GRID CODE

TRANSMISSION DIVISION
CEYLON ELECTRICITY BOARD
September 2023 (Final Draft)

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The Grid Code of CEB Transmission Licensee

Introduction

The Grid Code of the Transmission Licensee, Ceylon Electricity Board, (hereafter referred to as the "Grid Code") has been formulated in terms of the provisions of Clause 3.1 (c) and 17(f) of the Sri Lanka Electricity Act, No 20 of 2009 (SLEA20), which require the licensees to implement and maintain technical or operational codes in relation to the Transmission System.

Physical laws that govern the behaviour of electrical power systems do not recognise Licensee boundaries. To plan and operate the system, it needs to be studied and analysed without regard to such boundaries. The Grid Code sets out the operating procedure and principles governing the Transmission Licensee and all Users of the Transmission System. It specifies the procedures for both planning and operational purposes to cover both normal and exceptional circumstances.

The Grid Code has to be revised and amended from time to time, as and when the situations Demand, to reflect the development of the transmission network, to comply with legislations, and to adopt appropriate good industry practices.

The primary objectives of the Grid Code are to establish an effective, transparent, non-discriminatory and coordinated approach for Planning and Operation of the Transmission System, and to ensure equitable management of technical matters in the interest of all the parties connected to the grid including Distribution Licensees, Transmission Customers, Generation Licensees and any other Users.

In the Grid Code, Users are categorised into,

(a) Generation Licensees with generation from conventional resources
(b) Generation Licensees with generation-based on intermittent resources
(c) Generation Licensees with embedded generators
(d) Distribution Licensees
(e) Transmission Customers

This Grid Code has to be read in conjunction with the Distribution Codes of each Distribution Licensee, if any, for complete and appropriate understanding of the requirements where applicable, especially with respect to interconnected or overlapping matters.
Currently, the Grid Code consists of (but not limited to) the following Codes, which individually and collectively form the framework of policies, procedures, practices and requirements of this Grid Code.

1. General Code

Cites the legal and regulatory framework for the implementation and maintenance of the Grid Code, and also specifies the general terms and conditions, and definitions applicable to the Grid Code.

2. Grid Planning Code

Describes the technical criteria, planning criteria and planning procedures followed by the Transmission Licensee in the planning and development of the Licensee's Transmission System. The Grid Planning Code also specifies the data and information the Users or Parties seeking connection to the Transmission System shall supply, for the Transmission Licensee to undertake planning and development of the Transmission System.

3. Grid Connection Code

Specifies the minimum technical criteria and procedures with respect to connection requirements that needs to be complied with by the Transmission Licensee and all Users or parties seeking connection to the Transmission System.

4. Grid Operations Code

Specifies operations criteria, guidelines, and procedures to be followed by the Transmission Licensee, and requirements to be followed by all Users of the Transmission System for coordinated operation of the Transmission System.

5. Generation Dispatch Code

Specifies rules and procedures to be followed by the System Operator to optimise the system Dispatch, the role of other Licensees and the role of the Transmission Licensee in this optimisation, the mechanisms to coordinate the real time operation of the system, and reporting requirements.

6. Grid Metering Code

Specifies technical criteria and procedures for tariff metering between the Transmission Licensee and all Users or parties seeking connection to the Transmission System.

Annex 1

Annex 1 to the Grid Code gives Rules and Procedures for the Grid Code Enforcement and Review Panel (GCERP). The Transmission Licensee will ensure that the GCERP is functional within 03 months from the notification of the concurrence of Public Utilities Commission of Sri Lanka (PUCSL) to the Grid Code submitted for approval of PUCSL.

The Transmission Licensee is committed to improve the efficiency and the effectiveness of the Transmission System. The Grid Code has been prepared to reflect power industry international best practices adapted to Sri Lanka. Therefore, as international norms and best practices evolve, the contents of the following Appendices too are subject to change. The latest version of each appendix will be available with the Transmission Licensee, and will be published in the Transmission Licensee's website.

Appendix A - Criteria

Appendix A specifies technical criteria of the Transmission System which maybe relevant to Users.

Appendix B – Data

Appendix B specifies technical information and data to be made available by Users to the Transmission Licensee, and information and data to be made available by the Transmission Licensee to the Users.

Appendix C – Procedure for Application for Grid Connection

Appendix C specifies the procedure for an application for a connection to the Transmission System.

1 GENERAL CODE

1.1 INTRODUCTION

This code contains provisions of a general nature that apply to the entirety of the Grid Code. These include legal and regulatory provisions, and definitions of common terms.

1.2 APPLICABILITY

The General Code is primarily applicable to the Transmission Licensee and to all Users.

1.3 OBJECTIVES

Primary objectives of the General Code are to,

(a) cite the legal and regulatory framework for the implementation and maintenance of the Grid Code,
(b) define procedures for revising/amending the Grid Code,
(c) define common terms and abbreviations used in the Grid Code,
(d) specify general rules for interpreting provisions in the Grid Code , and
(e) specify rules on communication between the Transmission Licensee and Users.

1.4 RESPONSIBILITIES

1.4.1 PUCSL

PUCSL shall be responsible for approving the Grid Code and amendments there to, as required from time to time. The Grid Code and amendments will be developed by the Transmission Licensee as and when necessary to reflect the changes in the regulatory framework and the development of the transmission network to comply with legislations and good industry practices, and the inspection functions for the implementation of the Grid Code.

1.4.2 TRANSMISSION LICENSEE

The Transmission Licensee will be responsible for the implementation and maintenance of the Grid Code in relation to the Transmission System, and to act in accordance with the established good industry practices.

1.4.3 USERS

Users shall be required to abide by the Grid Code, comply with the instructions and requests of the Transmission Licensee that may require in discharging Transmission Licensee's duties in implementation of the provisions of the Grid Code, and act in accordance with good industry practices.

Specific responsibilities of all parties, the Transmission Licensee, Users and PUCSL, in respect of each code, have been clearly specified and listed under each code.

1.5 HIERARCHY OF AUTHORITY

The authority of the Grid Code is derived from a hierarchy consisting of parliamentary legislation, Ministerial regulations and rules, Licenses and guidelines issued by the PUCSL. The hierarchy is presented in top-down order below:

i. Legislation

(a) The Public Utilities Commission of Sri Lanka (PUCSL) Act, No. 35, 2002

(b) Sri Lanka Electricity Act, No 20, 2009 ii.

Regulations issued by the Minister iii. Rules issued by PUCSL

iv. Grid Code

v. Distribution Code

vi. Contracts between parties

(a) Power Purchase Agreements (PPA) between Generation Licensees and the Transmission Licensee
(b) Power Sales Agreements (PSA) between the Transmission Licensee, Distribution Licensees and other Users
(c) Terms and conditions of delivery and acceptance of electricity between CEB Generation Licensee and the Transmission Licensee
(d) Terms and conditions of delivery and acceptance of electricity between the Transmission Licensee and Distribution Licensees of CEB
(e) Connection agreements between Distribution Licensees and customers
(f) Internal codes of the Transmission Licensee and Distribution Licensees

The above hierarchy shall be applicable to the technical functions, in normal or emergency circumstances, covered by the Grid Code, but excluding matters of commercial nature, which have no technical implications.

1.6 PROCESS TO REVIEW AND REVISE THE GRID CODE

The Grid Code Enforcement and Review Panel (GCERP) is responsible for the review and revision of the Grid Code. Review of the Grid Code shall be carried out quarterly, and as and when required.

Recommendations of the GCERP comprising suggestions, and amendments shall be submitted by the Transmission Licensee to PUCSL for approval. Any changes or additions to the Grid Code proposed by PUCSL will be referred to the Transmission Licensee and processed through the GCERP for incorporation into the Grid Code.

Any recommendations of the GCERP applicable to Appendices A, B and C of the Grid Code will be incorporated by the Transmission Licensee and submitted to the Commission.

1.6.1 GRID CODE ENFORCEMENT AND REVIEW PANEL (GCERP)

The Transmission Licensee shall establish a Grid Code Enforcement and Review Panel (GCERP) to carry out the following functions:

(a) Review all suggestions and amendments in relation to the Grid Code proposed by any party and make suitable recommendations to the Transmission Licensee.
(b) Initiate and coordinate regular reviews and revisions to the Grid Code, and make suitable recommendations to the Transmission Licensee for incorporation.
(c) Facilitate the resolution of issues brought up by members of the GCERP or by PUCSL, and submit its recommendations to the Transmission Licensee.
(d) Produce written records on the activities of the GCERP.

The membership, rules and procedures to conduct functions of the GCERP are given in **Annex 1.**

1.7 ACTION IN UNFORESEEN CIRCUMSTANCES

In unforeseen and extraordinary circumstances, the Transmission Licensee will act in pursuance of any one or a combination of the following general requirements.

(a) Preservation or restoration of the integrity of the Transmission System.
(b) Avoidance of breakdown, separation or collapse (total or partial) of the Transmission System.
(c) Requirements of safety in all circumstances, including prevention of personal injury.
(d) Prevention of serious damage to Plant and/or apparatus.

The above shall also apply in the event of emergencies such as abnormal weather conditions, fuel shortages, war, national calamities and abnormal law and order situations.

1.8 PARTIAL INVALIDITY

If any provision or part of a provision of the Grid Code should become or be declared unlawful for any reason, the validity of all remaining provisions or parts of provisions of the Grid Code shall not be affected.

1.9 ACCURACY OF INFORMATION

The Transmission Licensee and all Users have a duty to provide such information as are necessary to facilitate compliance with requirements of the Grid Code. All parties are responsible to ensure accuracy of such information and data provided by them in accordance with the requirements of the Grid Code.

The Transmission Licensee has the right to verify such information and data provided by Users, and to request calculation methodologies, references and error estimations, where necessary, to ensure proper planning and operation of the Transmission System.

Failure of any party to provide reasonably accurate information and data, or any deliberate attempt to withhold such information and data or provision of inaccurate information and data, shall be considered to be non-compliance with the requirements of the Grid Code.

1.10 CONDITIONS OF DISCLAIMER

The Transmission Licensee, in planning and operating the Grid and in contributing to the planning and operation of the Grid, is required to rely on information provided by Generators, Distribution Licensees, and other Users, regarding their requirements and intentions. The Transmission Licensee will not be held responsible for any consequence arising from its reasonable and prudent actions on the basis of such information and data supplied by any of the Users.

Generators, Distribution Licensees and other Users shall not be held responsible for any consequence, which arises from the usage of any accurate information and data supplied by them to the Transmission Licensee.

1.11 CONFIDENTIALITY

Under the terms of the Grid Code, the Transmission Licensee will receive information and data from Users and vice versa. The Transmission Licensee or any User shall not, other than as required by the Grid Code or applicable rules, disclose such information and data to any other person without the prior written consent of the provider of the information and data.

1.12 PROCEDURE FOR SETTLEMENT OF DISPUTES

In the event of a dispute between the Transmission Licensee and another Licensee or any other party, on a matter covered in the Grid Code, the following procedure shall be followed.
The concerned parties shall discuss and attempt to arrive at an amicable settlement in terms of applicable rules/regulations. If an agreement cannot be reached, parties shall, after deliberations,

(a) formulate and implement a provisional working arrangement, which shall be implemented until a valid ruling is issued by PUCSL in accordance with the Electricity (Dispute Resolution Procedure) Rules,
(b) keep the GCERP informed of the provisional working arrangement within three days from the day such a provisional working arrangement has been implemented. (The GCERP shall submit its observations to PUCSL), and
(c) follow the applicable rules and regulations, and refer the unresolved dispute to PUCSL.

1.13 COMMUNICATION BETWEEN TRANSMISSION LICENSEE AND USERS

All communication between the Transmission Licensee and Users shall be in accordance with the provisions of the relevant section of the Grid Code.
Unless otherwise specifically required by the Grid Code, all communications shall be in writing, except where operation time-scales require oral, facsimile or electronic communication.

1.14 INTERPRETATION

1.14.1 DEFINITIONS

When a word or a phrase that is defined in the "Definitions and Abbreviations" is more particularly defined in another code of the Grid Code, and if there is any inconsistency between the two definitions, the latter of the two definitions shall prevail.

1.14.2 AMENDMENT OF STANDARDS

A reference to a standard shall include any revision, update or a replacement of that standard.

1.14.3 INFORMATION AND DATA

A reference to information shall include both information and data. Any reference to data shall include both information and data.

1.14.4 GENDER

Any reference to a gender shall include both genders.

1.14.5 INCLUDING

The word "including" or a grammatical variation thereof means "including but not limited to".

1.14.6 PARTY, PERSON OR ENTITY

Any reference to a party, person or entity shall include an individual, partnership, company, corporation, association, organisation, institution, or other similar groups.

1.14.7 SINGULARITY AND PLURALITY

Unless otherwise specified, singular shall include the plural and vice-versa.

1.15 NOMINAL VOLTAGE, NOMINAL FREQUENCY

Nominal Voltages in this Grid Code shall be 400,000 Volt (400 kV), 220,000 Volt (220 kV), 132,000 Volt (132 kV), 33,000 Volt (33 kV) and 11,000 Volt (11 kV), and the nominal Frequency shall be 50 Hz.

1.16 DEFINITIONS AND ABBREVIATIONS

In the Grid Code, the following words, abbreviations and expressions shall bear the meanings as indicated in the Table below.

TERM	DEFINITION
ac	Alternating Current
Active Energy	The electrical energy flowing or supplied by an electrical circuit during a time interval, being the integral with respect to time of Active Power, measured in units of watt-hours.
Active Power	Product of voltage and in-phase component of alternating current measured in units of Watt (W).
Alternator	The electrical machine which is driven by a prime mover and generates ac electric power. The term "Generator" is reserved, and separately defined (please see the definition of "Generator").
Allowed Charges	Approved charges Licensees are permitted to levy from customers, prospective customers and the general public for carrying out work requested by them.
ALS	Automatic Load Shedding
Apparent Power	The product of voltage and alternating current measured in units of volt ampere.
Appendix	An appendix to the Grid Code.
Availability	The long term average fraction of time that a component or system is in service and satisfactorily performing its intended function.
Automatic Load Shedding	A scheme to disconnect Loads without manual intervention, implemented by the Transmission Licensee to prevent Frequency collapse in the Transmission System.
Authorized Person	As defined in clause C-3 in part 1 of 'System Operations Manual' of CEB.
Auxiliary	Any item of plant and/or apparatus not directly a part of the energy conversion process in a Generating Unit, but required for its functional operation.
Automatic Voltage Regulator (AVR)	The continuously acting automatic equipment, controlling the terminal voltage of a Synchronous Generating Unit by comparing the actual terminal voltage with a reference value and controlling by appropriate means the output of an exciter, depending on the deviations.
Base Case (Plan)	Plan developed by adhering to the least cost principles including existing power plants of any description already in operation as of 1st January of the current year of the Plan and candidate power plants required to be included owing to Policy Guidelines in accordance with SLEA20.
Battery Energy Storage System	Battery Energy Storage System comprises batteries, chargers, power converters and related equipment for the purpose of storing electrical energy in the batteries during the charging process and discharging the stored electrical energy when required.

TERM	DEFINITION
Battery Storage	A type of energy storage power station that uses a group of batteries to store electrical energy/to provide electrical energy back to the network, which could be a part of **Power Park Module** as well as standalone installation.
Black Start	The procedure for recovery from a Total failure or Partial failure, using the Black Start Capability of Generating Units.
Black Start Capability	The capability to start a Generating Unit and synchronise with the System without relying on the external power, using the Power Station's own generating capacity.
Captive Power Plant	A Generating Unit or a group of Generating Units which produces electricity for the own use of a Customer.
Commission	Public Utilities Commission of Sri Lanka (PUCSL) established under Act, No. 35, 2002.
Common Connection Point (CCP)	Multiple **Generating Units** (S**PVG units** or **WTG units**) connected to the Grid.
Compensating Ramp Rate	A ramp rate setting of **Battery Storages** that may be used to reduce the impact of **Active Power** ramps of the **Power Park Modules**
Competent Person	As defined in clause C-2 in part 1 of 'System Operations Manual' of CEB.
Connected Load	Aggregate of rated capacity of all apparatus including portable apparatus in the Consumer's premises which are supplied or declared by the Consumer to be taking supply from the system. This shall be expressed in kW or kVA.
Connection Agreement	An agreement between a User and the Transmission Licensee specifying the procedure for the design, review, construction and commissioning procedure the User's connection to the Transmission System, and the safety procedures, and maintenance program of the equipment used at the Interconnection Point.
Consumer/Customer	Any person or entity, either as the owner or lawful occupier, supplied with electricity by a Licensee/Supplier, and whose premises are for the time being, connected to the Licensee's Transmission or Distribution System having accepted to receive the electricity supply on the terms and conditions laid down by the Licensee. A consumer/customer includes a prospective consumer. The term "Customer" has the same meaning as "Consumer", as defined in SLEA20.
Contingency Reserve	Generating capacity that is intended to take care within a short interval of time to meet the Demand in case of the loss of the largest Synchronised generating unit or the largest power import source that is connected to the Grid through an external interconnection.
Contract Demand	Maximum real (kW) or apparent (kVA) power Demand agreed to be supplied by the Licensee/Supplier as stated in the declaration made by a Customer.
Control Person	As defined in clause C-4 in part 1 of 'System Operations Manual' of CEB.
Declared Voltage	A voltage or voltages declared by a Licensee for the supply of electricity to a Customer.
Demand	The requirement for active power and reactive power unless otherwise stated.

TERM	DEFINITION
Demand Forecast	The activity which estimates Demand on the Transmission System.
Dispatch	The issue of instructions by the Transmission Licensee to a Generating Plant pursuant to scheduling and Dispatch under the Grid Operations Code, and the term "Dispatched" shall be construed accordingly.
Dispatch Instructions	An instruction by the Transmission Licensee to a Generator to operate, issued in accordance with the Grid Operations Code.
Disconnect	The act of physically separating User's (or Customer's) equipment from the Transmission System.
Distribution Code	The document produced by Distribution Licensees pursuant to conditions of the Electricity Supply License.
Distribution Licensee	A person appointed through a License issued by PUCSL to carry out the functions of Distribution and Supply Business.
Distribution System	The system consisting of lines owned and/or operated by a Distribution Licensee for the purposes of distribution of electricity from a Grid Substation to another Substation, or to or from any External Interconnection, or to deliver to Customers, including any plant and Apparatus and meters owned or used by the Distribution Licensee in connection with the distribution of electricity.
Driest Condition	Hydro energy potential during very dry condition.
Earthing	A way of providing a connection between conductors and earth by an Earthing Device.
Earthing Device	A means of providing a connection between a conductor and earth, being of adequate strength and capability, and conforming to applicable standards.
Embedded Generator	A single generating unit, or a group of generating units, connected to the distribution network, at voltages between 400 V and 33 kV.
Energy Park	An area identified and reserved for the development of IBRE, where facilities are available for collective connection to the Grid.
External Interconnection	A connection to a network outside the network of the Transmission Licensee.
Financial Year	Period commencing on the 1st day of January ending on 31st day of December of the same year.
Forced Outage	An outage of an equipment/system of which no notice can be given beforehand.
Frequency	The number of alternating current cycles per second (expressed in Hertz or Hz) at which a system is running.
Frequency Control	The function to control the Frequency of electricity served through the Transmission System.
Frequency Response Ramp Rate	A ramp rate setting of **Power Park Modules,** or **Battery Storages** used for **Primary Response** purpose.
Full Load	Maximum net electrical output of a Generating Unit after Auxiliaries, measured at the Interconnection Point.
GCERP	Grid Code Enforcement and Review Panel
Generating Plant	Plant comprising one or several electricity Generating Units (including equipment at the Interconnection Point) and all electrical installations required for operation of the plant.
Generating Unit	A single facility for the generation of electrical energy

TERM	DEFINITION
Generator	A person or agency who generates electricity and who is subject to the Grid Code.
Generation Licensee	A person who has been granted a generation license by PUCSL.
Generator Reactive Performance Chart (Capability Curve)	A diagram which shows the MW and MVar capability limits within which a Generating Unit is expected to operate under steady state conditions in the manner prescribed by the manufacturer of the alternator.
Governor	The equipment fixed to Generating Unit that controls its speed
Governor Speed Droop	In relation to the operation of the Governor of a Generating Unit, the percentage drop in Transmission System Frequency which would cause the Generating Unit under free Governor action to change its output from zero to full load.
GOSL	Government of Sri Lanka
Grid	The part of the Total System which is owned and operated by the Transmission Licensee, also referred to as the Transmission System
Grid Code	The Grid Code of Sri Lanka.
Grid Substation	There was no definition before. Need a definition: we propose "A facility at which electricity is converted from HV to MV"
Harmonic Voltage Compatibility Level	A maximum level under which the power grid can operate normally, taking into account the impact from nonlinear characteristics of equipment connected to the **Transmission System.** It represents a statistical measure of the overall condition of the **Power System** from a harmonic performance point of view**.**
Harmonic Voltage Planning Level	Maximum allowable voltage harmonic level at a specific point of connection and is relevant for the determination of any new **User** apportion.
High Voltage or HV	Voltage above 33,000 Volt (33 kV).
HV Apparatus	High Voltage electrical circuits forming part of a system.
Hydropower Station	A hydroelectric Power Station.
IEC	International Electrotechnical Commission
Interconnection Point	The point at which a Generating Plant, a Power import source, a Distribution Licensee system or a Transmission Customer system is connected to the Transmission System as specified in the relevant purchase/sales agreements, as applicable.
Intermittent Resource	The primary source of power for a Generating Unit that cannot be considered as controllable e.g. wind, wave or solar
Inverter Based Renewable Energy Technologies (IBRE)	Generating plants that produce electrical power using renewable energy resources with inverter based technologies
License	A License granted by PUCSL for the purpose specified.
Licensee	Licensee or License Holder is a person or business entity to whom a License or Authorisation is issued by PUCSL, under the Public Utilities Commission of Sri Lanka Act No 35 of 2002 and Sri Lanka Electricity Act No 20 of 2009, for carrying out Generation, Transmission, Distribution and Supply of electrical energy.

TERM	DEFINITION
Limitation of Access	A permit issued by an Authorised Person defining the limits and nature of work which may be carried out in the vicinity of live apparatus.
Limited Frequency Sensitive Mode	A mode whereby the operation of the **Power Park Modules** is frequency insensitive except when the **System Frequency** exceeds the predefined frequency threshold, from which point Limited Frequency Response shall be provided. For **Power Park Modules** operation in **Limited Frequency Sensitive Mode** would require **Limited Frequency Sensitive Mode – Overfrequency (LFSM-O)** capability and **Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)** capability.
Limited Frequency Sensitive Mode – Over frequency (LFSM-O)	A **Power Park Modules** operating mode which will result in **Active Power** output reduction in response to a change in **System Frequency** above a certain value.
Limited Frequency Sensitive Mode – Underfrequency (LFSM-U)	A **Power Park Modules** operating mode which will result in **Active Power** output increase in response to a change in **System Frequency** below a certain value.
Licensee Information Submission System or LISS	A facility through which all Licensees are required to submit the required information on line to the PUCSL.
Load	The Active and Reactive Power, as the context requires, generated, transmitted or distributed, and all similar terms shall be construed accordingly.
Load Following Capability	The ability of a Generating Unit to operate, continuously adjusting its generating output in accordance with the Demand fluctuations, while maintaining its speed within specified limits.
Loss of Load Probability (LOLP)	The percentage of time during which the System Load exceeds the available Generation capacity in the System.
Medium Voltage or MV	Above 400 Volt, up to and including 33,000 Volt
Minister	Minister in charge of Power in the Democratic Socialist Republic of Sri Lanka
Operating Margin	Extra Generation capacity comprising Contingency Reserve and Operating Reserve, that is required in a System to cover uncertainties in plant availability, deviation of Demand from its Forecast value, loss of external connections, loss of Generation, weakness of the Transmission System and other factors so that the system is operated within the specifications and standards of the License.
Operating Reserve	The additional output from Generating Plant and/or the reduction in Demand which is available to respond to manage the mismatch between Generation and Demand.
Outage	In relation to a Generating Plant, a total or partial reduction in availability owing to failure or maintenance of the plant or its Auxiliary System; or an interruption in supply of fuel. In relation to the Transmission System, the removal of any part of the Transmission System owing to a breakdown or maintenance.
Output	The actual output at the Interconnection Point of a Generating Plant derived from data measured pursuant to the Grid Metering Code.
Overall Accuracy	The combined accuracy of meters and instrument transformers whose secondary circuits feed the meters.

TERM	DEFINITION
Partial Failure	The condition existing when all generation as well as electricity supply from all external connections to a part of the Total System has ceased, causing loss of power to more than five (5) Grid Substations Transmission Customers. That part of the System is therefore cannot begin to function without the Transmission Licensee's directions relating to restoration.
Part Load	Condition of a Generating Unit which is loaded but is not running at its declared availability.
Party	Any person, corporate body, company, organisation, authority, firm or association subject to the provisions of the Grid Code.
Permit to Isolate	A permit issued by the Control Person to release the apparatus from the service as requested by the Competent Person/Authorized Person as appropriate.
Permit to Work (PTW)	A permit signed and given by an Authorised Person to a person in charge of work defining the work to be carried out on any earthed HV Apparatus for the purpose of making known to such person exactly what apparatus is dead, isolated from all live conductors, discharged, connected to earth, and on which it is safe to work.
Planned Outage	An Outage in relation to a Generating Plant or items of Power Station Equipment which has been planned and agreed with the Transmission Licensee in advance of the year in which it is to be taken. Planned outage also means the outage of any part of the Transmission System which may affect supply to a Distribution Licensee's system or a Transmission Customer, which is intimated by the Transmission Licensee to the Distribution Licensee or the Transmission Customer.
Policy Guidelines	General Policy Guidelines issued with respect to fuel diversity and the preferred fuel for new electricity generation, as provided in section 5(2)(b) of SLEA20, and approved as provided for in section 5(3) of SLEA20.
Power Factor	Ratio of active power (kW) to apparent power (kVA)
Power Park Module	Multiple interconnected **Generating Units** (S**PVG units** or **WTG units**) that have a common **Connection Point** and utilize renewable energy as the primary energy source.
Power Park Module User/Owner	An entity who owns/operates a power park module connected to **CEB's** AC grid.
Power Purchase Agreement	The Agreement entered into between a Generator and the Transmission Licensee pursuant to which the Transmission Licensee, amongst other matters, agrees to purchase electrical energy from the Generator at an identified Interconnection Point between the Generator and the Transmission System.
Power Station	An installation comprising one or more Generating units owned and/or controlled by the same Generator, which may reasonably be considered as being managed as one entity.
PPA	Power Purchase Agreement

TERM	DEFINITION
Protection	Provisions for detecting abnormal conditions on a system and initiating fault clearance, and activating alarms and indications.
Prudent Utility Practices	Any of the practices, methods and acts not specified in any specific standards, but has consistently shown results superior to those achieved with other means and generally accepted by the electric Utility industry as most appropriate to accomplish the desired results at a reasonable cost.
PUCSL	Public Utilities Commission of Sri Lanka incorporated under PUCSL Act, 2002.
Reactive Power	The product of voltage and the quadrature component of alternating current measured in units of volt-amperes reactive (Var).
Reactive Energy	The integral with respect to time of the Reactive Power measured in units of volt ampere hour reactive.
Reference Case (Plan)	Plan developed by adhering to least cost principles including only existing power plants of any description already in operation as of 1st January of the current year of the Plan, new power plants that fulfil least-cost principles, but excluding candidate power plants required to be included owing to Policy Guidelines.
Renewable Energy Desk (RED)	A real time control and monitoring system in which the control and data collection functions of IBRE are carried out from a central station through a communications system. Based on this data and the system requirements System Operator can issue control instructions via this desk to respective IBRE where applicable.
Rotational Load Shedding	Planned Disconnection of Customers on a rotational basis during periods when there is a significant shortfall of generation required to meet the total Demand.
Resource Following Ramp Rate	A ramp rate setting of **Power Park Modules** used during Start-Up and normal operation.
Sanction for Test	A permit signed and given by an Authorised Person to a person in charge of testing any apparatus connected to the Transmission or Distribution System for the purpose of making known to such person exactly what apparatus is to be tested, and the condition under which the testing is to be carried out.
Safety Precautions	Methods and procedures adopted to ensure safety and avoid danger when working in a hazardous environment. In relation to working on HV Apparatus, this entails but is not limited to Isolation and/or Earthing.
Safety Procedures	The procedures specified within a safety management system.
Set-Point Ramp Rate	A ramp rate setting of **Power Park Modules, or Battery Storages** used for **Active Power** control during **AGC** control process.
Shutdown	The condition of the equipment when it is de-energised or disconnected from the Transmission System or the Distribution System.

TERM	DEFINITION
Significant Incident	An event with a significant effect on either the Transmission System or a User's System, and usually entails one or more of the following operational effects: Tripping of plant and/or apparatus manually or automatically Voltage outside statutory limits System Frequency outside statutory limits System instability System overload Whether an event has a significant effect on a system is determined by the entity (Transmission Licensee or User) that owns that system.
Single Buyer	Transmission Licensee in relation to the Bulk Supply and Operations business.
SLEA20	Sri Lanka Electricity Act no 20 of 2009.
Spinning Reserve	Unloaded generating capacity, which is Synchronised to the system and is ready to provide increased generation at short notice pursuant to Dispatch Instruction or instantaneously in response to a Frequency drop.
Supervisory Control and Data Acquisition (SCADA)	A real time control and monitoring system in which the control and data collection functions are carried out from a central station through a communications system. System data is monitored and fed back to the central terminal continually, based on which control instructions are issued to all parts of the system. The communication system can be fibre optics, power line carrier, microwave or any other means of communication.
Synchronised	The condition where an incoming Generating Unit or system is connected to another system so that the Frequency and phase relationships of that Generating Unit or system, as the case may be, and the system to which it is connected are identical. The terms "Synchronise" and "Synchronisation" shall be construed accordingly.
Synthetic Inertia	A facility or system service provided by a **Power Park Module** system to replicate the effect of inertia of a **Synchronous Generating Unit** to a prescribed level of performance during a frequency deviation.
System Operator	Transmission Licensee in relation to its Operations Business including System Control Centre of the Transmission Licensee performing functions of a load dispatch centre and associated activities in planning, operations and control.
System Short Circuit Ratio (SSCR)	A measure of AC system strength at an interconnection point. It is typically defined as the ratio of the rated power of a piece of equipment (e.g. **Power Park Module** or **Synchronous Generating Unit**) to the short circuit power at the point of interconnection.
Transmission Customer	Customers/Consumers connected to the Transmission System and included in the License.
Transmission Licensee	Ceylon Electricity Board appointed through a license issued by PUCSL to carry out functions of Transmission Business and the Bulk Supply and Operations Business.

TERM	DEFINITION
Transmission System	The system which is owned and operated by the Transmission Licensee and which consists (wholly or mainly)of High Voltage transmission lines and generating plant, and which is used for transmitting electricity from a Generating Plant to a Substation, from one Generating Plant to another or from one Substation to another, including all High Voltage transmission lines which are used to convey electricity to the premises of Transmission Customers (but shall not include any such lines which form part of any Distribution System).
Total Failure	The condition of complete loss of generation in the Total System with no electricity supply from any External Interconnection. The Total System will not begin to function again without the Transmission Licensee's directions relating to Black Start.
Total System	The Transmission System and all systems of Users of the Transmission System connected directly or connected through the system of another Licensee.
Under-frequency Relay	An electric measuring relay intended to operate when its characteristic quantity (Frequency) decreases below the relay setting by decrease in Frequency.
Unserved Energy	The amount of energy which may not be served per year owing to generating capacity deficiencies or shortages.
User	Person or entity that is connected to the Transmission System. More specific definitions are identified in relevant codes.
User System or User's System	Any system owned or operated by a User including Generating Units, Distribution Systems and Customer equipment together with plant and/or Apparatus connecting them to the Transmission System.
Utility	Any person or entity engaged in the generation, transmission, sale, distribution or supply of electrical energy, as the case may be.
Virtual Metering Point	An effective point of measurement that may or may not be physically locatable, where active energy or reactive energy deemed to have been transferred through the point is derived from an algorithmic manipulation of the active energy and reactive energy data of one or more metering points.
Water Management Secretariat	The secretariat established to coordinate the management of surface water resources in Sri Lanka
WMS	Water Management Secretariat
WTG	Wind Turbine Generator

2 GRID PLANNING CODE

2.1 INTRODUCTION

The Grid Planning Code (**GPC)** specifies the planning criteria and procedures to be applied by the Transmission Licensee in

(a) planning of investments on the Transmission System (Grid) and (b) planning of investments on generation expansion.

Users of the Transmission System shall take into account the **GPC** when planning and developing their own systems, and shall take note of certain information to be supplied by them.

The Transmission System needs to be planned with sufficient lead time to allow any necessary statutory planning consent, the associated possibility of the need for a public consultation and the degree of complexity in undertaking the new work while maintaining satisfactory security and quality of supply in the existing Transmission System.

This **GPC** therefore imposes time scales for the exchange of information between the Transmission Licensee and Users, subject to all parties having regard, where appropriate, to the confidentiality of such information.

2.2 APPLICABILITY

The **GPC** applies to the Transmission Licensee, all existing Transmission System Users, prospective Users, and parties who are authorised to carry out distribution and supply activities and are connected to the Grid.

2.3 OBJECTIVES

Objectives of the **GPC** are to,

(a) enable the Transmission System to be planned, designed and constructed to operate in an economical, safe and reliable manner, conforming to the relevant acts of Parliament, regulations, rules, Licences and guidelines, standard specifications including other relevant manuals, and construction standards,
(b) ensure that the electricity generation required at a specified reliability, to meet the System Demand, is procured at the least cost,
(c) facilitate the use of the Grid by any User or party seeking connection to it,
(d) establish technical conditions and criteria for acceptable performance at the interface between the Grid and Users' Systems,
(e) facilitate the exchange of system data between Users and the Transmission Licensee, and
(f) provide information for a User to assess opportunities for connection, and to plan and develop its system so as to be compatible with the Transmission System.

In pursuance of the above objective, the **GPC**,

(i) defines the procedure for the exchange of data between the Transmission Licensee and a User in respect of any proposed development on the User's System which may have an impact on the performance of the Transmission System,
(ii) details the data which the Transmission Licensee shall make available to Users in order to facilitate the identification and evaluation of opportunities for use of or connection to the Transmission System, and
(iii) details the data required by the Transmission Licensee from Users, for the Transmission Licensee to plan the development of its Transmission System to facilitate proposed User developments,

and specifies the planning criteria which will be applied by the Transmission Licensee in the planning and development of the Transmission System.

2.4 RESPONSIBILITIES

2.4.1 TRANSMISSION LICENSEE

The Transmission Licensee shall be responsible for the following:

(a) Examining the present Transmission System and proposing solutions in respect of voltage levels, loading of equipment, switchgear ratings, power quality, system loss, reliability and security of supply.
(b) Planning the expansion of the Transmission System to meet the forecast Demand taking into consideration the impact of the increase in Demand and the expansion of,
    (i) Distribution Systems of Distribution Licensees,
    (ii) Transmission Customers,
    (iii) Generating Units as proposed in the Long Term Generation Expansion Plan, and (iv) any other parties connected to the system.
(c) Planning the system ensuring that the Transmission System will have the capability to meet the laid down criteria in relation to voltage, loading of switchgear, equipment ratings, power quality, system loss, reliability, and security of supply.
(d) Preparation of the Long Term Transmission Development Plan as laid down in this GPC.
(e) Assessing of resource plans for generation by renewable resources including hydro, wind, solar and biomass.
(f) Preparation of the Long Term Generation Expansion Plan as laid down in this GPC.
(g) Reviewing and recommending changes to the planning criteria on a periodic basis.
(h) Monitoring the implementation of the planned proposals.

2.4.2 USERS

Grid Users shall be responsible for,

(a) submitting all data the Transmission Licensee will require for planning the Transmission System, and
(b) keeping the Transmission Licensee informed of retirement of any Generating Units, and of closing down installations connected to the Grid, at least 12 months in advance.

Section 1 –TRANSMISSION PLANNING

2.5 TRANSMISSION SYSTEM

The Transmission System is the system which is owned and operated by the Transmission Licensee, and which consists (wholly or mainly) of High Voltage electricity transmission lines and power plants, and which is used for transmitting electricity from a Generating Plant to a Substation, from one Generation Plant to another, or from one Substation to another, including all High Voltage transmission lines which are used to transmit electricity to the premises of Transmission Customers (but shall not include any such lines which form part of any Distribution System).

2.6 LONG TERM TRANSMISSION DEVELOPMENT PLAN (LTTDP)

Long Term Transmission Development Plan (LTTDP) is a document that will,

(a) address the capability of the Transmission System to meet the present Demand on the Transmission System and future loads to be connected to the Transmission System,

(b) address the Transmission System limitations in meeting such Demands in accordance with the specified Transmission System planning criteria,
(c) address short term and long term infrastructure needs, identified using the best possible engineering analysis while meeting transmission planning criteria,
(d) accommodate proposed power generating plants in the Long Term Generation Expansion Plan, and to fulfil Policy Guidelines of GOSL, and
(e) identify appropriate capital expenditure requirements for the implementation of the proposals in (c) and (d).

Each new addition or replacement shall be made in an optimal manner, giving due consideration to technical, economic and social factors, so that the expenditure is commensurate with the benefits.

2.7 THE PLANNING PERIOD, FREQUENCY OF UPDATES AND DATE OF SUBMISSION

The planning period shall be ten (10) years, commencing from the first year after the year in which the plan is published.

The Transmission Licensee shall update the transmission plan at least once in two years. The plan shall be documented in the form of a report titled "Long Term Transmission Development Plan [*starting year – ending year*] (the LTTDP).

The start-year shall be the *current year+1*, and the ending year shall be the *current year+10.*

As part of the business plan, the Transmission Licensee shall submit the LTTDP to PUCSL for approval, not later than the specified day of the year in which a tariff filing is due.

The Transmission Licensee shall publish and retain the most recent LTTDP approved by PUCSL, on the Licensee's web site.

2.8 COORDINATION OF PLANNING DATA

The Transmission Licensee will coordinate planning with Users connected to the Transmission System who shall provide planning data in a manner prescribed in the **GPC**.

2.9 DATA TO BE FURNISHED BY TRANSMISSION LICENSEE

The Transmission Licensee will furnish information and data to any User connected or party seeking connection to the Transmission System on request, as specified in the **GPC**.

Information and data shall be supplied by the Transmission Licensee to Users upon request, relating to a part or parts of the Transmission System as specified in the request, to enable them to assess opportunities for connecting to and using the Transmission System.

2.9.1 TRANSMISSION LICENSEE SYSTEM DATA

Transmission System data consists of salient features of the existing Transmission System and the future system as contained in the prospective LTTDP. Such data shall include the following:

(a) The single line diagram of the Transmission System indicating the existing and proposed power plants and transmission lines,
(b) The map of Sri Lanka showing the existing lines of the Transmission System and proposed lines scale: 1cm = 10 km.

Distribution data shall be confined to Grid Substations indicating 33kV (in case of 132/33kV Grid Substations), 11kV (in case of 132/11kV Grid Substations) bus bars. The Transmission Licensee will furnish a single line diagram of the Grid Substation nearest to the area of the Distribution Licensees. The Transmission Licensee shall also furnish to Users, the data specifically required by them.

The Transmission Licensee shall obtain prior consent from a User for supplying the data of that User to another User.

2.9.2 DATA TO BE FURNISHED BY TRANSMISSION LICENSEE ON DEMAND

The Transmission Licensee will furnish any other data as may be reasonably required to enable a User or prospective User to identify and evaluate the opportunities available when connecting to and making use of the part or parts of the Transmission System specified in the request. If so required, the Transmission Licensee will also offer its views on the suitability of the parts of the Transmission System specified in the request for new connection and delivery or supply of further quantities of electricity.

2.9.3 CHARGES FOR DATA

The Transmission Licensee shall be entitled to charge the User requesting any Transmission System data any reasonable costs in providing the data and shall notify the User of such costs within a reasonable time, after receipt of a specific request. Subject to the User paying the cost as notified within the specified time, the Transmission System data shall be furnished within a reasonable time following the User's request, depending on the nature and complexity of the data requested.

2.9.4 TRANSMISSION LICENSEE'S RIGHT TO WITHHOLD INFORMATION

The Transmission Licensee shall be entitled to withhold any Transmission System information if, in the reasonable opinion of the Transmission Licensee, disclosure of such information would seriously and prejudicially affect the commercial interests of the Transmission Licensee. However, the Transmission Licensee shall not withhold the minimum information where it is clear that the User cannot carry out his business without such information.

2.9.5 CONFIDENTIALITY OF INFORMATION

All information supplied by the Transmission Licensee to any User shall be treated as confidential and should not be divulged to a third party. The information shall be used only for the purpose for which it is furnished.

2.10 DATA TO BE FURNISHED TO TRANSMISSION LICENSEE

Users or a party seeking connection to the Transmission System shall be required to furnish data to the Transmission Licensee as specified in the **GPC**.

2.10.1 DISPOSITION OF DATA TO BE SUPPLIED BY USERS TO TRANSMISSION LICENSEE

Each User shall furnish data to the Transmission Licensee regarding its system,

(a) to update the database for carrying out system studies and system planning of the Transmission Licensee,
(b) to formulate the overall 10-year plan for the Transmission System,
(c) to review the progress of new projects and developments earlier approved within the 10-year plan, and
(d) to confirm compliance with the requirements under its License and under the Grid Code.

The Transmission Licensee shall process all data and prepare a comprehensive plan.

2.10.2 CATEGORIES OF PLANNING DATA

Planning Data to be submitted by Users are divided into three main categories as Preliminary Project Planning data, Committed Project Planning Data and Standard System Planning Data.

(a) Preliminary Project Planning Data
This refers to the data that need to be submitted by a prospective User when submitting an application for a new project or a modification to an existing project. The data shall be submitted along with application for new connections, for addition of new lines and Substations, or for any modification of lines and equipment which may materially affect the performance of the Transmission System. The data shall be submitted by Users connected to the system in accordance with this **GPC**.

(b) Committed Project Planning Data
Upon receiving confirmation of the formal acceptance of the application, the prospective User shall be required to submit additional data for the purpose of carrying out detailed studies. These are categorised as the Committed Project Planning Data.

Committed Project Planning Data will not be treated as confidential and the Transmission Licensee may disclose such information to other parties.

For managing the data efficiently, the Transmission Licensee may categorise the data so submitted as Forecast data (generation), Estimated equipment data (values and parameters related to plant and equipment) and Registered equipment data (data of the plant/equipment used in the connection).

(c) Standard System Planning Data
By 15th April each year, standard planning data (Appendix B) shall be submitted by all Users connected to the Transmission System and prospective Users who have received a connection offer from the Transmission Licensee.

2.10.3 PLANNING DATA

(a) Transmission
The Transmission Licensee will update its Standard Planning Data in the format prescribed in **Appendix B**. The data will be updated in accordance with this **GPC**.

(b) Generators
The data shall be submitted along with the application for new connections, for addition of a new Generating Unit, or for any modification of Plant or equipment which may materially affect the performance of the Transmission System. The data shall be submitted by Users connected to the Transmission System in accordance with this **GPC**.

(c) Generators with IBRE
The data shall be submitted along with the application for new connections, for addition of a new Generating Unit, or for any modification of Plant or equipment which may materially affect the performance of the Transmission System. The data shall be submitted by Users connected to the Transmission System in accordance with the clause no 3.17.6 of **GPC**.

(d) Embedded Generators
Embedded generators shall furnish data in the formats prescribed by the Transmission Licensee for each entity.

(e) Distribution
Distribution Licensees shall submit comprehensive distribution system development plans once in two years to the Transmission Licensee. The plans should include (i) methodology and load (MW and MVar) forecast, (ii) methodology and results of distribution loss forecast, (iii) MV development proposals, (iv)

requirements for new MV in-feeds, and (v) spot loads greater than 2MW. Furthermore, Distribution Licensees will provide other information such as past and forecast data on area electricity sales, demand (MW and MVar) data of primary Substations, and the percentage area loads fed by each Grid Substation.

The basis of planning shall be the Distribution System Development Plan as prepared under the Distribution Code, and formulated by each Distribution Licensee. It shall be modified from time to time to suit the circumstances in the best interest of the Transmission System as a whole. After a period determined jointly by the Transmission Licensee and Distribution Licensees, Distribution Licensees shall independently formulate their Distribution System Development Plan.

Transmission Licensee and Distribution Licensees shall jointly work and shall consolidate the individual Distribution System Development Plans for the entire country. The Transmission Licensee shall validate and modify the plans, if necessary, after studying the methodology and comparing them with historic data.

(f) Transmission customers

Transmission Customers, who are specified under section 17 of the SLEA20, shall submit their expansion plans and future power requirements to the Transmission Licensee.

2.10.4 DATA SUBMISSION FORMATS

(a) Generators directly connected to the Transmission System, IBRE, Distribution Licensees and Transmission Customers shall furnish data as described in **Appendix B Section 2.**

(b) In all cases (i.e. standard planning data of Generation and Distribution), information and data shall be submitted in the format prescribed in **Appendix B Section 2,** and supported with a note covering items not included in Appendix B.

2.10.5 ADDITIONAL SPECIFIC DATA

In addition to the above, the Transmission Licensee may, following receipt of Planning Data, seek clarification and/or additional information from the User in respect of the data provided.

2.10.6 CONFIDENTIALITY OF INFORMATION

Until such time as a Connection Agreement is entered into between the Transmission Licensee and a User, data shall be treated as confidential by the Transmission Licensee and shall not be disclosed to third parties.

If, for carrying out planning or for discharging other functions of a Licensee, additional data other than what is prescribed in this **GPC** and its appendices is required by the Licensee from another Licensee, such data may be exchanged by mutual consent at any time subject to the general conditions in this **GPC**.

2.11 WAIVING OF REQUIREMENT TO SUPPLY DATA

Supply of certain items of data prescribed in this **GPC** may be waived at any time by means of a written statement by the data recipient Licensee on request by the data supplying Licensee.

2.12 TRANSMISSION PLANNING STUDIES

In preparing the Long-Term Transmission Development Plan, the Transmission Licensee will use the most recent version of the following studies conducted by relevant Licenses.

(a) Transmission System studies
(b) Distribution System studies
(c) Generating stations studies
(d) Protection System studies
(e) Harmonic studies

(f) Voltage assessment studies

2.12.1 TRANSMISSION SYSTEM PLANNING CRITERIA

The Transmission Licensee will determine the Transmission System planning criteria in coordination with other Users such that the planned Total System maintains its statutory limits within the planning period. In determining the planning criteria, the Transmission Licensee shall consider the parameters of other Licensees including planning criteria stated in the Distribution Code, transformer ratios, and maximum fault rating.

The planning criteria will include,

(a) Voltage criteria
(b) Thermal criteria
(c) Security criteria
(d) Stability criteria
(e) Short circuit criteria
(f) Load security criteria

The nominal Frequency shall be 50 Hz with a Frequency variation of □1% under normal planned operations

The applicable planning criteria are given in **Appendix A Section 2.**

2.12.2 TRANSMISSION SYSTEM STUDIES

The following transmission planning studies shall be conducted to formulate the LTTDP. (a) Load flow studies
(b) Contingency studies
(c) Short circuit studies
(d) Stability studies

The Transmission Licensee shall develop schemes to enhance the performance of its Transmission System. Areas in which such improvements are required will be determined by the Transmission Licensee from time to time.

2.12.3 DISTRIBUTION SYSTEM STUDIES

The Distribution System is connected to the Transmission System at Grid Substations either at 33,000 V or 11,000 V. Distribution Licensees, who own, operate and maintain the Distribution System shall in general follow the system design criteria as outlined in the Distribution Code.

Distribution Licensees shall prepare plans for modification of their protection systems and switchgear, and for installation of Under-frequency Relays, and obtain concurrence of the Transmission Licensee. The Transmission Licensee may advise on suitable modifications and improvements to the Distribution System such as special maintenance and replacement of parts that are necessary to reduce frequent fault tripping and their impacts on the Transmission System.

The Transmission Licensee may require Distribution Licensees to install shunt capacitors at specific locations urgently by invoking this sub-section of the GPC, to improve the Power Factor at various locations of the Transmission System. The foregoing is one instance wherein the Transmission Licensee requires modification/improvement to the Distribution System to mitigate strain on parts of the Transmission System.

The national Load forecast will be prepared by the Transmission Licensee, and Load forecasts of Distribution Licensees should correspond with the national Load forecast.

2.12.4 GENERATING STATION STUDIES

After detailed studies, the Transmission Licensee may advise Generators to install Power System Stabilisers to their Generating Units, if necessary, to enhance the performance of the Transmission System. The Transmission Licensee may also advise Generators to replace or modify AVR and turbine Governors. Generators shall carry out any modifications recommended by the Transmission Licensee if technically feasible. Under this provision, the Transmission Licensee shall not demand replacement of the main capital equipment. The cost of all modifications shall be borne by Generators, although such modifications are carried out as required by the Transmission Licensee for improving the stability and security of the Transmission System. Specifications of existing equipment (e.g. exciter, Governor and AVR) shall be furnished by Generators to the Transmission Licensee on request to study and examine the suitability with regard to performance of the Transmission System and for recommending modifications or replacements.

2.12.5 PROTECTION SYSTEM STUDIES

The Transmission Licensee shall ensure that all protection schemes in the Transmission System are capable of clearing electrical faults within acceptable time durations. It is the responsibility of the Transmission Licensee to develop and expand protection schemes in the Transmission System, and include plans for such development and expansions, in the Long-term Transmission Development Plan.

Each User is required to submit data of their system, current and planned, required for planning the above developments and expansion, as and when required.

The Transmission Licensee will study proposals from Users to modify the protection and control system of the Transmission Licensee and minor modifications to the Transmission System to prevent adverse impacts on the systems of Users, and will implement changes necessary based on the results of the study.

2.12.6 HARMONIC STUDIES

Each User is required to submit data of their system; present and planned, required to evaluate the generation/propagation of harmonic distortion in the Transmission System and the User's systems, especially when connecting equipment such as capacitor banks, to the Transmission Licensee, as and when required.

2.12.7 VOLTAGE ASSESSMENT STUDIES

Each User is required to submit data of their systems; present and planned, to conduct detailed voltage assessment studies, such as to examine potential voltage instabilities, voltage control coordination or to calculate voltage step changes, to the Transmission Licensee, as and when required.

2.13 IMPLEMENTATION

Studies may require modifications to be made to User systems including equipment.

Implementation of any modification work may be re-scheduled or postponed by mutual consent. A Licensee may request for postponement for technical reasons or due to funding difficulties. If parties fail to reach an agreement the dispute shall be resolved as prescribed in the General Code.

2.14 LONG TERM TRANSMISSION DEVELOPMENT PLAN

The Transmission Licensee shall submit to PUCSL, as a part of the business plan, a report titled "Long Term Transmission Development Plan [*starting year-ending year*] (LTTDP), which would include the following sections:

(a) Methodology
    (i) Transmission planning procedure
    (ii) Planning criteria
(b) Grid Substation peak Demand Forecast
(c) Transmission system analysis
    (i) Steady state system analysis – 10 year period
    (ii) Normal operating conditions
    (iii) Single contingency operating conditions
    (iv) Transient stability analysis
    (v) Short circuit analysis
    (vi) Transmission System development plan
    (vii) Transmission System expansion proposals
    (viii) Power plant connection proposals
    (ix) Other transmission system development proposals
(d) Investment plan
(e) Economic evaluation
(f) Recommendations on implementation of LTTDP

Section 2 - GENERATION PLANNING

2.15 LONG TERM GENERATION EXPANSION PLAN (LTGEP)

The objective of generation expansion planning is to aim at serving the demand at a specified level of reliability, at the lowest possible cost. Generation expansion planning shall be distinctly different from economic dispatch, which relates to existing and committed power plants.

The Long Term Generation Expansion Plan (LTGEP), in the minimum, shall address the following.

(a) Preparing the Demand Forecast
(b) Analysis of operations of the hydro-thermal system for each year in the planning period.
(c) Identifying candidate generating units and technologies.
(d) Determination of the economically optimal mix of generating units to meet the Forecast Demand at specified reliability levels, for each year in the planning period.
(e) Sensitivity of the proposed Generation Expansion Plan to key input parameters including fuel prices, Demand Forecast, discount rates, Policy Guidelines, and desired reliability levels.

2.16 PLANNING PERIOD, FREQUENCY OF UPDATES AND DATE OF SUBMISSION

The planning period shall be twenty (20) years, commencing from the first year after the year the plan is prepared.

The Transmission Licensee shall update the generation expansion plan once in two years. The plan shall be documented in the form of a report titled "Long Term Generation Expansion Plan [*start year – ending year*] (referred to as the "the LTGEP").

The start-year shall be the *current year+1*, and the ending year shall be the *current year+20*.

As a part of the business plan, the Transmission Licensee shall submit the LTGEP for the approval of PUCSL not later than the specified date of the year in which a tariff filing is due.

The commission shall review the plan for compliance with the guide lines provided herein, request for the clarifications and, request for amendments (if any) on the basis of submissions made by Generation and Distribution Licensees as stipulated in the Section 43 of SLEA and approve the plan.

The Transmission Licensee shall publish a summary of the approved LTGEP on the Licensee's web site.

2.17 DEMAND FORECAST

The Plan shall be prepared based on the Demand Forecast prepared by the Transmission Licensee.

Transmission licensee shall analyze historic demand variation, past socio-economic development, and any other significant factors which affect for the electricity demand and adopt an appropriate methodology for the preparation of the long-term demand forecast.

Transmission licensee shall consider and incorporate the loads from future planned major development projects and any other significant impact on future electricity demand by analysing load profiles and economic indicator projections.

Annual demand forecast of initial years (minimum 5 years) shall be verified with sales forecasts (including roof top solar demand) of distribution licensees.

2.18 GENERATION PLANNING PARAMETERS

2.18.1 PEAKING AVAILABILITY

The peaking availability of hydropower plants and thermal plants shall be in accordance with data furnished by the respective Generation Licensees. For new power plants considered as candidates, prudent information shall be used.

2.18.2 POWER SUPPLY SECURITY CRITERIA

To ensure that the generation reserve is sufficient to meet the Demand, even if one or more units are out of service for scheduled maintenance or in the event of non-availability of adequate hydropower generation capacity during the Driest Condition, adequate reserve capacity shall be built into the system as given in **Appendix A Section 2.1.2**.

The key planning criterion of Reserve Margin and Loss of Load Probability (LOLP) for generating system security shall be as given in **Appendix A Section 2.1.2**.

Spinning reserve requirement should be determined based on IBRE projections. The criteria used to determine the additional reserve requirement due to the connection of IBRE is given in **Appendix A Section 2.1.2.**

2.19 ECONOMIC PARAMETERS

2.19.1 REFERENCE DATE FOR COSTS

All cost and price estimates shall reflect economic conditions as on 1st January of the *current year* of the LTGEP. Costs shall exclude taxes and duties, and will be expressed in constant terms.

2.19.2 COST DATABASE

Capital and operating cost estimates of existing power plants and new generating units planned for system addition shall be developed by the Transmission Licensee.

Prior to commencing studies, the Transmission Licensee shall ensure that the operating costs of existing power plants are updated in accordance with the PPAs with Generation Licensees.

In the case of candidate power plants, the Transmission Licensee shall ensure that the most up to date information from feasibility studies, pre-feasibility studies and other studies will be used. The required studies shall be commissioned periodically by the Transmission Licensee, to ensure that the cost database is updated prior to commencing the studies.

Fuel Prices considered for planning studies shall be economic (border) prices as applicable on 1st of January of the current year of LTGEP which is decided considering, representative of the price variations in the recent past (for minimum of one year) and future projections from reliable sources.

2.19.3 PLANT ECONOMIC LIFE CRITERIA

For planning studies, the economic life of new generating plants shall be assumed as given in **Appendix A 2.1.2.**

The remaining economic life of existing generating plant or plants that are in the process of being built, will be limited to the duration as specified in the **Appendix A Section 2.1.2**.

2.19.4 VALUE OF UNSERVED ENERGY

The value of Unserved Energy shall be considered in the economic analysis to develop the LTGEP, and for each sensitivity study. The value of Unserved Energy shall be an appropriate value determined by the Transmission Licensee. The method used to determine the value of Unserved Energy will be described in the LTGEP.

2.19.5 REFERENCE YEAR FOR DISCOUNTED CASH FLOW ANALYSIS

For discounted cash flow analyses, the reference year shall be the *current year* of the Plan.

2.20 GENERATION PLANNING TOOLS

The Transmission Licensee shall select suitable optimisation tools to model the Demand and the generating system, and to generate and analyse the alternative combinations of power plants, and to conduct scenario studies.

2.21 DEVELOPMENT OF THE REFERENCE CASE, BASE CASE AND SENSITIVITY STUDIES

The LTGEP will develop and present cases of Long Term Generation Expansion Plan, under the following criteria:

(a) All capital costs expressed in constant currency terms, expressed in currency at the reference date, in economic terms (border prices)
(b) All fuel prices assumed to remain constant as of the reference date, and expressed in economic terms (border prices) (c) An economic discount rate.
(d) All other economic parameters remaining constant over the planning period
(e) All existing and candidate power plant costs shall include the cost of meeting the Sri Lanka Environmental standards, as applicable.

2.21.1 DEVELOPMENT OF THE REFERENCE CASE PLAN

Reference Case Plan shall be developed with exclusion of any Policy Guidelines on generation technology options that would cause the plan to deviate from least cost. However, Reference Case plan must comply with all the operational requirements of the power system and hence shall meet all the technical and reliability requirements of the power system, if implemented. The reference case plan is thus the unconstrained least cost plan and the total cost of reference case should give the total present value cost of generation expansion for the period unconstrained by policies.

Any comparison of costs of plans developed in the subsequent sections to include policies with the reference case should guide decision makers to calculate the "policy costs" of any such perceived or committed policies.

Candidate non-dispatchable power plants required to be included owing to policy guidelines issued by the commission or any of the Transmission Licensee's own policies, shall not be included in the reference case, unless the Transmission Licensee can demonstrate that such power Plant costs shall not violate the least-cost objective of developing the reference case. If such power plants are to be included, the Transmission Licensee requires developing a plan and a sequence of such power plant additions, and demonstrate that the reference case will continue to be least cost even after the addition of such non-dispatchable power plants.

2.21.2 DEVELOPMENT OF THE BASE CASE PLAN

The Base Case Plan shall be developed through the same procedure as the Reference Case, but shall include all the duly approved (committed) government policies and as prepared and issued under Section 5 of SLEA. Base Case plan also must consider Transmission Licensee's own guidelines to comply only with the operational requirements of the power system, which may require certain power plant investments (which may not be selected under strict least cost principles).

Any forced condition (other than duly approved government policies) that would not contribute to least cost objective shall not be considered in developing Base Case plan.

Investment requirements to implement the Base Case Plan shall be provided in economic terms.

The allowable amount and type of IBRE to be included in the system subject to Grid Integration study.

2.21.3 SENSITIVITY STUDIES

The LTGEP shall develop and present a number of sensitivity studies to examine the sensitivity of the Base Case Plan to variations in key input parameters. The variations to be modelled shall include variations such as,

(a) Discount Rate
(b) Demand Forecast
(c) Fuel Prices

The LTGEP shall present the inputs and results of the sensitivity studies and compare the key variations of results against the Base Case plan.

2.22 POLICY ANALYSIS AND SCENARIO ANALYSIS

In order to assist the decision makers to formulate policies, including those of specific generating technologies and fuel diversities, the LTGEP shall include analyses of certain perceived policies such as,

(a) Meeting a specified strategic fuel mix in generation by a given milestone year
(b) Meeting a target ratio of renewable energy in the generation mix
(c) Interventions to modify the load profiles by such strategies as demand-side management
(d) Interconnections with other countries
(e) Specific interventions by which the Transmission Licensee can demonstrate that the resulting plan would be of lower cost than the Base Case plan

Such analysis may also include, consideration of certain macro level implications such as externality cost to generation mix.

The list of such policies that should be included to policy analysis may be arrived at considering Transmission Licensee's own observations, requests from the commission, to analyse requirements given in the National Energy Policy or any other government policy document or considering requests from the Minister in-charge of the subject of Power.

The total cost of plans prepared under policies analysis (when compared with the reference case) should give the decision makers the costs of perceived policies.

The plan shall also include analysis of other scenarios, that the Transmission Licensee consider prudent and realistic.

2.23 STRUCTURE OF THE LONG TERM GENERATION EXPANSION PLAN

The Transmission Licensee shall submit to the Commission, , a report titled "Long Term Generation Expansion Plan [*starting year – ending year*]", which would include the following sections:

(a) The Existing and Committed Generating System
(b) Electricity Demand (Past and the Forecast)
(c) Thermal Power Generation Options for Future Expansion
(d) Renewable Generation Options for Future Expansion
(e) Generation Expansion Methodology and Parameters
(f) Development of the Reference Case
(g) Development of the Base Case and Sensitivity Analysis
(h) Policy and Scenario Analysis
(i) Analysis of Environmental Implications
(j) Review and Recommendation of Base Case Plan
(k) Implementation and Investment of Base Case Plan
(l) Contingency Analysis
(m) Comparison with Previous Plan

2.24 THE LEAST COST GENERATION EXPANSION PLAN

Once approved by the Commission, the Base Case of the LTGEP shall constitute the Least Cost Generation Expansion Plan on which the Transmission Licensee shall procure generation plants.

3 GRID CONNECTION CODE

3.1 INTRODUCTION

The Gird Connection Code (**GCC**) establishes minimum technical criteria with respect to design, connection, performance, protection and telecommunication requirements that need to be complied with by,

(a) the Transmission Licensee at the Interconnection Points,
(b) the Transmission Licensee when connecting new assets,
(c) Generation Licensees when seeking connection to the Transmission System or modifications of existing connections,
(d) Users when seeking connection to the Transmission System or modification of existing connections.

Establishment of such criteria will assure a safe, stable and secure Transmission System.

3.2 APPLICABILITY

GCC applies to the Transmission Licensee, all Users and all parties seeking connection to the Transmission System.

3.3 OBJECTIVES

Objectives of the **GCC** are to,

(a) specify technical, design and operational criteria at the Interconnection Points,
(b) specify data required by the Transmission Licensee from Users,
(c) specify data required by Users from the Transmission Licensee,
(d) ensure that the basic rules for connection to the Transmission System are clear and guarantee fairness and equality of treatment to all who request connections or modifications to existing connections, and
(e) ensure that any connection to the Transmission System will not cause unacceptable effects on the Transmission System or that it will not have any adverse effects on the User's system to be connected to it.

3.4 TRANSMISSION SYSTEM PERFORMANCE CRITERIA

The Transmission Licensee shall ensure that its system will operate in compliance with the limits given in relevant appendices to the GCC. Users who request new connections or modification of existing connections shall ensure that all their equipment will be able to be operated safely and reliably within the conditions specified in the relevant Sections of the Grid Code.

3.5 DECLARED VOLTAGE

Declared Voltages at the Interconnection Point shall be as given in **Appendix A Section 3.1,** whilst the nominal Frequency will be 50 Hz, with R-Y-B counter-clockwise phase rotation.

3.5.1 VOLTAGE LEVEL

Voltage level at which the User's installation is connected to the Transmission System will be decided by the Transmission Licensee based on the parameters of the User's system and the power to be injected or drawn out at the Interconnection Point.

3.6 SYSTEM POWER QUALITY

The Transmission Licensee will assess the power quality in the Transmission System with the parameters given below.

(a) Frequency variations
(b) Voltage variations
(c) Voltage waveform distortion
(d) Voltage fluctuations
(e) Unbalanced loading

3.6.1 FREQUENCY VARIATIONS

The Frequency of the system shall be nominally 50 Hz and shall be controlled within the limits of 49.5 Hz and 50.5 Hz unless abnormal conditions prevail. Under abnormal conditions, the system Frequency could fall or rise for system conditions specified in **Appendix A Table 3.1.B**. Users shall design their systems to operate under normal as well as abnormal conditions.

3.6.2 VOLTAGE VARIATIONS

The nominal voltages of the Transmission System will be as stated in the Grid Code. However, within the Transmission System, voltage may vary within the limits stated in **Appendix A Table 3.1.C.** Users shall design their systems to operate within these limits.

The Transmission Licensee and a User may agree to larger or smaller variations in voltage set out above in relation to a particular Interconnection Point, in so far as such a larger or smaller variation does not affect other Users.

3.6.3 VOLTAGE WAVEFORM DISTORTION

Allowed waveform distortion in the Transmission System is limited to that specified in **Appendix A Section 3.1(D)**. Users shall ensure that their connection to the Transmission System does not cause the level of distortion on the Transmission System at the Interconnection Point to exceed these limits. Prospective Users, who intend to connect their systems that generate harmonics, shall evaluate the production and propagation of harmonic distortion in the Transmission System and design their system so that distortions do not exceed the allowed limits. Such study reports shall be submitted to the Transmission Licensee. After each such User's System is connected to the Transmission System, the User shall measure and prove that distortions do not exceed the allowed limits.

3.6.4 VOLTAGE FLUCTUATIONS

Allowed voltage fluctuation in the Transmission System is limited to that specified in **Appendix A Section 3.1(E)**. Users shall ensure that their connection to the Transmission system does not result in exceeding the limits of fluctuation of supply voltage (producing flicker) on the Transmission System, at the Interconnection Point.

Users whose systems produce flicker, shall evaluate its effect on the Transmission System and design their system so that fluctuations do not exceed the allowed limits. Such study reports shall be submitted to the Transmission Licensee. After such a User's System is connected to the Transmission System, the User shall measure and prove that fluctuations do not exceed the allowed limits.

3.6.5 VOLTAGE UNBALANCE

Design of a User's system shall enable it to remain synchronised and connected to the Transmission System during an unbalance voltage condition, as specified in **Appendix A Section 3.1(F)**.

3.7 EQUIPMENT STANDARDS

All equipment used at the Interconnection Point, overhead lines, underground cables, Substations and User installations shall conform to applicable statutory obligations and comply with the relevant IEC standards. Where IEC standards are not available, the Transmission Licensee's specifications and publications shall be applicable. Prospective Users shall seek advice from the Transmission Licensee when necessary, in this regard, and the Transmission Licensee is required to comply with such requests.

The standards, publications and specifications referred to above shall be those prevailing at the time the plant or equipment was designed or manufactured. However, if any such equipment is reused or moved to a different location, then such standards, publications or specifications current at the time, shall become applicable.

3.7.1 BASIC IMPULSE LEVEL

Users shall ensure that their systems can withstand the impulse levels specified in **Appendix A Section 3.1(G)**.

3.7.2 POWER FREQUENCY WITHSTAND VOLTAGE

Users shall ensure that their systems can withstand the Power Frequency withstand voltages specified in **Appendix A Section 3.1(H)** for a period not less than one (1) minute.

3.7.3 SHORT CIRCUIT LEVEL

Users shall ensure the User's Systems can withstand the three phase short circuit levels specified in **Appendix A Section 3.1(I)**.

3.8 CURRENT DISTORTION LIMITS

The allowed current distortion limits are specified in **Appendix A Section 3.1(J)**. All Users shall ensure that their load current harmonic distortion does not exceed the allowed current distortion levels, at the Interconnection Point.

All Users and Prospective Users shall measure and evaluate the current harmonic distortion in the User's System or Generation system, and shall ensure that distortions do not exceed the allowed limits as specified in **Appendix A Section 3.1(J)**. Such measurement and study reports shall be submitted to the Transmission Licensee. After such new User's system is connected to the Transmission System, such User shall measure and prove that distortions do not exceed the allowed limits.

The method of measurement and preparation of study reports shall be as specified in **Appendix A Section 3.1(J).**

3.9 EMISSION LIMITS OF FLUCTUATING LOADS

The allowed emission limits are specified in **Appendix A Section 3.1(K)**. All Users shall ensure that the emissions from fluctuating loads do not exceed the allowed emission levels, at the Interconnection Point.

Users and prospective Users shall measure and evaluate the emission of fluctuations in the User's System and shall ensure that distortions do not exceed the allowed limits as specified in clause 3.11.1 of **Appendix A Section 3.1(K)**. Such measurement and study reports shall be submitted to the Transmission Licensee. After such new User's System is connected to the Transmission System, the User shall measure and prove that distortions do not exceed the allowed emission limits.

The method of measurement and preparation of study reports shall be as specified in **Appendix A Section 3.1(K).**

3.10 PROTECTION ARRANGEMENTS AND FAULT LEVEL CONSIDERATIONS

The Transmission Licensee shall ensure that its system is designed and operated in a manner to clear the abnormal conditions that may occur in the system in the minimum possible time, without causing any damages to the User's System or equipment.

The User shall ensure that all protection schemes on his side of the Interconnection Point are properly coordinated with protection systems of the Transmission System, and shall operate as required by the Connection Agreement, thus minimising adverse effects on the Transmission System during periods the User's plant and equipment remain connected to the Transmission System.

Protection schemes employed in the Transmission System and User's systems shall have appropriate backup protection schemes and breaker fail schemes. The Transmission Licensee shall provide all necessary information including maximum and minimum fault levels, maximum clearance times, auto-reclosing or sequential switching features to enable the User to design its protection system. Grid Users shall not change the protection relay settings without obtaining written permission from the Transmission Licensee.

Users shall obtain the approval of the Transmission Licensee for the protection systems and the protection settings employed in User's systems during the application process for connection.

3.11 NEUTRAL GROUNDING

The Transmission Licensee shall specify the grounding requirements of a system to be connected to the Transmission System to ensure that the User system grounding is compatible with that of the Transmission System.

3.12 METERING

Metering Equipment to be installed at Interconnection Points shall comply with the standards defined in the Grid Metering Code and provisions of the Connection Agreement.

3.13 SCADA & COMMUNICATION

A fully functional communication and SCADA System will be established and maintained by the Transmission Licensee.

The Transmission Licensee will provide the necessary facilities at the Interconnection Point for the User to upload data to the SCADA system and to receive control signals from the SCADA system in accordance with the Connection Agreement.

Communication and SCADA systems shall have the capability for the System Operator to carry out switching operations in the Transmission System and data acquisition. Voice and data communication facilities shall be secured against unauthorised access in accordance with the standards specified.

The above requirement shall also apply to all IBRE directly connected to grid substations.

3.14 SAFETY

All Users shall follow the procedures laid down in the Grid Operations Code on safety issues.

3.14.1 EQUIPMENT NUMBERING

All equipment used at the Interconnection Point including overhead lines, underground cables, Substations and User installations shall conform to the numbering and nomenclature of the Transmission Licensee.

3.15 MAINTENANCE

The Transmission Licensee and the User shall maintain all switchgear and equipment installed at the Interconnection Point according to well laid down programs. These shall not pose any threat to the safety of personnel or cause damage to other equipment.

Both the Transmission Licensee and Users shall be required to keep test records relating to the equipment installed by each Party, and shall make such records available whenever a request is made by the other Party.

3.16 SPECIAL CONNECTION REQUIREMENTS FOR GENERATING UNITS

All Generating Units other than the embedded generating units shall be centrally Dispatched and shall fulfil the following conditions:

3.16.1 FREQUENCY VARIATION CAPABILITY

Generating Units shall be capable of delivering the declared active and reactive power outputs within the system Frequency variations, specified in this **GCC.**

The Transmission Licensee and a User may agree to lower active power delivering capability when system Frequency falls below one percent (1%) of the rated Frequency.

Generating Units shall be protected against Frequency excursions outside the ranges specified in **Appendix A Section 3.2(A).**

3.16.2 VOLTAGE VARIATION CAPABILITY

Generating Units shall be capable of delivering the declared active and reactive power outputs within the voltage variations specified in **Appendix A Section 3.2(B)**.

3.16.3 POWER FACTOR VARIATION CAPABILITY

Generating Units shall be capable of continuously delivering the declared outputs at any point between the Power Factors of 0.8 lagging and 0.9 leading, in accordance with its reactive power Capability Curve, unless otherwise agreed in the Connection Agreement, and operate in voltage control mode to support dynamic reactive power requirements during disturbances.

3.16.4 UNBALANCED LOADING CAPABILITY

Generating Units shall be capable of being synchronised to the Transmission System during a load unbalance, in accordance with the relevant IEC standard.

In addition, under unbalanced fault conditions in the Transmission System or in a User's System, the Generating Units shall be capable of withstanding the resulting negative sequence loading and also remain connected to the Grid, until the appropriate protection scheme clears the fault.

3.16.5 LOAD FOLLOWING CAPABILITY

All Generating Units shall have the load following capability other than those exempted by the Transmission Licensee.

3.16.6 FAULT RIDE-THROUGH CAPABILITY

Generating Units shall be capable of remaining synchronised during and following any fault disturbance anywhere on the Transmission System which could result in voltage dips at the HV terminals of the generator transformer of no greater than 95% of nominal voltage (5% retained) for fault durations up to and including the fault ride-through times as defined in **Appendix A Section 3.2(C)** and voltage dips of no greater than 50% of nominal Voltage. (i.e. 50% retained) for fault durations up to and including the fault ride through times as defined in **Appendix A Section 3.2(C)** (see also fault ride through envelopes in **Appendix A Section 3.2(D)**). Following the fault clearance, the Generating Unit should return to pre-fault conditions subject to its normal Governor control system and Automatic Voltage Regulator (AVR) response.

Fault ride-through times given in Appendix A section 3.2 (C) and (D) will only serve as a guide.

The use of extraordinary Governor response and/or extraordinary AVR response to remain synchronised during and following a fault is prohibited unless specifically agreed with the Transmission Licensee.

3.16.7 BLACK START CAPABILITY

The Transmission Licensee shall decide on the generators where Black Start Capability is required. If any Generating Unit intends having Black Start Capability, then the Transmission Licensee shall be informed accordingly.

3.16.8 LINE CHARGING CAPABILITY

All Generating Units shall have line charging capability other than those exempted by the Transmission Licensee.

3.16.9 EXCITATION SYSTEM

Generating Units shall be equipped with a continuously-acting automatic excitation control system to control the open circuit terminal voltage within 10% of the declared voltage specified in this **GCC**, with facilities for disabling constant reactive power control or constant Power Factor control.

3.16.10 GOVERNOR RESPONSE

(a) Power and Frequency Control of the Generating Units shall be achieved with fast-acting prime mover speed Governor.
(b) The Governor shall have the capability to freely regulate the Frequency with adjustable Governor Speed Droop settings in the range of 2% to 10%.
(c) The inherent dead band shall not be more than ±0.05 Hz. There shall be an adjustable dead band in the range of ±1 Hz incorporated with droop characteristics for flexibility of operations.
(d) If and when the Generating Unit is required to operate in an islanded mode, then the Governor Control System shall ensure that the islanded system will operate within the system Frequency range specified in this **GCC.**

3.16.11 PERFORMANCE MONITORING FACILITY

Generating Units shall be provided with a high resolution performance monitoring/recording facility that shall include the following features:

(a) Governor Frequency response
(b) Transient and dynamic response of the Generating Unit in terms of real and reactive power output (MW and MVar)
(c) Frequency (Hz) and voltage (Volt) at the Generating Unit terminal and on the HV side of the generator transformer

3.16.12 REMOTE MONITORING FACILITY

Generating Units shall be equipped with necessary provisions for remote monitoring of its operating conditions, which shall include the following:

(a) Generating Unit output
(b) Loading on switchgear
(c) Protection relay operations
(d) Alarms, indications and events

3.16.13 PROTECTION RELAYING

Generating Units shall be provided with protection against grid disturbances/abnormalities and also against internal faults within the Generating Unit and associated switchgear, which shall include loss of excitation and pole slipping protection. Users shall obtain the approval of the Transmission Licensee for the protection systems employed in Users' Systems during the application process for connection. Relay setting calculations and the proposed system related settings shall be submitted to the Transmission Licensee for approval. Approved Generating Unit protection systems and relay settings shall not be changed without prior written permission from the Transmission Licensee.

3.16.14 SYNCHRONISING

Synchronising facilities for generating units shall be provided either at the Generating Unit circuit breaker or at the generator transformer HV circuit breaker, as required by the Transmission Licensee.

3.17 SPECIAL CONNECTION REQUIREMENTS FOR INVERTER BASED RENEWABLE ENERGY TECHNOLOGIES (IBRE)

3.17.1 REQUIREMENTS FOR ACTIVE POWER CONTROL AND FREQUENCY SUPPORT

3.17.1.1 Frequency ranges

I. Operating ranges

a) "The **power park module** shall be capable of staying connected to the **Transmission System** and remain continuously operable within the **System Frequency** range 49 to 51Hz". Decrease of output Active Power is permitted in the frequency range of 47 to 49 Hz.

b) "Minimum time period a **power park module** shall be able to operate for different frequencies deviating from a nominal value without disconnecting from the Transmission System is as follows:"

Frequency Range	Requirement
47 - 47.5 Hz	Operation for a period of at least 1 continuous minute is required each time the **System Frequency** is below 47.5Hz.

47.5 – 49 Hz	Operation for a period of at least 90 continuous minutes is required each time the **System Frequency** is below 49Hz.
49 – 51 Hz	Continuous operation is required.
51- 51.5 Hz	Operation for a period of at least 90 continuous minutes is required each time the **System Frequency** is above 51 Hz. Decrease of output power is not permitted.
51.5 – 52 Hz	Operation for a period of at least 20 continuous minutes is required each time the **System Frequency** is above 51.5Hz. Decrease of output power is not permitted.
52 – 53 Hz	Operation for a period of at least 20 continuous seconds is required each time the System Frequency is above 52Hz. Decrease of output power is not permitted.

The proposed requirements for power park module are depicted in Figure 3.17- 1.

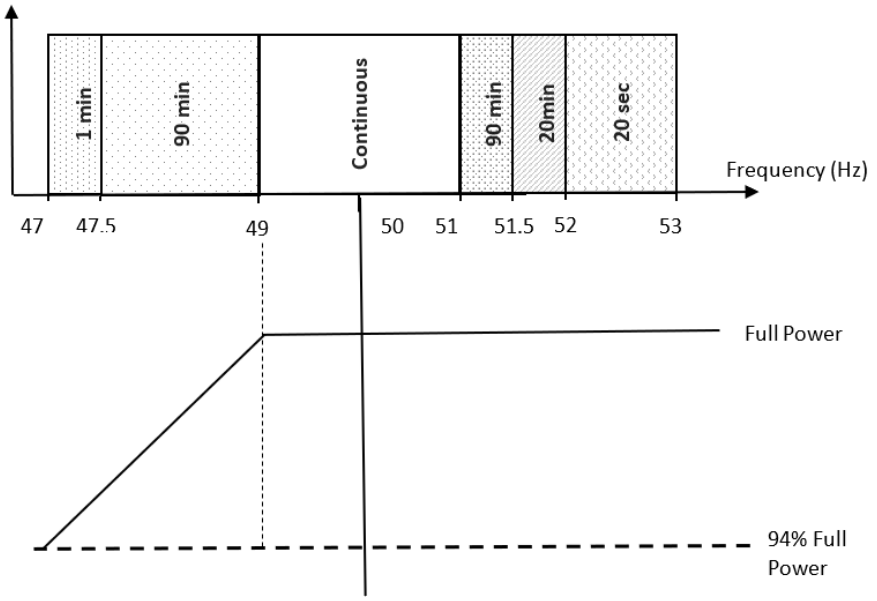

Figure 3.17- 1: Expected withstand durations and *real power capability during frequency Deviations*

The following points describe the requirements depicted in Figure 3.17- 1 further for clarity.

i The power park module is capable to operate within the frequency rage 47 – 53 Hz.

ii The power park module USER shall reduce the power level below this limit only upon instruction from the System Operator.

iii The above are minimum requirements. The power park module owner shall communicate their technical duration capability to CEB including when the frequency is above 53 Hz.

II. Operation over a wider frequency range

CEB may request a certain power park module owner to operate on wider frequency ranges or longer minimum times for operation if needed to preserve or to restore system security. If wider frequency ranges or longer minimum times for operation are economically and technically feasible, the power park module owner shall not unreasonably withhold consent. This will be defined in the **Connection Agreement/Power Purchases Agreement (PPA)** between CEB and the power park module owner, while ensuring that all the Regulations are also met.

III. Automatic disconnection

Without prejudice to Section I above, a power park module shall be capable of automatic disconnection at frequencies specified by CEB.

IV. Active Power capability

The power park module shall be capable of maintaining it full power rating (or the operating power at the time of the frequency drop) if the frequency drop is not below 49 Hz.
Maximum 6% admissible active power output reduction is allowed from its operating point if the system frequency falls within 49 Hz to 47 Hz.

V. Active Power capability outside listed frequency ranges

The power park module shall maintain its full power capability when the frequency is between 50 Hz and 51.5 Hz. The power park module owner shall communicate their technical duration capability (over and above what has been stated in Section I above) to CEB when the frequency is above 52 Hz.

VI. Protection settings

The protection settings of the power park module equipment connecting to the Transmission system should not violate the frequency limits provided in Section I above.

3.17.1.2 Rate of change of frequency withstand Capability

The power park module shall be capable of staying connected to the Transmission System and operable if the System Frequency changes at a rate between -2.5 Hz/s and +2.5 Hz/s (measured at any point in time as an average of the rate of change of frequency for the previous 500 ms).

In case of tripping due to activation of RoCoF, CEB may direct that the Power Park Module should not be automatically connected if the frequency is above 50.5Hz. When the frequency is restored to below 50.5Hz following a tripping due to the activation of RoCoF, CEB may direct that the reconnection will be initiated a delay of 5min from the time system frequency falls below 50.5Hz. Specific details will be determined on a case by case basis and informed to the PPM owner.

The requirements stated in above is the minimum requirement and CEB may list additional requirements for specific connections if system studies indicate a need. Such requirements will be specified in the Connection & Interface Agreement/Power Purchase Agreement (PPA) or possible other ancillary service agreements as applicable.

3.17.1.3 Active power controllability; control range and ramp rates

All Power Plants above 5MW capacity must comply with the Active Power Control Capability as specified under this section.

The Active Power output under steady state conditions of any power park module directly connected to the Transmission System shall not be affected by frequency and voltage changes in the normal operating range.

I. Active power control capability

i. A power park module shall be capable of adjusting the transmitted active power following dispatch instruction from CEB. Increase of active power output will be limited by the maximum declared active power capacity. Power Park Module shall be capable of reducing the output to any value below its declared active power capacity.

   It should be the responsibility of the Power Park Module Owner to Incorporate sufficient features and energy storage as necessary to meet CEB criteria.

ii. The power park module shall be equipped with control functions to support system frequency control. Upon receiving a signal, the power park module shall be capable of modulating the power output within 100 ms or as agreed between CEB and the PPM owner.

iii. Maximum and Minimum Power Step Size for Adjusting Active Power – Specific values may be specified by CEB to the PPM owner.

II. Active power ramp rates

A power park module shall be capable of adjusting the ramping rate of active power variations within its technical capabilities in accordance with instructions sent by CEB. Minimum acceptable values for each technology are indicated in below figures. These ramp rates are not to be confused with the resource side variation smoothing requirement set for PV plants. The settling time(Ts) shall be within 20-30 seconds and allowable set value tolerance shall be within -2% to +2%.

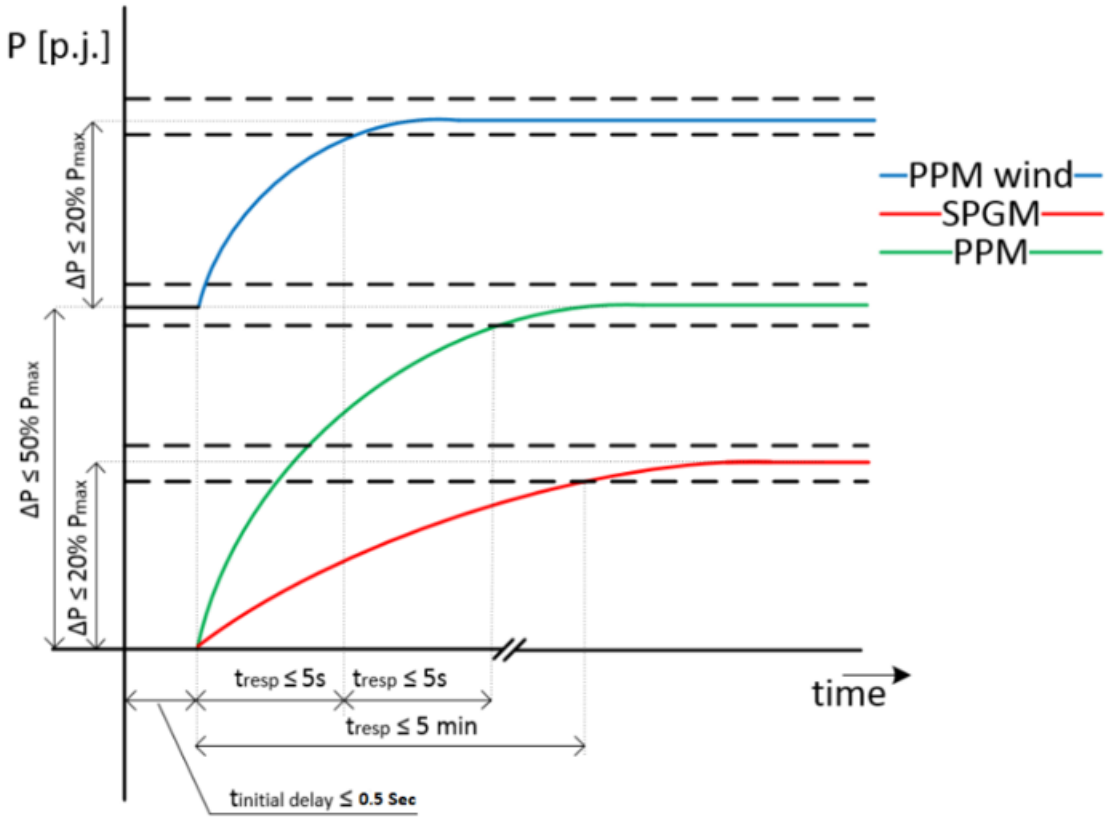

Figure 3.17- 2: Active power upward ramping rates

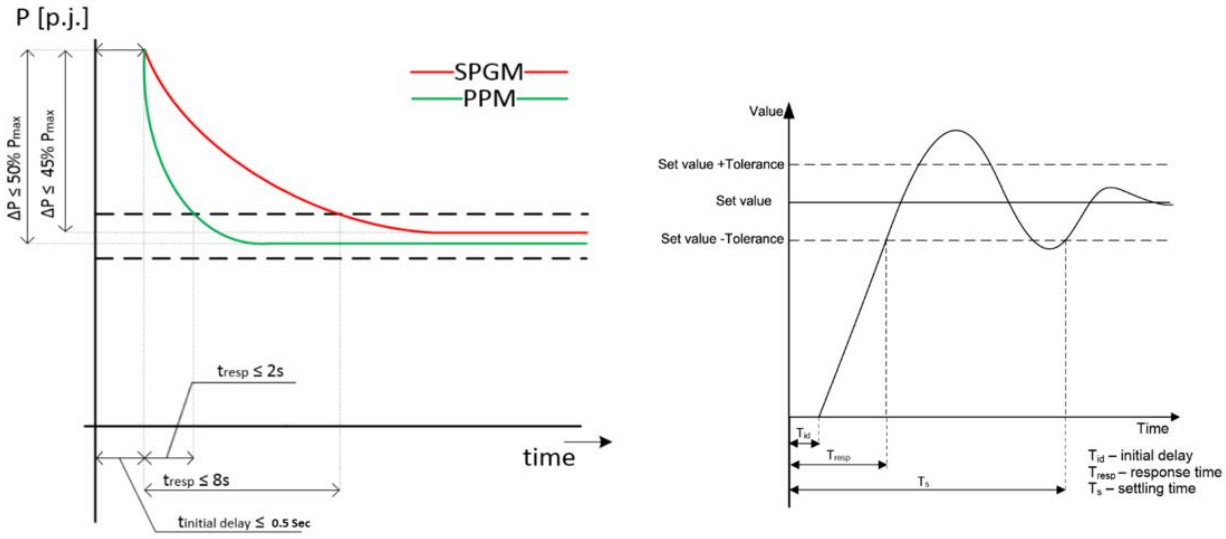

Figure 3.17- 3: Active power downward ramping rates [SPGM: synchronous power generation modules]

III. Active power control modes

If specified by CEB, the control functions of a power park module shall be capable of taking RAS (Remedial Action Scheme) including, but not limited to, stopping the ramping and blocking FSM, LFSM-O, LFSM-U and frequency control. The triggering and blocking criteria shall be specified by CEB. The modalities of that notification shall be determined and agreed between the Power Park Module owner and CEB.

IV. Power control range

Figure 3.17- 4 shows the minimum active and reactive power (P-Q) requirements that the power park module shall comply with.

V. Active Power Dispatch during Operations

Despite the active power capability requirements specified under this section, final operation shall be based on operational instructions received from the national system control center (as long as such instructions are within the capability specified here)

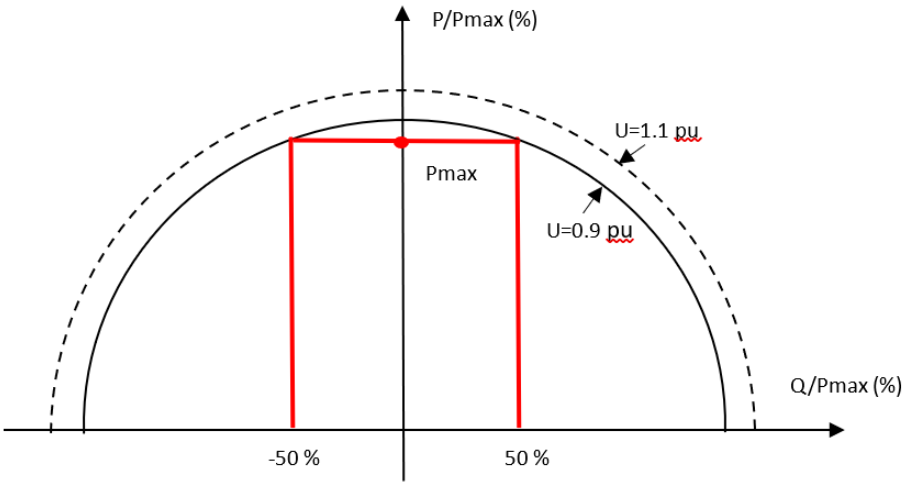

Figure 3.17- 4: Steady state active and reactive power limits

Note: Specific additional requirements may be determined by CEB through system studies for specific projects. In such cases, CEB may request a design with a wider reactive power capability. (Under reduced active power operation). This may include higher reactive power injection at reduced power output and reactive power injection up to the plant capacity at P=0.

3.17.1.4 Synthetic inertia capability

If requested by CEB as a requirement, the Power Park module shall be capable of providing synthetic inertia in response to frequency changes, activated in low and/or high frequency regimes by rapidly adjusting the active power injected to or withdrawn from the AC network in order to limit the rate of change of frequency. The requirement shall at least take account of the results of the studies undertaken by the CEB to identify if there is a need to set out the minimum inertia.

The principle of this control system and the associated performance parameters shall be agreed between CEB and the park module owner. The performance shall be demonstrated through system studies.

3.17.1.5 Frequency Control

3.17.1.6 Primary Frequency Regulation Mode/ Droop Control (FSM)

Frequency Sensitive Mode (FSM)

Power Park Modules shall be able to operate at a specified power reference point under normal Transmission System conditions.
The Power Park Modules shall be able to contribute to frequency response for frequencies specified in this Grid Code. The power output shall be continuous at a specified ramp rate. The active power ramp adjustment shall be possible in the range specified by CEB.

The Generator should be capable of operating within any of the following settings.

Parameters	Capability of the Plant	Set Point[1]
Frequency Dead band	0 to 0.5 Hz	0.01 Hz
Droop setting	2% to 9%	4%
Frequency response insensitivity	0.01 Hz-0.03 Hz	0.015Hz
Active power margin that must be maintained to allow for frequency response	- 10% to +10%	-5% to + 5%
Allowable delay for activation	0.5 s	
Reponses time for full deployment of full FSM active power range	10 s	

A typical FSM implementation is shown in Figure 3.17- 5.

[1] If the final set point is different to the values specified in the table, such value will be communicated by CEB at the time of the interconnection.

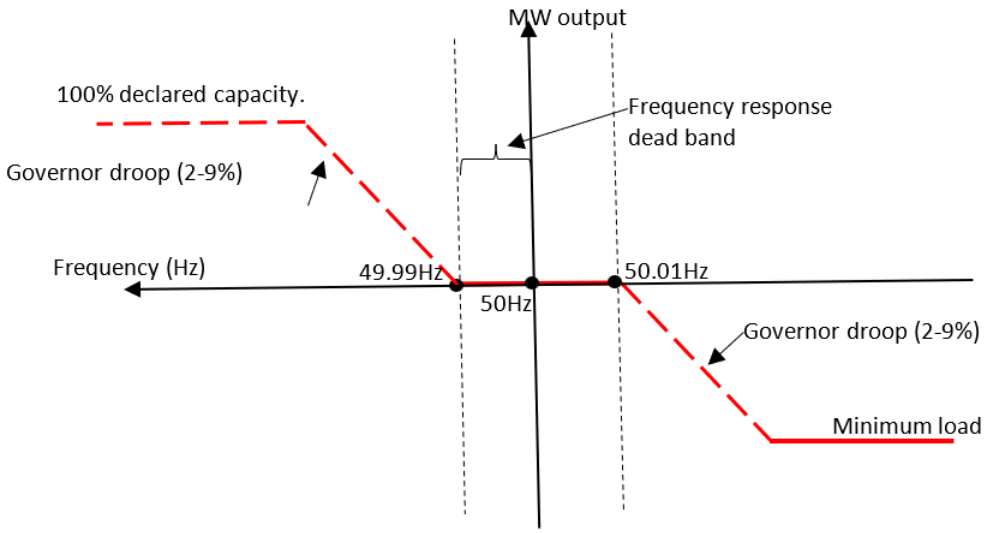

Figure 3.17- 5: Typical FSM settings

3.17.1.7 Limited Frequency sensitive mode [over-frequency (LFSM-O), under-frequency (LFSM-U)]

Limited Frequency Sensitive Mode (LFSM) shall be activated when the system is in an emergency state after a severe disturbance. The Power Park Modules shall have the Limited Frequency Sensitive Modes included in the design.

The generic settings for LFSM is given below and if any specific settings are required for a given Power Park Module, they shall be informed by CEB on a case by case basis, based on specific system characteristics, expected operating conditions and the interconnection points.

- Step response time (typically 2s-5s).
- Settling time (typically 20s-30s).
- Set point tolerance (+-2%)

The LFSM-U is activated when the frequency is below 49.8Hz. The Power Park module shall be able to continuously increase the active power output to the agreed limit at a rate specified by CEB.

The LFSM-O is activated when the frequency is above 50.1Hz. The Power Park module shall be able to continuously decrease the active power output to the agreed limit at rate specified by CEB.

The agreed limit of real power reduction (or injection) is typically 7% of the output power reference as the time of LFSM activation and is deployed (typical) at a rate of 2%/0.1 Hz. The full reduction (or injection) capability shall be achieved in less than 10 s. The activation time shall be less than 2 s (unless otherwise agreed between CEB and the power park module owner).

In case of a frequency reduction below 49 Hz active power must be injected up to 7% of the output power reference prevailing at the time following the applicable droop, reaching 7% of the output within not more than 10 s (subjected to the frequency deviations).

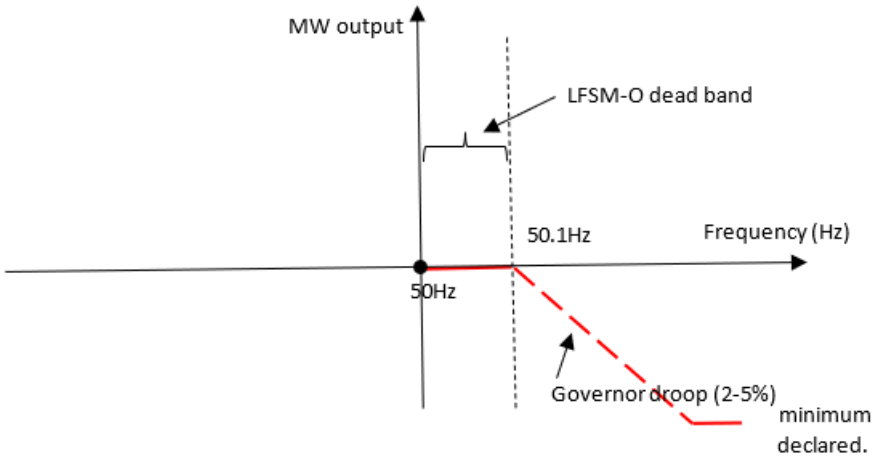

Figure 3.17- 6: Typical LFSM-O settings

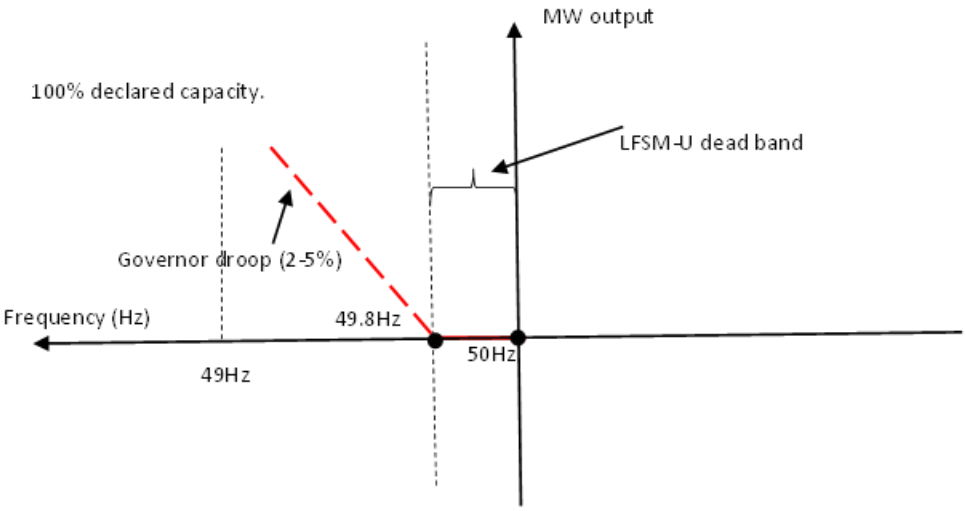

Figure 3.17- 7: Typical LFSM-U settings

3.17.2 Requirements for Reactive Power Control and Voltage Support

The Power Park module shall be capable of operating in the following modes as determined by CEB.

1 Voltage control mode (the voltage droop shall be adjustable as specified by CEB)
2 Reactive power control mode
3 Power factor control mode

A power park module shall be capable of operating in additional control modes specified by the Power Park Module Owner in coordination with the requirements of CEB.

3.17.2.1 Voltage Ranges

I. Operating Range

The Power Park Module shall be capable of staying connected to the transmission system and remaining operable within the voltage ranges and time period defined as follows:

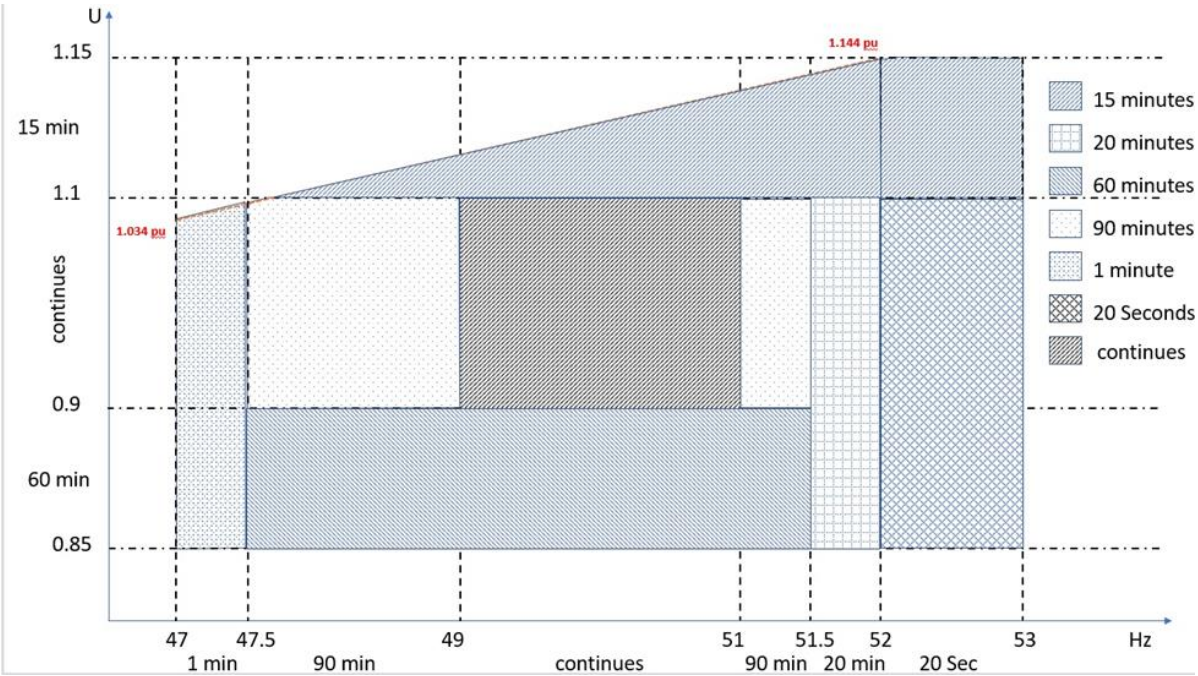

Figure 3.17- 8: Minimum time periods during which a power park module must be capable of maintaining operation at different frequencies without disconnecting from the grid.

Voltage Range (pu)	Time Period for Operation (s)
0.85pu – 0.9pu	60 minutes
0.9pu – 1.1pu	Unlimited
1.1pu – 1.15pu	15 minutes

II. Control Modes

The power park module shall be equipped with automatic voltage control capability, reactive power control capability and power factor control capability. The control slope on the automatic voltage control mode should be adjustable at the Connection point within a range specified by CEB. Depending on system requirements CEB will specify the mode of operation, control slope, voltage set point or power factor or reactive power set point.

3.17.2.2 Reactive Power Capability

Figure 3.17- 9 shows the minimum active and reactive power requirements that the Power Park module shall comply with. Requirements for specific projects will be provided by CEB.

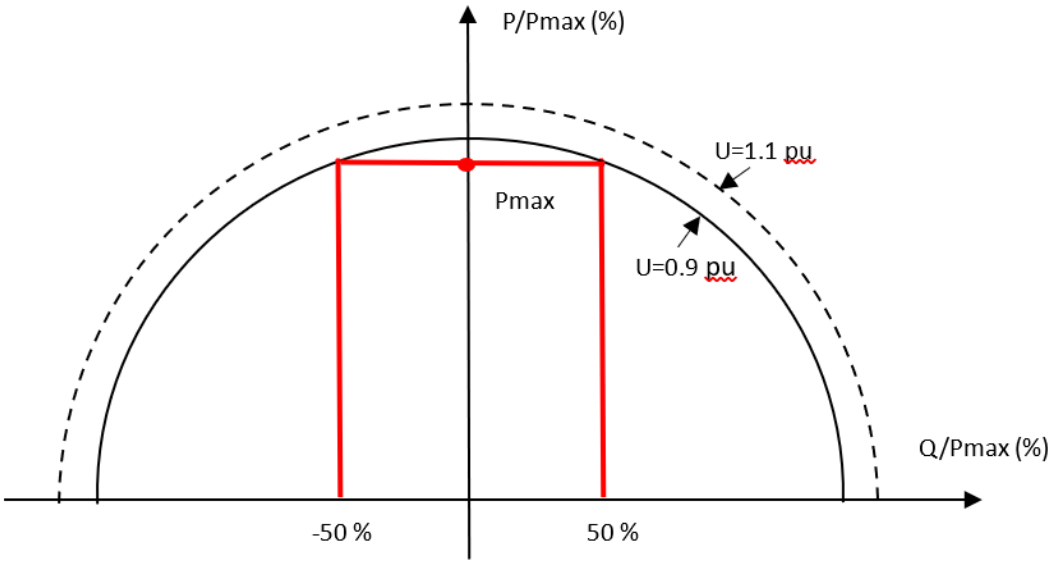

Figure 3.17- 9: P-Q capability that can be specified for power park module

I. Complying with the reactive power requirements

If the power park module cannot meet the reactive power exchange requirements as outlined above, the Power Park Module owner is expected to install additional equipment necessary to meet those requirements. The specific selection and design of such equipment shall be approved by the CEB.

II. Reactive Power Support under reduced active power transfer

The power park module shall be able to utilize available equipment rating to supply reactive power in both leading and lagging directions.

For VSC-based power park modules, unless otherwise agreed based on specific system requirements, the converter shall be capable of providing up to 80% when the converter operates at zero active power.

In case the machine is required to operate at a lower active power output that what the plant is capable of in order to meet a given Q requirements requested by the System Operator.

3.17.2.3 AC Voltage, reactive power and power factor control modes

The power park module shall be able to provide automatic control at the Connection Point over the entire operating range of the Power Park module, without causing system instability.

The reactive power variation caused by the reactive power control operation mode of the power park module, shall not result in a voltage step exceeding the allowed value at the Connection point.

I. AC voltage control

Each power park module shall be capable of contributing to voltage control at the connection point utilizing its capabilities, while respecting reactive power capability and reactive power exchange with the AC network, in accordance with the following control characteristics:

Voltage set-point at the connection point shall be capable of being specified within the range (0.9 pu-1.1 pu), either continuously or in steps.

- It shall be possible to operate voltage control with or without a dead band around the set-point. The dead band shall be adjustable.
- Following a step change in the voltage, the power park module shall be capable of achieving 90% of the change in reactive power output within a rise time t1 specified by CEB (typically 40ms or less).
- Voltage control mode shall include the capability to change reactive power output based on a combination of a modified voltage set-point and an additional instructed reactive power component (i.e. voltage-reactive power droop). The slope (i.e. voltage droop) shall be adjustable in the range (typically 3% -12%).

II. Reactive Power Control

The power park module shall be capable of operating at a designated reactive power value specified by the system operator as long as the same is within the reactive power capability of the Power Park Module.

III. Power Factor Control

The power park module shall be capable of controlling the power factor to a target at the connection point, while respecting Reactive Power Capability and Reactive Power Exchange with the network.

3.17.2.4 Priority to Active or Reactive power contribution

The power park module shall be capable of operating in the active or reactive power priority modes, as requested by CEB, while meeting continuous operating rating and short-term overload ratings. This includes utilizing the full rating (continuous and short-term overload) of the inverter current capability and operating in zero active power transfer.

Taking into account the capabilities of the power park module, CEB may inform on case by case basis whether active power contribution or reactive power contribution has the priority during low or high voltage operation. If not specified active power control shall have the priority.

3.17.2.5 Power quality and harmonic performance

I. Harmonic distortions, fluctuations, and flicker

Power park module owner shall ensure that its Power park module connection to the Transmission System does not result in a level of distortion or fluctuation of the supply voltage at the Connection point, exceeding the level specified by CEB.

Power park module owner shall ensure that the Power park module is capable of staying connected to the Transmission system. The power park module shall remain operable within the voltage ranges and time period defined in the Grid Code.

The harmonic distortion, unbalance and flicker requirements shall comply with the requirements in the Grid Code and following applicable regulations or standards. The power quality requirements shall be met at the point of common coupling as well as in the surrounding ac network.

In addition to the requirements listed in the Grid Code, the harmonic analysis for Power park modules should consider the harmonic range from N=1 to N=100.

II. Harmonic apportionment

CEB may allow only a portion of the total harmonic headroom available at a particular point of connection in order to facilitate future connections of generation and transmission equipment to the grid (only a portion of the available headroom should be allowed for a particular connection). Factor M defines the allotment to a particular connection.

$$V_{hr-user}^{h} = V_{hr}^{h} \times M$$

The value of M will be as specified in the applicable connection agreement for the specific Power Park Module. In case no value is specified the same should be considered as 0.25.

III. Voltage changes

Connection of power park module shall not lead to rapid voltage changes in the Transmission system exceeding 3% of the nominal voltage during the normal operation.

3.17.3 Fault Ride Through / Low Voltage Fault Ride Through (LVRT)

If the ac system experience voltage dips during system faults, the power park module shall stay connected so that the power transfer can resume without delays once the voltage recovers to levels within the specified operating ranges.

Magnitude and time profile of active power recovery of the Power Park Module during Fault Ride Through - To be specified later.

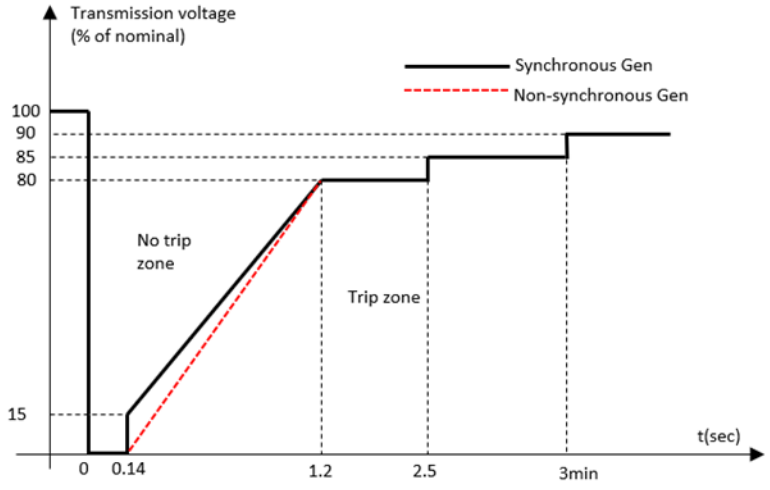

Figure 3.17- 10: Fault Ride Through requirement – Voltage duration curve

Short circuit current contribution during faults

Power Park Module shall be capable of contributing reactive currents to the Transmission system faults as shown in Figure 3.17- 11. If the Power Park Module is capable of contributing to fault exceeding the requirement shown in Figure 3.17- 11, the power park module owner should inform CEB. The fault conditions shall be identified, for instance, through the detection of a low voltage at the point of connection. The specific short circuit contribution shall be agreed as part of the connection process. CEB may request the contribution of positive, negative and zero sequence currents depending on the requirements of fault detection near the Connection point.

Unless a specific Power Park Module is excluded from contributing reactive currents during low voltage conditions by CEB, all other Power Park Modules are required to provide short circuit current contribution as specified below.

- Voltage threshold for activation 90% of rated nominal voltage
- The characteristics (magnitude in relation to voltage dip) of the injected current in time domain
    - As a minimum, the reactive current injection shall be in proportion to the available voltage at the connection point.
    - The injected current shall utilize (up to) the full current rating of the Power Park Module
- Allowable activation delays (20ms - 40ms: in order for ac protection systems to detect faults without undue delays)

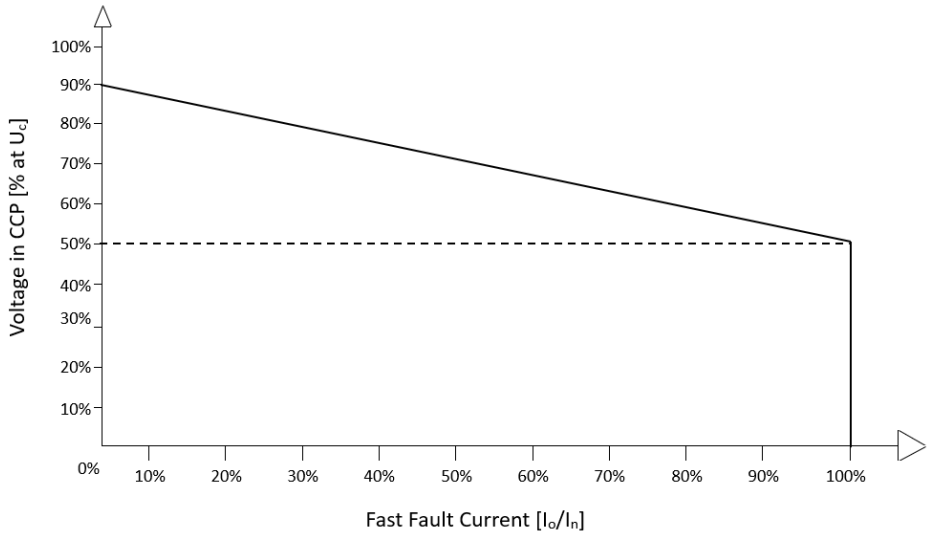

Figure 3.17- 11: Supply of fast fault current from a power park module

3.17.4 REQUIREMENTS FOR CONTROL

In addition to general requirements outlined in the Grid Code, the following Plant Performance Requirements shall be met by the power park module owner.

1 The connection of the power park module shall not negatively impact the operation of other dynamic devices in its close vicinity. The stable operation shall be demonstrated through appropriate RMS (PSS®E) and electromagnetic-transients-type (EMT) (PSCAD™/EMTDC™) simulation tools.
2 The connection of the power park module shall not result in transient and temporary over voltages that will impact existing generation, transmission and distribution equipment.
3 The connection of the power park module shall not lead to unstable or poorly damped system conditions (commonly referred to as control interactions).
4 The connection of power park module shall not adversely impact the torsional oscillations (sub-synchronous torsional oscillations and interactions (SSO/SSTI).
5 The power park module controls shall be equipped with inputs that can be used to facilitate power oscillation damping (POD) and sub-synchronous torsional interaction (SSTI) damping.

3.17.4.1 Control Interaction between the power park module and other dynamic devices (conventional generators, wind, photovoltaic, FACTS devices)

Control Interaction is a specific issue that can impact the coordinated operation of Power Electronic devices in a local area. Control systems of dynamic devices can interact in an undesirable manner resulting in unstable or poorly damped oscillations following system disturbances such as fault recovery. The power park module users shall design the equipment to avoid such undesirable interactions and the acceptable operation demonstrated through interconnection studies.

3.17.4.2 Power oscillation damping (POD)

The power park module shall be capable of contributing to the damping of power oscillations in the connected AC Transmission System.

The power park module owner shall provide all the required data to CEB including those related to power park module Control system models, including the parameters of any small signal modulation controls such as power oscillation damping (POD) controls, or sub-synchronous oscillation damping controls.

3.17.4.3 Sub synchronous torsional interaction (SSTI) damping

Regarding the sub-synchronous torsional interaction (SSTI) damping control, the power park module shall be capable of contributing to electrical damping at torsional oscillation frequencies. The SSTI studies shall be undertaken by the power park module owner. The studies shall identify the conditions, if any, where SSTI exists and propose any necessary mitigation measures. Any necessary mitigating actions identified by the studies shall be reviewed by CEB. The mitigating actions shall be undertaken by the power park module owner as part of the connection of the new power park module. The power park module owner shall provide all relevant data and models that allow such study to be performed to CEB.

3.17.4.4 Converter operational robustness

The power park module, shall be capable of finding stable operation points with a minimum change in active power flow and voltage level, during and after any planned or unplanned change in the Power park module or AC Transmission System to which it is connected.

3.17.5 REQUIREMENTS FOR CONTROL AND PROTECTION PARAMETERS AND SETTINGS

3.17.5.1 Electrical protection scheme and settings

The electrical protection scheme and settings relevant for the power park module and the Transmission network shall be coordinated and agreed between CEB and the power park module owner.

Electrical protection of the power park module shall take precedence over operational controls taking into account system security, health and safety of staff, the public and mitigation of the damage to the Power Park module.

Any change to the protection schemes or their settings relevant to the power park module and the Transmission System shall be agreed between CEB and the power park module owner before being implemented.

3.17.5.2 Changes to Protection and Control Settings

The parameters and settings of the main control functions of a power park module shall be agreed between the power park module owner and CEB.

The parameters and settings shall be implemented within such a control hierarchy that makes their modification possible, as required.

The power park module controls shall not lead to undesirable (control) interactions (unstable or poorly damped) with other dynamic plants in the vicinity of the point of connection.

The power park module owner shall be able to change the control parameters and/or protection settings of the power park module. These changes may be requested by CEB. Those parameters shall include, but not be limited to:

- Real and reactive power control mode, as applicable.
- Frequency control, as applicable
- Frequency sensitive modes (FSM, LFSM-O, LFSM-U)
- Power oscillation damping capability (POD)
- Sub-synchronous torsional interaction damping capability (SSTI).
- Synthetic inertia, if applicable

Any change to the schemes or settings of parameters of the different control modes and protection of the power park module, including the procedure, shall be coordinated and agreed between CEB and the power park module owner.

3.17.5.3 Priority Ranking of Protection and Control

A control scheme, specified by the power park module owner consisting of different control modes, including the settings of the specific parameters, shall be coordinated and agreed between CEB and the power park module owner.

3.17.5.4 Changes to Protection Schemes and Settings - Coordination and Agreement

The power park module owner shall design and implement the control modes and protection schemes to be flexible. Making changes to the control modes and protection settings shall be possible, at the converter stations, with appropriate password protection for different authorized access levels.

3.17.6 DATA AND INFORMATION EXCHANGE BETWEEN POWER PARK MODULE OWNER AND THE CEB

3.17.6.1 Exchanged Information

Regarding instrumentation for the operation, the power park module shall be equipped with an automatic controller capable of receiving instructions from the power park module owner. This automatic controller shall be capable of operating the units of the power park module in a coordinated way.

The following information shall be provided to CEB from the power park module owner.

1. Typical SCADA signal requirement as per the System Control is attached as Annex I.I and Annex I.II.
2. Detailed high resolution forecast data to be sent to System Control for the PPM having curtailment facility.

The power park module controller shall be able to receive the following signals and commands from CEB or the power park module owner based on communication with CEB. CEB shall specify the variable type and quality requirements of the supplied signals.

a) Start-up command
b) Active power order set-point
c) Frequency sensitive mode settings
d) Reactive power, voltage, or similar set-points
e) Reactive power control mode
f) Power oscillation damping (POD) control settings, if applicable
g) Synthetic inertia, if applicable
h) Normal and emergency blocking command
i) Ramp blocking command
j) Remedial Action Schemes status and settings
k) Active power flow direction command, if applicable
l) Fast active power reversal command, if applicable
m) Redundancy reductions and auxiliary power single source status
n) Other project-specific set-points and commands, as specified by CEB.

The power park module owner shall specify any equipment needed to enable the remote selection of control modes and relevant set-points.

3.17.6.2 Parameter setting

Requirements are addressed in Section-6 titled "Requirements for Control and Protection Parameters and Settings".

3.17.6.3 Fault recording and dynamic system behaviour monitoring

The power park module owner shall be equipped with a number of digital transient fault recorders (TFR) with high-speed frequency response to record faults, disturbances and evaluate the dynamic performance of the Power Park module and its effect on the Transmission System. Each power park module shall also be equipped with one or more Sequence of Events Recorders (SER).

A power park module shall be equipped with a facility to provide fault recording and dynamic system behavior monitoring of the following parameters for each of its units. The following quantities shall be monitored as a minimum:

a) AC voltages and currents (instantaneous and RMS)
b) DC voltages and currents
c) Active and reactive power
d) Frequency
e) Other site-specific parameters specified by CEB including resource information

CEB will specify the quality of parameters required from the PPM will be specified in the latest "Guideline for Interconnection of Renewable Energy based Power Plants"

The particulars of the fault recording equipment referred to in this section, including analog and digital channels, the settings, including triggering criteria and the sampling rates, shall be agreed between the power park module owner and CEB.

All dynamic system behavior monitoring equipment shall include an oscillation trigger, specified by CEB with the purpose of detecting poorly damped power oscillations.

The facilities for quality of supply and dynamic system behavior monitoring shall include arrangements for the power park module owner and CEB to access the information electronically. The communications protocols for recorded data shall be agreed between the PPM owner and CEB

3.17.6.4 Fault and disturbance analysis

Refer Section 3.17.6.3 "Fault Recording and dynamic performance behavior monitoring".

3.17.6.5 Simulation models

The Power park module owner shall provide all the relevant information details as listed in "Data and Model Requirement to be Complied by Inverter based RE Plants prior to be Interconnected to CEB Network".

The power park module owner shall provide models that accurately represent the dynamic response of the model. The model shall include all site-specific protection, control and other parameter settings as applicable. Both RMS-type and EMT-type models shall be in PSS®E and PSCAD™/EMTDC™ formats, respectively. The proprietary information of the power park module Manufacturer that forms the model may be protected. However, the models shall have the flexibility to change parameters and select

options that CEB will have access to with the field equipment.

The POWER PARK MODULE OWNER shall provide the study results as per "Dynamic Plant Model Quality and Dynamic Response Test" in PSS®E and PSCAD™/EMTDC™ for review and agreement by CEB. Those simulation studies shall be revised based on the actual system and Power Park module tests and adhere to the requirements for the Transmission System and Power park module per the power park module Technical Specifications, as well as the following requirements:

For the purpose of dynamic simulations, the models provided shall contain at least, but not limited to, the following sub-models, depending on the existence of the mentioned components: (a) power park module model b) AC component models; (c) DC system models; (d) Voltage and power controller; (e) Special control features if applicable (e.g. power oscillation damping (POD) function, sub-synchronous torsional interaction (SSTI) control); (f) Multi terminal control, if applicable; (g) Power park module protection models as agreed between CEB and the power park module owner.

The power park module owner shall verify the models against the results of compliance tests carried out and a report of this verification shall be submitted to CEB. The models shall then be used for the purpose of verifying compliance with the requirements of this Regulation including, but not limited to, compliance simulations and used in studies for continuous evaluation in system planning and operation.
The power park module owner shall submit Power park module recordings to CEB, if requested, in order to compare the response of the models with these recordings.

3.17.7 Requirements for Power System Restoration

Black start and capability to take part in isolated network operation

This feature is not applicable unless specifically requested by CEB from specific Power Park Module.

CEB may specify a Black Start feature for the Power Park module. In that case, the Power Park module shall be capable of operating in an isolated network in accordance with Black Start operation requirements.

The power park module owner shall comply with the Black start procedure and other requirements of CEB. In addition, CEB and the power park module owner shall agree on the capacity and availability of the black start capability and any other operational procedures.

The Power park module shall be able to synchronize with the AC system within the frequency limits set out in Section 3.17.1.1 and within the voltage limits specified in the Section 3.17.2.1 where applicable.

Wider frequency and voltage ranges may be specified by CEB where needed in order to restore the AC Network security.

3.17.8 Testing, Monitoring and Compliance Review

The additional requirements considered for Power park modules.

3.17.8.1 Testing and compliance

The Power Park module shall be designed and tested to meet the requirements of the Transmission System, operational requirements, performance studies and any Interconnection Agreements. Sufficient monitoring shall be provided to CEB to determine that the Power Park module complies with those performance requirements.

3.17.8.2 Grid Connection Testing

In addition to the site acceptance tests, the power park module owner shall recommend, provide procedures and carry out compliance tests in line with Best Industry practices. The tests shall include, but not be limited to:

a) Harmonic voltage distortion measurements
b) Frequency response test
c) Reactive power compensation test
d) Voltage control test
e) Tariff metering tests
f) Fault ride through capability tests
    - In order to facilitate this, firstly there needs to be a good PSCAD model. Second, the inverter controls design has to be identical or closely corelated to the PSCAD model. Finally, the FST will test the actual controls in the factory to increase the probability there will work in the field.
    - Most utilities will not allow this kind of testing on their AC system.
g) Audile Noise measurements
h) Performance Guarantee requirements
i) Electro-Magnetic Interference measurements

These tests shall be performed at different active and reactive power levels (worst case also) to demonstrate the features and the stability of the Power park module with respect to CEB's AC system.

The Power park module shall include any additional monitoring and recording required for the purpose of completing grid connection testing in the scope of supply.

The power park module owner shall coordinate grid connection testing with CEB, including notification to all relevant parties and seeking approval for all test procedures prior the commencement of any system tests.

3.17.8.3 Non-Compliance

Should there be a concern or question of non-compliance the power park module owner shall meet with CEB to discuss and resolve. If it cannot be resolved at that stage, the power park module owner shall perform testing with agreement from CEB to demonstrate that the power park module complies. Should the plant scheme be deemed to be non-complaint, the power park module owner shall take the appropriate steps to rectify as soon as reasonably possible to re-establish compliance.

3.17.9 HANDLING DEVIATIONS

Given the involving nature of inverter-based resource (IBR) technology, a request for any deviation from the requirements as specified in this document received from a PPM owner may be considered by CEB on case by case basis. The final decision in this regard is at the sole discretion of CEB.

3.17.10 ANNEX I.I

Typical Signal List for Solar Power Station **Annex I.I**

Signal Description	Type of Signal	Signal Type Description For IEC 60870 - 5 - 104		User Data of Class
		Type ID No.	Description	
From each Generator Bay				
Status Indications				
Circuit Breaker Open/Close	DPI	31	M_DP_TB_1	Class 1
Bus Isolator Open/Close	DPI	31	M_DP_TB_1	Class 2
Line Isolator Open/Close	DPI	31	M_DP_TB_1	Class 2
Earth Switch Open/Close	DPI	31	M_DP_TB_1	Class 2
Generator Running/Stop	DPI	31	M_DP_TB_1	Class 2
Measurements				
Active Power (MW)	AI	13	M_ME_NC_1	Class 2
Reactive Power (MVar)	AI	13	M_ME_NC_1	Class 2
Current (A)	AI	13	M_ME_NC_1	Class 2
Voltage (kV)	AI	13	M_ME_NC_1	Class 2
Power Factor	AI	13	M_ME_NC_1	Class 2
Frequency (Hz)	AI	13	M_ME_NC_1	Class 2
Solar Irradiance	AI	13	M_ME_NC_1	Class 2
From Total Solar Plant				
Status Indications				
Plant Control NSCC / SAS/ Siyambalanduwa GS	DPI	31	M_DP_TB_1	Class 1
Operating Mode I	SPI	30	M_SP_TB_1	Class 1
Operating Mode 2	SPI	30	M_SP_TB_1	Class 1
Operating Mode n	SPI	30	M_SP_TB_1	Class 1
Active Power Controller Mode	SPI	30	M_SP_TB_1	Class 1
Reactive Power Controller Mode	SPI	30	M_SP_TB_1	Class 1
Voltage Controller Mode	SPI	30	M_SP_TB_1	Class 1
Power Factor Controller Mode	SPI	30	M_SP_TB_1	Class 1
Control Commands				
Select Operating Mode 1	SPC	45	C_SC_NA_1	Class 1
Select Operating Mode 2	SPC	45	C_SC_NA_1	Class 1
Select Operating Mode n	SPC	45	C_SC_NA_1	Class 1
Select Active Power Control	SPC	45	C_SC_NA_1	Class 1
Select Reactive Power Control	SPC	45	C_SC_NA_1	Class 1
Select Voltage Control	SPC	45	C_SC_NA_1	Class 1
Select Power Factor Control	SPC	45	C_SC_NA_1	Class 1
Active Power Set Point Command	AO	50	C_SE_NC_1	Class 1
Reactive Power Set point Command	AO	50	C_SE_NC_1	Class 1
Signal Description		**Signal Type Description**		

	Type Of Signal	For IEC 60870 - 5 - 104		User Data of Class
		Type ID No.	Description	
Voltage Set Point Command	AO	50	C_SE_NC_1	Class 1
Power Factor Set Point Command	AO	50	C_SE_NC_1	Class 1
Measurements				
Total Plant Active Power	AI	13	M_ME_NC_1	Class 2
Total Plant Reactive Power	AI	13	M_ME_NC_1	Class 2
Plant Control Voltage	AI	13	M_ME_NC_1	Class 2
Plant Control Power Factor	AI	13	M_ME_NC_1	Class 2
Total Active Energy	AI	13	M_ME_NC_1	Class 2
Total Reactive Energy	AI	13	M_ME_NC_1	Class 2
No. of Running Solar units	AI	13	M_ME_NC_1	Class 2
Plant Availability Factor	AI	13	M_ME_NC_1	Class 2
Plant Factor	AI	13	M_ME_NC_1	Class 2
Total Available Capacity	AI	13	M_ME_NC_1	Class 2
Total possible generation (MW) with respect to Solar Forecasting	AI	13	M_ME_NC_1	Class 2

Legends:

DPI - Double Point Indication
SPI - Single Point Indication
DPC - Double Point Control Command
SPC - Single Point Control Command

AI - Measurements (Analog Input)
AO - Analog Output

C_DC_NA_1 :- Double Command
C_SC_NA_1 :- Single Command
M_DP_TA_1 :- Double Point Information with time tag
M_SP_TA_1 :- Single Point Information with time tag
M_ME_NC_1 :- Measured Value, short floating point number
M_DP_TB_1 :- Double Point Information with time tag CP56Time2a
M_SP_TB_1 :- Single Point Information with time tag CP56Time2a
M_IT_NA_1 :- Integrated Totals
C_SE_NC_1:- Set Point Command,Short Floating point
C_SC_TA_1 :- Single point Command with Timetag CP56Time2a
C_DC_TA_1:- Double point Command with Timetag CP56Time2a

3.17.11 ANNEX I.II

Typical Signal List for Wind Power Station **Annex I.II**

Signal Description	Type Of Signal	Signal Type Description For IEC 60870 - 5 - 104		User Data of Class
		Type ID No.	Description	
Status Indications				
Wind Transformer(LV Side)				
CB	DPI	31	M_DP_TB_1	Class 1
Disconnector	DPI	31	M_DP_TB_1	Class 2
Earth Switch	DPI	31	M_DP_TB_1	Class 2
Wind Transformer(HV Side)				
CB	DPI	31	M_DP_TB_1	Class 1
Disconnector	DPI	31	M_DP_TB_1	Class 2
Earth Swith	DPI	31	M_DP_TB_1	Class 2
Unit Status(Running/Not Running)	SPI	30	M_SP_TB_1	Class 1
Unit shut down (Raise/Release)	SPI	30	M_SP_TB_1	Class 1
PControlStatus_PPC	SPI	30	M_SP_TB_1	Class 1
QControlStatus_PPC	SPI	30	M_SP_TB_1	Class 1
VControlStatus_PPC	SPI	30	M_SP_TB_1	Class 1
PFControlStatus_PPC	SPI	30	M_SP_TB_1	Class 1
LocalRemoteStatus_PPC(Station Control(Wind PS/NSCC)	DPI	31	M_DP_TB_1	Class 1
Alarms				
WT fault (Group Signal)	SPI	30	M_SP_TB_1	Class 1
Transformer Alarm (Group Signal)	SPI	30	M_SP_TB_1	Class 1
Bay Control(Local Remote)	SPI	31	M_SP_TB_2	Class 2
Protection Signal				
WT Trip (Group Signal)	SPI	30	M_SP_TB_1	Class 1
Transformer Trip (Group Signal)	SPI	30	M_SP_TB_1	Class 1
Measurements				
Wind Transformer(HV Side)				
Active Power	AI	13	M_ME_NC_1	Class 2
Reactive Power	AI	13	M_ME_NC_1	Class 2
Voltage	AI	13	M_ME_NC_1	Class 2
Current	AI	13	M_ME_NC_1	Class 2
Wind Transformer (LV Side)				
Active Power	AI	13	M_ME_NC_1	Class 2
Reactive Power	AI	13	M_ME_NC_1	Class 2
Voltage	AI	13	M_ME_NC_1	Class 2
Current	AI	13	M_ME_NC_1	Class 2
Signal Description	**Type Of Signal**	**Signal Type Description**		

		For IEC 60870 - 5 - 104		User Data of Class
		Type ID No.	Description	
Controls Command				
Wind Transformer(HV Side)				
CB	DPC	46	C_DC_NA_1	Class 1
Disconnector	DPC	46	C_DC_NA_1	Class 1
Earth Switch	DPC	46	C_DC_NA_1	Class 1
Unit shut down Command from Park Control	DPC	46	C_DC_NA_1	Class 1
Protection Reset	SPC	45	C_SC_NA_1	Class 1
Wind Transformer (LV Side)				
CB	DPC	46	C_DC_NA_1	Class 1
Disconnector	DPC	46	C_DC_NA_1	Class 1
Earth Switch	DPC	46	C_DC_NA_1	Class 1
Protection Reset	SPC	45	C_SC_NA_1	Class 1
Wind Park				
Control Commands				
Park MW set point	AO	50	C_SE_NC_1	Class 1
Park Mvar set point	AO	50	C_SE_NC_1	Class 1
PControlMode_PPC	SPC	45	C_SC_NA_1	Class 1
QControlMode_PPC	SPC	45	C_SC_NA_1	Class 1
VControlMode_PPC	SPC	45	C_SC_NA_1	Class 1
PFControlMode_PPC	SPC	45	C_SC_NA_1	Class 1
Alarm Indications				
Station alarms (Group Signal)	SPI	30	M_SP_TB_1	Class 1
Measurements				
Park Active Power	AI	13	M_ME_NC_1	Class 2
Park Reactive Power	AI	13	M_ME_NC_1	Class 2
Park Availability factor	AI	13	M_ME_NC_1	Class 2
Park plant factor	AI	13	M_ME_NC_1	Class 2
Wind Energy Forecast (Park MW availability)	AI	13	M_ME_NC_1	Class 2
Energy Measurements				
Park Active Energy	AI	13	M_ME_NC_1	Class 2
Park Re-Active Energy	AI	13	M_ME_NC_1	Class 2

DPI - Double Point Indication
SPI - Single Point Indication
DPC - Double Point Command
SPC - Single Pont Command
BCP - Binary Coaded Measurement
AI - Analog Input
AO - Analog Out Put

C_DC_NA_1 :- Double Command
C_SC_NA_1 :- Single Command
M_DP_TA_1 :- Double Point Information with time tag
M_SP_TA_1 :- Single Point Information with time tag
M_ME_NC_1 :- Measured Value, short floating point number
M_DP_TB_1 :- Double Point Information with time tag CP56Time2a
M_SP_TB_1 :- Single Point Information with time tag CP56Time2a

M_IT_NA_1 :- Integrated Totals
C_SE_NC_1:- Set Point Command,Short Floating point
C_SC_TA_1 :- Single point Command with Timetag CP56Time2a
C_DC_TA_1:- Double point Command with Timetag CP56Time2a

3.18 SPECIAL CONNECTION REQUIREMENTS FOR EMBEDDED GENERATING UNITS

Embedded Generating Units shall fulfil the requirements and conditions stated in the CEB Guide for Grid Interconnection of Embedded Generators, Part 1: Application, Evaluation and Interconnection Procedure and Part 2: Protection and Operation of Grid Interconnection, included in the Distribution Code.

Responsibility to fulfil requirements and conditions given in the CEB Guide for Grid Interconnection of Embedded Generators, Parts 1 and 2 remains with Generators with Embedded Generating Units.

3.19 SPECIAL CONNECTION REQUIREMENTS FOR DISTRIBUTION LICENSEES

3.19.1 UNDER-FREQUENCY LOAD SHEDDING

The Transmission Licensee shall provide Under-frequency Relays for Automatic Load Shedding, where necessary, at Interconnection Points with Distribution Licensees and Transmission Customers.

3.19.2 CURRENT DISTORTION LIMITS

Distribution Licensees shall ensure that their load current harmonic distortion does not exceed the allowed current distortion levels, at the Interconnection Point. The allowed current distortion limits are specified in this **GCC**.

3.19.3 EMISSION LIMITS OF FLUCTUATING LOADS

Distribution Licensees shall ensure that their emission of fluctuating Loads does not exceed the allowed emission levels, at the Interconnection Point. The allowed emission limits are specified in this **GCC**.

3.20 SPECIAL CONNECTION REQUIREMENTS FOR TRANSMISSION CUSTOMERS

3.20.1 UNDER-FREQUENCY LOAD SHEDDING

The Transmission Licensee shall provide Under-frequency Relays for ALS, as necessary, at the Interconnection Point with a Transmission Customer.

3.20.2 CURRENT DISTORTION LIMITS

Transmission Customers shall ensure that their load current harmonic distortion does not exceed the allowed current distortion levels, at the Interconnection Point. The allowed current distortion limits are specified in this **GCC**.

3.20.3 EMISSION LIMITS OF FLUCTUATING LOADS

Transmission Customers shall ensure that their emission of fluctuating Loads does not exceed the allowed emission levels, at the Interconnection Point. The allowed emission limits are specified in this **GCC**.

3.21 PROCEDURES FOR APPLICATION FOR GRID CONNECTION

Procedure for application for grid connection is given in **Appendix C.**

4 GRID OPERATIONS CODE

4.1 INTRODUCTION

The Grid Operations Code (**GOC**) of the Grid Code specifies operational criteria, including guidelines, procedures and requirements to be followed by the Transmission Licensee and to be followed by all Users, for coordinated operation of the Transmission System.

4.2 APPLICABILITY

GOC applies to the Transmission Licensee, Generation Licensees including IBRE and Embedded Generators, Distribution Licensees, Transmission Customers, all grid Users and all parties who are authorised to carry out generation, distribution/supply activities and are connected to the Grid.

4.3 OBJECTIVES

Objectives of the **GOC** are to ensure,

(a) safe and efficient operation of the Transmission System under both normal and abnormal situations in accordance with the requirements specified in this **GOC**,
(b) that the Transmission System is operated satisfying the minimum security criteria and maintaining system stability,
(c) that the operation of User's plant and equipment will have no adverse effect on the Transmission System, and
(d) that the Transmission Licensee and Users have an unambiguous understanding of each others' roles and responsibilities in relation to the operation of the Transmission System.

4.4 RESPONSIBILITIES

4.4.1 TRANSMISSION LICENSEE

The operational planning related responsibilities of the Transmission Licensee's ~~System Operator~~ include the following.

(a) Compilation of estimates of generation availability and Demand Forecast, based on inputs from Generators and Users.
(b) Specifying the data to be supplied by Users for the preparation of the Demand Forecast for operational planning.
(c) Preparing the Demand Forecast of the Transmission System within the specified timescales.
(d) Operating the Transmission System at optimum economic efficiency subject to technical and non-technical constraints.
(e) Coordination of planned outages and unscheduled outages to maintain the reliability and security of the Transmission System.

The operational related responsibilities of the Transmission Licensee's ~~System Operator~~ include the following.

a) Operating the Transmission System to ensure reliability, security, stability and directing/carrying out switching operations.
(b) Recording, archiving operational information from SCADA systems and other sources, and making the information available in appropriate formats.
(c) Arranging alternative supplies during failures and planned outages.
(d) Accepting new apparatus to the Transmission System.

(e) Consenting to issue of "Permit to isolate", "Permit to Work", "Sanction for Tests" and "Limitation of Access".
(f) Analysing all Transmission System failures and preparing reports with recommendations for performance improvement.
(g) Functioning as an IBRE Operator.
(h) Ensure proper operation of the available control systems.

The asset management related responsibilities of the Transmission Licensee include the following.

(a) Preventive maintenance
(b) Follow up maintenance
(c) Breakdown ~~Remedial~~ maintenance
(d) Condition Monitoring
(e) Network refurbishment
(f) Management of spares

The ~~system~~ transmission system protection related responsibilities of the Transmission Licensee include the following.

(a).ensure the protection system of the Transmission System is well coordinated with those of the Distribution Systems, Transmission Customer Systems and Generating Units, and that the individual protection schemes are capable of speedily, selectively and reliably disconnecting a faulty section from the rest of the system

The communication related responsibilities of the Transmission Licensee include the following.

(a). A reliable communication system will be established and maintained for the purpose of facilitating exchange of information in the form of voice and data to satisfy the requirements specified under each code of the Grid Code.

4.4.2 USERS

The responsibilities of Users shall include the following.

(a) Providing all data requested by the Transmission Licensee as specified in this GOC.
(b) Operating User's System and equipment at the Interconnection Point in accordance with the agreed procedures to ensure that they will not cause any adverse impact on the stability, security and reliability of the Grid.
(c) Taking timely action to remedy situations that may arise in the User's plant and equipment which may adversely affect the Transmission Licensee's system.
(d) Cooperating with the Transmission Licensee to mitigate/overcome abnormal operating situations of the Transmission System by carrying out Transmission Licensee's instructions with regard to operation of User's plant and equipment.

4.5 TRANSMISSION ASSET MANAGEMENT

The transmission asset management will include the following,

(a) Preventive maintenance
(b) Follow up maintenance
(c) Breakdown maintenance
(d) Condition monitoring
(e) Network refurbishment
(f) Management of Spares

4.5.1 MAINTENANCE PLANNING

The maintenance personnel shall prepare the following maintenance plans.

(a) Annual Maintenance Plan
(b) Monthly Maintenance Plan

4.5.2 PREVENTIVE MAINTENANCE PROGRAM

Systematic inspection of Transmission System assets according to the operation and maintenance manuals of the equipment and standard maintenance practices to identify incipient failures, recording equipment condition and determining the need for partial or complete refurbishment of equipment will be included in the preventive maintenance program.

The Transmission Licensee shall prepare and implement a maintenance program to ensure that all plant and equipment installed in the Transmission System are maintained in good working order to meet the needs of Users.

4.5.3 FOLLOW-UP MAINTENANCE PROGRAM

Corrective action as a result of inspection and condition monitoring identified will be included in the follow-up maintenance program.

Defects or abnormal conditions of system assets shall be identified during the preventive maintenance program, some of which will be rectified by the maintenance staff. Defects that cannot be rectified through the preventive maintenance programme and any other defects that have been found through other means shall be rectified systematically by preparing a follow-up programme.

4.5.4 BREAKDOWN MAINTENANCE PROGRAM

Unplanned maintenance due to a breakdown or any alarming condition that needs attention will be included in the breakdown maintenance program.

The Transmission Licensee shall attend to these failures and restore the Transmission System to normal condition with the least possible delay.

4.5.5 CONDITION MONITORING

The Transmission Licensee will assess the healthiness of transmission assets by planning and executing condition monitoring program to ensure the availability.

4.5.6 NETWORK REFURBISHMENT PROGRAM

The Transmission Licensee will have a network refurbishment programme in terms of a corrective action as a result of inspection and condition monitoring to extend the life of existing assets or upgrading them, thereby deferring or eliminating the need for major capital expenditure for new transmission assets.

4.5.7 MANAGEMENT OF SPARES

The Transmission Licensee shall ensure essential spares are available in order to carry out maintenance activities.

4.6 OUTAGE PLANNING

The System Operator will prepare

(a) The annual transmission outage plan, and
(b) The annual generation outage plan

The final Transmission and Generation outage plan will be prepared in a coordinated manner, considering outage plans of Distribution Licensees and other Users, to ensure that the least number of Users are affected by the outages.

4.6.1 ANNUAL TRANSMISSION OUTAGE PLAN

The System Operator will prepare an annual transmission outage plan considering the Transmission System refurbishments, planned developments, and preventive and follow-up maintenance requirements. This plan will be updated monthly.

4.6.2 ANNUAL GENERATOR OUTAGE PLAN

The System Operator will prepare an annual generator outage plan based on the requests of the Generation Licensees, constraints of the Transmission System and the Demand Forecast. This plan will be updated monthly.

Generation Licensees having capacities equal or above 5 MW, shall submit their annual outage requirements for the next three years to the System Operator by 1st May every year.

Generation Licensee shall provide the information and data in **Appendix B Section 4.2** and **Appendix B Section 4.3**.

Upon receipt of the generation outage requirements, the System Operator will conduct reliability and security analysis of the Transmission System giving due consideration to the,

(a) forecast Demand
(b) Operating Margin, and
(c) Transmission System constraints,

to ascertain whether plans submitted can be accepted. The System Operator shall also examine the effect of outages on reservoir storage levels in rainy/dry seasons to ensure that spilling of reservoirs or ponds are avoided.

The System Operator may permit a Generation Licensee to take an outage of a different Generating Unit in place of another Generating Unit for which an outage has already been approved, provided, the System Operator is satisfied that such a decision will not affect the system reliability and security as described above.

In allowing the inflexible outages, the System Operator will satisfy itself, that reasons and justifications submitted are acceptable.

If at any time the analysis conducted shows that the reliability or security of the Transmission System is compromised, the System Operator will make all efforts to resolve them through mutual discussions. It shall use the powers granted under the Transmission License only as a last resort.

Accordingly, the System Operator, having taken all efforts to accommodate the requests of the Generation Licensees, shall arrive at the final outage program which will include the data in **Appendix B Section 4.2** and **Appendix B Section 4.3**.

The System Operator shall forward the finalised annual Generation Outage Program to all Generation Licensees by 31st December.

If there are any disputes on the program, those shall be resolved in accordance with the Electricity (Dispute Resolution Procedure) Rules under PUCSL.

4.6.3 OUTAGES UNDER UNFORESEEN SITUATIONS

During the current year, a Generation Licensee/Transmission Licensee may request an outage for its Generation/Transmission Units by providing at least seven (07) days' notice and provide the following information:

(a) Generating/ Transmission Units to be taken out of service and their capacities
(b) Outage periods for each unit with starting/ending times and dates
(c) Brief description giving reasons for the outages requested

On receipt of an outage request under this program, the System Operator shall analyse the proposed outages considering the following:

(a) Capability of the Generating Units to meet the peak Demand
(b) Transmission System constraints
(c) Operating Margin
(d) System security and reliability levels.

If the analysis shows that the outage will not have any harmful effects on the Transmission System, permission shall be granted for the outage, and the Generation/ Transmission Licensee shall be informed accordingly in writing, within 48 hours from the receipt of the request.

4.6.4 OUTAGES FOR EMERGENCIES

Generation/ Transmission Licensees may require outages to attend to urgent needs for plant and equipment, and may make a request from the System Operator, providing information as prescribed in this **GOC.**

The System Operator shall make all efforts to grant the request as expeditiously as possible, and orally inform its decision to the respective Licensee.

4.6.5 FORCED OUTAGES

Within 30 minutes of occurrence of a forced outage, Generation/ Transmission Licensee shall inform the System Operator the cause of the outage, and shall also inform the estimated date and time by which the Generating/ Transmission Unit can be made available, as expeditiously as possible.

Within 24 hours of the occurrence of the outage, the Generation/ Transmission Licensee shall provide a report of sufficient detail, describing the reasons for the outage, the date/time of the Generating/ Transmission Units availability, levels of availability, (ie full or partial).

The Transmission Licensee shall have the right to inspect the Generating Unit and all records under such situations, on any business day at any reasonable time.

The Generation/ Transmission Licensees shall make all efforts to conduct the repairs and to make it available at the shortest possible time.

4.7 RELEASE OF GENERATION UNITS

A Generation Licensee shall make a written request to the System Operator for the release of a Generating Unit in accordance with the approved planned outage programs and shall not withdraw any Generating Units from the Grid without obtaining express permission from the System Operator.

When such a request is made, the System Operator shall make all efforts to comply with the request, but may withhold the permission if it would result in insufficient generation capacity or jeopardise the system reliability and security.

Request for permission to withdraw a Generating Unit and permission issued by the System Operator shall be on formats to be prepared by the System Operator including data in **Appendix B Section 4.2**and **Appendix B Section 4.3**.

4.7.1 POSTPONEMENT OR ADVANCEMENT OF OUTAGES

The System Operator is authorised to defer or advance any planned outage, which may affect the satisfactory operation of the system.

4.8 MAKING GENERATION UNITS AVAILABLE AFTER AN OUTAGE

Generation Licensees shall endeavour to complete their repair/maintenance/improvements within the approved outage period, and shall inform the System Operator at least 3 days before the expiry of the outage period, on the probability of making the Generating Unit available on the due date.

Whilst carrying out the targeted tasks, if the Generation Licensee has any reason/evidence to believe that the Generating Unit cannot be made available on the due date, the System Operator shall be informed accordingly at the earliest, indicating the date and time the Generating Unit can be made available with all relevant information substantiating the request for extension of time allocated.

In such situations, the Transmission Licensees may inspect the Generating Unit/s under repairs to verify the information and grant or reject approval for the request for extension, and act in accordance with the regulatory obligations.

4.9 IMPLEMENTING OUTAGE PROGRAMS

In accordance with the outage planning procedures specified in the foregoing, all Licensees shall prepare the monthly outage programs to carry out the targeted tasks.

4.10 DISPATCHING OF GENERATION

Procedures and requirements for economic Dispatch of generation are given in the Grid Dispatch Code.

4.11 FREQUENCY CONTROL

The System Operator shall monitor the Frequency of the Transmission System and take action to ensure that they are within acceptable limits given in **Appendix A Section 4.1.**

4.12 VOLTAGE CONTROL

The System Operator shall monitor the voltage of strategic Substations to identify appropriate measures such as changing transformer tap settings or switching in compensation equipment to ensure that voltages remain within the defined limits in **Appendix A Section 4.1**.

On the basis of these studies, the System Operator may instruct Generators to maintain specified voltage levels. Generators shall inform the System Operator of their reactive reserve capability promptly on request.

4.13 SWITCHING OPERATIONS

The Transmission Licensee shall ensure that switching operations are carried out only by Authorised Persons, under the direction of the System Operator. Switching programs for planned switching operations shall be prepared at least two weeks in advance by the Authorised Persons who are responsible for carrying out the switching, and forward the same to the System Operator. These include the switching operations,

(a) for the implementation of the Transmission Outage Program
(b) for the implementation of the Generation
(c) Outage Program,
(d) in normal day to day operations of the Transmission System
(e) in responding to emergency and fault situations of the Transmission System, and (e) in responding to User requirements.

In extreme emergencies where there is a threat to human life or to system equipment, switching operations may be carried out without being directed by the System Operator. Immediately after

carrying out any switching operations, all related information shall be reported to the System Operator by the relevant officers.

The System Operator shall not direct or undertake any switching operations or outages outside the programs as listed above, unless the removal of any circuit or equipment becomes necessary under emergency situations or if there is any violation in the agreements entered into with Users.

4.14 SYSTEM OPERATOR RECORDS

The System Operator shall record events and incidents that take place or may affect the Transmission System. These shall include, but not be limited to, the following:

(a) All switching operations.
(b) Outages, restorations, and Demand control activities.
(c) Issue and cancellation of Permit to Work, Sanction for Tests and Limitation of Access.
(d) Commissioning and decommissioning of Transmission System plant and equipment, Generating Units.
(e) Failure of any Generating Units, Transmission System plant and equipment.
(f) Any dangerous or abnormal occurrences with implications on the Transmission System operations, including any occurrences in User Systems that have an effect on the Transmission System.
(g) All messages received or transmitted in connection with Transmission System operations. (h) Accidents and fatalities.

4.14.1 SYSTEM OPERATOR REPORTS

The information collected shall be documented in the following formats.

(a) daily report
(b) outage report
(c) monthly report

(a) Daily Report

The daily report will include a summary of incidents, events such as system loadings at night peak, day peak and off peak, generation by plant, system failures, Demand control activities, planned outages of generating units, etc., for the preceding 24 hour period ending at 0600 on each day. This report shall be ready by 09:00 on the following day, and submitted to PUCSL by 10:00 each day.

(b) Outage Report

(i) Whenever a Total System Outage or a Partial failure occurs, the System Operator shall, inform Distribution Licensee deemed to have been affected, of occurrence of such Outage, and provide an update as appropriate, as long as the Total System Outage continues.
(ii) prepare an event report, which is a summary of events leading to the Total System Outage or Partial ~~Shutdown~~ failure, restoration activities, and actual restoration times of the relevant Generators and the Transmission System, and
(iii) prepare a detailed report.

The event report described in (ii) above shall be submitted to PUCSL within 30 days of the Total System Outage or the Partial Outage.

The detailed report shall be submitted to PUCSL within a period agreed with PUCSL at the time of submitting the event report. The detailed report submitted to PUCSL and its subsequent revisions shall be published and retained on the System Operator's website.

(c) Monthly Report

The System Operator shall carry out a statistical analysis of the system performance monthly, which will include data relating to system outages, Demand control measures, quality of supply indicators, etc.,

The monthly report shall be submitted to PUCSL not later than 4 months from the end of each month.

4.15 CONTINGENCY PLANNING

A contingency in the Transmission system may arise owing to generation deficiencies, inadvertent tripping of Transmission System components, and failure of Transmission System equipment or operational errors.

These may result in Partial Outages or Total System Outages, and the Transmission Licensee is required to develop contingency plans to manage such situations and bring back normalcy to the Transmission System safely, and as fast as possible.

4.15.1 RESTORATION PLANS

It is the responsibility of the Transmission Licensee to develop and maintain restoration plans to manage contingencies that arise in the Transmission System. These shall include the following.

(a) Issuing instructions to Generators with Black start capability and Battery Energy Storage Systems (BESS) to start, energise the system and synchronise where possible
(b) Issuing standing instructions to Users
(c) Creation of small independent systems (islands) with identified generation and loads.
(d) Deciding the synchronising points for the islands
(e) Step-by-step process of integration of the islanded parts forming larger islands
(f) Completing the restoration

Recovery from a Partial Shutdown or a Total System Outage is often associated with uncertainties and unexpected complexities, and hence the restoration plans cover many possible scenarios and also need to be flexible.

The restoration plans shall be consistent with the accepted international best practices and shall be formulated in consultation with Users, especially the Generation Licensees and Distribution Licensees. It is essential that these plans are subjected to periodic review.

Transmission Licensee's personnel and all Users shall be aware of the restoration plans and shall be well versed with the role each has to play in such eventualities. All Users shall cooperate with the Transmission Licensee by following System Operator's instructions.

4.15.2 VOLTAGE AND FREQUENCY

Under contingency situations, normal criteria of voltage and Frequency shall not be applicable.

4.15.3 SYSTEM STUDIES

The Transmission Licensee shall carry out system studies to determine the effect of various Transmission System component failures, on the system reliability and security, and strengthen such weak links in the Transmission System.

4.15.4 DEMAND CONTROL

Power system behaviour during a restoration process depends on its characteristics as related to its active and reactive power balance. Therefore, Demand control measures shall be adopted to secure a Demand reduction in situations where Transmission System operational difficulties pose a threat to the Transmission System stability or where available generation capacity becomes insufficient to meet the System Demand.

Demand control methods to be implemented will be as follows:

(a) Automatic Load Shedding
(b) Manual load shedding
(c) Demand side management initiatives and agreements
(d) Demand response initiatives

4.15.5 AUTOMATIC LOAD SHEDDING

An Automatic Load Shedding (ALS) scheme based on under-frequency will be implemented by the Transmission Licensee to control the system Demand in order to limit the consequences of transmission or generation failures. The ALS scheme shall be executed in a number of stages, and the selection of the loads to be shed shall be based on the information provided by Distribution Licensees.

Accordingly, each Distribution Licensee shall be required to submit a schedule annually to the Transmission Licensee, classifying feeders at each Grid Substation as either essential or nonessential loads, with feeders serving non-essential loads being further ranked in the order of priority. The schedule shall also include the range of loading on the feeders during the day, peak and offpeak periods.

Each Distribution Licensee shall be required to submit a feeder wise (33kV and 11kV) existing IBRE installed capacities to the Transmission Licensee quarterly by 15th of next month.
The Transmission Licensee shall finalise the ALS program in consultation with Distribution Licensees.

Distribution Licensees shall ensure that permanent load transfers from one feeder to another feeder which are assigned for ALS shall not be done without the Transmission Licensee being informed. Once a feeder is disconnected on ALS, it shall not be reconnected to the system without permission from the System Operator.

Operation of ALS, if any, and the restoration activities along with the final restoration times, will be submitted to PUCSL as a separate report (see section 4.14.1).

4.15.6 MANUAL LOAD SHEDDING

Manual load shedding may become necessary in situations where operational difficulties or insufficient generation capacity pose foreseeable constraints in meeting the forecast Demand. In such situations, the System Operator will accord priority to requirements and meeting the Demand of the overall System rather than servicing an individual or group of Users.

Such operational difficulties may be known beforehand on most occasions, and where possible, the Transmission Licensee shall issue warnings on manual load shedding to the appropriate Distribution Licensees and to Transmission Customers.

At times, when demand reduction is required due to Transmission/Generation System deficiencies and if such forewarnings become impractical, then the System Operator shall carry out load shedding to stabilize the system.

These load shedding programs will be prepared based on the information provided by Distribution Licensees and the Transmission Licensee, with both parties being aware of the percentage of load shed, depending on the time period.

Electronic/print media shall be used by the Transmission Licensee to convey the information giving the times at which the load will be shed, the scheme followed and the times of restoration.

If the manual load shedding activity is foreseen to be required only once, to overcome a specific constraint in the Transmission System or the generating system, the Transmission Licensee shall inform the affected Distribution Licensees and Transmission Customers.

If the manual load shedding activity is foreseen to be required repeatedly, to overcome recurring constraints in the Transmission System or the generating system, the Transmission Licensee shall

prepare the manual load shedding schedule ~~plan~~ in consultation with Distribution Licensees and Transmission Customers and submit to PUCSL prior to the planned date of commencement of manual load shedding.

Estimated energy saving due to manual load shedding will be provided in the monthly report.

4.15.7 DEMAND MANAGEMENT AGREEMENTS

The Transmission Licensee may enter into agreements with Transmission Customers to act on warnings issued by the Transmission Licensee a day ahead or at short notice.

4.15.8 DEMAND CONTROL THROUGH OTHER MEASURES

The Transmission Licensee may resort to control the Demand through voltage reduction and instruct the Distribution Licensees also to act in the same manner.

In extreme emergencies, as the last resort, the Transmission Licensee may operate the system, lowering the system Frequency below the nominal frequency band as a Demand control measure.

4.16 TRANSMISSION SYSTEM PROTECTION

The Transmission Licensee shall have the authority to ensure the protection system of the Transmission System is well coordinated with those of the Distribution Systems, Transmission Customer Systems and Generating Units, and that the individual protection schemes are capable of speedily, selectively and reliably disconnecting a faulty section from the rest of the system. The Transmission Licensee may convene meetings with the Users to discuss any issues related to protection relaying, as and when necessary.

All literature relating to protective relaying including associated wiring/schematic diagrams, commissioning reports, technical literature of protection equipment, relay settings, relay testing data and operational records, shall be kept securely and safely, both in hardcopy in file and softcopy in a data base, by all Users to enable ready access by the Transmission Licensee to such information.

Protection relay settings shall be reviewed, whenever significant changes are effected to the Transmission System or when generation resource changes necessitate such action. All relay operations shall be recorded, carefully analysed and the cause for every operation shall be established, and corrective action shall be taken to ensure that protective schemes are in proper working order.

4.17 SCADA AND COMMUNICATION

A reliable communication system will be established and maintained for the purpose of facilitating exchange of information in the form of voice and data to satisfy the requirements specified under each code of the Grid Code. The SCADA system shall have the capability for the System Operator to carry out switching operations in the Transmission System, and acquisition of data from the identified locations of the Transmission System. The communication protocol for SCADA shall be IEC 60870-5-104. The communication system will also facilitate tele-protection signaling.

All Users shall be responsible to provide required systems to facilitate voice, SCADA and Inter-tripping signal up to the Interconnection Point in the Transmission System in accordance with the Connection Agreement.

All users shall be responsible to establish necessary security measures to avoid cyber security threats initiated from the user end.

4.17.1 OPERATIONAL AND SYSTEM DATA

All Generators which are having capacities of equal or greater than 5 MW shall provide ~~half hourly~~ active power and reactive power generation (MW and MVar) to System Operator on real time basis. Hydropower generators except IBRE, in addition, shall provide the reservoir level and rainfall information on a daily basis. In addition~~,~~ IBRE shall report information as per Appendix E.

The Transmission Licensee shall submit operational data to PUCSL, other Licensees and Users as and when required or as agreed.

4.18 SAFETY

4.18.1 SAFETY MANUAL

The Transmission Licensee will abide by the existing CEB System Operations Manual (the "Safety Manual") applicable to the Transmission System. The objective of the Safety Manual is to lay down the requirements to ensure safety of persons working at or across the operational and ownership boundaries between the Transmission System and those of its Users.

The Safety Manual will specify procedures to be applied to ensure the health and safety of all who are liable to be working on or testing the Transmission System or on plant and equipment connected to it. The Transmission Licensee will make available the Safety Manual to all Users for information and compliance. Users shall also furnish a copy of their own Safety Manuals to the Transmission Licensee in advance. Transmission Licensee may suggest revisions to such Safety Manuals. If any User who desires to revise any provision of its Safety Manual shall carry out such revisions in consultation with the Transmission Licensee. Transmission Licensee shall inform all other Users who have an electrical interface with the User, of those finalized revisions.

4.18.2 SAFETY MANAGEMENT SYSTEM

The Transmission Licensee will establish and document a safety management system, primary objective of which would be to minimize the loss of human life, injury and destruction caused due totheir work practices, thereby achieving improvements in safety performance.

4.18.3 SAFETY PRECAUTIONS

Working in Dead Systems (Working in electrical system/plant/apparatus in the absence of voltage)

All main electrical apparatus/equipment shall be kept locked/keyed. Only authorized persons will have access to them. Following are the most important safety precautions that need to be followed, when working on apparatus/equipment connected to High Voltage systems, unless otherwise Live Line work provisions are allowed.

(a) Isolation of the system/plant/apparatus on which work is to be carried out from the remainder of the system using approved isolation devices, keeping them locked and tagged in the isolated position.
(b) Testing the working zone and all connected system/plant/apparatus with approved and updated live detection Equipment for ensuring absence of voltage.
(c) Earthing the system/plant/apparatus on which work is to be carried out, preferably at either ends of the working zone to ensure no direct or induced voltages/surge voltages would appear in the working zone by way of providing a connection with an approved earthing device.

Working in Live Systems (Working in electrical system/plant/apparatus in the presence of voltage)

Working in live systems shall be carried out as prescribed in the System Operations Manual of CEB. Only competent persons shall be deployed in the Live Systems except competent persons who are previously identified and certified by the User.
The tools and equipment used shall be periodically tested, checked and verified as prescribed by the manufacturer.

4.19 OPERATING INSTRUCTIONS AMONG TRANSMISSION LICENSEE AND OTHER LICENSEES & USERS

Operations in the Transmission System, Users' Systems or the Distribution System could have an operational effect on each other's systems. It shall be the responsibility of each party to bring such information to the notice of relevant parties whose systems may be affected as a result of such operations.

4.20 SIGNIFICANT EVENTS/INCIDENTS

Licensees may be confronted by situations that will require the system operations to be carried out with known weaknesses that will have an operational effect on the system. It is the responsibility of every Licensee to inform such risks. These notifications shall enable all parties to take appropriate action to mitigate the effect of lowering of quality or facing outages.

All incidents occurring in Generating Units shall promptly be reported to the System Operator. The System Operator may ask for a written report on any incident and also call for a report from any other Users affected by an incident. On such a request, the Generator or User shall submit the report expeditiously.

5 GENERATION DISPATCH CODE

5.1 INTRODUCTION

This Generation Dispatch Code (**GDC**) specifies the procedure to be adopted for the scheduling and economic Dispatch of Generating Units to meet the Demand and to maintain voltage and Frequency within an acceptable range, and defines the responsibilities of the Transmission Licensee and contributions by Users to help achieve this goal.

5.2 APPLICABILITY

This **GDC** applies to the Transmission Licensee, Generation Licensees including IBRE, Distribution Licensees, Transmission Customers and Embedded Generators.

5.3 OBJECTIVES

The objectives of the **GDC** are the following:

(a) Enable the Transmission Licensee to Dispatch adequate generation resources to meet the Demand at all times
(b) Establish the rules and procedures the System Operator shall follow in scheduling the required generation resources in the short and medium term
(c) Define the role of the Transmission Licensee (in relation to both the transmission business, and the bulk supply and operations business) and other Users in this process, and the mechanisms to coordinate the real-time operation of the system and the reporting requirements.

5.4 RESPONSIBILITIES

5.4.1 TRANSMISSION LICENSEE

The Transmission Licensee, as the Single Buyer, shall be responsible for preparation of the capacity and energy Demand Forecast as required by the System Operator.

5.4.2 SYSTEM OPERATOR

The responsibilities of the Transmission Licensee's System Operator include,

(a) Dispatch planning, including planning of reservoir operations subject to decisions by Water Management Secretariat (WMS), Dispatch forecast and identification of generation resources expected to be available to supply the forecast Demand with adequate reserve, considering system constraints,

(b) Dispatching of generation to meet the electricity Demand taking into consideration the operational features of dispatchable and non-dispatchable generating units and operating the Transmission System at optimum economic efficiency,

(c) specifying the information and data, procedures, formats, time frames for the submission of such data by the Single Buyer and Licensees for operations and generation Dispatch planning,

(d) validating, confirming or rejecting the data to ensure that operations and generation Dispatch planning is done with accuracy,

(e) communicating of the plans and results associated with the operations and Dispatch plans,

(f) issuing Dispatch Instructions including request for load disconnections during real time operation, and

(g) coordinating the IBRE operations based on the inputs received from the Intermittent Resource based Generators as per Appendix E.

(h) Controlling the real time generation output of IBRE which have capacities greater than or equal to 5 MW, via the Renewable Energy Desk.

(i) Curtailment of the IBRE generation equal or greater than 5 MW will be practiced as per the conditions in PPA. If the point of connection of relevant IBRE generation is within the transmission network, curtailment instructions shall be provided by System Operator to the relevant plant.

5.4.3 GENERATION LICENSES

Responsibilities of Generation Licensees include the following.

(a) Cooperate with the System Operator to mitigate and overcome abnormal operating situations of the Transmission System by carrying out System Operator's instructions with regard to operation of Licensees' plant and equipment

(b) Provision of all data required by the System Operator in respect of availability.

(c) Dispatching as required by the System Operator.

(d) Cooperating with the System Operator by carrying out its instructions in respect of the Dispatch of Generating Units.

(e) All IBRE shall limit its generation to meet the maximum voltage criteria stated in Appendix A, Table 3.2(B).

(f) Provision of MW and Mvar availability of all power plants with greater than 5 MW capacity with 15 minutes interval for the period of 72 hours by 10:00 hrs each day for the Daily Dispatch Plan preparation.

5.4.4 DISTRIBUTION LICENSES

(a) Load details(MW) of each feeder shall be forwarded to System Operator on real time basis by the relevant Distribution Licensees and monthly demand forecast data shall be forwarded in long-term run by Distribution Licensee ~~before~~ 10 days prior to the beginning of each month as a rolling plan for next twelve months.

(b) Curtailments shall be implemented as per the instructions given by the System Operator.

5.5 DISPATCH PLANNING

5.5.1 ROLLING DISPATCH PLAN

The Rolling Dispatch Plan (including water management and reservoir planning) with a year ahead planning period and updated monthly will be prepared by the System Operator considering the Demand Forecast based on the information provided by the Distribution Licensees, expected transmission constraints and generation availability.

The Rolling Dispatch Plan will represent the energy Dispatch forecast taking into consideration the Demand Forecast.

The actual Dispatch may vary from the forecast, owing to uncertainties including hydrological conditions, weather conditions, non-dispatchable IBRE generation, fuel availability, fuel Price variations, WMS directives, Demand Forecast, network constraints and forced outages.

The purpose of the Rolling Dispatch Plan is to schedule the available generation resources along the year, taking into account the maintenance plans for generation and transmission to minimise the risks of non-supply, and to forecast the generation costs to be transferred to the end user tariffs. The System Operator will define the data required to prepare these plans, and the Licensees and Users shall be obliged to supply such data.
All IBRE of 5 MW or above, shall submit a year-ahead Rolling Dispatch Plan, updated monthly with forecast generation. The System Operator shall include this forecast generation in dispatch planning.

The System Operator shall develop the Dispatch Plan using a medium term operation planning software model that can consider security constraints, to derive probable allocation of hydropower resources for power generation and conduct optimal hydro-thermal Dispatch, considering reliability, security constraints and non-dispatchable generation.

(a) Data and Information

Before the end of each year, the System Operator will request the Licensees, the information indicated in **Appendix B Section 5.1.**

(b) Results

The System Operator shall derive the expected energy forecast for the Rolling Dispatch Plan which shall include the following results for each month:

(i) Generation forecast.
(ii) Expected energy balance.

5.5.2 MONTHLY UPDATED DISPATCH PLAN

The System Operator shall update the Rolling Dispatch Plan every month aimed at adjusting the economic positioning of hydro resources made available for power generation.

Before the end of each month, the System Operator shall require Licensees to update relevant information including generating unit outages and fuel prices. Licensees shall respond to such requests expeditiously.

5.5.3 DAILY DISPATCH PLAN

The System Operator will participate in the weekly operational meeting of Water Management Secretariat and will update the Monthly Dispatch Plan on the directives of the Water Management Secretariat which are considered for weekly operation planning.

The System Operator will prepare a Daily Dispatch Plan based on the information and Data available, for the next day (or days considering non-working days to follow) based on the monthly updated plan, for the guidance of the Control Person.

The Daily Dispatch Plan shall be submitted to PUCSL before 22:00 on the preceding day.

5.5.4 ANNUAL DISPATCH PLAN

The System Operator will prepare an annual dispatch plan for the next year in September of every year in monthly time steps, based on the latest available Rolling Dispatch Plan.

(a) Methodology

The methodology and software used will be that used for the Rolling Dispatch Plan.

(b) Results

The System Operator will derive the expected energy Dispatch forecast for the Annual Dispatch Plan which will include the following results for each month:

(i) Generation forecast.
(ii) Expected energy balance.

(c) Timing and Publication

The Annual Dispatch Plan will be submitted to PUCSL for the subsequent year, on or before 31st December.

The System Operator shall prepare a provisional version of the Annual Dispatch Plan covering a future period of one year, in monthly time steps, on or before any other date specifically stated by PUCSL in years when tariff filings are scheduled.

5.6 DISPATCH PROCEDURES

System Operator will prepare a daily dispatch schedule and Generators will be requested to generate according to this schedule. All dispatchable Generating Units will be subject to central Dispatch instructions. The Dispatch shall be a least-cost, security-constrained Dispatch, meaning that generating unit commitments will be optimised with full recognition of unit availability, unit start-up and operating costs, and grid constraints due to system operating limits and irrigation constraints in the case of multi-purpose hydropower Generating Units. Log notes shall be maintained regarding any deviation from the Daily Dispatch Plan, including the reasons for the same.

Dispatchable Generators shall generate according to the daily Dispatch schedule. Dispatch Instructions shall be in a standard format. These instructions shall include time, Power Station, Generating Unit, and names of operators sending and receiving the same.

5.6.1 COMMUNICATION WITH GENERATORS

Dispatch instructions shall be issued by telephone (or other methods of oral communication), with the exchange of names of operators sending and receiving the same, and logging the instructions at each end. All such oral instructions shall be compiled subsequently into written form.

5.6.2 ACTION REQUIRED BY GENERATORS

All Generators shall comply promptly with a Dispatch instruction issued by the System Operator unless this action would compromise the safety of personnel or plant. In the event of any unforeseen difficulties in carrying out an instruction, a Generator shall promptly inform the System Operator.

All Generating Units shall have Automatic Voltage Regulator (AVR) in service and shall have the Governor available and in service, The Governor should be capable of causing automatic increase or decrease in output of a Generating Unit within the normal declared Frequency range and within the respective capability limit. All Generators shall promptly transmit an Outage Notice to the System Operator intimating all unplanned outages of any Generating Unit/auxiliaries, which reduce the generation capacity dispatched the Transmission System. Generators shall immediately inform the System Operator by telephone (or any other means of oral communication) of any loss or change (temporary or otherwise) to the operational capability of any Generating Unit which is synchronised to the system or which is being used to maintain system reserve. Generators shall inform System Operator any removal of AVR and/or Governor from service, with reasons.

On receiving instructions from the System Operator to synchronise, generators shall synchronise the particular unit to the grid within the time prescribed. Generators shall immediately advise the System Operator of any circumstances which may prevent the Generator from performing the required Dispatch instructions. Generators shall not disconnect Generating Units without instruction from the System Operator, except on the grounds of threats to personnel safety or equipment integrity, which shall be promptly reported to the System Operator.

Generators shall report any abnormal voltage and Frequency-related operation of Generating Units promptly to the System Operator. Generators shall not synchronise Generating Units to the Transmission System without instructions from the System Operator. In emergency situations, a Generator may synchronise Units with the Transmission System without prior notification, in the interest of the operation of the Transmission System, following standing instructions developed for such purpose under "contingency planning". Generator shall inform System Operator promptly if they fail to comply with any of the above provisions.

5.7 SHORTAGE MANAGEMENT

The System Operator may plan and instruct a Licensee to shed load if the daily dispatch schedule or real time Dispatch shows shortage of energy in the system as a whole or in one or more specific regions in the system, owing to insufficient generation or insufficient transmission capacity. All Licensees are obliged to comply with the curtailment schedules, load shedding plans and instructions of the System Operator.

In case of prolonged shortages, the Transmission Licensee shall prepare a rotational load shedding scheme in coordination with Distribution Licensees. The System Operator will determine the amount, timing and duration of load shedding to Licensees.

5.8 REAL TIME OPERATIONS AND DISPATCH INSTRUCTIONS

The System Operator shall monitor and coordinate in real time, the operation of the system, reliability, security and quality of service. To be able to fulfill these functions, each Licensee is obliged to inform immediately any modification to the day ahead expected conditions that may affect generation schedules, loads, reserve, ancillary services, reliability or security in the system.

Each Licensee is obliged to follow Dispatch and operation instructions received from the System Operator, unless when by doing so it could endanger the safety of its staff or security of its equipment. During the operation of the system, the System Operator shall

(a) review forecast and actual system conditions, including load, generation availability and constraints, and update the expected conditions for the rest of the day, and

modify the schedule of generation when a Generation Licensee informs a modification on the availability or Distribution Licensee informs a modification on the load requirement.

In case of significant deviations between expected day-ahead conditions and updated conditions for the rest of the day, the System Operator shall re-schedule generation. The System Operator shall issue the required Dispatch instructions based on the re-scheduling for the rest of the day and, when necessary, the foreseen load curtailments.

In case of emergencies or unexpected conditions that endanger the security of the system, the System Operator has the right to issue generation instructions that differ from the generation schedules prepared already, to maintain the security of the system and the quality of service within the criteria in this **GDC**.

In case of emergencies or any other unexpected condition that endangers the security of the system, the System Operator shall give priority to system reliability over economic Dispatch. In these conditions, the System Operator shall issue the instructions and follow the emergency procedures to restore the system to normal operation as soon as possible, independent of economic dispatch. Once the emergency or disturbance or unexpected condition has been solved or, if it is not solved and the system has been adjusted to the new conditions, the System Operator shall again accord the due priority to economic Dispatch.

5.9 OBLIGATIONS OF GENERATORS, DISTRIBUTION LICENSEES AND TRANSMISSION CUSTOMERS

As instructed by the System Operator, Generators shall meet operating schedules, Spinning Reserve, participation in the regulation of Frequency, and other requirements to maintain the supply to the Transmission System in accordance with the Dispatch planning and operating criteria. Deviations from the agreed values beyond the defined tolerance are considered a breach of the Generator's obligations.

In the case of IBRE, it may be necessary to limit the power output of an Energy Park at any given time at the Interconnection Point to a maximum to avoid overloading of the Grid. It should be possible to reduce the power output of the energy park by a desired amount compared with what is possible at the time, thereby setting aside regulating reserves to serve critical power requirement of the Grid. The power output of the Energy Park must be adjusted to the power requirement at that time with a view to avoiding starting cost of large generating units during off-peak periods, hence downward and upward regulation of production shall be possible. The energy park shall maintain the power output at the level at that time, (if the intermittent resource makes it possible) hence load limiting function should be available to stop upward regulation if the intermittent resource increases.

For system operational reasons it may be necessary for IBRE to limit the maximum rate at which the power output changes in relation to changes in the intermittent resource. Therefore, power ramp up/ramp down rate shall be able to be limited by IBRE control scheme and shall be able to automatically change the power output of the Energy Park to a level which is acceptable to power system.

Distribution Licensees and Transmission Customers shall meet the restrictions indicated by the System Operator, and meet other requirements to maintain the operation of the Total System within the established performance criteria. Deviations from the agreed values beyond the defined tolerance are considered a breach of the Distribution Licensee's obligations. IBRE on Standardized Power Purchase Agreements will have to be duly considered, when Distribution Licensee obligations are agreed between the System Operator and each Distribution Licensee.

6 GRID METERING CODE

6.1 INTRODUCTION

The Grid Metering Code (**GMC**) of the Grid Code,

(a) describes the procedures adopted by the Transmission Licensee with respect to measuring the electricity transfer between Licensees and Users
(b) defines the responsibilities of the Users with respect to metering of electricity transfer,
(c) specifies the minimum requirements for metering, and
(d) lays down the procedures Licensees have to adopt on maintenance, validation, collection, processing and verification of metering data.

6.2 APPLICABILITY

GMC applies to the Transmission Licensee, Distribution Licensees, Generation Licensees, Transmission Customers, all Users and all Parties who are authorized to carry out generation/distribution/supply activities, and are connected to the Grid.

6.3 OBJECTIVES

Objectives of the **GMC** are to ensure that,

(a) the electricity transfer metering function is done in a just, fair and an unbiased manner,
(b) measuring electricity flow at the interface transfer points of the Transmission System/Generators, boundaries between Licensees and Transmission System/Distribution Licensees, and also the Transmission System/Transmission Customers,
(c) Transmission Licensee as well as all the Users are aware of their responsibilities in respect of the metering services,
(d) appropriate procedures are followed in providing metering data for billing and settlement, and
(e) a dispute settlement process is in operation for resolving any disputes quickly and satisfactorily.

6.4 RESPONSIBILITIES

6.4.1 TRANSMISSION LICENSEE

The Transmission Licensee will be responsible for the following:

(a) Installing, commissioning, maintaining, repairing, replacing, testing and inspecting all meters and associated equipment at all Interconnection Points belongs to the transmission licensee in accordance with the provisions and the standards specified in this **GMC**.
The generation licensee shall be responsible for supplying, installing and commissioning of main and check meters at the stage of connecting to the grid. Reference is made to paragraph 3 under clause 6.5.1.

(b) Collection, storage and communication of metered data.
(c) Ensuring that meters or any associated equipment which do not meet the minimum requirements stipulated by the standards specified in this **GMC** are removed and replaced with the least possible delay, thus guaranteeing the integrity and Overall Accuracy of the metering function.
(d) Keeping the test certificates/records for a period of four (04) years.
(e) Providing all necessary information on the preparation needed at the User end for the installation of the metering equipment.
(f) Informing the User of the meter reading dates, cumulative Active Energy and Reactive Energy usage where applicable, and Demand for the billing period.

6.4.2 USERS

Users shall be responsible for the following:

(a) Installing energy meters at the interconnection points
(b) Ensuring safety of meters and associated equipment installed in their premises.
(c) Providing unrestricted access to authorized representatives of the Transmission Licensee at all times, and where metering equipment has been installed in a restricted area, the two parties will agree on a procedure for the Licensee to gain access to the same.
(d) Notifying the Transmission Licensee of any suspected malfunctioning, defects, damages or any potential dangers to the equipment, within five working days from the User becoming aware of such situations.
(e) Refraining from tampering and not to permit tampering by others, of any meters or related equipment.

6.5 METERING: GENERAL REQUIREMENTS

6.5.1 GENERATION/TRANSMISSION BOUNDARY

Meters for electricity transfers at Generation/Transmission boundaries shall be designed and installed in such a manner that the net output from each Generating Unit and the total amount of energy exported to the Transmission System can be accurately measured.

As far as possible, meters shall be at the Interconnection Point.

At interconnection Points, one main meter and one check meter shall be installed. The main meter shall be the meter used in commercial transactions. If the main meter is not available for any reason, the check meter may be used.

Maintaining, repairing, replacing, testing and inspecting of check meters and associated equipment shall be conducted by Transmission licensee. Maintaining, repairing, replacing, testing and inspecting of main meters and associated equipment shall be conducted by Generation licensee.

Initially, at the stage of connecting to the grid, Generation licensee should supply both main meter and check meter at its sole cost and expense. At the time of meter replacements, check meter shall be provided by Transmission licensee and main meter shall be provided by Generation licensee.

6.5.2 TRANSMISSION/DISTRIBUTION BOUNDARY AND INTER-LICENSEE BOUNDARIES

Two meters shall be installed at the lower voltage (33 kV or 11kV, as relevant) side of power transformers at Grid Substations, one the main meter and the other the check meter,

(i) for measuring electricity flow between the Transmission System and the relevant Distribution Licensee systems, and
(ii) for measuring electricity transfer across the inter-Licensee boundaries.

Initially, at the stage of connecting to the distribution boundaries, Transmission licensee should supply both main meter (TRANSCO) and check meter (DISCO) at its sole cost and expense. At the time of meter replacements, main meter shall be provided by Transmission licensee and check meter shall be provided by Distribution licensee.

The measurement points for Transmission Customers shall be at the entry side of the stepdown transformers of the customer's facilities. The main meter shall be the meter used in commercial transactions. If the main meter is not available for any reason, the check meter may be used.

In the alternative, at the request of a Distribution Licensee or if the situation Demands, spare meters may be installed on each 33kV or 11kV feeder serving a Distribution Licensee, and cost shall be transferred to the relevant distribution licensee.

6.5.3 INSTALLATION OF METERING SYSTEMS AND OWNERSHIP

Generation Licensees, Distribution Licensees and Users shall bear the cost of the meters and the associated equipment, which shall include the equipment given below:

(a) energy/demand meters
(b) instrument transformers
(c) communication equipment
(d) cabling
(e) protective devices
(f) test terminals

The respective Licensee will install the metering system in accordance with the Connection Agreement. Meters will be installed as close as reasonably practical to the Interconnection Point, taking into consideration the physical location, costs and relevant technical issues.
Main meters at Generation/Transmission boundary will be owned by the Generator Licensee and main meters at Transmission/Distribution boundary will be owned by the Transmission Licensee.
Check meters at Generation/Transmission boundary will be owned by the Transmission Licensee and check meters at Transmission/Distribution boundary will be owned by the Distribution Licensee.

6.5.4 METERING POINT AND INTERIM REQUIREMENTS

The metering point shall be at the Interconnection Point, as specified in the Connection Agreement.

However, in the existing system, owing to practical difficulties, some metering points will not coincide with the Interconnection Points and in such situations, compensation shall be applied to account for the energy and demand required for any plant and equipment that lie between the Interconnection Point and the metering point.

The preferred method of applying compensation would be to establish a Virtual Metering Point by installing meters, which have the capability of being configured for on-line dynamic loss compensation. In the alternative, compensation may be applied to the recorded meter readings. In both cases, the User and the Transmission Licensee will reach agreement on the compensation and adjustment factors to be applied off-line.
Compensation and adjustment factors will be derived using the loss percentages/values of the equipment between the physical metering point and the interconnection point.

The respective Licensee will test meters and equipment in accordance with the accepted international practices. The Transmission Licensee will make the details available to Users on request.

6.6 DESIGN REQUIREMENTS

The respective Licensee as mentioned under clause 6.5.3, will ensure that the design of all meters and the related equipment are in compliance with the requirements of the applicable standards and the latest energy meter specification available with the Transmission Licensee including the following:

(a) Full four quadrant metering where active and reactive energy flow, or is likely to flow, in both directions, are separately measured.
(b) Measuring and recording the appropriate electrical quantities in accordance with the applicable tariff or other charging arrangements between the Licensee and the User.
(c) Energy and demand registers on the basis of time of use, as specified by the Transmission Licensee, and the time to be based on standard Sri Lanka time.
(d) Burden requirements of the current and voltage transformers are correctly determined and used in a manner to enhance accuracy.
(e) Capable of electronic data transfer and compatible with the Transmission Licensee's interrogation and data collection systems.

6.6.1 ACCURACY OF METERS AND ASSOCIATED EQUIPMENT

(a) Meters used at the Connection Points shall be static and of Class 0.2S accuracy or higher accuracy.
(b) Measuring core of the current transformer shall be of 0.2S accuracy class and voltage transformer shall be of 0.2 accuracy class to be compatible with the accuracy of the meters used.

6.6.2 PROGRAMMING REQUIREMENTS OF METERS

All meters will be programmed to comply with the criteria listed below, in accordance with the relevant values stipulated in the applicable tariff decision issued by PUCSL or the Power Purchase Agreement, as relevant and should comply with the latest energy meter specification available with the Transmission Licensee.

(a) Demand

The average demand over each averaging period, commencing at 00:00 each day will be recorded. Unless otherwise stated in the tariff decision issued by PUCSL, (i) the averaging period shall be 15 minutes, and (ii) demand shall be measured and recorded in kilowatt (kW).

(b) Time of Use

The Transmission Licensee will ensure that all meters except those at the Generator/Transmission System interfaces are programmed to comply with the time intervals of the Time of Use (TOU) tariff regime, specified in the applicable tariff decision issued by PUCSL for the purpose of measuring Active and Reactive Energy, or any other quantity. The accuracy of the boundaries of each time interval shall be within 05 minutes.

6.7 DATA COLLECTION

The Transmission Licensee has the right to collect, import/export data relating to Active Power, Reactive Power, Active Energy and Reactive Energy, or any other measured data, if required from the respective metering installations for the Transmission/Distribution boundary. The Generation Licensee has the right to collect, import/export data relating to Active Power, Reactive Power, Active Energy and Reactive Energy, or any other measured data, if required from the respective metering installations for the Generation/Transmission boundary. Information may be collected by remote interrogation or manual on-site interrogation in accordance with the terms of this **GMC**.
Relevant Power Purchase Agreement (PPA) or Power Sales Agreement (PSA) shall be referred regarding access rights.

6.7.1 DATA STORAGE

The Transmission Licensee will establish a database for metering data, and for each meter installation. The information and data will be as in **Appendix B Section 6.1**.

Users shall make available any information and data to the Transmission Licensee on request, which may be required to establish and maintain the database.

6.7.2 OWNERSHIP AND SECURITY OF THE DATABASE

The Transmission Licensee will be the owner of the metering database and be responsible for the security of data. Database information shall be considered as strictly confidential and shall not be disclosed to any Party other than to the metered entity or as required by the License conditions or for law enforcement purposes.

The Transmission Licensee will ensure all relevant data in the database is made available on schedule to the relevant parties for billing and settlement purposes.

6.7.3 METER READINGS AND MONITORING

All metering data will be directly downloaded to the metering database from the respective metering installations. However, during the transition period, manual meter reading and reporting may be needed and in such instances, manual meter readings will be taken, witnessed and certified by authorised representatives of all concerned parties.

In the event of any fault or failure of communication lines or any error or omission in such data, the Transmission Licensee will retrieve such data by manual on-site interrogation, duly certified by authorised representatives of all concerned parties.

In case of failure to retrieve data for the particular period, quantity of electricity shall be measured or determined by agreement between the Parties as per Power Purchase Agreement (PPA) or Power Sales Agreement (PSA).

6.7.4 DATA VALIDATION

The Transmission Licensee will be responsible for data validation and substitution of metering data. When the main metering system becomes non-functional, erroneous or operating outside the prescribed limits, the Transmission Licensee will use readings of the check meters, wherever such meters are available.

In situations when both the main meters and check meters are not available or not functioning, the method described in the relevant PPAs/PSAs or Connections Agreements for estimation of data will be used to calculate the monthly bills.

6.8 MAINTENANCE OF METERING SYSTEMS

6.8.1 MAINTENANCE, TESTING AND AUDITING PROGRAMS

The respective Licensee as mentioned under clause 6.5.3, will maintain, test and audit all metering systems according to a planned program and shall keep all test results, maintenance records and sealing records in respect of all items tested/inspected. On request, relevant information will be made available to Users.

When carrying out maintenance, testing or auditing, prior notice will be given to Users in accordance with Sri Lanka Electricity Act No. 20 of 2009. The User or the User's authorized representative's signature shall be obtained to certify the meter readings before and after testing.

The Transmission Licensee will develop procedures on the removal or replacement of meters, and for surcharges and fines where applicable, and make such information available to Users.

6.8.2 TESTING OF METERING SYSTEMS

Metering systems will be tested adopting international best practices. Any testing activity shall be in one of the two categories: (i) routine testing and (ii) testing upon a request made either by the Transmission Licensee or a User.

(a) Routine Testing

Routine testing will be conducted according to a pre-planned schedule. The respective Licensee as mentioned under clause 6.5.3, shall test all meters at least once in twelve months, and the instrument transformers at least once in five years.

(b) Testing Upon Request

The Transmission Licensee or a User may make a request for testing.

(i) If and when the Transmission Licensee has any doubts about the accuracy of the metering systems, a written notification will be issued to the User. Results of the most recent routine test, which shall not be more than 12 months old (five years in case of instrument transformers),will be attached to the notification. If a routine test has not been conducted

within the last 12 months (five years in case of instrument transformers) or if a routine test is due within the next 30 days, the Transmission Licensee shall conduct a routine test.

(ii) A User may make a written request to the Transmission Licensee, and upon payment of the necessary charges[1], the test shall be conducted.

Testing shall be arranged by the Transmission Licensee.

Sufficient notice will be given by the Transmission Licensee announcing the test date and time, and Users will be invited to witness them. As soon as practicable, the Transmission Licensee will make the test results available to the relevant User.

6.8.3 METER SYSTEMS OPERATING OUTSIDE THE PRESCRIBED LIMITS

During a test, if a metering system is found to be operating outside the prescribed limits of accuracy, the Transmission Licensee will implement the following:

(a) If the Test was Routine, as required in section 6.8.2 (a)

Restore the metering systems to operate within the prescribed limits of accuracy as soon as reasonably practicable. No compensation shall be payable to the Transmission Licensee or the User, as the case may be.

(b) If the test was conducted upon notification by the Transmission Licensee to User, as required in section 6.8.2 (b)(i)

(i) Restore the metering systems to operate within the prescribed limits of accuracy as soon as reasonably practicable.

(ii) Revise all charges on the basis of test results if the invoice was prepared based on erroneous meter readings. The period for revision shall be from the date the Transmission Licensee has informed the User in writing of the suspected malfunctioning up to the date of testing.

(c) If the test was conducted upon notification by a User to the Transmission Licensee, as required in section 6.8.2 (b)(ii)

(i) Restore the metering systems to operate within the prescribed limits of accuracy as soon as reasonably practicable.

(ii) Refund all payments by the User as testing charges if those are not owned by them.

(iii) Revise all charges on the basis of test results if the invoice was prepared based on erroneous meter readings. The period for revision shall be from the date the User has made his written complaint to the Transmission Licensee up to the time of testing.

6.9 METER TESTING EQUIPMENT

Meter testing equipment will be calibrated and tested at time intervals not exceeding five (05) years.

6.10 DISPUTES

The Transmission Licensee will make all efforts to resolve disputes on matters related to metering and reach agreement with the User. However, if the User is not satisfied with the solution offered, the matter shall be resolved in accordance with the agreement in place.

[1] These charges are fixed in the procedure for setting Allowed Charges.

ANNEX 1 TO THE GRID CODE

RULES AND PROCEDURES FOR GRID CODE ENFORCEMENTAND REVIEW PANEL (GCERP)

Reference in the Grid Code: Section 1.6.1

1 FUNCTIONS

Functions of the GCERP (the "Panel") shall be as follows:

(i) Review all suggestions and amendments proposed by any party and make suitable recommendations to the Transmission Licensee.
(ii) Initiate and coordinate revisions and regular reviews to the Grid Code, and make suitable recommendations to the Transmission Licensee for incorporation.
(iii) Facilitate the resolution of issues brought up by the members of the GCERP or by the PUCSL, and submit its recommendations to the Transmission Licensee. (iv) Produce written records on the activities of the Panel.

2 MEMBERSHIP

GCERP shall comprise eleven (11) members excluding the chairperson as follows:

(i) Four members representing the Transmission Licensee
(ii) Two members representing Distribution Licensees who shall also be members of the Distribution Code Enforcement and Review Panel (DCERP) as well.
(iii) One member representing the Generation Licensee.
(iv) One member representing Licensees with IBRE.
(v) One member representing Generators other than above.
(vi) One member representing Transmission Customers.
(vii) Director (Licensing) of PUCSL, or such other official of PUCSL nominated by the Commission, shall function as the Secretary to the panel One member representing PUCSL, who shall not have voting rights.

All members shall be academically and professionally qualified engineers with experience in electric power system engineering.

3 The CHAIRPERSON

Chairperson shall be one of the four members from TL, the most senior officer in TL or one appointed by AGM(Tr).

4 SECRETARY TO GCERP

(a) The Chairperson will appoint an official to function as the Secretary of the GCERP (the "Secretary").
(b) The Secretary will not be a member of the GCERP and shall not have voting rights.
(c) The Secretary shall be responsible for all administrative work of the GCERP and shall keep the records of GCERP activities and progress, as directed by GCERP.

5 APPOINTMENT OF MEMBERS TO GCERP

(a) Within two week from the date PUCSL communicates the Commission's approval of the Grid Code, the Secretary shall request the organisations listed in Section 2 to nominate suitable officers with requisite qualifications and experience to be appointed as members of GCERP.
(b) All organisations from which such requests have been made shall be required to nominate suitable officers within two weeks from the receipt of the request under 5(a).

(c) Within seven days from the receipt of the said nominations, the Secretary shall seek approval of the Chairperson to appoint them as the members of the GCERP.
(d) Unless the Chairperson has valid reasons to refuse acceptance of the nominations, the Chairperson will approve the same.
(e) If the Chairperson decides against any of the nominations, it will be informed to the relevant Licensee or organization accordingly, and a new nomination will be requested.
(f) When the Chairperson grants approvals to the nominations, it will be informed to the member and the relevant organization accordingly.
(g) Whenever a vacancy occurs in the GCRP, the above procedure will be followed, commencing within two weeks of a member leaving GCERP.

6 PERIOD OF MEMBERSHIP

(a) The term of office of a member of GCERP (other than the Chairperson) shall be for two years from the date of appointment.
(b) Of the first members of the GCERP, four members representing Licensees shall hold office for 6 months, 9 months, 12 months, 18 months respectively.
(c) GCERP shall decide on the members whose terms will be limited as stated in (b).
(d) No member shall hold office continuously for a period exceeding four years.
(e) No member (other than the Chairperson) shall hold office continuously for a period exceeding four years.

7 CESSATION OF MEMBERSHIP OF GCERP

A person who is a member of GCERP shall cease to be a member if,
(a) he/she ceases to be an employee of the Licensee that nominated him/her, or
(b) he/she ceases to be holding the position in the organisation that nominated him/her to the GCERP in the case of nominees of organisations other than Licensees, or
(c) he/she does not attend more than three consecutive meetings, or more than four meetings in a year, without the approval of the GCERP, or (d) if he/she resigns from the GCERP on his/her own accord.

8 MEETINGS OF GCERP

(a) The Chairperson will summon all meetings of the GCERP and at least one meeting shall be convened every month.
(b) Any member of GCERP may request the Chairperson to call a meeting, and the Chairperson shall not turn down such requests, unless he/she has good reason to do so.
(c) The Chairperson will preside at all meetings, and in his/her absence, GCERP shall elect one of its members as Chairperson pro tem.
(d) The Notice of Meeting will be issued at least five days prior to the date of the meeting, conveying the date, time and place.
(e) An agenda shall be provided with the Notice of Meeting.
(f) A quorum shall consist of not less than five members, and the Chairperson shall be considered as a member in a quorum count.
(g) In the event that all the business contained on the agenda cannot be dealt with judiciously within the time allocated for the meeting an adjournment shall occur.
(h) The Chairperson with the consent of GCERP may invite guests with relevant expertise to specific meetings.

9 GCERP DECISIONS

Decisions shall normally be by consensus, except at the request for a vote on specific requests by any member. In the event of a tie, the Chairperson shall have a casting vote. However, implementing the final decision having financial or commercial consequences on the Transmission Licensee will be with the concurrence of the Chairperson).

APPENDIX A – CRITERIA

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GRID CODE CRITERIA

INTRODUCTION Appendix A – Criteria

Describes the Criteria used in the Grid Code. This Appendix A is cross-referred in the Grid Code.

EFFECTIVE DATE

This Appendix A to the Grid Code has been recommended by the Grid Code Enforcement and Review Panel (GCERP) to be effective from DD-MM-YYYY.

1 GENERAL CODE – CRITERIA

No criteria to be listed

2 PLANNING CODE– CRITERIA

2.1 ALL USERS

2.1.1 TRANSMISSION SYSTEM PLANNING CRITERIA (GPC 2.3)

(A) VOLTAGE CRITERIA

The voltage criteria defines the allowable voltage deviation planned at any live bus bar of the network under normal operating conditions as given in Table 2.1.A.

Table 2.1.A: Planned Voltage Variations

Bus bar nominal voltage	Planned Maximum Voltage Variation (%)	
	Normal operating condition	Single contingency condition
400 kV	□5%	+5% -10%
220 kV	□5%	□10%
132 kV	□5%	□10%
33 kV	0%	□02%
22 kV	0%	□02%
11 kV	0%	□02%

(B) THERMAL CRITERIA

The design thermal criteria limits the loading of any transmission network element, in order to avoid overheating due to overload. The loading of transmission network elements should not exceed their rated thermal loading values for steady state conditions.

(C) SECURITY CRITERIA

The performance of the transmission system under contingency situation is taken into consideration in the security criteria. The adopted contingency level for planning purposes is N-1, i.e. outage of any one element of the transmission system at a time.

After outage of any one element (i.e. any one circuit of a transmission line or a transformer and without any adjustment or corrective measure), the system should be able to meet the distribution demand while maintaining the bus bar voltage levels as given in **Table 2.1.A** and loading of all the remaining elements should not exceed their thermal ratings.

(D) STABILITY CRITERIA

Stability criteria should ensure the system remains stable during and after a system disturbance in case of:

- Three-phase fault at any one overhead line terminal, cleared by the primary protection with successful and unsuccessful auto re-closing
- Loss of any one generation unit
- Large load rejection

(E) SHORT CIRCUIT CRITERIA

The short circuit criteria limits the maximum three phase circuit currents at the 132 kV, 33 kV and 11 kV bus bars of any Grid Substation (see **Table 2.1.E**), in order to protect the downstream transmission and distribution network elements.

Table 2.1.E: Planned Maximum 3 phase Short Circuit Levels

Bus bar nominal voltage	System	Maximum 3 phase fault level (kA)
220 kV and above	Overhead	40.0
	Underground cable	40.0
132 kV	Overhead	31.5
	Underground cable	31.5
33 kV	Overhead	25.0
	Underground cable	25.0
22 kV	Underground cable	25.0
11 kV	Underground cable	25.0

2.1.2 GENERATION PLANNING CRITERIA

(A) POWER SUPPLY SECURITY CRITERIA (GPC 2.18.2)

Table 2.1.2.A: Power Supply Security Criteria

Criterion	Value
Loss of Load probability (LOLP)	Maximum: 1.5%
Reserve Margin	Minimum: 2.5% Maximum: 20%

Table 2.1.2.B: Probabilities of Hydro Conditions

Hydro Condition	Probability
Very Wet	10%
Wet	20%
Medium	50%
Dry	15%
Very dry	5%

Table 2.1.2.C - Additional Spinning Reserve Requirement for IBRE power plants (GPC 2.18.2)

Criterion	Value
to be defined by Transmission Licensee based on Integration Study	

Table 2.1.2.D– Plant Economic Life (GPC 2.19.3)

Plant Type	Economic Life (Years)
Hydroelectric	50
Steam Turbine Generator	30
Open Cycle Gas Turbine	20
Combined Cycle Gas Turbine	30
Biomass	20
Wind	20
Solar	20

3 CONNECTION CODE– CRITERIA

3.1 ALL USERS

(A) DECLARED VOLTAGE (GCC 3.5)

Declared Voltages at the Interconnection Point will be 11 kV,22 kV, 33 kV, 132 kV, 220 kV and 400 kV.

(B) FREQUENCY VARIATIONS (GCC 3.6.1)

Table 3.1.B: Frequency Variation

Frequency (Hz)	System Conditions
50.5 - 52.0	Emergency
49.5 - 50.5	Normal
47.0 - 49.5	Emergency

(C) VOLTAGE VARIATIONS (GCC 3.6.2)

Table 3.1.C: Voltage Variation

System Nominal Voltage (kV)	Variation
400 kV	± 10 %
220 kV	± 10 %
132 kV	± 10 %
33 kV	± 6 %
22 kV	± 6 %
11 kV	± 6 %

(D) VOLTAGE WAVEFORM DISTORTION (GCC 3.6.3)

Allowed Distortion is limited to indicative planning levels given in Table 2 of sub-clause 4.2.1 of IEC 61000 -3-6 (Harmonics).

(E) VOLTAGE FLUCTUATIONS (GCC 3.6.4)

Allowed fluctuation is limited to indicative values of planning levels given in Table 2 of sub-clause 4.2.1 of IEC 61000-3-7(Voltage fluctuation).

(F) VOLTAGE UNBALANCE (GCC 3.6.5)

Negative phase sequence load unbalance in accordance with IEC 60034-1.

(G) BASIC IMPULSE LEVEL (GCC 3.7.1)

Table 3.1.G: Basic Impulse Level (BIL)

System Nominal Voltage (kV)	BIL (kV)
400	1,425
220	1,050
132	650
33	170
22	125
11	95

(H) POWER FREQUENCY WITHSTAND VOLTAGE (GCC 3.7.2)

Table 3.1.H: Power Frequency withstand Voltage One (01) minute

System Nominal Voltage (kV)	Power Frequency Withstand Voltage (kV)
400	650
220	460
132	275
33	70
22	50
11	28

(I) THREE PHASE SHORT CIRCUIT LEVEL (GCC 3.7.3)

Table 3.1.I: Three Phase Short Circuit Level

System Nominal Voltage (kV)	Three phase Short Circuit Level (kA)
400	40.0
220	40.0
132	31.5
33	25.0
22	25.0
11	25.0

(J) CURRENT DISTORTION LIMITS (GCC 3.8)

Allowed Current Distortion by an individual User shall be limited to the current distortion limits described in clause 10 of IEEE 519-1992.

Measurement and evaluation of the current harmonic distortion shall be carried out in accordance with clause 9, 12 and 13 of IEEE 519-1992. Measurement and evaluation reports shall be prepared in accordance with IEEE 519-1992.

(K) EMISSION LIMITS OF FLUCTUATING LOADS (GCC 3.9)

Allowed emission is limited to the emission limits described in clause 6, 7, 8 and 9 of IEC 61000-37 (Voltage fluctuation).

Measurement and evaluation of emissions shall be carried out in accordance with IEC 61000-3-6. Measurement and evaluation reports shall be prepared in accordance with IEC 61000-3-7.

3.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCES

(A) FREQUENCY VARIATION CAPABILITY (GCC 3.16.1)

Table 3.2.A: Frequency Variation Capability

Frequency (Hz)	Duration
50.5 - 52.0	60 minutes
49.5 - 50.5	Continuous
47.5 - 49.5	60 minutes
47.0 – 47.5	30 seconds

(B) VOLTAGE VARIATION CAPABILITY (GCC 3.16.2)

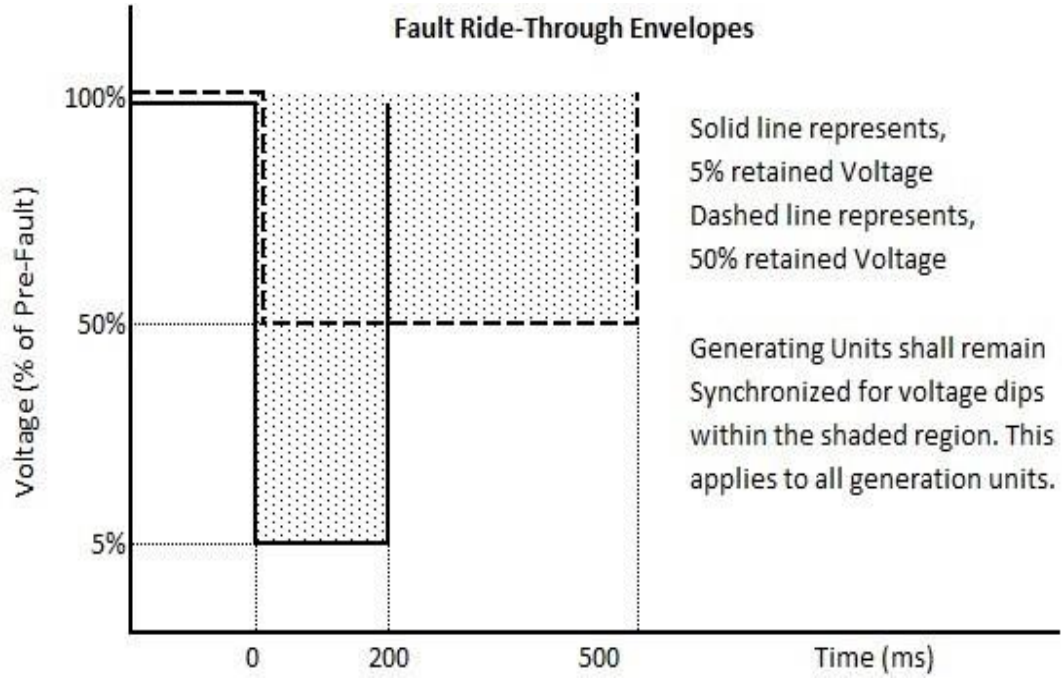
Table 3.2.B: Voltage Variation Capability

System Nominal Voltage	Variation
400 kV	± 10 %
220 kV	± 10 %
132 kV	± 10 %
33 kV	± 6%
22 kV	± 6%
11kV	± 6%

(C) FAULT RIDE-THROUGH CAPABILITY (GCC 3.16.6)

Voltage Dip Magnitude	Fault Ride-through Time
95% (5% retained)	200 ms
50% (50% retained)	500 ms

(D) FAULT RIDE-THROUGH CAPABILITY ENVELOPES (GCC 3.16.6)



3.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

3.3.1 POWER FACTOR VARIATION CAPABILITY AND REACTIVE POWER CAPABILITY

Refer Section 3.17 of this Grid Code.

3.3.2 POWER CURTAILMENT REQUIREMENTS (GCC 3.17.5)

Refer Section 3.17 of this Grid Code.

4 OPERATIONS CODE - CRITERIA

4.1 ALL USERS

4.2 ALL USERS

(A) FREQUENCY CONTROL (GOC 4.11)

Table 4.1.A: Frequency Variations under Normal System Conditions

Frequency (Hz)	Duration
49.5 - 50.5	Continuous

(B) VOLTAGE CONTROL (GOC4.12)

Table 4.1.B: Voltage Variations under Normal System Conditions

Nominal Voltage	Variation
400 kV	± 5 %
220 kV	± 5 %
132 kV	± 5 %
33 kV	± 6 %
22 kV	± 6 %
11 kV	± 6 %

APPENDIX B – DATA

TABLE OF CONTENTS

GRID CODE DATA

INTRODUCTION

Appendix B - Grid Code Data describes the data requirements of the Grid Code. The Appendix is cross-referred to the Grid Code.

EFFECTIVE DATE

This Appendix B to the Grid Code has been recommended by the Grid Code Review and Enforcement Panel (GCREP) from the DD-MM-YYYY.

1 GENERAL CODE - DATA

None

2 PLANNING CODE –DATA

2.1 DATA TO BE FURNISHED BY THE TRANSMISSION LICENSEE (GPC 2.9)

2.1.1 PRELIMINARY PROJECT PLANNING DATA

Preliminary Project Planning data and information to be made available by the Transmission Licensee to a prospective User.

(a) Single line diagram of the Transmission System indicating the existing lines and proposed lines.
(b) Relevant data on plant and equipment of the Transmission System.
(c) Transmission Licensee's connection requirements.
(d) Map of Sri Lanka showing the existing lines of the Transmission System and proposed lines. (e) Data related to Grid Substations indicating 33 kV (in case of 132/33kV or 220/33 kV Grid Substations), 11kV (in case of 132/11kV Grid Substations) outlets as applicable. (f) Long Term Transmission Development Plan.
(g) Long Term Generation Expansion Plan

2.1.2 COMMITTED PROJECT PLANNING DATA

None

2.1.3 STANDARD PLANNING DATA

None

2.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCE-DATA TO BE FURNISHED TO TRANSMISSION LICENSEE (2.10)

(Note: CR.IEEE stands for reference to the relevant IEEE Committee Report)

2.2.1 PRELIMINARY PROJECT PLANNING DATA

Part (I) Preliminary planning data of standard planning data

2.2.2 COMMITTED PROJECT PLANNING DATA

Part (I) Preliminary planning data of standard planning data and
Part (II) Committed project planning data of standard planning data

2.2.3 STANDARD PLANNING DATA

2.2.3.1 Standard Planning Data - Part (I) - Preliminary Planning Data

2.2.3.1.1 Thermal Generation

A. Connection

1	Interconnection Point	(Provide the single-line diagram of the proposed connection with the system)
2	Step up voltage for connection	(kV)
3	Approximate period and confirmation	

B. Station Capacity

1	Total station capacity (MW)	State whether development will be carried out in phases and if so, furnish details
2	No. of units and unit size	MW

C. Generating Unit Data

1	Generator	State type and capacity Energy source: coal/gas/diesel/fuel oil/naphtha etc. Technology (GT, CC, diesel engine, steam turbine or any other specify)
2.	Steam turbine	(State type, capacity) Inertia constant of the prime mover
3.	Alternator	(a) Type (b) Rating (Sn and Pn in MVA and MW) (c) Terminal voltage (Vn in kV) (d) Rated Power Factor (e) Reactive Power capability(MVar) at full MVA in the range 0.95 pf leading & 0.85 lagging (f) Short circuit ratio (g) Direct axis transient reactance (% on MVA rating) (h) Direct axis sub-transient reactance (% on MVA rating) (i) Auxiliary power requirement (MW) (j) Generator capability curve (k) Open circuit saturation curve (l) Inertia constant of the generator
4.	Generator Transformer	(a) Type (b) Rated capacity (MVA) (c) Voltage ratio (HV/LV) (d) Tap change range (+% to -%) (e) Percentage impedance (positive sequence at full load)

D. Auxiliaries and Start up data

1	Total power in (MW and MVA) required for auxiliaries	
2	Total external power required for start-up	

2.2.3.1.2 Hydroelectric Generation

Connection

1	Interconnection Point	Provide the single-line diagram of the proposed connection with the Transmission System
2	Step up voltage for connection	

A. Station Capacity

1	Total station capacity (MW)	State whether development will be carried out in phases and if so furnish details
2	No. of units and unit size in (MW)	

B. Generating Unit Data

1 Operating Head (in meters)

a) Maximum
b) Minimum
c) Average

2 Turbine (state type and capacity)
a) Inertia constant of the prime mover

3 Alternator
a) Type
b) Rating (MVA)
c) Terminal voltage (kV)
d) Rated Power Factor
e) Reactive Power capability (MVar) at full MW in the range 0.95 pf leading and 0.85 lagging
f) Short circuit ratio
g) Direct axis transient reactance (% on MVA rating)
h) Direct axis sub-transient reactance (% on MVA rating)
i) Auxiliary power requirement (MW)
a) Generator capability curve
b) Open circuit saturation curve
c) Inertia constant of the generator

4 Generator Transformer
a) Type
b) Rated capacity (MVA)
c) Voltage ratio (HV/LV)
d) Tap change range (+% to -%)
e) Percentage impedance (positive sequence at full load)

2.2.3.2 Standard Planning Data - Part (II) - Committed Project Planning Data

Detailed planning data required from generation are included in this section.

2.2.3.2.1 Detailed Planning Data Thermal Power Generation-Routine Submission

The generating unit data will include data of thermal units which consist of unit rating, performance and operating data as follows.

A. General (Provide what is applicable)

1. Name of the plant
2. Unit number and capacity in MVA
3. Commissioning date
4. Retirement date
5. Maximum available output in MW
6. Minimum output in MW
7. Forced outage rate
8. Maintenance schedule
9. Must-run status
10. Heat rate at minimum load kCal/kWh
11. Fuel data, fuel type, heat content of fuel, fuel limits (maximum and minimum per day), fuel cost (units of currency/GCal)
12. Emission rates of SO2 and NOx
13. Ratings of all major equipment in the plant such as
    a) Boiler (steam temperature/pressure)
    b) Coal mill (HP)
    c) Feed water pumps (HP)
    d) ID fans (HP)
    e) Turbines (HP)
    f) Alternators (MVA)
    g) Generator transformers (MVA)
    h) Auxiliary transformers (MVA)
14. Single line diagram of power station and switchyard
15. Relaying and metering diagram
16. Neutral grounding of generators
17. Excitation control (what type is used? e.g. thyrister, fast brushless?)
18. Earthing arrangements with earth resistance values.

B. Protection and Metering

1. Full description including settings for all relays and protection systems installed on the generating transformer, auxiliary transformer and electrical motor of major equipment listed, but not limited to, under I.14 (General)
2. Full description including settings for all relays installed on all outgoing feeders from power station switchyard, tie breakers, incoming breakers.
3. Full description of inter-tripping of breakers at the point or points of connection with Transmission System.
4. Most probable fault clearance time for electrical faults on the User's system.
5. Details of tariff and operational metering including instrument transformers and cables on the secondary side.

C. Switchyard

1. In relation to interconnecting transformers between the Transmission System and the Generator transformer high voltage system.
    a) Rated MVA
    b) Voltage ratio
    c) Vector group
    d) Positive sequence reactance (at maximum, minimum, normal tap) (% on MVA)
    e) Positive sequence resistance (at maximum, minimum, normal tap) (% on MVA)
    f) Zero sequence reactance (% on MVA)
    g) Tap changer range (+% to -%) and steps
    h) Type of tap changer (Off/On)

2. In relation to switchgear including circuit breakers, isolators on all circuits connected to the Points of Connection.
    i) Rated voltage (kV)
    j) Type of breaker (MOCB/ABCB/SF6)
    k) Rated short circuit breaking current (kA) 3ø
    l) Rated short circuit breaking current (kA) 1ø
    m) Rated short circuit making current (kA) 3ø
    n) Rated short circuit making current (kA) 1ø
    o) Provisions of auto reclosing with details
3. Lightning arresters, technical data
4. Details of PLC equipment installed at points of connections.
5. Basic insulation level (kV)
    a) Bus bar
    b) Switchgear
    c) Transformer bushings
    d) Transformer windings

D. GENERATING UNITS

I. *Parameters of alternators*

1. Rated terminal voltage Vn (kV)
2. Rated apparent power Sn (MVA)
3. Rated real power output Pn (MW)
4. Rated stator phase current in Ampere
5. Rated power factor Cos □
6. Nominal Frequency fn (Hz)
7. Nominal speed Nn (in rpm)
8. Inertia constant H (MW second/MVA)
9. Short circuit ratio Kc
10. Direct–axis synchronous reactance (unsaturated) {X d1 in pu}
11. Direct-axis transient reactance (unsaturated) {X' d1 in pu}
12. Direct-axis sub-transient reactance (unsaturated) {X" d1 in pu}
13. Quadrature-axis synchronous reactance (unsaturated) {Xq1 in pu}
14. Quadrature-axis transient reactance (unsaturated) {X'q1 in pu}
15. Quadrature-axis sub-transient reactive (unsaturated) {X"q1 in pu}
16. Leakage reactance (stator) { XL in pu}
17. Stator resistance per phase at 75 0c { Ra in Ohm}
18. Direct-axis transient open circuit time constant (unsaturated) {T'do in second}
19. Direct-axis sub-transient open circuit time constant (unsaturated) {T''_{do} in second}
20. Quadrature-axis transient open circuit time constant (unsaturated) (T'_{qo} in second}
21. Quadrature-axis sub-transient open circuit time constant (unsaturated) {T''_{qo} in second
22. Open-circuit saturation curve
23. Generator capability curve

II. *Parameters of Excitation Control System*

1. Exciter type
2. Exciter rated output current IFD in Ampere
3. Exciter rated output voltage (output voltage of control amplifier) EFD in Volt
4. Exciter ceiling current along with transient time capability (IFD ceiling, t ceiling}
5. Exciter ceiling voltage (max output voltage of control amplifier (EFD max in Volt)
6. Excitation system transient response with rise time (tr), overshoot and setting time (tg)
7. Excitation system open-loop frequency response characteristic with time low frequency gain (G), cross-over frequency (WC), phase margin (□m) and gain margin (GM)
8. Excitation system closed loop frequency response characteristic with band -width (WB), peak value of gain characteristic (Mg) and the corresponding frequency (WM) at which this peak occurs.
9. Dynamic characteristics of under excitation limiters.
10. Dynamic characteristics of over excitation limiters.
11. Detailed block diagram of entire excitation system showing transfer functions of individual elements.

12. Based on the exciter type as defined in the IEEE Committee Report on excitation system models for power system stability studies the following parameters shall be provided along with any other parameter which is relevant to the excitation system type as determined in the CR-IEEE. All parameter ranges shall be provided.
KA - Voltage regulator gain TA
- Voltage regulator time constant.
VR max - Voltage regular max output.
VA max, VA min - Regulator internal voltage maximum and minimum.

III. *Parameters of Governor*

1. Governor type. (based on CR-IEEE)
2. Governor gain (K_G in MW/Hx) along with governor gain range as defined in CR-IEEE.
3. Speed relay time constant (T_{SR}) along with range.
4. Valve positioning servomotor time constant (TSM) along with range.
5. Governor value opening rate limit (Cv open)
6. Governor valve closing rate limit (CV close)
7. Governor valve limit (CV max and CV msin)
8. Governor droop along with droop setting range (R)
9. Based on the compound steam turbine system in CR-IEEE the following parameters shall be provided where appropriate.

   TCN - Steam chest time constant {control values to HP (VHP) exhaust} TRH, TRH1 - Reheat time constant {control values to HP (VHP) exhaust (to IPHP exhaust)}
   TRH2 - Second reheat time constant (HP exhaust to IP exhaust)
10. Governor dead-band along with dead band design range.
11. A complete governor block diagram showing transfer functions of individual elements and conforming to models recommended in CR – IEEE.

IV. *Power system stabiliser*

Type and block diagram and parameters according to IEEE format.

V. *Turbine frequency versus time*

Operating limits

E. PLANT PERFORMANCE

I. *Station*

1. Daily demand profiles (last year) (peak and average)
2. Daily demand profiles (in time marked 30 minutes throughout the day)
3. Daily demand profiles (forecast) in time marked 30 minutes throughout the day
4. Generation (GWh)
5. Consumption in auxiliaries (GWh)
6. Supplied from system to auxiliary load (GWh)
7. Plant factor

II. *Generating Unit*

1. Generation (GWh)
2. Hours run
3. Deviation from schedule of planned outage

F. Maximum three-phase short circuit in feed at point of connection to the Grid.

2.2.3.2.2 Detailed Planning Data Hydroelectric Power Generation-Routine Submission The generating unit data will include data of hydro units which consist of unit rating, performance and operating data as follows.

A. General

1. Name of plant

2. Number of units and capacity of units (MVA)
3. River basin
4. Location
5. Maximum capacity (MW)
6. Capacity of the reservoir (MCM)
7. Full supply level of the reservoir (masl)
8. Minimum operating level of the reservoir (masl)
9. Area-capacity curve of the reservoir
10. Monthly seepage losses
11. Monthly evaporation losses
12. Power plant availability
13. Maximum turbine release (m^3/s)
14. Minimum turbine release (m^3/s)
15. Power output matrix
16. Ratings of all major equipment
    a) Turbines (HP)
    b) Generators (MVA)
    c) Generator transformers (MVA)
    d) Auxiliary transformers (MVA)
17. Single line diagram of power station and switchyard
18. Relaying and metering diagram
19. Neutral grounding of generator
20. Excitation control
21. Earthling arrangements with earth resistance values
22. Reservoir data
    a) Salient features
    b) Type of reservoir
        (i) Multipurpose
        (ii) Dedicated for power
    c) Operating table

B. Protection and Metering

1. Full description including settings for all relays and protection systems installed on the Generating Unit, generator transformer, auxiliary transformer and electrical motors of major equipment listed, but not limited to, under I-16 General.
2. Full description including settings for all relays installed on all outgoing feeders from the power station switchyard, tie breakers, incoming breakers.
3. Full description of inter-tripping of breakers at the point or points of connection with the Transmission System.
4. Most probable fault clearance time for electrical faults on the User's system.
5. Details of tariff and operational metering including details of instrument transformers and secondary cables.

C. Switchyard

1. Interconnecting transformers between the Transmission System and the Generator transformer high voltage system.
    a) Rated capacity (MVA)
    b) Voltage ratio
    c) Vector group
    d) Positive sequence reactance (maximum, minimum, normal Tap) (% on MVA)
    e) Positive sequence resistance (maximum, minimum, normal Tap) (% on MVA)
    f) Zero sequence reactance (% on MVA)
    g) Tap changer range (+ % to -%) and steps
    h) Type of tap changer (off/on)
2. Switchgear including circuit breakers, isolators on all circuits connected to the points of connection.
    a) Rated voltage (kV)
    b) Type of breaker (MOCB/ABCB/SF6)
    c) Rated short circuit breaking current (kA) 3 phase

d) Rated short circuit breaking current (kA) 1 phase
e) Rated short circuit making current (kA) 3 phase
f) Rated short circuit making current (kA) 1 phase
g) Provisions of auto reclosing with details

3. Lightning arresters, technical data
4. Details of power line carrier communication equipment installed at Interconnection Points.
5. Basic insulation level (kV)
   a) Bus bar
   b) Switchgear
   c) Transformer bushings
   d) Transformer windings

D. Generating Units

I. Parameters of Alternators

The parameters are the same as for Alternators of thermal stations (nos 1 to 23)

1. Type of turbine
2. Operating head (meter)
3. Discharge (m^3/s) at full gate opening
4. Speed rise on total load throw off (%)
5. Parameters q11, q13 q21 and q 23 as defined in CR-IEEE.

II. Parameters of Excitation Control System

Same as for excitation system of thermal alternators.

III. Parameters of Governors

1. Permanent speed droop (b_p)
2. Temporary speed droop (b_t)
3. Governor speed dead band (DBs)
4. Governor integral gain (K_I)
5. Governor proportional gain (K_P)
6. Governor derivative gain (K_D)
7. Water inertia time (T_w)
8. A complete governor block diagram showing transfer functions of individual elements and conforming to models recommended in CR-IEEE.

IV. Power system stabiliser

Type and block diagram and parameters according to IEEE format.

V. Turbine frequency versus time

Operating limits

E. PLANT PERFORMANCE

I. Station

1. Daily demand profile (previous year) (peak and average)
2. Daily demand profiles (In time marked 30 minutes throughout the day)
3. Daily demand profiles (forecast) (in time marked 30 minute throughout the day)
4. Generation (GWh)
5. Consumption in auxiliaries (GWh)
6. Auxiliaries supplied from the System (GWh)

II. Generating Unit

1. Generation (GWh)
2. Low head generation capacity
3. Hours run
4. Deviation from schedule of planned outage

F. Maximum three-phase short circuit infeed at point of connection to the Grid

2.2.3.2.3 Submission on request by transmission licensee – Thermal Power Stations

A. General

1. Feasibility Study Report
2. Status report
    a) Land
    b) Fuel
    c) Water
    d) Environmental clearance
    e) Rehabilitation of displaced persons.
3. Other approvals
4. Financing plan

B. Connection

1. Reports of studies for parallel operation with the Transmission System.
    a) Short circuit studies
    b) Stability studies
    c) Load flow studies
2. Proposed connections with the Transmission System.
    a) Voltage
    b) Number of circuits
    c) Interconnection Point

2.2.3.2.4 Submission on request by transmission licensee – Hydroelectric Power Stations

A. General

1. Feasibility Study Report
2. Status report
    a) Topographical survey
    b) Geological survey
    c) Land
    d) Environmental clearance
    e) Rehabilitation of displaced persons 3. Other approvals
4. Financing Plan.

B. II. Connection

i. Reports of studies for parallel operation with the Transmission System.
    a) Short circuit studies
    b) Stability studies
    c) Load flow studies

ii. Proposed connections with the Transmission System
    a) Voltage
    b) Number of circuits
    c) Interconnection Point

2.2.3.3 Standard Planning Data - Part (III)- Other Planning Data

2.2.3.3.1 Six Year System Plan Data (To be furnished by all Users)

1. Projection of works in the next 6 years (year wise)
2. Status
    a) Whether the feasibility study has been prepared and forwarded to the Transmission Licensee
    b) Any PUCSL directives
    c) Environmental clearance received for individual projects
    d) coal/water arrangements made for coal-fired thermal stations

e) Geological survey completed for hydropower stations
f) Route surveys completed for transmission lines
g) Load forecast made for distribution areas
h) Financial arrangement made

3. Phasing of expenditure (year wise)

Further to the above data, following are needed annually for the next 6 years

1. Scope (describe details of works)
2. Status (whether continued from the previous year or new works)
3. Plan outlay (indicate cost)
4. Benefits accrued (quantify)
   a) Generation
      (i) Capacity added (ii) Performance improved
   b) Transmission
      (i) Stability improved
      (ii) Reduction of losses
      (iii) Increase in power flow capability
   c) Distribution
      (i) Meeting load growth in area
      (ii) Reduction of losses (iii) Increase in voltage profile

2.2.3.3.2 Works in Progress Data

Performance Evaluation and Review Technique (PERT) network (of major works such as power stations, the Transmission System)
Gantt Chart (of works in distribution areas)

2.2.3.3.3 Completion Data

Date of completion: (means readiness for connection to the Transmission System) (for plant and equipment, transmission lines, switchgear, communication devices etc. connection of which may materially affect the efficiency and performance of the Transmission System)

2.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

DATA TO BE FURNISHED TO TRANSMISSION LICENSEE (2.10)

(Note: CR.IEEE stands for reference to the relevant IEEE Committee Report)

2.3.1 PRELIMINARY PROJECT PLANNING DATA

Preliminary planning data Part (I) standard planning data

2.3.2 COMMITTED PROJECT PLANNING DATA

Preliminary planning data Part (I)of standard planning data and committed project planning data Part (II) of standard planning data

2.3.3 STANDARD PLANNING DATA

2.3.3.1 *Standard Planning Data - Part (I) – Preliminary Planning Data*

2.3.3.1.1 Wind Power Generator Facilities (WPGF)

Applicants requesting for a new grid connection of WPGF or a modification of existing connection shall submit the following data at the preliminary stage.

(i) Name of the proposed WPGF and location (as decided by the Transmission Licensee)

(ii) Contact details

- Name of the contact person
- Address
- Telephone
- Email

(iii) Description of the project

- Total generation capacity (MW and MVA)

(If the application is for a modification, data submitted shall be for both existing as well as for the proposed modification)

- Type of WTGs proposed
- Number of WTGs proposed
- Rated generation capacity of each unit
- Total power required for auxiliaries
- Single line diagram, which shall include all parts of the existing and proposed systems operating at generating voltage and above, but not limited to the following:
    - Busbar arrangements
    - Electric circuit configurations (collector network, overhead lines/underground cables, transformers)
    - Switchgear
    - Current transformers, voltage transformers ○ Operating voltages, ○ Earthing arrangements ○ Numbering and nomenclature
- Location maps, site plans
- Transmission line route for the connection to the grid
- Scheduled date of commissioning

2.3.3.1.2 Solar Power Generation Facility (SPGF)

Applicants requesting for a new grid connection of SPGF or a modification of existing connection shall submit the following data at the preliminary stage.

(i) Name of the proposed SPGF and location (as decided by the Transmission Licensee) (ii) Contact details

- Name of the contact person
- Address
- Telephone
- Email

(iii) Description of the project

- Total generation capacity (MW and MVA)
- (If the application is for a modification, data submitted shall be for both existing as well as for the proposed modification)
- Type of solar facility (concentrated solar or solar photovoltaic)
- No of PV arrays proposed (if multiple inverters are to be used)
- Rated generation capacity of each array
- Total power required for auxiliaries
- Single line diagram, which shall include all parts of the existing and proposed systems operating at generating voltage and above, but not limited to the following:
    - Bus bar arrangements
    - Electric circuit configurations (collector network, overhead lines/underground cables, transformers)
    - Switchgear
    - Current transformers, voltage transformers ○ Operating voltages, ○ Earthing arrangements ○ Numbering and nomenclature
- Location maps, site plans

- Transmission line route for the connection to the grid
- Scheduled date of commissioning

2.3.3.2 Standard Planning Data - Part II - Committed Project Planning Data

2.3.3.2.1 Wind Power Generator Facilities (WPGF)

(A). Wind Turbine Generator

The information shall be provided for each unit where applicable.

(i) Information description
(ii) Unit number
(iii) Type (C or D)
(iv) Manufacturer
(v) Rated generation voltage
(vi) Rated capacity (MVA)
(vii) Rated capacity (MW)
(viii) A detailed simulation model of the wind turbine(s) to be used in PSS/E format capable of representing its transient and dynamic behaviour under both small and large disturbance conditions
(ix) For the year for which data is submitted
- Average site air density (kg/m^3)
- Maximum site air density (kg/m^3)
- Minimum site air density (kg/m^3)

(x) Blade swept area (m^2)
(xi) Inertia constant (H) (MW seconds /MVA)
(xii) "Turbine + Generating Unit" inertia constant (H) (MW seconds / MVA)
(xiii) Frequency- Voltage tolerances
- Frequency/voltage range within which continuous operation is guaranteed.
- Time based capabilities for frequencies/voltages lower and above the limits where continuous operation is guaranteed

(xiv) Low voltage ride through (LVRT/FRT)
- Curve showing the tolerable drop in voltage, settling time to resume normal output

(xv) Unbalanced loading
- Negative phase sequence withstand

(xvi) Active power regulation
- Ramp rate (% of rated output per minute)

(xvii) Frequency control
- Frequency response

(xviii) Reactive power capability
- Limits on lagging and leading power factors within which the rated output can be guaranteed
- P-Q capability curve

(xix) Power factors
(xx) Short circuit ratio

(B). Generator Transformer

(i) Information description
(ii) Rated capacity (MVA)
(iii) Rated voltage
- Primary (kV)
- Secondary (kV)

(iv) Nominal voltage ratio, primary/secondary
(v) Positive sequence impedance at
- Maximum tap (%)
- Minimum tap (%)
- Nominal tap (%)

(vi) Zero phase sequence impedance (%)
(vii) Tap changer range + % - %
(viii) Tap changer step size %
(ix) Tap changer type on load / off load
(x) Earthing
  - Primary
  - Secondary
(xi) Vector group
(xii) Magnetising curve

(C). Collector Network

(i) Information description
(ii) Technical parameters of the plan and equipment used
(iii) Geographical map of the collector network

(D). WFGF Protection

(i) Information description
(ii) Current transformer and voltage transformer details, such as ratios, burdens, class etc.
(iii) Protection relay settings and calculations with the grading curves/characteristics

(E). Other Information

(i) Information description
(ii) Safety manual and schemes at the IBRE facilities and for the connection point
(iii) All requested technical diagrams of the connection
(iv) List of names and telephone numbers of the applicant's authorised representatives
(v) Proposed maintenance program for the connection point equipment

2.3.3.2.2 Solar Power Generation Facility (SPGF)

(A). Solar Power Generation Facility (SPGF)

(i) Information description
(ii) Unit number
(iii) Plant type - (concentrated or photovoltaic)
(iv) Manufacturer
(v) Rated generation voltage
(vi) Rated capacity (MVA)
(vii) Rated capacity (MW)
(viii) A detailed simulation model of the SPGF to be used in PSS/E format capable of representing its transient and dynamic behavior under both small and large disturbance conditions
(ix) For the year for which data is submitted
  - Geographical distribution of the solar energy resource

- Average daily total solar resource
- PV array data

(x) Frequency- Voltage Tolerances
- Frequency/voltage range within which continuous operation is guaranteed.
- Time based capabilities for frequencies/voltages lower and above the limits where continuous operation is guaranteed

(xi) Low Voltage ride through (LVRT/FRT)
- Curve showing the tolerable drop in voltage, settling time to resume normal output

(xii) Unbalanced Loading
- Negative phase sequence withstand

(xiii) Active Power Regulation
- Ramp rate (% of rated output per minute)

(xiv) Frequency Control
- Frequency response (xv)

Reactive Power Capability
- Limits on lagging and leading power factors within which the rated output can be guaranteed.
- P-Q capability curve

(xvi) Power factors

(xvii) Short Circuit Ratio

(B). Transformer

(i) Information Description

(ii) Rated Capacity MVA

(iii) Rated Voltage
- Primary (kV)
- Secondary (kV)

(iv) Nominal Voltage Ratio, Primary/Secondary

(v) Positive Sequence Impedance at
- Maximum tap (%)
- Minimum tap (%)
- Nominal tap (%)

(vi) Zero Phase Sequence Impedance (%)

(vii) Tap Changer Range + % - %

(viii) Tap Changer Step Size %

(ix) Tap Changer Type on Load / off Load

(x) Earthing
- Primary
- Secondary

(xi) Vector Group

(xii) Magnetising Curve

(C). Collector network

(i) Information Description

(ii) Technical Parameters of the Plan and Equipment used

(iii) Geographical Map of the Collector Network

(D). SPGF protection

(i) Information Description

(ii) Current Transformer and voltage transformer details, such as ratios, burdens, class etc

(iii) Protection relay settings and calculations with the grading curves/characteristics

(E). Other Information

(i) Information Description
(ii) Safety Manual and schemes at the IBRE facilities and for the Connection Point
(iii) All requested Technical Diagrams of the Connection
(iv) List of Names and Telephone Numbers of the Applicant's Authorised Representatives
(v) Proposed Maintenance Program for the Connection Point Equipment

2.3.3.3 Standard Planning Data - Part (III) - Other Planning Data

2.3.3.3.1 Six Year System Plan Data

1. Projection of works in the first six years (year wise)
2. Status
   a) Whether the feasibility study has been prepared and forwarded to the Transmission Licensee
   b) Any PUCSL directives
   c) Environmental clearance received for individual projects
   d) Geological surveys completed
   e) Route surveys completed for transmission lines
   f) Load forecast made for distribution areas
   g) Financial arrangements made
3. Phasing of expenditure (year by year)

Further to the above data, following are needed annually for the following six years

1. Scope (describe details of works)
2. Status (whether continued from previous year or new works)
3. Plan outlay (indicate cost)
4. Benefits accrued (quantify)

1.1 Generation
(i) Capacity added
(ii) Performance improved

1.2 Transmission
(i) Stability improved
(ii) Reduction of losses
(iii) Increase in power flow capability

1.3 Distribution
(i) Meeting load growth in area
(ii) Reduction of losses
(iii) Increase in voltage profile

2.3.3.3.2 Works in Progress Data

1. PERT Network (of major works such as power stations, Transmission System)
2. Gantt Chart (of works involved in distribution areas)

2.3.3.3.3 Completion Data

Date of completion: (means readiness for connection to the Transmission System) (for Plant equipment, lines, switchgear, communication devices etc. connection of which may materially affect the efficiency and performance of the System)

2.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

to be decided

2.5 DISTRIBUTION LICENSEES

DATA TO BE FURNISHED TO TRANSMISSION LICENSEE (2.10)
(Note: CR.IEEE stands for reference to the relevant IEEE Committee Report)

2.5.1 PRELIMINARY PROJECT PLANNING DATA

2.5.2 PRELIMINARY PLANNING DATA PART (I) STANDARD PLANNING DATA

2.5.3 COMMITTED PROJECT PLANNING DATA

Preliminary planning data Part (I) of standard planning data and committed project planning data Part (II) of standard planning data

2.5.4 STANDARD PLANNING DATA

2.5.4.1 Standard Planning Data Part(I)- Preliminary Project Planning Data

2.5.4.1.1 GENERAL

1	Area map (to scale)	Marking the area in the map of Sri Lanka
2	Consumer data	Furnish categories of consumers, their nos., and connected loads
3	Reference to region	

2.5.4.1.2 CONNECTION

1.	Points of connection	Furnish single-line diagram showing points of connection
2.	Voltage of supply at points of connection	
3.	Names of Grid Substation feeding the points of connection	

2.5.4.1.3 LINES AND SUBSTATIONS

1	Line data	furnish lengths of line and voltages within the area
2	Substation data	furnish details of 33/11 kV Substation, 33/0.4 kV 11/0.4 kV Substations, capacitor installations

2.5.4.1.4 DEMAND DATA

Past and forecast data on

1. Area wise electricity sales
2. Load data (MW and MVar) on primary substations (at day peak and system peak)
3. Present and forecast data on percentage area loads fed by each Grid Substation.

2.5.4.2 STANDARD PLANNING DATA - PART (II) - COMMITTED PROJECT PLANNING DATA

2.5.4.2.1 DISTRIBUTION

I.GENERAL

1. Distribution map (to scale) (showing all lines up to 33 kV and substations belonging to the Distribution Licensee)
2. Single line diagram of distribution system (showing distribution lines from points of connection with the Transmission System, 33/11 kV substation, 33/0.4kV Substation 11/0.4 kV Substation.

3. Numbering and nomenclature of lines and Substations (identified with feeding Grid Substation of the Transmission Licensee and concerned 33/11 kV Substation, 33/0.4kV Substation, 11/0.4 kV Substation of the Distribution Licensee)
4. Monitoring of distribution losses

(state methods adopted for reduction of losses)

II.CONNECTION

1. Interconnection Point (furnish details of existing arrangement of connection)
2. Details of metering of points of connection.

For requests by the Transmission Licensee in addition to the information contained in Part (II)

III.Connection

1. Interconnection Point (as applied for)
   a) New
   b) Upgrading existing connection

2. Changes in metering at Interconnection Point
3. Single-line diagram (showing proposed lines and substations)

2.5.4.3 Standard Planning Data –Part (III) - Other Planning Data

2.5.4.3.1 Six Year System Plan Data

1. Projection of works in the next 6 years (year by year)
2. Status
   a) Whether Project Report prepared and forwarded to the Transmission Licensee
   b) Any PUCSL directions
   c) Environmental clearance received for individual projects
   d) Coal/water arrangements made for coal-fired Thermal Stations
   e) Geological survey completed for hydropower stations
   f) Route survey completed for transmission lines
   g) Load forecast made for distribution areas
   h) Financial arrangement made
3. Phasing of Expenditure (Year by year)

Further to the above data, following are needed annually for the next 6 years

1. Scope (describe details of works)
2. Status (whether continued from previous year or new works)
3. Plan outlay (indicate cost)
4. Benefits accrued (quantify)

a) Generation

(i) Capacity added
(ii) Performance improved

b) Transmission

(i) Stability improved
(ii) Reduction of losses
(iii) Increase in power flow capability

c) Distribution

(i) Meeting load growth in area
(ii) Reduction of losses
(iii) Increase in voltage profile

2.5.4.3.2 Works in Progress Data

PERT Network (of major works such as power stations, Transmission System) Gantt Chart (of works involved in distribution areas)

2.5.4.3.3 Completion Data

Date of completion: (means readiness for connection to the Transmission System) (for Plant equipment, lines, switchgear, communication devices etc. connection of which may materially affect the efficiency and performance of the Transmission System)

2.6 TRANSMISSION BULK CUSTOMERS

2.6.1 PRELIMINARY PROJECT PLANNING DATA

2.6.2 COMMITTED PROJECT PLANNING DATA

2.6.3 STANDARD PLANNING DATA

2.6.3.1 Standard Planning Data - Part (III) - Other Planning Data

2.6.3.1.1 Six Year System Plan Data

1. Projection of works in the next 6 years (year wise)
2. Status
    a) Whether the feasibility study has been prepared and forwarded to the Transmission Licensee
    b) Any PUCSL directives
    c) Environmental clearance received for individual projects
    d) Coal/water arrangements made for coal-fired thermal stations
    e) Geological survey completed for hydropower stations
    f) Route survey completed for transmission lines
    g) load forecast made for distribution areas
    h) financial arrangements made
3. Phasing of expenditure (year by year)

Further to the above data, following are needed annually for the next 6 years

1. Scope (describe details of works)
2. Status (whether continued from the previous year or new works)
3. Plan outlay (indicate cost)
4. Benefits accrued (quantify)
    a) Generation
        (i) Capacity added (ii) Performance improved
    b) Transmission
        (i) Stability improved
        (ii) Reduction of losses
        (iii) Increase in power flow capability
    c) Distribution
        (i) Meeting load growth in area
        (ii) Reduction of losses (iii) Increase in voltage profile

2.6.3.1.2 Works in Progress Data

1. PERT Network (of major works such as power stations, Transmission System)
2. Gantt Chart (of works involved in distribution areas)

2.6.3.1.3 Completion Data

Date of completion: (means readiness for connection to the Transmission System) (for plant and equipment, lines, switchgear, communication devices etc. connection of which may materially affect the efficiency and performance of the Transmission System)

B.2.1 PLANNING DATA REQUIREMENT

Appendix C

PROTECTION PLANNING DATA

Item		To be Submitted to
i.	**Generators/CPPs** shall submit details of protection requirements and schemes installed by them as referred to in Appendix A, Part II-1 Detailed Planning Data under sub-Section II "Protection and Metering".	As applicable to Detailed Planning Data.
ii.	**Transmission Licensee** shall submit details of protection equipment and schemes installed by them as referred to in Appendix A, Part II-2. Detailed System Data, Transmission under sub-Section IV "Relaying and Metering" in relation to connection with any User.	As applicable to Detailed Planning Data.

3 GRID CONNECTION CODE - DATA

3.1.1 ALL USERS

3.1.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCE

3.1.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

3.1.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

3.1.5 DISTRIBUTION LICENSEES

3.1.6 TRANSMISSION BULK CUSTOMERS

4 GRID OPERATION CODE - DATA

4.1 ALL USERS

Intentionally left blank

4.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCE

(A) ANNUAL GENERATOR OUTAGE PLAN (GoP 4.6.2)

Each Generation Licensee shall provide the following information and data.

(a) Brief description giving reasons for the outages requested

(b) Flexibility of the outages planned, stating whether the outage plans could be deferred or advanced, and if flexible, the period for deferment/advancement (c) If inflexible, justify the same.
(d) For outages planned for first and second year, confirmation that the proposed outages have been included in the previous outage programs.

(B) ANNUAL GENERATOR OUTAGE PLAN (GOP 4.6.2)

Accordingly, the System Operator having taken all efforts to accommodate the requests of the Generation Licensees shall arrive at the final outage program which will include the following:

(a) Generation Unit identity and capacity
(b) Date and time of the planned outage for each unit
(c) Flexible and Inflexible Outages
(d) Generating Units that will be available
(e) Demand forecast and the operating margins
(f) Changes made to the proposed Generation Outage Program, submitted by the Generation Licensees.

(C) RELEASE OF GENERATING UNITS (GOP 4.7)

Request for permission to withdraw a Generating Unit and permission issued by the System Operator will be on standard formats to be prepared by the System Operator including following data,

(a) date of request
(b) outage planning program reference
(c) Generating Unit identity
(d) capacity
(e) period of the outage
(f) starting and ending time of the outage
(g) name and designation of the officer requesting permission
(h) name and designation of the officer granting permission

4.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

(A) ANNUAL GENERATOR OUTAGE PLAN(GOC 4.6.2)

Each Generation Licensee (or a Generation Licensee through an IBRE Operator) shall provide the following information and data,

(a) Brief description giving reasons for the outages requested
(b) Flexibility of the outages planned, stating whether the outage plans could be deferred or advanced, and if flexible, the period for deferment/advancement (c) If inflexible, justify the same.
(d) For outages planned for first and second year, confirmation that the proposed outages have been included in the previous Outage Programs

(B) ANNUAL GENERATOR OUTAGE PLAN (GOC 4.6.2)

Accordingly, the System Operator having taken all efforts to accommodate the requests of the Generation Licensees shall arrive at the final outage program which will include the following:

(a) Generation Unit identity and capacity
(b) Date and time of the planned outage for each unit
(c) Flexible and inflexible outages
(d) Generating Units that will be available
(e) Demand forecast and the operating margins
(f) Changes made to the proposed Generation Outage Program, submitted by the Generation Licensees.

(C) RELEASE OF GENERATING UNITS (GOC 4.7)

Request for permission to withdraw a Generating Unit and permission issued by the System Operator will be on standard formats to be prepared by the System Operator including following data,

(a) Date of request
(b) Outage planning program reference
(c) Generating Unit identity
(d) Capacity
(e) Period of the outage
(f) Starting and ending time of the outage.
(g) Name and designation of the officer requesting permission
(h) Name and designation of the officer granting permission

4.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

Intentionally left blank

4.5 DISTRIBUTION LICENSEES

Intentionally left blank

4.6 TRANSMISSION BULK CUSTOMERS

Intentionally left blank

5 GRID DISPATCH CODE - DATA

5.1 ALL USERS

(A) ROLLING DISPATCH PLAN (GDC 5.5.1)

Required Information and data

Transmission Licensee	Annual maintenance plan, transmission restrictions, ancillary service requirements, new transmission capacity to be commissioned during the year, decommissioning, etc.
Generators	Generation: Generator's contract prices, annual maintenance plan and other foreseen restrictions fuel availability and fuel prices
Hydropower Stations	Reservoir security constraints and restrictions due to other water users or environmental reasons Reservoir operation and dispatch restrictions due to downstream obligations; Upstream and downstream water restrictions due to other users or environmental restrictions.
IBRE	Annual maintenance plan and other foreseen restrictions Wind and solar resource measurements and historical data
Distribution Licensee	Demand: load forecast for the calendar year, total and discriminated by delivery points to each Distribution Licensee, including monthly energy demand, peak capacity.
	Embedded Generation: load forecast shall be net of this generation. However for the sake of improving optimisation of system costs, Distribution Licensees should be required to provide the Transmission Licensee with discriminated information about each embedded power plant located in their authorised areas, for the Transmission Licensee to inform it to the System Operator.

Transmission Customers	Demand: load forecast for the calendar year, total and discriminated by delivery points to each Transmission Customer, including monthly energy demand, peak capacity.

5.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCE

Intentionally left blank

5.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

Intentionally left blank

5.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

Intentionally left blank

5.5 DISTRIBUTION LICENSEES

Intentionally left blank

5.6 TRANSMISSION BULK CUSTOMERS

Intentionally left blank

6 GRID METERING CODE - DATA

6.1 ALL USERS

(A) DATA STORAGE (GMC 6.7.1)

The Transmission Licensee will establish a database for metering data, and for each meter installation. The information and data will include:

(a) Name of the Licensee/customer/account number
(b) Unique identification number for the installation
(c) Site-specific adjustment factors to be applied
(d) All metering data such as demand, energy, at specified intervals as required by the Transmission Licensee and the relevant tariff decisions of PUCSL
(e) All information related to meters and instrument transformers
(f) Test certificates of the metering equipment
(g) Communication details
(h) Date of commissioning and commissioning documents
(i) Testing, calibration history and the persons who carried out the work
(j) Fault, repair, and maintenance history of the installation
(k) Contact details of the User representatives

6.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCES

Intentionally left blank

6.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

Intentionally left blank

6.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

Intentionally left blank

6.5 DISTRIBUTION LICENSEES

Intentionally left blank

6.6 TRANSMISSION BULK CUSTOMERS

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APPENDIX C – PROCEDURE FOR APPLICATION FOR GRID CONNECTION

INTRODUCTION

Appendix C – PROCEDURE FOR APPLICATION FOR GRID CONNECTION describes the procedure a prospective user has to adopt prior to connection the Grid.

EFFECTIVE DATE

This Appendix C to the Grid Code has been recommended by the Grid Code Review Panel (GCREP) to be effective from the DD-MM-YYYY.

1. ALL USERS

APPLICATION PROCEDURE FOR A NEW OR MODIFICATION OF A FACILITY

Any User seeking a new connection or modification of an existing connection shall submit a formal application to the Transmission Licensee along with the application fee for preliminary evaluation, approved by the PUCSL.

Details that shall be provided at various stages of the grid connection process are given in Appendix B.

1.1 APPLICATION PROCESSING

The Transmission Licensee shall establish a procedure to process the applications for new connections/modifications. It shall clearly identify the important events in the process from the time of submission up to the time of making the connection and the maximum lead time for completion of each event. This procedure shall be published in the Licensee website.

Broadly, the procedure for processing the application will include the following events. (a) Preliminary evaluation
(b) Grid impact assessment
(c) Submission of the offer to the applicant
(d) Applicant's acceptance of the offer
(e) Entering into the agreement for detailed studies and further processing
(f) Submission of information pursuant to the agreement entered into
(g) Detailed evaluation of the application
(h) Entering into connection agreement
(i) Submission of information prior to commissioning tests
(j) Commissioning tests
(k) Commissioning and connection
(l) Connection records

1.2 GENERATION LICENSEES WITH GENERATION FROM CONVENTIONAL RESOURCE

Any prospective generation licensee with generation from conventional resources, seeking a new connection or modification of the existing connection shall conform to the procedure approved by PUCSL in terms of the SLEA20.

1.3 GENERATION LICENSEES WITH INTERMITTENT RESOURCE BASED GENERATION SYSTEMS

Any prospective generation licensee with generation from conventional resources, seeking a new connection or modification of the existing connection shall conform to the procedure approved by PUCSL in terms of the SLEA20.

1.4 GENERATION LICENSEES WITH EMBEDDED GENERATORS

Any prospective generation licensee with embedded generators, seeking a new connection or modification of the existing connection shall conform to the procedure approved by PUCSL in each Distribution Code.

1.5 DISTRIBUTION LICENSEES

Intentionally left blank

1.6 TRANSMISSION BULK CUSTOMERS

Intentionally left blank

APPENDIX D: Forecast data

As mentioned in clause 4.4.1, Generators and users shall provide measured and forecast data in the following manner;

This section details the 10-year demand forecasts that are required from each **User** of the **Transmission System** who is the **Distribution Control Centre (DCC)** in respect of each infeed from the **Transmission System.** This section applies equally to the **Transmission Customer.**

The **System Operator** shall notify each **User** upon request in advance of each load reading day.

The 10-year demand forecasts with monthly energy and peak demands should be submitted by the first week of September each year.

APPENDIX E: Data to be provided by IBRE

As per clause 5.4.2 –(g),

(i) All IBRE which have capacities greater than or equal to 5 MW shall provide the following data in real time through a **dedicated communication channel** to the System Operator.

(j) All IBRE which have capacities greater than 100 kW to less than 5 MW shall provide the following data in near real time through an appropriate communication channel to the System Operator.

1. Real power output Pn (MW).
2. Reactive power output Qn (MVar).
3. Terminal Voltage Vn (kV).