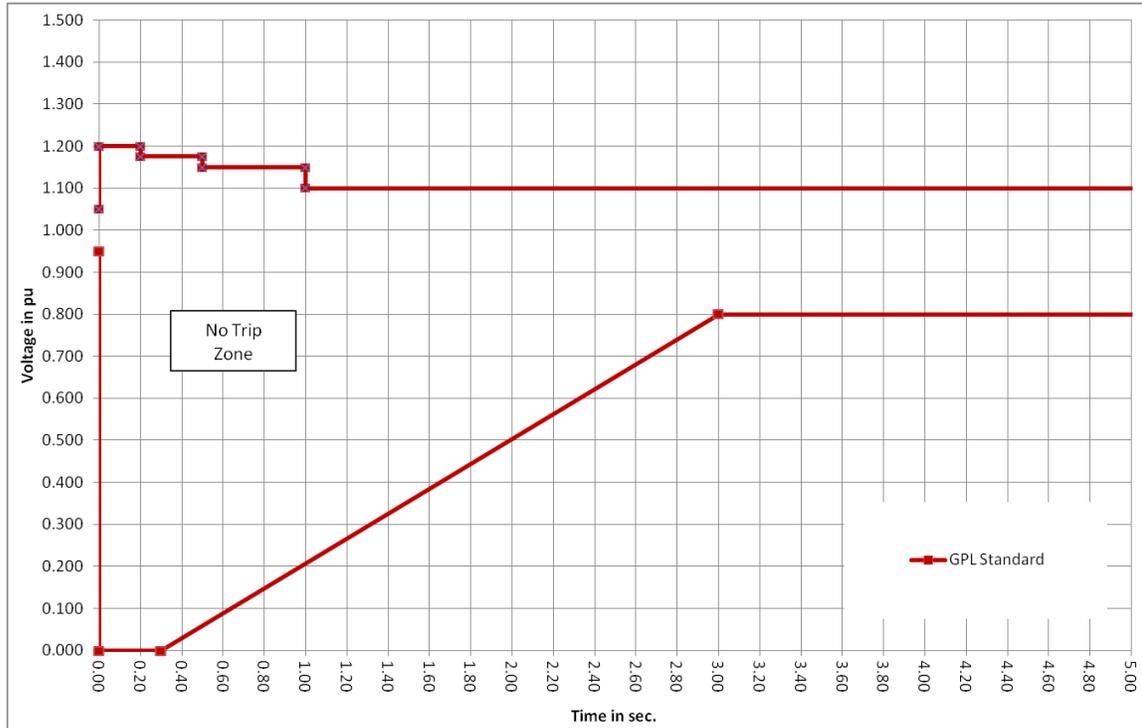
This requirement is defined by voltage-time curves of the following two types:

- a. Low Voltage Ride-Through (LVRT) is the low voltage limit at which the generator must not trip when its voltage is above it for a prescribed time.
- b. High Voltage Ride-Through (HVRT) is the high voltage limit at which the generator must not trip when its voltage is below it for a prescribed time; and

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Figure 5-1 and Figure 5-2 below show the LVRT/HVRT standard for the GPL System at 5 second and 13 second resolution, respectively.

Figure 5-1: LVRT/HVRT Standard for GPL (5 seconds)



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Figure 5-2: LVRT/HVRT Standards for GPL (13 seconds)

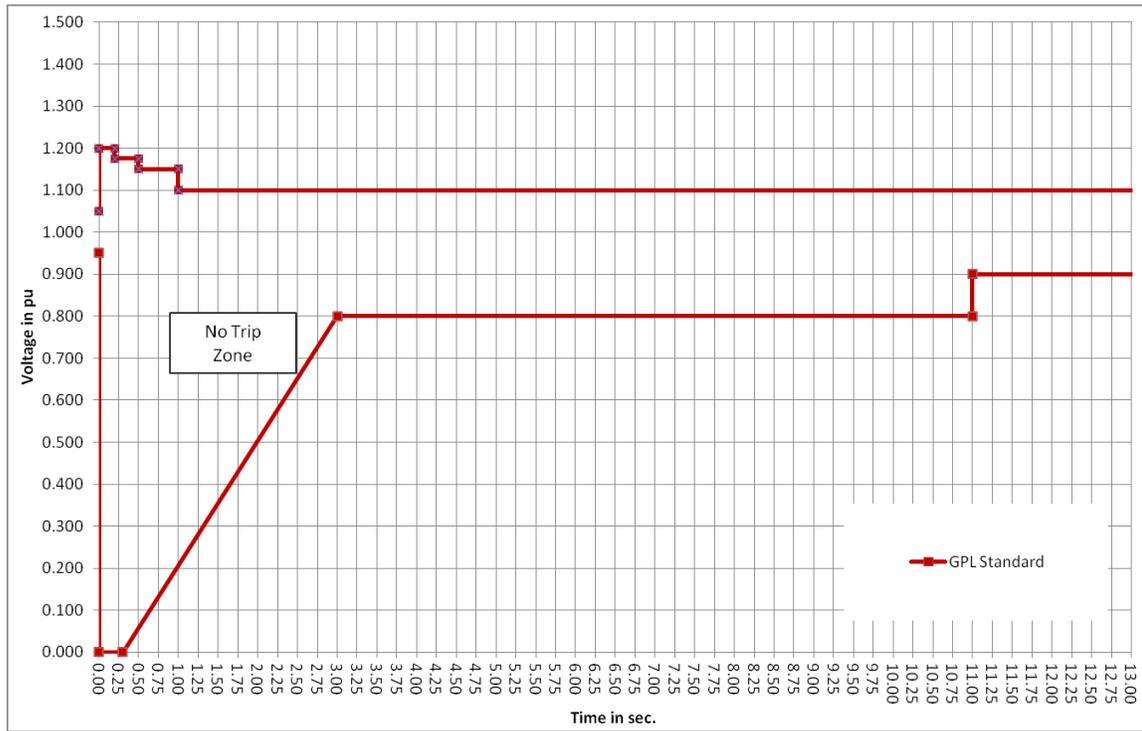


Table 5-1 below shows the numerical values associated with each curve.

Table 5-1: Low Voltage Ride-Through and High Voltage Ride-through Requirements

LVRT		HVRT	
Time (s)	Voltage (pu)	Time (s)	Voltage (pu)
Pre-event	0.950	Pre-event	1.050
$0 < t < 0.3$	0.000	$0 < t < 0.2$	1.200
$0.3 \leq t < 3.0$	$\frac{8}{27} * t - \frac{4}{45}$	$0.2 \leq t < 0.5$	1.175
$3.0 \leq t < 11.0$	0.800	$0.5 \leq t < 1.0$	1.150

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$11.0 \leq t$	0.900	$1 \leq t$	1.100
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In addition to LVRT/HVRT, for compliance with this requirement, the following is required:

- a. GPL shall require all generation to remain online and able to ride through symmetrical and asymmetrical overvoltage conditions specified by the values in these standards.
- b. All generation shall remain online and operating during and after normally cleared faults on the point of interconnection unless as provided below.
- c. All generation shall remain online and operating during delayed (backup) cleared faults on the point of interconnection unless as provided below.
- d. During the low voltage fault conditions, the generation facilities, both conventional and inverter-connected, shall operate on reactive current injection mode. This will happen automatically for conventional generation resources and will be a control feature of inverter connected resources.

The following are the only exception for non-compliance with the requirements of the code:

- a. Generation Facilities are not required to comply with the voltage ride-through standards in these MTRs for faults that results in the isolation of the Generation Facility due to a trip of a radial line to the facility.
- b. Generation Facilities are not required to comply with voltage ride-through for faults that occur on the lower voltage networks of the facility, e.g. faults on the low voltage side of the transmission step-up transformer, Collector Bus, collector systems, or generator turbines or inverters.
- c. To account for over-fluxing on conventional generation, Volt-Hertz relay trips due to high voltage are permitted when the trip happened during low frequency events provided that at “nominal frequency” there would not have been a trip. Operators shall endeavour to prevent high voltage conditions at the generator terminals that may lead to these trips. This exception does not apply for inverter connected generation.

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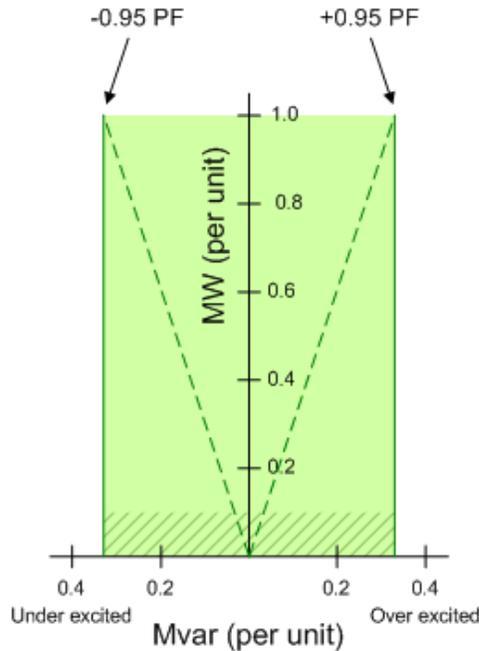
5.5.2 Reactive Power Capability and Minimum Power Factor

Generating Facilities shall comply with the following minimum reactive power capability:

- a. Conventional synchronous generators, shall have a reactive capability (Q_{max} / Q_{min}) equivalent to 0.85 power factor (PF) leading and lagging (under / over excited) at the rated MW capacity when measured at the POI. Conventional generators shall be able to continuously control the voltage at the POI within this range without the assistance of switchable reactive devices
- b. Renewable Generation (inverter connected / supported), shall have a reactive capability (Q_{max} / Q_{min}) equivalent to 0.95 power factor (PF) leading and lagging (under / over excited) at the rated MW capacity when measured at the POI. Renewable Generation shall be able to continuously control the voltage at the POI within this range without the assistance of switchable reactive devices
- c. Renewable Generation shall maintain the Q_{max} / Q_{min} defined above at reduced power output down 10% of capacity; see Figure 5-3. If output falls below 10%, this requirement does not apply, and GPL System Operators may ask the plant to disconnect. GPL reserves the right to remotely disconnect any IPP facility in the event of that facility not responding to GPL's instruction to self disconnect.
- d. If during the interconnection studies it is identified that greater reactive capability is necessary for voltage support at the Renewable Generation's POI, then GPL can require the over-excited power factor (reactive injection) to be 0.85 ($Q_{max @ 0.85} > Q_{max @ 0.95}$). In this case, the additional required reactive power support ($Q_{max @ 0.85} - Q_{max @ 0.95}$) can be provided by the use of switchable capacitor banks, subject to a) use of automatic control of these devices and b) confirmation of adequacy via dynamic stability studies. If dynamic stability studies identify the need for continuous voltage support dynamic devices shall be installed (e.g. STATCOM or TSC).
- e. The developer shall be responsible for any expense for any reactive power injection reinforcement required to comply with the Codes and the MTRs.

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Figure 5-3 Reactive Power Requirements (solid lines)



5.5.3 Voltage Regulation

The Voltage Regulation requirement ensures proper response to disturbances as well as proper steady-state regulation by controlling voltage within the requirements of the Grid Code. Generation Facilities shall comply with the following:

- a. Conventional generation shall be equipped with Automatic Voltage Regulator (AVR) and capable of performing the desired voltage regulation within the ranges specified above (leading / lagging 0.85 PF at the POI).
- b. Renewable generation shall provide voltage regulation at the POI (within the reactive limits above) and meet the following:
 - i. Renewable facilities must have a continuously-variable, continuously-acting, closed loop control Voltage Regulation System (VRS).
 - ii. The VRS set-point must be adjustable between 95% to 105% of rated voltage at the POI. The VRS set-point must also be adjustable remotely by the Control Center via SCADA.

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- iii. The VRS will operate in a voltage set point control mode. Controllers such as constant Power Factor or constant VAR are not permitted, but should be available on GPL Operators' request.
- iv. The VRS shall be capable of adjustable Droop or adjustable gain. VRS that utilize Droop shall be adjustable from 0 to 10%.
- v. At zero percent (0%) droop, the VRS should achieve a steady-state voltage regulation accuracy of $\pm 0.5\%$ of the controlled voltage at the POI.
- vi. The VRS shall be calibrated such that a change in reactive power will achieve 95% of its final value no sooner than 0.1 seconds and no later than 1 second following a step change in voltage. The change in reactive power shall not cause excessive voltage excursions or overshoot.
- vii. For renewable generation facilities that utilize shunt reactive devices, the VRS shall delay operation of these devices (connection or disconnection) for 10 seconds. These devices should be used to extend the dynamic range of the controller; i.e. switched in or out to ensure that the dynamic range is utilized as close to neutral as practicable.
- viii. The generator facility VRS must be in service at any time the facility is electrically connected to the grid regardless of MW output from the facility.
- ix. The VRS dead band shall not exceed 0.1%.

5.5.4 Short Circuit Ratio (SCR)

Full or partially Inverter Connected Renewable Generation may experience control instability when connected to relatively weak points of the transmission system.

The relative strength of the system is measured by the Short Circuit Ratio (SCR). The SCR is calculated as the ratio of (a) the short circuit capacity of the POI in MVA measured without the Renewable Generation in service or any electrically close Renewable Generation to (b) the Renewable Generation total MW capacity.

Provided that the Renewable Generation has updated state-of-the-art controls, the following shall govern the interconnection:

- a. If the SCR at the POI is greater than or equal 2.5, then the Generating Facility can interconnect and no control stability issues are expected.

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- b. If SCR at the POI is less than 2.5 but greater than or equal to 1.5 then control stability analysis are required to verify stability; otherwise, a new POI must be chosen or synchronous condenser must be installed to increase the short circuit capacity of the POI.
- c. SCR less than 1.5 require a new POI to be selected.

5.5.5 Frequency Ride-Through (FRT)

The Frequency Ride-Through requirement defines the no-trip zone in which the generating facility is required to stay connected to the system. This requirement ensures that the plant will remain connected during off-nominal frequency conditions within a “prescribed no-trip zone” that allows for internal controls including governor response and under-frequency load shedding to take place before the generation trips.

The off-nominal frequency requirement is defined by frequency-time curves of the following two types:

- a. Low Frequency Ride-Through (LFRT) is the low frequency limit at which the generator must not trip when the frequency is above the said limit up to the prescribed time.
- b. High Frequency Ride-Through (HFRT) is the high frequency limit at which the generator must not trip when the frequency is below the said limit up to prescribed time.

The FRT requirements are based on the type of generation as follows:

Hydro electric generation, reciprocating engines generation and renewable generation must comply with the FRT Base Standard shown in Figure 5-4 and in Table 5-2 below.

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Figure 5-4: Base Frequency Ride-Trough Standard

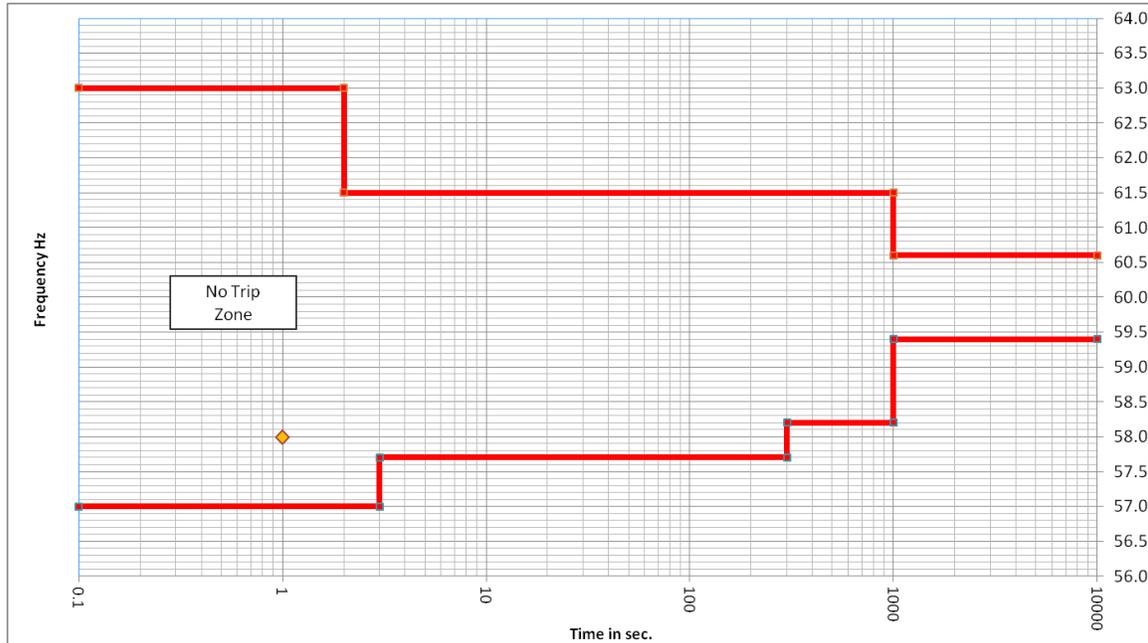


Table 5-2 below shows the numerical values associated with each curve of the FRT Base Standard.

Table 5-2: Base Frequency Ride-Trough standard

LFRT		HFRT	
Time (s)	Frequency (Hz)	Time (s)	Frequency (Hz)
$0 \leq t < 3$	57.0	$0 \leq t < 2$	63.0
$3 \leq t < 300$	57.7	$2 \leq t < 1000$	61.5
$300 \leq t < 1000$	58.2	$1000 \leq t$	60.6
$1000 \leq t$	59.4		

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Turbine driven thermal generation are more sensitive to frequency deviations and specific limits are defined for these units. These limits are provided in Figure 5-5 and standard for the GPL System.

Figure 5-5: Turbine Driven Generation Frequency Ride-Trough

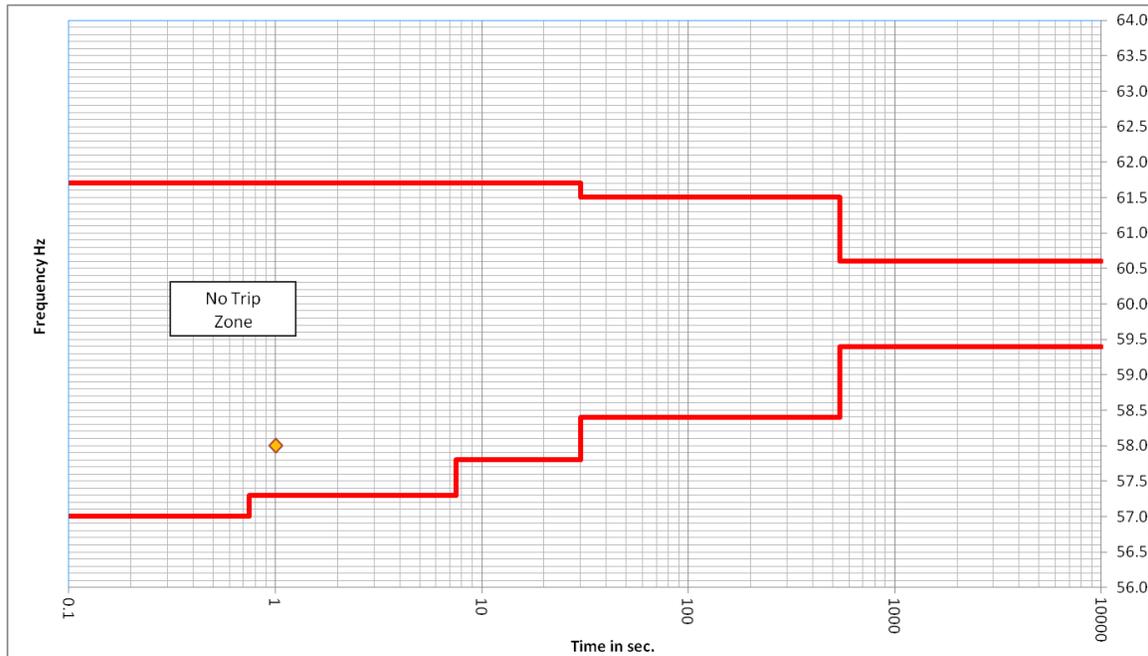


Table 5-3 below shows the numerical values associated with each curve of the FRT Turbine-Thermal Standard.

Table 5-3: Turbine Driven Frequency Ride-Trough standard

LFRT		HFRT	
Time (s)	Frequency (Hz)	Time (s)	Frequency (Hz)
$0 \leq t < 0.75$	57.0	$0 \leq t < 30$	61.7
$0.75 \leq t < 7.5$	57.3	$30 \leq t < 540$	61.5
$7.5 \leq t < 30$	57.8	$540 \leq t$	60.6
$30 \leq t < 540$	58.4		

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540 \leq t	59.4
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The following are the only exception for non-compliance with this requirement:

- a. Generating unit(s) may trip if the protective functions (such as out-of-step functions or loss-of-field functions) operate due to an impending or actual loss of synchronism or, for asynchronous generating units, due to instability in power conversion control equipment.
- b. Generating unit(s) may trip if clearing a system fault necessitates disconnecting (a) generating unit(s).
- c. Documented existing equipment limitations.
- d. Actions initiated by Volt-Hertz relays on thermal units when the voltage is above nominal and provided that for the same frequency where the trip occurred, there would be no trip if the voltage was maintained at nominal. Operators shall endeavour to prevent high voltage conditions at the generator terminals that may lead to these trips.

5.5.6 Frequency Response/Regulation

This requirement consists of two regulations:

- a. Primary Frequency Regulation which covers the timeframe from a few seconds to 30 seconds and is provided by governor response; and
- b. Secondary Regulation which covers the timeframe greater than 30 seconds and is provided by Automatic Generation Control (AGC) that brings frequency back to nominal.

Currently there is only Primary Frequency Regulation in GPL System as the AGC is not yet implemented. Thus the second set of requirements shall be implemented at such time.

5.5.6.1 Primary Frequency Regulation

Conventional generation shall be required to provide primary frequency regulation by utilizing their governor with a droop of 5% and with a dead-band of +/- 0.036 Hz around 60 Hz.

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The primary regulation response is to be fully achieved within 10 seconds and must be sustained for the duration of the frequency excursion up to 9 minutes. The units are required to respond to the full designed minimum operational capability of the unit at the time of the occurrence. For conventional generation, the minimum is the smaller of 10% of the Sustained Maximum Limit or the margin to the generation limits (max / min).

Renewable generation facilities (RGFs) shall be required to participate in Primary Frequency Regulation, in the down regulation (generation reduction in response to frequency increases) in a “Governor Like Response”. As with conventional generators, RGFs shall have the rate of real power response to frequency deviations with droop characteristic of 5%. However, RGFs shall have a large dead-band of +/- 0.3 Hz.

If as a result of the system interconnection studies it is identified that the RGF is required to provide up-regulation (generation increases in response to frequency drop), then the RGF shall install a Battery Energy Storage System (BESS) or similar. The amount of storage shall be such that the RGF is able to provide regulation up to 10% of the contractual capacity of the RGF. This response shall be maintained for 9 minutes. After the ninth minute the real power primary frequency response is allowed to reduce but subject to the ramping limitations discussed below.

5.5.6.2 Secondary Regulation

All Generating Facilities, including RGFs, shall be equipped to receive setting point instructions from the AGC.

5.5.7 Inertial Response

This requirement will ensure that RGFs provide a Fast Frequency Response (FFR) in order to emulate the inertial response of synchronous generators. GPL requires all RGFs to have controls installed that enable inertial response.

5.5.8 Ramp Rate Control

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The RGFs within GPL System shall be required to have in its master plant controller the capability of controlling the rate of change of power output during various circumstances, including but not limited to:

- a. Rate of increase of power
- b. Rate of decrease of power as identified in the interconnection studies
- c. Rate of increase of power when a curtailment of power output is released
- d. Rate of decrease in power when a curtailment of power output is engaged.

A 10% per minute rate (based on nameplate capacity) limitation shall be enforced. This limit applies to all increases in power and for decrease in response to a curtailment instruction. The ramp rate control tolerance is +10%.

If during the interconnection studies it is identified that limits on decreases in power due to changes in meteorological conditions are necessary, then the RGF shall limit its power decrease rate to 10% per minute rate (based on nameplate capacity) subject to the following.

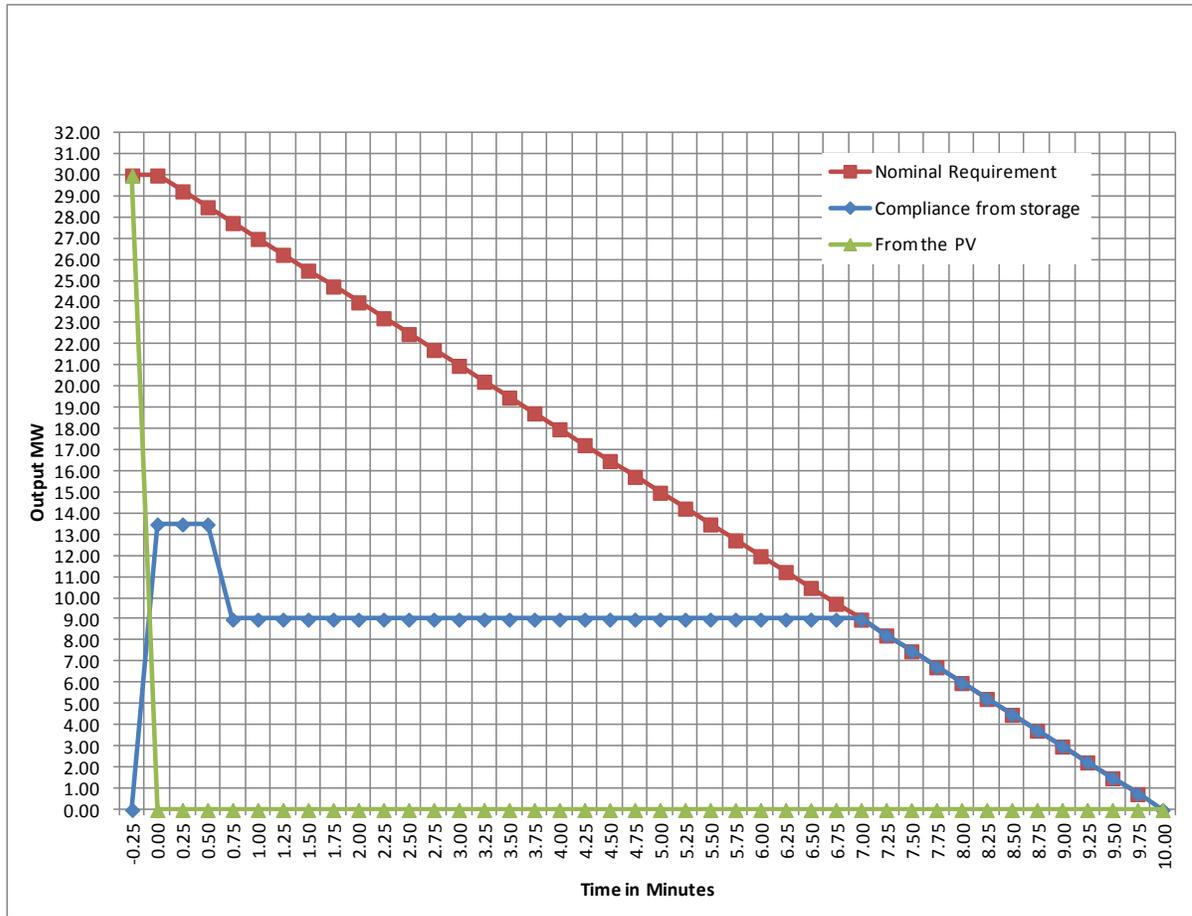
The RGF shall install a BEES with minimum nominal capacity (MNC) equal to 30% of the RGF's contractual capacity and with a short term overload capacity (STOC) up to 45% of the RGF's capacity for 1 minute. The energy storage capacity of the device shall be such that; (1) the RGF is able to maintain the STOC for up to 1 minute (2) able to maintain MNC for up to 7 minutes after which it is allowed to reduce to zero linearly in over 3 minutes.

The performance of the RGF with respect of this MTR shall be measured first to check if there was compliance with the ramp requirements (10% per minute) and if greater ramps were observed then the contribution of the BEES will be verified to check compliance with the requirement above less any contribution provided for frequency control.

The figure below illustrates a situation where a 30 MW RGF would have experienced a rapid drop in output (modelled from 30 MW to zero) and it shows the reduction that would be required to comply with a ramp rate of 10% per minute and the contribution from the BESS.

Figure 5-6: Illustrative Ramp Control Case

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5.5.9 Power Quality Requirements

This requirement ensures that all generators connected to the grid do not deteriorate the quality of the wave form and proper mitigations are implemented in the design of the facilities prior to interconnection. The requirement contains three parts: phase unbalance, voltage fluctuations and flicker, and harmonic distortion.

5.5.9.1 Phase Unbalance

To protect transmission and customer equipment, the contribution from Generating Resources at the POI shall not cause a voltage unbalance greater than 1% or a current unbalance greater than 5% where phase unbalance is defined as the percent deviation of one phase from the average of all three phases.

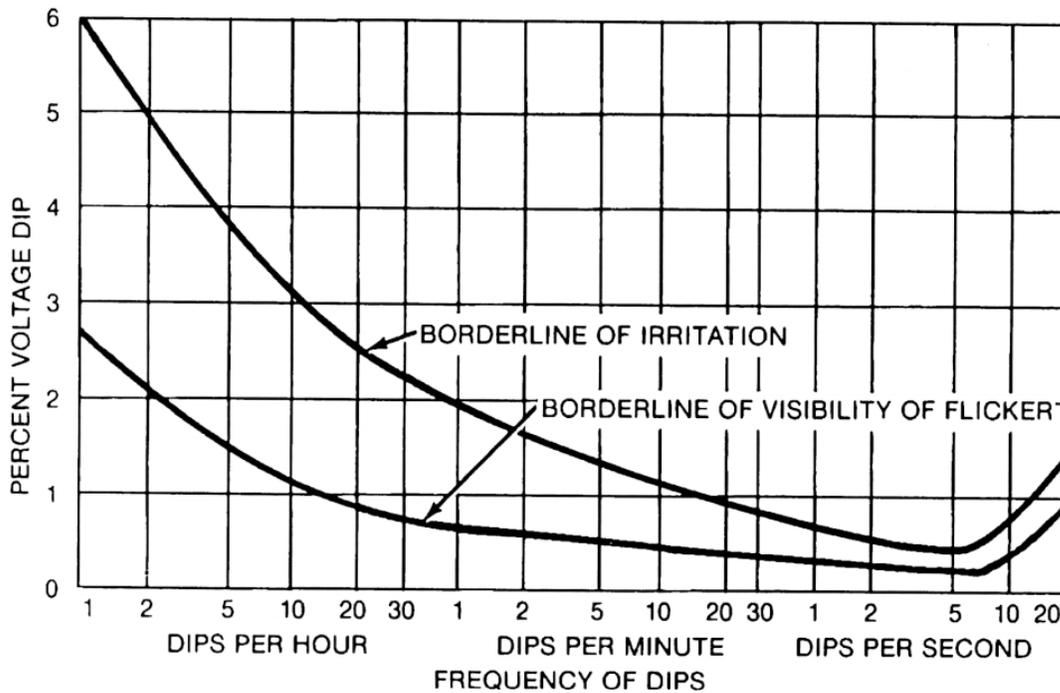
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This requirement also requires that generators protect their equipment against temporary unbalances that may occur due to abnormal system conditions.

5.5.9.2 Voltage Fluctuations and Flicker

GPL requires Generation Resources not to cause voltage flicker (dips) above the borderline of visibility flicker of IEEE-519 (and IEEE-141) shown in the figure below.

Figure 5-7: Flicker Tolerance Curve IEEE Std 141-1993/IEEE Std 519-1992



Flicker test shall be part of the commissioning test and whenever there is a suspected issue (particularly in weak parts of the system).

If it is determined that the new or existing connection is the source of unacceptable fluctuations, necessary equipment to control the fluctuations to the acceptable limits shall be installed at the responsibility of the Customer.

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5.5.9.3 Harmonics

GPL requires Generation Resources to not exceed harmonic voltage and current limits at the POI defined by the IEEE-519 Standard (see Tables below).

Voltage Distortion Limits

Bus Voltage at PCC	Individual Voltage Distortion (%)	Total Voltage Distortion THD (%)
69 kV and below	3.0	5.0
69.001 kV through 161 kV	1.5	2.5
161.001 kV and above	1.0	1.5

NOTE: High-voltage systems can have up to 2.0% THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user.

Current Distortion Limits for General Distribution Systems (120 V Through 69000 V)

Maximum Harmonic Current Distortion in Percent of I_L						
Individual Harmonic Order (Odd Harmonics)						
I_{sc}/I_L	<11	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h$	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

Even harmonics are limited to 25% of the odd harmonic limits above.

Current distortions that result in a dc offset, e.g. half-wave converters, are not allowed.

* All power generation equipment is limited to these values of current distortion, regardless of actual I_{sc}/I_L .

Where

I_{sc} = maximum short-circuit current at PCC.

I_L = maximum demand load current (fundamental frequency component) at PCC.

TDD = Total demand distortion (RSS), harmonic current distortion in % of maximum demand load current (15 or 30 min demand).

PCC = Point of common coupling.

Harmonic measurements shall be part of commissioning under various switching conditions and whenever a new generation facility is installed.

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5.5.10 General Interconnection Substation Configuration

An interconnecting generation producer must interconnect at an existing GPL switchyard. The configuration requirements of the interconnection depend on where the physical interconnection is to occur and the performance of the system with the proposed interconnection. The interconnection must conform, at a minimum, to the original designed configuration of the switchyard. GPL, at its sole discretion, may consider different configurations due to physical limitations at the site or limitations to additional transmission line along a particular route where there is an existing line(s).

5.5.11 Modelling and Validation

This requirement ensures that GPL maintains an accurate representation of its systems specifically by the following:

- a. During the interconnection request process, the developer shall provide all pertinent data to GPL to allow the modelling of the generator and its controls (governor-turbine and exciter), transformers, collector system(s) (if applicable) and control systems at the generating facility.
- b. If the appropriate model is not available as a standard model (mathematical mode, transient model, etc), the developer shall supply a working user written model. This model must be validated against physical tests or at least against a detailed manufacturing model that has been validated against physical tests. The test must demonstrate the accuracy of the model in representing power output and voltage regulation under various transient conditions.
- c. Once the facility is interconnected, model validation tests will be carried out to:
 - i. Validate the active and reactive power capabilities of the generating unit.
 - ii. Confirm capability to control voltage and validate the AVR model.
 - iii. Confirm capability to control frequency and validate the governor model.
- d. GPL must be permitted by the developer to make available models if required to external consultants with an NDA in place.

5.5.12 Resource Management

Renewable Generation developers shall provide adequate technology (communicating technology and the corresponding control equipment) and implement resource (wind speed / irradiance) power management requirements (ramp rate limits, output limits, curtailment) as established by GPL.

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5.5.13 Meteorological Information

Renewable Generation Developers shall provide site meteorological information to support production forecasting systems (short term and day-ahead) as established by GPL. Individual turbine's / PV inverter availability shall be included.

5.5.14 Protection Scheme

The Interconnection Customer within GPL System shall be required to install the required protection schemes and measures required by GPL to ensure system safety and preservation.

- a. An Interconnection Customer applying to be connected to the transmission system shall install protection systems for the service connection in accordance with GPL requirements. No interconnection service shall occur unless the specifications of the protection systems for the interconnection service conform to GPL requirements and that the protection systems have been tested and are ready for commissioning.
- b. Each Interconnection Customer shall ensure that the protection systems referred to in (a) shall be compatible with and able to be fully coordinated with the existing protection systems on the GPL System. The Interconnection Customer shall ensure that such protection systems are properly set and maintained in accordance with good utility practice, this Code, and the relevant Connection Agreement.
- c. GPL and Interconnection Customer shall ensure that their protection systems and operating time comply with the requirements set out by GPL.
- d. For on-load commissioning or re-commissioning of the unit protection systems involving both GPL and the Interconnection Customer, the Interconnection Customer shall be responsible for coordinating the commissioning or re-commissioning of the unit protection systems and shall determine whether the unit protection systems have been successfully commissioned. The Interconnection Customer shall provide the necessary resources and actively participate in the commissioning or re-commissioning of the protection systems.

At minimum the following protection functions shall be provided as defined to protect the interconnected Generation Facilities:

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Backup Impedance: An impedance scheme with a large reach shall be used. This shall operate for phase faults in the unit, in the HV yard or in the adjacent transmission lines, with a suitable delay, for cases when the corresponding main protection fails to operate. The impedance facility shall have fuse fail interlocking.

Loss of Field: All generating units shall be fitted with a loss of field facility that matches the system requirements. The type of facility to be implemented shall be agreed with GPL.

Pole Slipping Facility: Generating units shall be fitted with a pole slipping facility that matches the system requirements, where GPL determines that it is required.

Unit Transformer HV back-up Earth Fault Protection: This is an inverse definite minimum time (IDMT) facility that shall monitor the current in the unit transformer neutral. It can detect faults in the transformer HV side or in the adjacent network. The back-up earth fault facility shall trip the HV circuit-breaker.

HV Breaker Fail Protection: The “breaker fail” protection shall monitor the HV circuit breaker operation for protection trip signals, i.e. fault conditions. If a circuit breaker fails to open and the fault is still present after a specific time delay (e.g. 10 cycles), it shall trip the necessary adjacent circuit breakers.

HV Pole disagreement protection: The pole disagreement protection shall cover the cases where one or two poles of a circuit breaker fail to operate after a trip or close signal.

Unit Switch onto Standstill protection: This protection shall be installed in the HV yard substation or in the unit protection panels. If this protection is installed in the unit protection panels then the DC supply for this protection and that used for the circuit-breaker closing circuit shall be the same. This protection safeguards the generator against an unintended connection to the Transmission System (back energization) when at standstill or at low speed.

In addition, should system conditions dictate, other protection requirements shall be determined by GPL in consultation with the Interconnection Customer and these should be provided and maintained by the relevant Interconnection Customer at its own cost.

5.5.15 Supervisory Control and Data Acquisition (SCADA)

To ensure reliable and secure operation of GPL system, GPL must require the all generators to comply with the information requirements described below that will be provided via SCADA:

Requirements for all generators

This data consists of the information needed for monitoring generators on GPL Energy Management System (EMS) and provide Automatic Generation Control (AGC) and includes:

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Data to be sent to GPL

- Active and reactive power at the generator terminal (conventional generators) and POI with a precision of at least 1 MW
- Voltage at the generator terminal (conventional generators) and the POI with a precision of at least 1/10th of a kV
- Frequency with a precision of at least 1/000th of Hz.
- Regulation capacity up (margin to increase) and down (margin to decrease) with a precision of at least 1 MW.

Data to be received from GPL

- Individual unit MW set point (power production) as determined by Security Constrained Economic Dispatch. Precision 1/10th of MW.
- Regulation Signal (power increase / decrease) as determined by operators or in the future the Automatic Generation Control (AGC).

This data is in addition to the revenue data that is treated in the Metering Code.

Special requirements for renewable generators

- Wind Speed and direction at all points available in the facility at tower height or Solar Radiation.
- Air density, humidity and temperature at the site as well as any other meteorological data that will enhance the wind forecasting capabilities of GPL dispatch.
- Rolling forecast of production; typically for the next 15, 30, 45 minutes and hour by hour thereafter.
- The objective of this information is to reduce the impact of errors in the scheduling of renewable generation.

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Metering Code

ABBREVIATIONS: VI

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Abbreviations:

AGC	Automatic Generation Control
AVR	Automatic Voltage Regulator
BESS	Battery Energy Storage System
CT	Current Transformer
DBIS	Demerara Berbice Interconnected System
DNO	Distribution Network Operator
EPC	Engineering, Procurement, and Construction
ERIS	Energy Resource Interconnection Service.
FFR	Fast Frequency Response
FIS	Full Interconnection Study
FISR	Full Interconnection Study Request
FISSA	Full Interconnection Study Scope Agreement
FRT	Frequency Ride-Through
GCR	Grid Code Requirement
GIA	Generation Interconnection Agreement
GIAp	Generation Interconnection Application
GPL	Guyana Power and Light Incorporated
HFRT	High Frequency Ride-Through
HV	High Voltage
HVRT	High Voltage Ride-Through
IA	Interconnection Agreements
IC	Interconnection Customer
IPDS	Interconnection Project Dataset
IPP	Independent Power Producer
IPS	Interconnected Power System
ITU	International Telecommunications Union
LFRT	Low Frequency Ride-Through
LVRT	Low Voltage Ride-Through
MCR	Maximum Continuous Rating
MNC	Minimum Nominal Capacity

MTR	Minimum Technical Requirements
MV	Medium Voltage
NDA	Non Disclose Agreement (NDA)
NRIS	Network Resource Interconnection Service.
O&M	Operation and Maintenance
ONAF	Oil Natural Air Forced circulation
ONAN	Oil Natural Air Natural circulation
OTDF	Outage Transfer Distribution Factor
POI	Point of Interconnection.
PPA	Power Purchase Agreement
PVG	Photovoltaic Generation
RGF	Renewable Generation Facility
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SISR	System Impact Study Report
STOC	Short Term Overload Capacity
TDF	Transfer Distribution Factor
TS	Transmission System
VRS	Voltage Regulation System
VT	Voltage Transformer
WTG	Wind Turbine Generation

6. Metering Code

6.1 Introduction

All active and reactive power entering or exiting the transmission system and distribution systems shall be metered using one or more metering systems. Electricity delivered to consumer premises shall also be metered.

The metering of all such quantities and flows is required for a variety of purposes, including:

- i. Establishing a record of electrical quantities entering or exiting the systems of a GPL and distribution networks operators;
- ii. Establishing the quantities of electricity delivered to consumer premises;
- iii. For calculating amounts to be paid in accordance with agreements between persons to whom this code applies;
- iv. For certain contractual purposes between persons to whom this code applies;
- v. For the provision of data to the regulatory authority in connection with the monitoring and enforcement of licenses, the sector law and related matters, including the calculation and establishment of cost reflective tariffs and the monitoring of the electricity supply market;
- vi. For the purpose of establishing compliance with the grid code by those persons who are bound by it; and
- vii. Such other purposes as may be expedient or requisite from time to time in connection with matters contemplated by the sector law and/or under this grid code.

The requirements of this metering code are complimentary to the metering and data exchange requirements of agreements between persons to whom this code applies.

References in this code to meter owner include meters and metering systems used by persons under any agreement with a third party.

The code is structured in 11 sections including:

- Section 1: Introduction
- Section 2: Objectives
- Section 3: Scope
- Section 4: Definitions
- Section 5: Meter and Metering System Ownership
- Section 6: Electricity Meters
- Section 7: Data Exchange

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- Section 8: Appendix A Metering Systems Standards
- Section 9: Appendix B Metering Identification
- Section 10: Appendix C Commissioning Test
- Section 11: Appendix D Metering Registration System

6.2 Objectives

The objectives of the metering code are to establish:

- The standards to be met in the provision, location, installation, operation and maintenance of metering systems;
- The standards to be met by those bound by this code in relation to all matters associated with metering systems;
- The responsibilities of each person bound by this code in relation to ownership and management of metering systems and meters and the provision and use of meter data; and
- The responsibilities of all persons bound by this code in relation to the storage of meter data.

Meter data of reliable quality and accuracy must be available for prepare, calculate, assess and validate invoices with a view to their prompt settlement.

6.3 Scope

The metering code applies to the following entities:

- a. GPL
- b. Distribution Networks Operators
- c. Any generation facility connected to the grid
- d. Directly Connected Customers
- e. Internally Interconnected Parties
- f. International Interconnected Parties

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6.4 Definitions

Accuracy Test: A test to determine the percentage error of any item of a metering system.

Active Energy: The electrical energy produced during a time interval measured in units of watt-hours or standard multiples.

Active Power: The product of voltage and the in-phase component of alternating current measured in units of watts or multiples.

Actual Metering Point: The physical point at which electricity is metered.

Ancillary Services: The services that generation facilities or other users connected to grid may be required to provide from time to time in connection with the security and stability of the DBIS. Those services included but are not limited to: frequency control, reserve margin, voltage regulation, black start capability, etc.

Benchmark Case: A system model without the Interconnection Project(s) under study. It is considered the reference.

Bi-directional meter: Meter that measures the active energy (kWh) flow in both directions (import and export) and displays both imported and exported energy in separate registers.

Business Day: shall mean Monday through Friday, excluding Holidays.

Calendar Day: shall mean any day including Saturday, Sunday or a Holiday.

Check Meter: A device where required, that duplicates and provides backup to the main meter for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Cluster / Cluster Study: A group of Interconnection Projects that are studied simultaneously in the same FIS due to the time proximity of their applications.

Connection Point: The point on the transmission system to which a user connects its system to the grid.

Connection Site: The physical site belonging to GPL or a user where a connection point is located.

Consequential Load Shed: Load that is dropped as a direct implication of a fault (e.g. a radial line).

Contingency Reserve: is the margin of generation capacity required in the period from 24 hours ahead down to real time over and above the forecast demand, provide by units that are not required to be synchronized.

Conventional Generation: A resource using conventional fuels or water and is fully dispatchable and controllable.

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Customer-generator: Any Customer of a DNO that generates electricity on the Customer's side of the billing meter with renewable energy generation system that is primarily intended to offset part or all of the Customer's electricity.

Delivery Point: The point at which electricity is delivered.

Demand Control Refers to measures that allow secure a reduction in demand to preserve the integrity of the network operation.

Directly Connected Customers: Any customer that is directly connected to the transmission network.

Dispatch Instructions: Mandatory dispatch orders issue by the System Operator during any operation day.

Distribution Networks Operators: Any user connected to the transmission grid to exchange power and that delivers power through his own network to final customers.

Economic Dispatch: The process to assign the available resources to cover the electric load in merit order.

Electric Time: The time shown on an electric clock connected to the DBIS.

Emergency Conditions: Abnormal system conditions that require automatic or manual actions to prevent or limit loss of transmission and distribution facilities or generation capacity that could adversely affect the reliability of the transmission network.

Emergency Instructions: A dispatch instruction issued by GPL that may require an action or response that is outside the limits declared in the day ahead dispatch for a generation unit and issue to prevent or limit an emergency condition.

Facility aggregated power MW capacity: It is the basis to determine the requirements associated with real and reactive power capability. This capacity is usually defined as gross capacity (i.e. the aggregated capacity of all generation) but the developer shall also provide a maximum net capacity to be delivered at the POI. It is of particular importance of Wind Turbine Generation (WTG) facilities or PV; called here Renewable Generating Facilities (RGF).

Feasibility Study: A preliminary system impact study as presented in this code.

Firm Loads: Loads that require continuous electric service from GPL and should not be interrupted except in extreme conditions to preserve the integrity of the system.

FIS Study Scope Agreement: A binding document defining the basis for the FIS.

Frequency Excursions: System frequency deviation from nominal frequency as a result of contingencies or load-generation imbalance.

Frequency Sensitive Mode: The operation of a generation unit that will result in active power output changing automatically in response to changes in the DBIS frequency.

Full Interconnection Study (FIS): A detailed system impact study as presented in this code.

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Full Interconnection Study Request (FISR): A letter from IC notifying GPL to proceed with the Full Interconnection Study for the Interconnection Project identified in the letter.

Generation Owner: Independent Power Producers (IPP), Large Customers and/or GPL that own a Generation Resource as defined in this code.

Generation Resource: Any device capable of injecting active power into GPL System regardless of technology; conventional generation, renewable generation or any type of storage devices. Generation Resources inject into the grid 5 MW (net after auxiliary services) or more if the POI is at 69 kV or 1.5 MW for POI at the 13.8 kV level.

Generating Resource, Generation Facility, or Generating Facility: See Generation Resource.

Good Utility Practice: Acting in good faith to perform obligations in accordance with international good practices in the electricity sector. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather to be acceptable practices, methods, or acts generally accepted.

GPL: Guyana Power and Light, provider of Transmission and Interconnection Services, owner and operator of the GPL System, and has central responsibility of planning the System.

GPL Operators: Personnel at the Energy Control Centre in charge of providing dispatch instructions to generation, monitoring the system performance, open and reconnect transmission facilities for normal operation or during emergency procedures and system restoration.

GPL System: All interconnect transmission and distribution facilities owned by GPL. Currently consists of the Demerara Berbice Interconnected System (DBIS)

GPL Transmission System: Facilities at 69 kV or above, used by GPL to interconnect generating resources to the distribution system MV system. Includes the transformation to MV (13.8 kV) level.

Hourly Economic Dispatch Program: The program output for each of the generation units in all the hours of the day generated by the Economic Dispatch.

Instation: Equipment located within GPL's premises that receive and stores metering data from Outstations.

Interconnecting Customer's System Impact Responsibility: Consists of the overloads or voltage violations that the Interconnection Project is likely to produce or aggravate in the system and that until corrected limit the capacity that the Interconnection Project can inject into the system. This limit can be zero. IC may or may not have financial responsibility on the cost of the associated reinforcements.

Interconnection Customer (IC): Party seeking interconnection service from GPL. Can be and Independent Power Producer, a Cogenerators or GPL itself operating as a resource owner.

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Interconnection Project: The New Generation Resource or Generation Resource change seeking interconnection to GPL System.

Internally Interconnected Party: An entity located in Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

International Interconnected Party: An entity located outside Guyana that owns and/or operates a transmission network or a plant that is connected to the DBIS.

Interruption Loads: Loads that have contractual conditions that allow interrupting their service during emergency conditions or for economic considerations. This is also called Load acting as a Resource.

Long term: A one to five years period for operational planning. The long term has been initially set up to 1 year.

Main Meter: The primary meter for measuring and recording electrical quantities.

Major Customers: Customers with annual peak load demand higher than 1 MW.

Measurement Transformers: Voltage and/or current transformers or combinations of those, used in metering systems.

Medium Term: A 4 weeks period for operational planning.

Merit Order: an order for ranking available generation facilities which shall optimize the DBIS economy, security, stability and reliability and that shall be determined by GPL.

Meter: A device for measuring and recording units of active power, active energy, reactive power or reactive energy or other electrical quantities.

Meter Certificate: The statement issued by GPL confirming that a meter or metering system complies with the requirements of the metering code.

Meter Owner: The person responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of meters.

Meter Register: A device associated with a meter, from which it is possible to obtain a visual reading of the quantities that have passed the meter.

Meter Registration System: A system that uniquely identifies the meter and users associated with the meter and contains pertinent data relating to the meter as required by the metering code.

Meter Service Provider: A person that provides to a meter owner meter services such as the installation, commissioning, operation, maintenance, and general servicing of metering systems.

Metering: The activity of measuring and recording units of active power, active energy, reactive power, reactive energy or other electrical quantities using a metering system or a meter.

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Metering System: The group of equipments including meters, measurement transformers, metering protection and isolation equipment, including alarms, circuitry, associated data storage and data communications equipment that are part of the active energy, reactive energy and demand measuring equipment at or relating to a connection site.

Minimum Technical Requirements (MTR): A set of requirements that any new generating resource needs to comply with to safely interconnect and not degrade the reliability of the system.

Net Metering: A methodology under which electrical energy generated by a customer-generator and delivered to the DNO facilities as measured by an appropriate device to offset electric energy supply by the DNO to the customer-generator during the applicable billing period. Net Metering is not designed to be an income generating mechanism and the supplier will not have to make monetary payments to customer-generators.

Non Consequential Load Shed: Load that needs to be shed to alleviate an overload or remediate a severe voltage violation.

Non Disclosure Agreement (NDA): A bidding document limiting the information that the parties may disclose to third parties and the conditions according to which this disclose can be made.

Operating Margin: The amount of reserve available over and above that required to meet the expected demand. It includes the contingency and operating reserves.

Operating Reserve: The amount of reserve to provide spare generation capacity for frequency control in real time and is provided by generation sets that are either synchronized or can be synchronized within minutes (fast start reserves). It includes the primary and secondary regulation and the tertiary response.

Operating Parameters: The onsite technical capabilities, flexibilities and limitations of a generation unit, that need to be declared for the day ahead dispatch.

Operational Test: a test carried out to acquire information in respect of a plant under pre-determined system conditions.

Outstation: On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an Instation or SCADA system or downloading to a local interrogation unit on request. When used with metering systems the outstation will store data from a meter(s) and may perform some processing of data.

Performance Standards: Define acceptable response to normal or contingency events and are measured in voltage magnitude or voltage change, thermal loading, stability or voltage swing limits and damping.

Photovoltaic Generation (PVG) Facility: Photovoltaic Facility has several photovoltaic arrays with solar panels connected to individual inverters and step-up transformers. The PVG transformers will step-up voltages from a typical 200-volt level to a typical 13.8 kV to 34.5 kV collector. A PVG may have several collectors that will connect to the Collector Bus. The

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Collector Bus is connected to the low side of the transmission step-up transformer(s), that changes the voltage to 13.8 kV, 69 kV or higher. Photovoltaic facilities output is a function of the site itself and the tracking system employed, with production that varies depending on whether tracking is used or not. PVG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

Plant: Any apparatus, equipment or appliance used for, or for purposes connected with, the generation, transmission, dispatch, distribution or supply of electricity.

Point of Interconnection (POI): A physical point in the System where ownership changes from the IC to GPL. Facilities towards the generator from the POI belong and are maintained by the IC, facilities from the POI to the GPL System are owned, maintained and operated by GPL.

Power Factor (PF): Ratio of the active power delivered by a generator or consumed by a load to the total apparent power delivered by the same generator or consumed by the same load. Over excited, lagging or positive PF corresponds to the condition of the generator injecting reactive power. Under excited, leading or negative power factor corresponds to the condition of the generator absorbing reactive power.

Project: See Interconnection Project

Primary Regulation: The real time variation in the power delivery of the generator in response to changes in the system frequency.

Reactive Energy: The integral with respect to Reactive Power, measured in units of voltampere reactive hours (Varh) and standard multiples.

Reactive Power: The product of alternating voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive (vars) and standard multiples.

Reliability Criteria: Define the acceptable operating limits for normal (N-0), as well as for various single and double contingency conditions such as: N-1, N-1-1, and N-2. Steady state, transient, and dynamic aspects are considered in determining reliability criteria for each type of contingency.

Remedial Action Scheme (RAS): A protective device that trips generation or load upon the occurrence of defined events to prevent overloads or voltage violations.

Resource: See Generation Resource.

Running Orders: Indicative dispatch instructions issue by the system operator as part of the day ahead generation dispatch.

Schedule Day: The 24 hours period starting at midnight of the day concerned.

Secondary Regulation: The automatic or manual adjustment to the power delivery by the generators to re-establish the generation – load balance.

Short Term: A 24 hours period for operational planning.

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Significant Incident: An incident that GPL has determined that shall be defined as significant in the context of reporting.

Site Investigations: Test conducted in relation to plant and operation procedures at generation facilities sites to monitor and assess the characteristics of the plant.

System: See GPL System.

System Operator: Guyana Power & Light Incorporated.

System Protection Facilities: Shall mean the equipment, including necessary protection signal communications equipment, required to protect (1) the Transmission System or other delivery systems or other generating systems from faults or other electrical disturbances occurring at the Generating Facility and (2) the Generating Facility from faults or other electrical system disturbances occurring on the Transmission System or on other delivery systems or other generating systems to which the Transmission System is directly connected.

Tertiary Respond: This is component of the operating reserve that will be available as a result of emergency instructions to synchronize and /or to dispatch other generation sets.

Transfer Distribution Factor: A fraction of the generation injection increase that flows over a defined element or flow gate (groups of elements) when balanced against the swing bus or sink area.

Unidirectional Meter: A meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction

User: Any entity different than GPL that is connected to transmission network and uses it to receive or delivery electricity.

Utility Scale Generating Facility: See Generating Resource.

Wind Power Facility: A Wind Turbine Generating facility (WTG) typically will have several Wind Turbine Generators (WTGs) connected to individual WTG step-up transformers. The WTG transformers will step-up voltages from a typical 600-volt level to a typical 13.8 kV or 34.5 kV collector. A WTG facility may have several collectors that will connect to the Main Collector Substation. The Main Collector Substation typically has a step-up transformer(s) that change the voltage to the transmission voltage (69 kV and above). The step-up transformer is connected to the POI through one or more lines, unless the transformer connects directly to the POI. WTG facilities can include additional reactive support to comply with voltage support requirements at the POI as discussed later in this code.

6.5 Meter and Metering System Ownership

Metering systems and meters shall be established, metering shall take place and meter data shall be recorded, checked and exchanged between persons bound by this code and then stored, sufficient to ensure that all such persons are able to prepare and calculate, assess and

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validate and, keep appropriate records concerning and where appropriate, challenge, invoices as listed below, on a prompt, comprehensive and accurate basis.

Meter data shall be permanently recorded and stored for these purposes in accordance with other provisions of this code. If a contract between relevant persons has additional requirements for metering systems or in relation to meters, those requirements shall, so long as they do not prevent compliance with this code, apply in addition to the metering code requirements.

Each electrical meters and/or metering systems shall be installed, operated and maintained and metering shall take place sufficient for all purposes of this code. The delivery points shall be at the ownership boundary and shall be set out in each connection agreement.

GPL and users shall each respectively take all reasonable steps to ensure that each relevant metering system is located as close as is reasonably practicable to the delivery point at each connection point.

The actual location of a metering system is referred to as the “Actual Metering Point”. This may be different from the delivery point established pursuant to the relevant connection agreement. Where the actual metering point is not coincident with the delivery point, compensation shall be provided for power transformer and/or line losses so that the overall accuracy requirement at the delivery point is met.

Each user shall have appropriated metering systems to measure capacity and output. Each generation unit shall have a metering system to measure capacity and output.

The term, meter owner, also relates to meters and metering systems used by persons under any agreement with a third party. The meter owner shall be responsible for all aspects of ownership, purchase, maintenance, calibration and testing unless stated otherwise in this code.

Meter ownership shall be determined as follows:

- Power producers shall own and be responsible for electricity metering systems for entry/exit to/from GPL or DNO busbars.
- GPL shall own and be responsible for the metering systems at a substation with a DNO and at the point of delivery of direct connected customers.
- The ownership and responsibility for metering systems between GPL or DNO and consumers shall be established in the connection agreement or other similar agreement between the parties.

6.6 Electricity Meters

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6.6.1 General

All meters and metering systems procured, installed, operated and maintained for the purposes of this code shall be sufficient for all purposes of this code such that the standards to be met in relation to those meters and metering systems, metering and the recording and exchange of meter data set out in this code are met.

Each meter and metering system shall comply with the all provisions of this code, including those as to the standards of accuracy and calibration to be achieved in metering systems.

All data communications equipment required for the purposes of this code and forming part of or associated with any meter or metering system shall perform to the relevant International Telecommunications Union (ITU) standards and recommendations for data transmission over telecommunication systems, or such other communication protocols as GPL may specify.

6.6.2 Meter, CT and VT requirements

i. Equipment Requirement

Meters

For connections greater than or equal to one MVA, metering systems shall include main and check meter equipment both having the same levels of accuracy and functionality.

Main meters and check meters shall be installed, operated and maintained so as to comply at all relevant times with the standards indicated in Appendix A.

For each delivery point, a metering system shall be installed, operated and maintained to measure the following parameters;

- i) Entry and exit active energy; and
- ii) Entry and exit reactive energy

All meters shall be label by the meter owner or otherwise be readily identifiable in accordance with Appendix B.

The metering systems shall meter quantities on a continuous basis and the information shall be displayed on a non-volatile meter register. The meter registers shall not pass through zero more than once within the normal meter reading cycle.

The meter owner shall provide test terminals for main meters and check meters to facilitate on-site tests. These terminals shall be in close proximity to

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the meters and shall be capable of providing suitable means for accessing current and voltage signals, injecting test quantities, connecting test meters, and replacing meters without a circuit outage.

Current Transformers

The meter owner shall provide current transformers in accordance with the standards indicated in Appendix A.

Where main meters and check meters are required, the meter owner shall provide two sets of current transformers. The current transformers supplying main meters, the current transformer windings and cables connecting such windings to main meters shall be dedicated for such purposes and such cables and connections shall be securely sealed.

The current transformers supplying check meters may be used for other purposes provided that overall accuracy requirements are met. Evidence of the additional burden imposed by such purposes shall be made available for inspection by relevant parties.

The additional burden shall not be modified without prior agreement from relevant parties and evidence of the value of the modified additional burden shall be available for inspection by relevant parties. The total burden on each current transformer shall not exceed the rated burden of such current transformer.

Voltage Transformers

The meter owner shall provide voltage transformers in accordance with standards indicated in Appendix A.

Where main meters and check meters are required the meter owner shall provide two voltage transformers or one voltage transformer with two or more secondary windings.

The voltage transformer winding supplying main meters shall be dedicated to that purpose and such windings and connections shall be securely sealed.

The voltage transformer secondary winding supplying check meters may be used for other purposes provided the overall burden and accuracy requirements are met and evidence of the additional burden imposed by such purposes is available for inspection by the relevant parties.

The additional burden shall not be modified without prior argument from the relevant parties and evidence of the value of such additional burden shall be available for inspection by the relevant parties. The total burden on each voltage transformer shall not exceed the rated burden of such voltage transformer.

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Separately fused voltage transformer supplies shall be provided by the Plant Owner for the main meter, the check meter, and any additional burden. The fuses shall be located as close to the voltage transformer as possible.

ii. Accuracy requirements

The accuracy of the various items of measuring equipment comprising meters and metering systems shall conform to the relevant standards current at the time that the user’s connection agreement is signed. Standards relevant to this code are listed in Appendix A.

Where the actual metering point is not coincident with the delivery point, compensation shall be provided for power transformer and/or line losses so that the overall accuracy requirement at the delivery point is met. The compensation may be applied locally within the metering system or remotely. Compensation factors and their justification shall be established in accordance with Good Industry Practice and must be recorded in the meter registration system.

Errors arising from the measurement transformers and associated leads to the meters that affect the overall accuracy shall be compensated such that the overall accuracy requirement is met. Values of the compensation factors and their justification including test certificates shall be established in accordance with Good Industry Practice and recorded in the meter registration system and shall be available for inspection by relevant parties.

iii. Meter approval and Certification

Meters used in accordance with this code shall be approved meter types. GPL shall maintain a list of approved meter types that shall be made available on request. GPL shall also be responsible for type approval of meters to ensure compliance with the provisions of this code in accordance with Good Industry Practice.

GPL will issue meter certificates to the relevant meter owner and the Regulatory Authority in accordance with Good Industry Practice to confirm that meters and metering systems comply with the requirements of this code. Meter Certificates shall be issued for specified time spans and the duration may differ for different meter types.

iv. Operation and Maintenance

Metering systems shall be operated and maintained in accordance with the manufacturer’s recommendations or as otherwise necessary for the meter owner to comply with its obligations under this code.

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6.6.3 Meter System Calibration and Testing

i. Initial Calibration

All new meters shall undergo relevant certification tests in accordance with Good Industry Practice.

All initial calibration of meters shall be performed in a recognized test facility. These tests shall be performed in accordance with the relevant standards and shall confirm that meter accuracy. A uniquely identifiable calibration record shall be provided by the recognized test facility before the connection is made live.

The meter owner will apply a certification seal following initial calibration. The meter owner must maintain this seal intact in order for the meter to retain certified status. No person bound by this code shall break the seal unless properly authorized to do so. The meter owner is responsible for ensuring that meter certification is carried out for compliance with the provisions of this code.

Meters removed from service must be re-certified before reconnection for use under this code.

New voltage transformers and current transformers shall be calibrated prior to installation on site. Meter owners shall provide manufacturers' test certificates to GPL for inclusion in the meter registration system to show compliance with the accuracy classes.

ii. Commissioning

Commissioning tests shall be carried out on all new metering systems providing meter data before the connection is made live and in accordance with Good Industry Practice. Commissioning tests shall also be carried out before reconnection where a replacement metering system is fitted as part of an existing metering system. No Connection or reconnection shall be permitted unless the tests are passed.

Following commissioning, the meter owner shall provide such evidence that relevant parties may require confirming that a metering system meets the requirements of this code.

All meters, current transformers and voltage transformers shall be tested by the respective owner for accuracy in accordance with Good Industry Practice at initial commissioning before the connection is made live, as indicated in Appendix C. This appendix sets out the tests and checks that as a minimum shall be included in a commissioning program.

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iii. Periodic Calibration and Testing

Periodic calibration of metering systems shall be undertaken by the meter owners to ensure that the requirements of this code are met at all relevant times.

Periodic calibration of meters shall be performed in a recognized test facility using standard meters certified by a recognized authority. Accuracy tests shall be performed in accordance with the relevant standards (Appendix A) and shall confirm that meter accuracy. The calibration record shall be uniquely identifiable, retained in a safe place and the significant details (identification number, date, names and status of authorized testing persons and accuracy results) recorded in the meter registration system.

Meters shall also be tested outside of the prescribed intervals stated below if the main meters and check meters diverge by more than 1.5 times the prescribed limit of error associated with the accuracy classes.

Complete and accurate records of accuracy tests, work carried out and pertinent data to confirm successful testing/calibration in accordance with the requirements of this code shall be kept by the meter owner and promptly registered in the meter registration system where appropriate.

Electromechanical meters shall be calibrated and refurbished as necessary at intervals not exceeding ten years.

For electronic meters, at least one of each type of electronic meter owned by each meter owner shall be calibrated in any 5-year period. A minimum of 20% of the total of each type of meter on-circuit with a meter owner shall be calibrated in an evenly phased program over a 10-year period.

Periodic testing of measurement transformers is not required.

If any item of a metering system is suspected of performing incorrectly, any affected party may request the meter owner to carry out accuracy tests in accordance with Good Industry Practice and the provisions of this code, to confirm correct operation and accuracy. The meter owner shall carry out any test so requested.

The party requesting the accuracy test shall bear the reasonable costs of such testing if the meter is found to be operating within the prescribed limits of error, otherwise the cost of the accuracy test shall be borne by the meter owner. All affected parties shall be given 24 hours notice of such tests and be invited to witness the tests. Accuracy test results shall be made available promptly and in writing to the affected parties.

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6.6.4 Meter and Data Security and Registration

i. Meter Access and Sealing

All Metering Systems and associated communications equipment shall be located in secure metering cabinets located in an area that is readily accessible, free from obstructions and well lit by artificial light. The cabinets shall include as a minimum, effective protection from moisture and dust ingress and from physical damage, including vibration. Appropriate temperature controls shall be provided. The cabinets must be lockable and capable of being sealed to prevent unauthorized access.

Meter owners and the relevant parties, as appropriate, shall jointly seal the metering system that shall include data collection equipment and associated modems and telephone links. Only the meter owner’s personnel shall break such seals. All other affected parties shall be given at least forty-eight (48) hours' advance notice of the breaking of seals on any part of the metering system. No such notice will be necessary when the breaking of a seal is necessitated by the occurrence of an emergency.

Neither party shall tamper or otherwise interfere with any part of the metering system in any way. Where it is established that the metering system has been tampered or interfered with, then until such tampering or interference has been rectified either;

- the quantity measured or recorded shall be that measured or recorded by any other relevant installed metering system; or
- if there is no other relevant metering system or it is established to have been tampered or interfered with, the quantity shall be agreed by the parties, or, in the absence of such agreement, either party shall be entitled to refer the matter to an expert for determination.

If the meter owner is not the person who owns or controls the land on which the meter or metering system is situated, that person (if bound by this code) shall grant the meter owner and all other persons who require the same for the purposes of this code sufficient rights of access for metering purposes and for the purposes of testing calibration, operation and maintenance and replacement of the meter and metering system.

The right of access provided for in this code includes the right to bring onto such a party’s property any vehicles, plant, machinery and maintenance or

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other materials as shall be reasonably necessary for the purposes of performance of obligations under this code.

Each party shall ensure that all reasonable arrangements and provisions are made and/or revised from time to time as and when necessary or desirable in accordance with Good Industry Practice to facilitate the safe exercise of any right of access.

ii. Meter Records

The meter owner shall label all meters with a unique identification number from lists maintained by GPL.

Each meter owner shall ensure that complete and accurate records are maintained of the calibration and operation of metering system. These records shall include but not be limited to the dates and results of any tests, readings, adjustments or inspection carried out and the dates on which any seal was applied or broken. The reasons for any seal being broken and the persons, and their affiliations, attending any such tests, readings, inspections or sealings shall be recorded.

Meter owners shall ensure that the pertinent data is provided promptly to GPL for entry into the Meter Registration System. Such data shall be kept up to date. They shall also provide any other metering system data requested by other involved parties.

iii. Meter Registration

Metering systems shall be registered in a central database, the Meter Registration System, which is to be operated and maintained by GPL in accordance with Good Industry Practice. The purpose of the Meter Registration System is to provide a complete, accurate and up to date central database of all meter data and to ensure an auditable trail to demonstrate compliance with this code. The Meter Registration System shall contain, as a minimum, specific information at each actual metering point as indicated in Appendix D.

All Users are responsible for ensuring that data relating to all changes to Users’ metering systems including any changes to the types of data set out in Appendix D and any site de-energizations or disconnections are promptly reported in writing, to the meter registration system.

The meter registration system shall maintain the specified information for a minimum of seven years after the replacement or disconnection of a meter.

Any data held in the meter registration system:

(a) shall be the intellectual property of GPL and

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(b) may be freely accessed by;

- The meter owner;
- The regulatory authority;
- GPL
- Any user but with access limited to that equipment directly associated with the metering system of that user.

6.7 Data Exchange

6.7.1 General

Meter data covered by this code is required by persons to prepare and calculate invoices and to assess, verify and where appropriate, challenge invoices. Meter data is also required for accounting and record keeping purposes.

Meter owners shall in good faith, and in accordance with Good Industry Practice conduct such metering operations as may be necessary to produce and record complete and accurate meter data. Meter owners shall provide meter data to other persons bound by this code in accordance with the following provisions.

Where this code requires data to be exchanged between such persons or invoices to pass between them supported by meter data, meter owners shall undertake meter reading at the times required by this code. If no time is specified for meter reading to take place, meter reading shall take place as close in time as possible to the time required in relation to the relevant invoice or meter data flow specified in this code. All meter data shall include the time or times at which meter reading took place.

Where meter data is required for the purpose of this code or relevant contracts referred to in this code, the meter data shall be provided by making accurate readings of the relevant meter or meters, accurately recording the meter data arising from those readings and supplying that meter data to other persons in accordance with the requirements of this code.

6.7.2 Meter Validation and Quality Check

Meter data shall be collected, validated and aggregated as required for the proper functioning of invoicing in accordance with the relevant parties.

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In cases where meter data is not available due to a failure of the main meter or its associated equipment such as CT, VT, cabling or protection devices, or in cases where the main meter has been proven to have operated outside the prescribed limits of error, the meter data obtained from the check meter shall be admissible.

In cases where check meters are not provided, estimated or substitute meter data will be used as required in accordance with procedures agreed between the relevant parties.

6.7.3 Meter data communication system

Local or remote communications provided in connection with any metering system shall conform to the requirements of this section.

Meters may be provided with either integral or separate local outstations. Any local outstations must be capable of being connected to and interrogated by remote installations at a central location, such as GPL Control Center. The remote installations would read the meter data at the specified time and frequency.

Any meter communications system would be independent from the operational SCADA data systems in order to avoid potential conflicts of interfacing and protocol.

The meter communication system would be a duplex system, wherever possible, i.e., each remote installation shall be able to interrogate both the main meter and check meter outstations over either of two communication routes.

6.7.4 Meter data display and storage

The metering systems shall meter the quantities on a continuous 24 hour basis and the data shall be displayed on a non-volatile meter register.

Any local outstations provided shall have the capability to store all meter data collected by the respective meters including alarms and other functions for relevant parties for two (2) complete calendar months.

All users responsible for providing meter data in accordance with this code shall retain a copy of the data in electronic format. The format of data to be stored shall include the following essential parameters; time period, meter identification number and meter readings.

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GPL shall maintain a log in the form of electronic storage of digital data of all data from all metering systems and local outstations and the associated data received from relevant parties for at least ten (10) complete operational years.

GPL and Users shall ensure that backup copies of data in electronic format are made. All backup copies shall be made promptly at the end of the period or immediately following completion of the data set.

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6.8 Appendix A: Metering System Standards

All metering systems shall comply with the following standards:

- i. IEC Standards 62052- Electricity metering Equipment (AC) – General requirements and test conditions
- ii. IEC Standards 62053- Electricity metering equipment (a.c.) – Particular requirements
- iii. IEC Standards 62059- Electricity metering equipment – Dependability
- iv. IEC Standards 61869- Instrument transformers.
- v. IEC Standards 62056 – Data exchange for meter reading, tariff and load control
- vi. IEC Standards 62056- Electricity metering data exchange – The DLMS/COSEM suite

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6.9 Appendix B: Meter Identification

Each meter shall be allocated a unique meter identification number that will be given by GPL and recorded in the meter registration system.

The number shall be marked permanently on the meter in a position that is clearly visible under all normal viewing of the meter.

The number will be quoted on all records arising from and related to the meter including meter readings.

Other related metering equipment shall be clearly identified with the metering system with which they are associated.

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6.10 Appendix C: Commissioning Test

This appendix sets out the tests and checks that shall be included in the metering systems commissioning programme.

6.10.1 Measurement Transformers

For all installations with new/replaced measurement transformers the meter owner shall ensure that from site tests and inspections the following are confirmed and recorded;

1. Details of the installed units, including serial numbers, rating, accuracy classes, ratio(s)
2. CT ratio and polarity for selected tap.
3. VT ratio and phasing for each winding.
4. Confirm that the VT and CT connections are correct.
5. Confirm that the VT and CT burden ratings are not exceeded.
6. Determine and record the value of any burdens (including any burdens not associated with the system) necessary to provide evidence of the overall metering accuracy.

6.10.2 Metering

For all new/replaced meters the following test must be confirmed and recorded

1. Record the metering system details required by the meter registration system.
2. Confirm that the VT/CT ratios applied to the meter(s) agree with the site measurement transformer ratios.
3. Confirm correct operation of meter test terminal blocks where these are available.
4. Check that all cabling and wiring of the new or modified installation is correct.
5. Confirm that meter registers advance for entry and where appropriate exit flow directions. Confirm meter operation separately for each phase current and for normal polyphase current operation.
6. Where separate remote metering is used confirm the meter communications channel allocations and that the meter units per pulse values or equivalent data are correct.
7. Confirm that the local interrogation facility and local display etc. operate correctly.
8. Check any site cabling, wiring, connections.
9. Check that the voltage and the phase rotation of the measurement supply at the meter terminals are correct.
10. Record meter start readings (including date and time of readings).
11. Confirm the operation of metering System alarms (not data alarm or flags in the transmitted data).
12. Confirm from meter owner that accuracy certificates exist for the meters.

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6.11 Appendix D: Metering Registration System

The meter registration system is a database that holds meter data.

Data in the meter registration systems shall be treated as confidential and only relevant meter data shall be released to the appropriate party.

Meter data to be contained in the meter registration system shall include, but is not limited to the following:

1. A unique meter identification number.
2. Connection point and metering point reference details for both delivery point and actual metering point, including:
 - a. Location and reference details (i.e. drawing numbers).
 - b. Participant details at the connection point.
 - c. Site identification nomenclature.
 - d. Meter owner.
 - e. Loss compensation calculation details where actual metering point and delivery point differ.
3. Main and check Meter installation details, including:
 - a. Serial numbers.
 - b. Metering installation identification name.
 - c. Meter types and models.
 - d. Instrument transformer ratios (available and connected).
 - e. Test and calibration programme details; test results and reference test certificates for meters and measurement transformers.
 - f. Testing schedule.
 - g. Calibration tables, where applied to achieve meter installation accuracy.
 - h. Any meter summation scheme values and multipliers.
4. Data register coding details.
5. Data communication details (when communication systems are used).
6. Telephone number for access to data.
7. Communication equipment type and serial numbers.
8. Communication protocol details or references.
9. Data conversion details.
10. User identifications and access rights.
11. Data validation and substitution processes agreed between affected parties, including:
 - a. Algorithm.
 - b. Data comparison technique.
 - c. Processing and alarms (i.e. voltage source limits, phase-angle limits).

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- d. check metering compensation details.

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