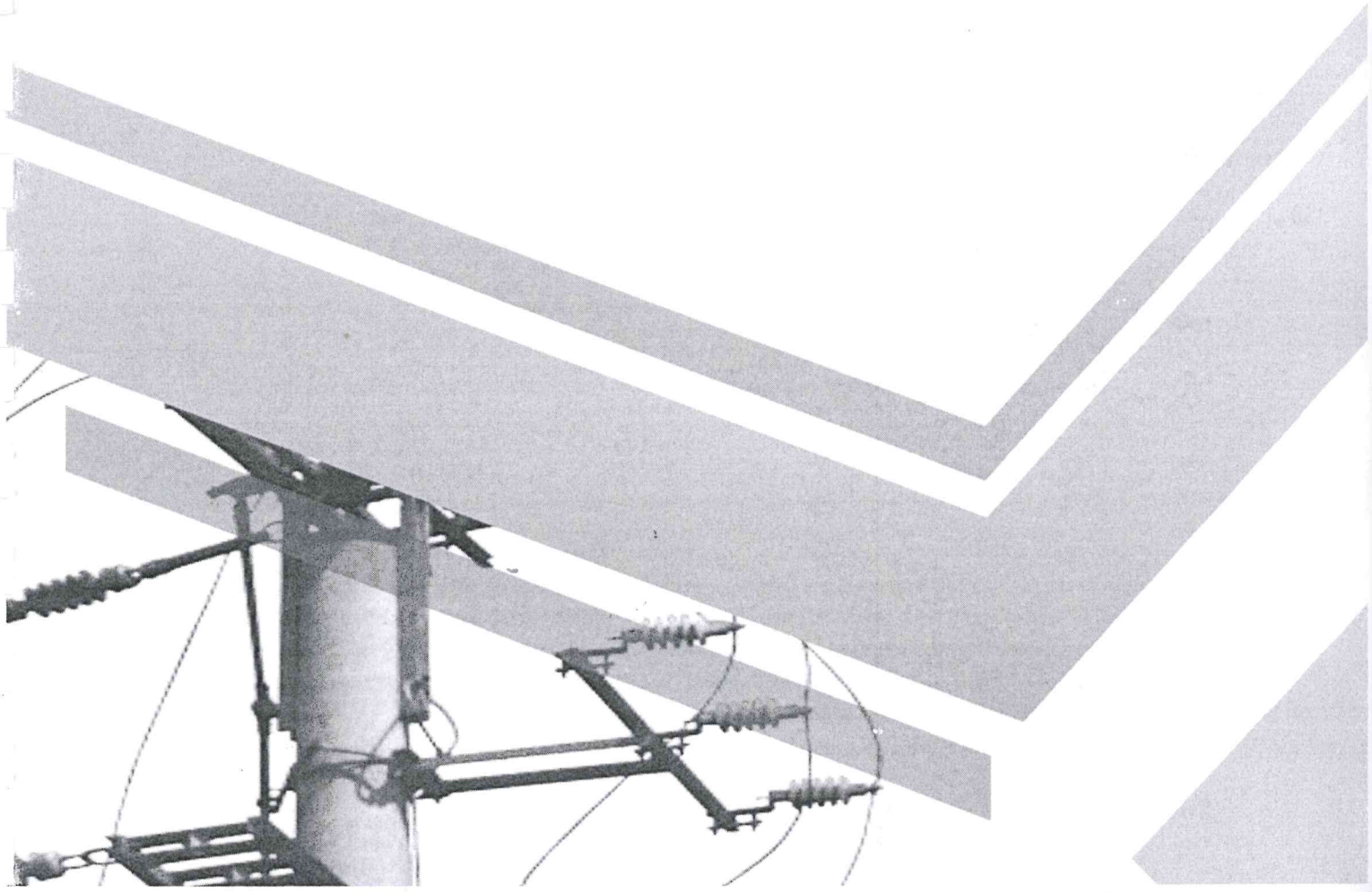
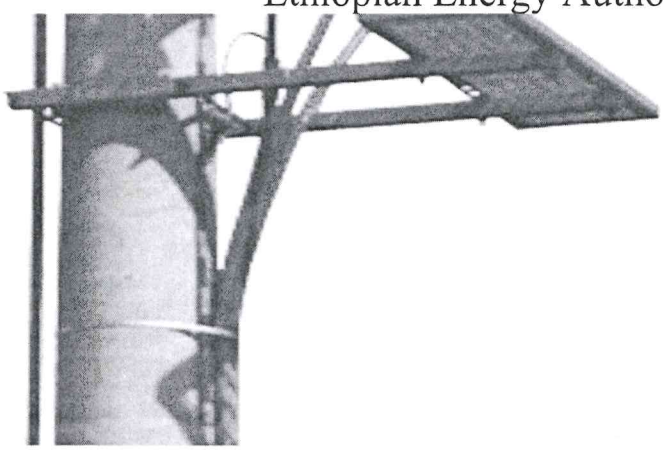


ETHIOPIAN NATIONAL DISTRIBUTION GRID CODE

(Directive No. 866/2022)

Ethiopian Energy Authority (EEA)



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1 PREAMBLE

1.1 INTRODUCTION

The term Grid Code is widely used to refer to a document or set of documents, that legally establishes technical and other requirements for the connection to and use of an electrical transmission and distribution system in a manner that will ensure a safe, secure, reliable and efficient operation.

This preamble provides the background and rationale for the development of the formal Ethiopia National Distribution System Grid Code (*ENDGC*) and summarizes its provisions. The ENDGC has been developed through a rigorous approval process involving the (i) *Regulatory Authority*, and (ii) Ministry of Water, Irrigation and Energy (MOWIE).

The ENDGC has been developed to define the rules and regulations for various participants for accessing and using the Distribution System that includes mini-grid, micro-grid and off-grid systems. The objective of the *ENDGC* is to improve the ability of Ethiopia's power distribution system to be planned and operated safely, reliably, efficiently, and economically in a transparent and non-discriminatory manner. It establishes the obligations of the Distribution Network Service Providers (*DNSP*), *Embedded Generators* and other Distribution Network Users for accessing and using the Distribution System. Stated more specifically, the objectives of the *ENDGC* are to:

(a) Define the reciprocal obligations, responsibilities and accountabilities of all of the participants to ensure open, transparent, non-discriminatory and economic access and use of the system while maintaining its safe, secure, reliable and efficient operation;

(b) Define minimum technical requirements for the participants; and

(c) Set out the information exchange obligations of the participants.

1.2 STRUCTURE OF DISTRIBUTION CODE

The Distribution Code is organized into nine chapters as follows;

(a) **Preamble:** This chapter outlines the purpose of the *ENDGC*, and how the various parts of the Code are relevant to the different *Distribution Network Users* of the *Distribution System*. The Preamble is provided for information purposes only and does not constitute part of the *ENDGC*.

(b) **Glossary and Definitions:** This chapter provides the definitions of terms, acronyms and units pertinent to this *ENDGC*. Defined terms are italicised and capitalised throughout the *ENDGC* and hold the meanings as defined. However, if a term is not capitalised or italicised, it shall still hold the definition as provided in the Glossary

(c) **General Conditions:** This chapter presents the provisions which are of general application to all parts of the *ENDGC* including the provisions necessary for the overall administration and review of the various aspects of the *ENDGC*. This chapter also deals with those aspects of the *ENDGC* not covered in other chapters, including the resolution of disputes, bilateral

agreements, confidentiality, non-compliance and the revision of the *ENDGC* through the *Ethiopia National Distribution Code Review Committee*.

(d) **Governance**: This chapter summarises the main documents and organisations that provide the authority governing the planning, construction, and operation of the *ENDS*.

(e) **Distribution System Planning**: This chapter specifies the technical and design criteria and procedures for the planning and development of the *ENDS*.

(f) **Distribution System Connection Requirements:** This chapter defines the minimum standards for the methods of connection to the *ENDS*.

(g) **Distribution System Operations:** This chapter addresses the various operational components, including demand management, interruptions, incident reporting, safety matters and system emergencies.

(h) **Metering:** This chapter specifies the technical and operational criteria in carrying out the obligation of providing metering services to all *Distribution Network Users*.

(i) **Performance Standards:** This chapter describes the technical and operational standards and the indicators that are used to measure the system's performance.

1.3 Scope of the ENDGC

The *ENDGC* establishes the technical aspects of the planning, connection, operation, and use of the *ENDS* and the relationships between the *DNSP* (s) and Distribution Network Users of the Distribution System.

Upon the request from Distribution Network Users, the *DNSP* must provide a connection to the distribution system and deliver electric energy to the Distribution Network Users in accordance with the applicable laws, its license and the *ENDGC*, at a level of service quality consistent with the applicable Performance Standards described in the Code. Once connected to the *Distribution System*, the *Distribution Network Users* must comply with the conditions and standards specified in this Code to avoid adverse effects on the distribution system or other Distribution Network User's systems.

The ENDGC shall be read in conjunction with the relevant legislation including the Proclamation No. 810/2013 and "Council of Ministers Regulation to Provide for the Regulation of Energy Operations". These legislative policies shall be utilised in conjunction with the Licences issued to generators, transmission companies and DNSPs and all applicable codes and regulation adopted by the *Regulatory Authority* and the MOWIE. All Licences that are issued after enactment of the ENDGC shall include the obligation of parties to comply with the ENDGC requirements.

2 GLOSSARY

2.1 INTRODUCTION

This Chapter contains a glossary of terms and a list of abbreviations and units used the *ENDGC*.

2.2 GLOSSARY

Table 2-1 provides a summary of the terms and definitions used in the *ENDGC*.

Table 2-1 Glossary and Definitions

WORD OR PHRASE	DEFINITION
Active Energy	A measure of electrical energy flow during a time interval. It is measured in units of Watt-Hours or multiples thereof. It is the time integral of the product of voltage and the in phase component of current flow across a connection point
Active Power	Instantaneous power derived from the product of voltage and current and the cosine of the voltage phase angle measured in units of Watts and multiples thereof
Active Power Capability	Maximum rate at which active energy may be transferred from a generator to a connection point as specified in a connection agreement
Aerial Bundled Cable	Insulated cable used in substitution for multiple bare conductors
Ancillary Services	Services provided by the licensees or customers not directly related to the generation and supply of electricity but to ensure stable and secure operation of an electrical power system and its recovery from emergency situations. Ancillary services include frequency regulation or control, spinning reserve, voltage and reactive power support, black start and load shedding facilities as defined in the "Council of Ministers Regulation to Provide for the Regulation of Energy Operation"
Apparent Power	Square root of the sum of the squares of the active power and the reactive power
Application for Connection	The application made by a User for connection to a Distribution Network and/or the provision of network services or modification of a connection to a network and/or the provision of network services
Authorized Person	A person adequately trained, and possessing technical knowledge and experience and appointed in writing to carry out specific operation and/or work on the power system
Black Start	The procedure necessary for recovery of the Ethiopia National Transmission System from Total Shutdown or Partial Shutdown

Black Start Capability	Ability of a Generating Plant to move at least one of its units to Start-Up from Shutdown without an external electrical power supply, and to energise a part of the Ethiopia National Transmission System and be Synchronised to the System upon instruction from the Transmission Licensee or Distribution Licensee
Business Day	A day other than a Saturday, Sunday or a day that is lawfully observed as a public holiday in Ethiopia
Capacitor Bank	Electrical equipment used to generate reactive power and support voltage levels on transmission/distribution lines in periods of high load
Chairperson	The person duly appointed by the Ethiopian Energy Authority to be Chairperson of the Ethiopian National Distribution Code Review Committee, or the person appointed by the Chairperson to be his alternate, or the person appointed to act as Chairperson of a meeting of the Ethiopian National Distribution Code Review Committee in the absence of the Chairperson or his alternate
Check Meter	A Meter nominated to provide electrical energy measurements at a Defined Metering Point for verification or substitution of the Main Meter; also known as Backup Meter
Clearance Space	A space surrounding a distribution power line, which should be clear of obstructions and vegetation at all times
Conductor	A material that allows the flow of electrical current in one or more directions
Confidential Information	Information which is or has been provided under or, in connection with the Ethiopia National Distribution Grid Code and which is stated under the Ethiopia National Distribution Grid Code or by the Ethiopian Energy Authority to be confidential information
Connection	Physical link to or through a transmission/distribution network that will allow the supply of electricity between electrical systems
Connection Agreement	Agreement between a DNSP and a Distribution Network User or other person by which the User is connected to the Distribution System and/or receives Distribution Services
Connection Applicant	An individual or an entity who wants to establish or modify connection to the Distribution System and/or who wishes to receive Distribution Services
Connection Point	The physical point at which a User is connected to the Ethiopia Electric Transmission System
Constraint	A limitation on the capability of a network, load or a generator such that it is unacceptable to either transfer, consume or generate the level of electrical power that would occur if the limitation was removed
Consumer	A person or entity obtaining services from a Distribution Licensee
Control Center	Facility used by the System Operator for directing the minute to minute operation of the power system

Control System	A set of devices used for monitoring and controlling the operation of a power system or equipment including Generating Plants connected to a transmission or distribution network
Current Rating	Maximum current that may be permitted to flow (under defined conditions) through a transmission or distribution line or other item of equipment that forms part of a power system
Current Transformer	A transformer for use with meters and/or protection devices in which the current in the secondary winding is, within prescribed error limits, proportional to and in phase with the current in the primary winding
Customer	A person obtaining electricity services from a Licensee as defined in the Energy Proclamation 810/2013
Day	Unless otherwise specified, the 24 hour period beginning and ending at midnight East African Standard Time (EAST)
Demand	The rate at which electrical energy is delivered or used over a specified period, usually expressed in kW or kVA or multiples thereof such as MW or MVA, or other suitable units
Derogation	A waiver issued by Ethiopian Energy Authority to suspend a Distribution Licensee's or a Distribution Network User's obligations to implement or comply with a provision or provisions of the ENDGC
Disconnection	The operation of switching equipment or other action so as to prevent the flow of electricity at a connection point
Dispatch	The process of precisely matching generation with load in real time
Dispute	Any difference between the Ethiopian Energy Authority and any Distribution Licensee or User or between Users in connection with, or arising out of, the interpretation, implementation or breach of any provision of the ENDGC
Dispute Notice	A written notice issued by either Party to a Dispute outlining the matter of such Dispute
Distribution	The supply of electricity services to customers through medium and low voltage lines as defined in the Energy Proclamation 810/2013
Distribution Area	Area in which the Distribution Network Service Provider is licensed to distribute electricity
Distribution Licence	A license granted by the Ethiopian Energy Authority to distribute and sell electricity as defined in the "Council of Ministers Regulation to Provide for the Regulation of Energy Operations"
Distribution Licensee	An entity granted a licence by the Ethiopian Energy Authority to distribute and sell electricity as defined in the "Council of Ministers Regulation to Provide for the Regulation of Energy Operations"
Distribution Line	A power line, including underground cables, that is part of a distribution network
Distribution Losses	Electrical energy losses incurred in distributing electricity over a distribution network

Distribution Network	A power delivery system that carries electric power from electrical substations at sub-transmission level to Customers
Distribution Network Service Provider	An entity with license to operate a distribution system pursuant to Proclamation 810/2013 and the "Council of Ministers Regulation to Provide for the Regulation of Energy Operations"
Distribution Network User	A Customer, Generation Licensee, or any user of the Distribution Network
Distribution Power Line	An electric delivery line (overhead or underground), operated by a distribution network service provider
Distribution Service	The service of delivering energy at an acceptable level of electric voltage from transmission lines to Customers, and the operation and maintenance of the Distribution System
Distribution System	A distribution network, together with the connection assets associated with the distribution network, which is connected to another transmission or distribution system
Electric Industry	The industry in Ethiopia involved in the generation, transmission, distribution, supply and sale of electricity
Electrical Energy Loss	Energy dissipated in the production, transportation and/or use of electricity
Electrical Infrastructure	A system of high tension cables by which electrical power is distributed throughout a region
Electrical Installation	Any electrical equipment that is fixed (or to be fixed) in, on, under or over a Customer's premises, but does not include: (i) any electrical supply main or service line of a distribution network service provider; (ii) any electrical equipment that is fixed (or to be fixed) in, on, under or over any premises owned or occupied by a distribution network service provider; and (iii) that is not used for the consumption of electricity on those premises, or solely for purposes incidental to that consumption; (iv) any connections to a Customer's terminals for the purpose of providing electrical energy; or (v) any metering equipment owned by a distribution network service provider
Embedded Generator	A Generating Plant connected within a distribution network and not having direct access to the transmission network
Energisation	Operation of switching equipment or the start- up of a Generating Plant resulting in a non- zero voltage beyond a connection point or part of the transmission or distribution network
Excitation Control System	Automatic control system (including excitation limiting devices and any power system stabilizer) that provides field excitation for the Generating Plant
Fiscal Year	Ethiopian fiscal year that starts on July 8th of a year and ends on July 7th of the following year
Fire Control Authority	Fire Service under the control of any local or public authority or any other authorized entity in Ethiopia

Fire Hazard Rating	Rating assigned by the Fire Control Authority designating propensity for ignition and spread of fire
Flicker	The impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time
Force Majeure	Causes beyond the reasonable control of and without the fault or negligence of the Party claiming Force Majeure. It shall include failure or interruption of the delivery of electric power due to causes beyond that Party's control, including Acts of God, wars, sabotage, riots, hurricanes and other actions of the elements, civil disturbances and strikes as set out in Chapter 4 (Governance), and as defined in the "Council of Ministers Regulation to Provide for the Regulation of Energy Operations"
Frequency	Number of cycles for alternating current electricity occurring in each second. The term Hertz (Hz) corresponds to cycles per second
Generation License	License authorizing an entity to generate electricity for supply or sale granted under Proclamation 810/2013
Generation Licensee	For the purposes of ENDGC, an entity licensed to operate and maintain generation assets and generate electricity within the Ethiopia Electric Distribution System
Generating Plant	A facility for the generation of electric power comprised of one or more generating units which are likely to be individually controllable
Generating Unit	A specific unit within a Generating Plant that generates electric power from other sources of energy
Governor	Automatic control system which maintains the desired system frequency by adjusting the mechanical power output of the turbine of a Generating Plant
Grid	Network of transmission system/distribution systems and connection points that transports electrical energy from Generating Plants to Customers
Grid Code Revision Register	A Register of all revisions to the Ethiopia Grid Code as set out in Section 4.9 of Chapter 4 (Governance)
Harmonic Distortion	The sinusoidal voltages and currents having frequencies that are integral multiples of the fundamental frequency.
Hazard Space	Space outside the clearance space and re- growth space in which trees or limbs due to their unsafe condition are a potential hazard to the safety of a distribution power line under the range of weather conditions
High Voltage	A voltage level above 33,000 volts
Independent Power Producers	Any entity that owns generation plant and sells bulk electricity to the national grid through power purchase agreement
Individual Contract	A contract for the sale of electricity to a Customer negotiated under Proclamation 810/2013
Interconnection	Technical aspects and equipment required to connect generators or other resources to the electric transmission (or distribution system)

Interruptible Load	A load that can be disconnected manually or automatically and can be provided for the restoration or control of power system frequency to mitigate contingency events or shortages of supply
Ethiopian Standard	The most recent edition of a standard publication by Ethiopia Bureau of Standards
License	A license as defined in the Proclamation 810/2013
Load	A connection point or defined set of connection points at which electrical power is delivered: (i) in relation to a public electricity supplier, the energy required by a Customer to whom the public electricity supplier sells electricity; (ii) in relation to an Embedded Generator, the energy supplied or to be supplied by an Embedded Generator to the distribution system; and (iii) in relation to a Customer, the energy supply required by the Customer in respect of an electrical installation
Load Shedding	A method of reducing power system demand by disconnecting load from the power system
Loading Level	The level of output or consumption (in MW) of a Generating or load
Loss Factor	Multiplier used to describe the additional electrical energy loss for each increment of electricity used or transmitted
Low Voltage	A nominal voltage up to 400 volts as per Proclamation 810/2013
Main Meter	The Meter nominated to provide electrical energy measurements at a Defined Metering Point; also known as Billing Meter
Medium Voltage	A voltage level above 400 volts up to 33,000 volts
Member, Ethiopia National Distribution Grid Code Review Committee	A person duly appointed to be a member of or the Chairperson of the Ethiopia National Distribution Grid Code Review Committee
Meter	A device, including associated equipment, complying with Ethiopian Standards which measures and records the production or consumption of electrical energy
Metering Data	The data obtained from a Metering Installation, the processed data or substituted data and the records of data stored in metering equipment collected by a distribution network service provider
Metering Database	A database of metering data controlled by a Distribution Network Service Provider
Metering Equipment	Meters, time-switches, measurement transformers, metering protection and isolation equipment, circuitry and their associated data storage and data communications equipment and wiring which are part of the Active Energy and Reactive Energy measuring equipment at or relating to the Defined Metering Point
Metering Installation	Assembly of components between metering point(s) and the connection point to the public telecommunications network (may include combination of several metering points to derive the metering data for a Connection Point)

Metering Point	The point of physical connection of the device measuring the current in the power conductor
Metering System	Collection of all components and arrangements installed/existing between each metering point and the metering database
Micro-grid	Refers to small-scale systems used to provide minimal electric services such as lighting and cell phone charging in multiple households. It also refers to distributed generation in areas already supplied with grid electricity, the intent being to increase use of on-site renewable generation and/or to improve local electric power system reliability or power quality
Mini-grid	Refers to isolated grids generally in remote areas
Monitoring Equipment	Testing instruments and devices used to record the performance of plant for comparison with expected performance
Month	Unless otherwise specified, the period of beginning at 11 midnight on the relevant commencement date and ending at 11 midnight on the date in the next calendar month corresponding to the commencement date of the period
Nameplate Rating	Maximum continuous output or consumption in KW or MW of an item of equipment as specified by the manufacturer
Network	The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity to wholesale/retail Customers excluding any connection assets
Network Service	Transmission/Distribution service associated with the conveyance and controlling the conveyance, of electricity through the Network. It includes ancillary services as defined in the "Council of Ministers Regulation to Provide for the Regulation of Energy Operations"
Network Service Provider	A legal entity that engages in the activity of controlling, or operating a transmission or distribution system and who holds or is deemed to hold a licence under the Proclamation 810/2013
Network User	A User of the Ethiopia National Distribution System
Normal Operating Frequency Band	Range of frequency of the power system so specified in the Code
Normal Operating Frequency Excursion Band	in relation to the frequency of the power system, the range specified as being acceptable for infrequent and momentary excursions of frequency outside the normal operating frequency band
Off-grid system	An off-grid system is when a power system such as a small solar, hydro or wind resource produces its own electricity in an isolated mode from the utility grid and you are producing your own electricity. An off-grid system is generally equipped with a battery bank in order to store the electricity for use when needed.
Outage	Full or partial unavailability of equipment or facility.
Owner	In the case of public land, the person responsible for administering that land

Ownership Boundary	The point or points at which supply is given or taken between the Distribution System and Distribution Network Users
Participant	A person bound by the Ethiopia National Distribution Grid Code and includes: the Commission; the DNSPs; electric power producers; Customers; a person who holds or is deemed to hold a licence as per the Energy Proclamation 810/2013
Party	Any person or entity with the specific meaning ascribed in the related provision of the Ethiopia National Distribution Grid Code
Peak Load	Maximum load
Planning and Development Organisation	Those entities that have responsibility for the planning and development of transmission, distribution, and generation in Ethiopia. These entities include but are not limited to the Ethiopia National TSO, the Ethiopian Energy Authority, Transmission Licensees, Distribution Licensees, and Generation Licensees
Plant	In relation to a connection point, includes all equipment involved in generating, utilizing or transmitting electrical energy
Point of Supply	(1) The load side terminals of the service protection equipment at the end of an underground electric supply line; or (2) The first Connection Point of an overhead electric supply line on the land, being: (a) where the electric supply line is carried onto the land by one or more poles, the first pole on the land carrying that electric supply line; (b) where the electric supply line is connected directly to premises on that land, that connection to the premises; or(c) where it is not possible to determine a point of supply in accordance with (a) or (b) above, the point at which the electric supply line crosses the boundary of the land
Power Factor	Ratio of the active power to the apparent power at a metering point
Power Station	A facility in which a Generation Licensee's Generating Plants are located
Power Purchase Agreement	A contract, usually long term, between parties for the sale of electrical energy at predetermined prices or price formulae
Power System	Electric power system that includes associated generation and transmission and distribution networks for the supply of electricity operated as an integrated system or otherwise
Power System Demand	Total load (in MW) supplied by the power system
Professional Engineer	An engineer licensed with the Engineers Registration Board in Ethiopia
Profile	With respect to the output from a Generating Plant, the electricity consumption by a load or power system demand, the quantification in MW of the variation of that output, consumption, or demand over a given period of time
Protection System	A system, which includes equipment, used to protect a User's facilities from damage due to an electrical or mechanical fault or due to certain conditions of the power system

Prudent Utility Practice	The practices generally accepted and followed by electric utility industry of a region conforming to the design, construction, operation, maintenance, safety and legal requirements which are attained by exercising that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from skilled and experienced operators engaged in the same type of undertaking under the same or similar conditions
Pruning and Clearing Cycle	The frequency of successive pruning or clearing which the distribution network service provider judges as optimal for maintaining the clearance space taking account of recurrent costs, community values, negotiation with the landowner, and utility and amenity in the area
Public Land	Land belonging to a public or local authority as defined in the Ethiopian Land Act
Public Lighting	Street lighting provided by a governmental body or agency in Ethiopia.
Ramp Rate	Rate of change of electricity produced from a generator
Reactive Energy	A measure, in varhours (varh) of the alternating exchange of stored energy in inductors and capacitors, which is the time- integral of the product of voltage and the out of phase component of current flow across a connection point
Reactive Plant	Plant which is capable of providing or absorbing reactive power.
Reactive power	Instantaneous power derived from the product of voltage and current and the sine of the voltage- current phase angle, which is measured in units of var and multiples thereof
Reactive Power Capability	Maximum rate at which reactive energy may be transferred from a Generating Plant to a Connection Point as specified in the connection agreement
Reactor	A device, similar to a transformer, specifically arranged to be connected into the transmission system during periods of low load demand or low reactive power demand to counteract the natural capacitive effects of long transmission lines in generating excess reactive power and so correct any transmission voltage effects during these periods
Regional Control Centre	A control centre responsible for the operation of the Distribution Network
Registered Equipment Data	Validated actual values of parameters and information about the Distribution Network User's equipment, as filed with the Distribution Network Service Provider at the time of connection
Regrowth Space	Space beyond the clearance space, to be cleared to allow for anticipated vegetation regrowth for the period of the pruning and clearing cycle
Regulatory Authority	Ethiopian Energy Authority established by the Proclamation 810/2013 and the Council of Ministers Regulation No. 308/2014 replacing Ethiopian Energy Agency to issue licenses for generation, transmission and distribution, sale, and import/export of electric energy in Ethiopia

Reliability	The probability of a system, device, plant or equipment performing its function adequately for the period of time intended, under the operating conditions encountered
Renewable Power Plant	A Generating Plant whose primary energy source is a form of renewable energy, including but not limited to solar energy (for photovoltaic and concentrated solar plants), small hydro, geothermal, landfill gas, biomass, biogas, and wind, and whose generation output is variable in nature
Reserve	A measure of available capacity over and above the capacity needed to meet normal peak demand levels. In case of a Generating Plant, it is the capacity to generate more energy than the system normally requires. For a transmission company, it is the capacity to handle additional energy transport if demand levels rise beyond expected peak levels
Rural Customer	A Customer located in town or village that has been designated as rural in Ethiopia
Secretary	The person appointed by the Ethiopian Energy Authority to the Ethiopia National Distribution Review Committee and named as such
Service Line	Any portion of any electric supply line through which electrical energy is supplied, or is intended to be supplied by a Licensee: (a) to a Customer either directly from the premises of the Licensee, or from a distributing main; or (b) from a distributing main to a group of Customers on the same premises or on adjoining premises supplied from the same point of the distributing main up to the point where such electric supply line reaches the supply terminals
Series or Shunt Capacitor	A type of plant connected to a network to control reactive power
Shunt Reactor	A type of plant connected to a network to absorb reactive power
Single Contingency	Also known as an unplanned outage, it indicates loss or failure of a small part of the power system (e.g. a transmission line), or the loss/failure of individual equipment such as a Generating Plant or transformer
Static VAR Compensator	A device with the ability to generate/absorb reactive power; and respond automatically and rapidly to voltage fluctuations or voltage instability arising from a disturbance or disruption on a transmission network
Substation	A facility at which two or more electric supply lines are switched for operational purposes. It may include one or more transformers so that some connected electric supply lines operate at different nominal voltages to others
Switchyard	Connection point of a Generating Plant into the network, generally involving the ability to connect the Generating Plant to one or more outgoing network circuits
Synchronization	The act of electrically connecting a Generating Plant to the power system.
Synchronous Condensers	Plant, similar in construction to a Generating Plant of the synchronous generator category, which operates at the equivalent speed of the frequency of the power system, specifically provided for voltage control, or for power factor improvement through the adjustment of rotor current

Synchronous Generator	Alternating current generators of most thermal and hydro (water) driven power turbines which operate at the equivalent speed of frequency of the power system in its satisfactory operating state
System Operator	The entity responsible for the overall coordination of the planning and operation of the Ethiopia National Transmission System, including the scheduling and dispatch of Generating Plants connected to it
Transformer	A plant or device that reduces or increases the voltage of alternating current
Transmission Line	An electric conductor that is part of a transmission network.
Transmission Network	Infrastructure that supports the transportation of electricity from the point of generation to the distribution with the ultimate objective of bringing to the end users or consumers
Transmission and Distribution System	Allows electricity to move through infrastructure of poles and wires, known as the Grid
Transmission Plant	Apparatus or equipment associated with the function or operation of a transmission line or an associated substation or switchyard, which may include transformers, circuit breakers, reactive plant and monitoring equipment and control equipment
TNC	In the context of earthing system, TNC indicates when the neutral is earthed, and protective earth and neutral are combined
TNCS	In the context of earthing system, it means protective earth and neutral conductors are combined from transformer to building distribution point, but separate in fixed indoor wiring and flexible power cords
TNS	In the context of earthing system, TNS indicates when the neutral conductor is earthed, but protective earth and neutral conductors are separate
TT	In the context of earthing system, this means customer provides its own earthing since no earthing conductor is provided by supplier of electricity
Urban Customer	Any Customer not designated as a Rural Customer
User	Any person or entity connected to or making use of the Ethiopia National Distribution System as a Generation Licensee with a Generation Plant connected to the Distribution System (an Embedded Generator), a , Distribution Licensee, Transmission Licensee, or Customer
Voltage	The electronic force or electric potential between two points that gives rise to the flow of electricity, and for the purposes of Chapter 8, the root mean square (RMS) of the phase to phase voltage
Voltage Transformer	A transformer for use with meters and/or protection devices in which the voltage across the secondary terminals is, within prescribed error limits, proportional to and in phase with the voltage across the primary terminals
Wayleave	A right of way granted by a landowner, generally in exchange for payment and typically for purposes such as the erection of transmission or distribution lines

2.3 LIST OF ABBREVIATIONS

The list below provides a summary of the abbreviations used in the ENDGC.

Table 2-2: Abbreviations used in the ENDGC

Abbreviation	Description
AC	Alternating Current
ACE	Area Control Error
AGC	Automatic Generation Control
ANSI	American National Standards Institute
AS	Ancillary Services
AVR	Automatic Voltage Regulator
CAIDI	Customer Average Interruption Duration Index
CAIFI	Customer Average Interruption Frequency Index
CEO	Chief Executive Officer
CT	Current Transformer
DC	Direct Current
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
DR	Demand Response
EAST	East African Standard Time
EEA	Ethiopian Energy Authority
EEP	Ethiopia Electric Power
EEU	Ethiopian Electric Utility
ENA	Energy Network Association
ENDGC	Ethiopia National Distribution System Grid Code
ENDGCRC	Ethiopia National Distribution System Grid Code Review Committee
ENDS	Ethiopia National Distribution System
ENTGC	Ethiopia National Transmission System Grid Code
ENTS	Ethiopia National Transmission System
ENTSO	Ethiopia National Transmission System Operator
GoE	Government of Ethiopia
GTP	Growth and Transformation Plan
HV	High Voltage (above 33kV)

HVDC	High Voltage Direct Current
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPP	Independent Power Producer
ISO	International Standard Organisation
LV	Low Voltage (up to 400 volts)
MAIFI	Momentary Average Interruptions Frequency Indicator
MOWIE	Ministry of Water, Irrigation, and Energy
MV	Medium Voltage (400 to 33,000 volts)
PSS	Power System Stabilizer
PV	Photo Voltaic
RMS	Root Mean Square
RPP	Renewable Power Plant
RTU	Remote Terminal Unit
SAIDI	System Average Interruption Duration Indicator
SAIFI	System Average Interruption Frequency Indicator
SCADA	Supervisory Control and Data Acquisition
TSO	Transmission System Operator
UM	Voltage Maximum
UN	Voltage Nominal
VT	Voltage Transformer

2.4 LIST OF UNITS

The table below provides a summary of the units used in one or more of the chapters in ENDGC

Table 2-3: List of Units

Unit	Description
Amp	Ampere
GW	Gigawatt (1,000,000,000 W)
GWh	Gigawatt-hour
h, hrs	Hour
Hz	Hertz
Kbps	Kilobits per second
kV	Kilovolt

Unit	Description
kVA	Kilovolt-ampere
kvar	Kilovar
kvarh	Kilovar-hour
kW	Kilowatt
kWh	Kilowatt-hour
Mbps	Megabits per second
mHz	Milli-hertz (1/1000 Hz)
Min	Minute
m	Metre
mm	Millimetre
Ms	Milli-second (1/1000 s)
MVA	Megavolt-ampere
Mvar	Megavars
Mvarh	Megavar-hour
MW	Megawatt
MWh	Megawatt-hour
s, sec	Second
TW	Terawatt (1,000,000,000,000 W)
V	Volt
W	Watt

3 GENERAL CONDITIONS

3.1 INTRODUCTION

The General Conditions (GC) set out the over-riding principles to be used in the operation of the *ENDS* and form the basis for the decisions of a reasonable and prudent operator should specific events not be covered by the relevant code. The GC describes the provisions necessary for the overall administration and review of the various aspects of the *ENDGC*. The GC also deal with those aspects of *ENDGC* not covered in other chapters, including the resolution of *Disputes*, bilateral agreements, confidentiality, non-compliance and the revision of the *ENDGC* through the recommendations of *ENDGCRC.*

3.2 SCOPE

These General Conditions apply to the *Regulatory Authority*, *ENTSO, Regional Control Centre*, and *Users* of the *ENDS*.

3.3 OBJECTIVE

The objective of the General Conditions are to establish the conditions applicable to all chapters of the *ENDGC* and, to the extent possible, ensure that the various chapters and sections of the *E* work together for the benefit of the *DNSP* and all *Distribution Network Users*, and apply consistently to all *Distribution Network Users*.

3.4 IMPLEMENTATION AND ENFORCEMENT

The *Regulatory Authority* is responsible for the implementation and enforcement of the *ENDGC*.

The *Regulatory Authority*, may, in certain cases, need access to services and facilities of *Distribution Network Users* or *DNSPs*, or to issue instructions to *Distribution Network Users* or *DNSPs* to implement and enforce the *ENDGC*. Accordingly, all *Distribution Network Users* and *DNSPs* are required not only to abide by the letter and spirit of the *ENDGC*, but also to provide the *Regulatory Authority. A* with such rights of access, services and facilities and to comply with any instructions of the *Regulatory Authority*.

Each *DNSP* and *Distribution Network User* shall at all-time act in good faith and in accordance with *Prudent Utility Practice*.

This ENDGC will be applied and used together with the *ENTGC* and all other applicable policies and procedures that govern the use of the Ethiopian electric power system.

3.5 SAFETY AND ENVIRONMENT

Nothing in or pursuant to this *ENDGC* shall be taken to require a *Party* to do anything which could or would be unsafe or contrary to the *Party's* environmental, health and safety obligations.

3.6 UNFORESEEN CIRCUMSTANCES

The *ENDGC* cannot predict and address all possible operational situations. In case of circumstances unforeseen in the *ENDGC,* or in the case of difference in interpretation, the *DNSP* has the right (and all *Distribution Network Users* must accept) to act in the course of the reasonable and *Prudent Utility Practice* discharge to its responsibilities within the following general principles and priorities:

(a) As first priority, preserve or restore the integrity of the *Distribution System* or the *Transmission System*, including the avoidance of breakdown, separation or collapse (total or partial);

(b) Compliance by the *DNSP* with the Proclamation 810/2013 and all other applicable regulations , conditions of its *Distribution Licence* and the *ENDGC;*

(c) Preserve the safety of the public and workforce to prevent personal injury;

(d) Protect equipment and apparatus to prevent damage to plant;

(e) The achievement of objectives specifically identified in the *ENDGC.*

In case of an unforeseen circumstance that cannot be resolved with the general principles defined in the previous conditions, the *DNSP* shall act according to the following:

(a) The application of a policy aimed at the equitable sharing amongst *Distribution Network Users* of any temporary restriction that might be necessary in exceptional circumstances; and

(b) The application of *Prudent Utility Practice.*

If circumstances not envisioned by the provisions of the *ENDGC* should arise, the *DNSPs* shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith with the *Regulatory Authority* and all affected *Distribution Network Users* in an effort to reach agreement as to what should be done. If agreement between the *DNSP* and *Regulatory Authority* and affected *Distribution Network Users* cannot be reached in the time available, the issue shall be reviewed by the *Regulatory Authority*to determine what shall be done in accordance to this *ENDGC.* The *Regulatory Authority* may refer the matter to the *ENDGCRC,* which may make recommendations to the *Regulatory Authority* on the resolution of the issue.

The *DNSP* shall promptly refer any unforeseen circumstance identified, together with the determinations and interpretations made, to the *Regulatory Authority* for consideration.

Each *Distribution Network User* shall comply with all instructions given to it by the *DNSP* following a determination for an unforeseen circumstance or a difference in interpretation, provided that such instructions are consistent with the technical characteristics of the *Distribution Network User*'s system and the principles established in the *ENDGC*, and do not endanger the safety of its equipment or staff.

3.7 FORCE MAJEURE

In situations of *Force Majeure*, the provisions of the *ENDGC* may be suspended in whole, or in part, pursuant to any directions given by the *Regulatory Authority*.

Neither *Party* shall be held to have defaulted in respect of any obligation under the *ENDGC* if prevented or delayed from performing that obligation, in whole or in part, because of a *Force Majeure* event. If a *Force Majeure* event prevents or delays a *Party* from performing any of its obligations under the *ENDGC*, that *Party* shall:

(a) Promptly notify any other *Party* involved and the *Regulatory Authority* of the *Force Majeure* event and its assessment in good faith of the nature and the effect that the event will have on its ability to perform any of its obligations and the measures that the *Party* proposes to take to alleviate the impact of the *Force Majeure* event. If the immediate notice is not in writing, it shall be confirmed in writing as soon as reasonably practicable. The notice shall be posted on the *Regulatory Authority* website.

(b) Not be entitled to suspend performance of any of its obligations under the *ENDGC* to any greater extent or for any longer time than the *Force Majeure* event requires it to do;

(c) Use its best efforts to mitigate the effects of the *Force Majeure* event, remedy its inability to perform, and resume full performance of its obligations;

(d) Keep the other *Party* and the *Regulatory Authority* continually informed of its efforts, and

(e) Provide written notice to the other *Party* and the *Regulatory Authority* when it resumes performance of any obligations affected by the *Force Majeure* event. The notice shall be published on the *Regulatory Authority* website.

3.8 COMPLIANCE

(a) All *DNSP*s and *Distribution Network User*s shall comply with the *ENDGC* as updated via the decisions of the *Regulatory Authority* from time to time.

(b) *DNSP*s shall inform the *Regulatory Authority* of any non-compliance report without delay, but no later than thirty (30) days after becoming aware of the item unless there is a significant risk to the safety of the public, electrical workers, and/or *ENDS* or the *ENTS*, which then must be reported immediately.

(c) The *Regulatory Authority* may require a *User* to provide the *Regulatory Authority* with information that it deems necessary for the proper administration of the *ENDGC*. This information shall, upon request, be treated as confidential.

(d) Upon report of a suspicion of non-compliance, the *Regulatory Authority* may seek to:

1. Resolve the issue through negotiation
2. Take action in terms of the procedures for handling contraventions
3. Consider an application for amendment
4. Consider an application for exemption

(e) Application for exemption or suspension of obligations under the *ENDGC* is treated under Section 3.9 "Non-Compliance".

3.9 NON-COMPLIANCE

If a *DNSP* or *Distribution Network User* finds that it is, or will be unable to comply with any provision of this *ENDGC*, then that party shall without delay, but not later than thirty (30) days after discovery, report such non-compliance to the *Regulatory Authority* or the *DNSP* as appropriate

3.9.1 Non-Compliance Situations

If the *DNSP* or a *User* fails to fulfill all the provisions established in this *ENDGC*, it shall be considered a Non-Compliance situation.

A Non-Compliance situation will include, but is not limited to:

a. Failure to provide the *Regulatory Authority*, on time, all required information in the *ENDGC*
b. Providing the *Regulatory Authority* incomplete or inaccurate data or reports, in particular inaccuracies or other problems verified by the audits of the *Regulatory Authority*
c. Failure to implement in time the procedures and information systems required in the *ENDGC*
d. Failure or unsuitable delays in the execution of the approved remedial actions and plans comply with *ENDGC* provisions following the approval of a *Derogation* and mitigation plan.

3.9.2 Penalties

If the *Regulatory Authority* determines that the User is in a non-compliance situation for which Derogation has not been filed, or is in the process of being filed, or for which a Derogation has not been approved by the *Regulatory Authority*, or is in violation of the terms of an approved Derogation, the *Regulatory Authority* will determine and apply a fine penalty for the non-compliance situation. The *Regulatory Authority* shall also consider that the Transmission Licensee is in non-compliance with its licence conditions, and may suspend or revoke the licence. The *Regulatory Authority* shall use directives under Item No. 144 (Fine Penalty) under the "Final English Draft Energy Operation Regulation – Version (2)", as appropriate, while issuing a fine penalty.

Generation, transmission, distribution, sales, import, export of electricity for commercial purposes; performing electrical work, energy audit, Energy Efficiency and Energy Conservation contracting or consultancy service without valid license are punishable as per the Energy Proclamation 810/2013.

The *Regulatory Authority* shall also consider the following factors while imposing penalties:

(a) Severity of the non-compliance and any environmental, health, and safety impacts
(b) Instances of repeated and deliberate non-compliance
(c) Penalties shall be comparable to those specified in other laws, regulations, and applicable contracts
(d) Penalties shall be set at a level such that non-compliance will not be economically preferable to compliance

3.10 DEROGATION

If a *DNSP* or *Distribution Network User* finds that it is, or will be, unable to comply with any provision of the *ENDGC*, then they shall, without delay, report such non-compliance. The applicant may request an exemption from the *ENDGC* requirement, or request additional time to correct the non-compliance item.

When the issuance of this *ENDGC*, or an amendment to this *ENDGC*, causes a *DNSP* to be in non-compliance with the *ENDGC* relating to facilities already connected or approved to be connected to the *ENDS*, and the *DNSP* believes either that it would be unreasonable (including on the grounds of cost and technical considerations) to remedy such non-compliance or that it should be granted an extended period to remedy such non-compliance, the *DNSP* shall promptly submit a Request for *Derogation* to the *Regulatory Authority* for review and resolution (as described in Section 3.10.1) The burden of proof shall rest with the *DNSP* to show good reason why it cannot comply.

Likewise, when the issuance of this *ENDGC*, or an amendment to this *ENDGC*, causes a *Distribution Network User* to be in non-compliance with the *ENDGC* relating to facilities already connected or approved to be connected to the *ENDS*, and the *Distribution Network User* believes either that it would be unreasonable (including on the grounds of cost and technical considerations) to remedy such non-compliance or that it should be granted an extended period to remedy such non-compliance, the *Distribution Network User* shall promptly submit a Request for *Derogation* to their *DNSP* for review and resolution. The burden of proof shall rest with the *Distribution Network User* to show good reason why it cannot comply.

3.10.1 Derogation Request

A *Derogation* Request form must be prepared and submitted along with any supporting documentation and evidence that supports the request as soon as the non-compliance issue is discovered.

3.10.1.1 DNSPs and Generation Licensees

A *DNSP* or *Generation Licensee* seeking Derogation shall submit *Derogation* Request forms (see Appendix B *Derogation* Request and Mitigation Plan Forms) along with any supporting evidence to the *Regulatory Authority* for their review and determination. The request shall contain:

(a) Name of *Party* applying for *Derogation*;

(b) Contact information, name and signature of *CEO* or other corporate officer delegated by the *CEO*;

(c) Whether the *Derogation* request is for a permanent exemption from a *ENDGC* requirement or a request for a time extension to achieve compliance;

(d) The specific provision of the *ENDGC* (section title and number) with which the *DNSP* or *Generation Licensee* is, or will be, unable to comply;

(e) The date of the discovery of the non-compliance and the date of reporting the non-compliance;

(f) The nature and extent of the non-compliance;

(g) The cause for the non-compliance;

(h) Identification and description of the system, facility, equipment, process, procedure or specific *Connection Point* in respect of which *Derogation* is sought;

(i) A description of any health and safety implications and the associated risk management measures;

(j) A description of the proposal for restoring compliance (where applicable) with the *ENDGC* requirement(s), including details of actions to:

1. Mitigate risks to *Customers* or other *Users*
2. Restore compliance (including timetable of works)

(k) A description of the reasonable alternative actions that have been considered

(l) A statement of the expected duration of the non-compliance

The DNSP or Generation Licensee is required to justify the Derogation request in terms of both the specific circumstances and the expected duration. Licensees are advised to give as much notice as possible when making Derogation requests since Derogations will not be granted unless the *Regulatory Authority* is satisfied that the request is justified.

3.10.1.2 Customers

A *Customer* seeking Derogation shall submit the *Derogation* form along with any supporting evidence to their *DNSP* for review and determination. The *DNSP* determines whether to approve the *Derogation*, and records the decision in the *Derogation* register, which is reviewed by the Regulatory Authority every three (3) months.

The request shall contain:

Details of the applicant, including the full name and service address of the *Customer* concerned;

(a) Details of the applicant, including the full name and service address of the Customer concerned

(b) A detail of the system, facility, equipment, process, procedure or specific *Connection Point* in respect of which *Derogation* is sought and the nature and extent of non-compliance;

(c) The reason for the non-compliance;

(d) The planned remedial actions that will be taken to remedy the non-compliance, including the date that compliance will be achieved; or

(e) An explanation of why an exemption of the code requirement will not pose a risk to the *Distribution Network*, other *Distribution Network Users*, utility workers or the public.

Customers may appeal determinations on *Derogations* as made by the *DNSP* to the *Regulatory Authority.*

3.10.2 Derogation Review

Upon receipt of any request for *Derogation*, the *Regulatory Authority* shall promptly consider such a request provided that the *Regulatory Authority* considers that the grounds for the derogation are reasonable. In its consideration of a derogation request, the *Regulatory Authority* may contact the relevant *DNSP* or *Distribution Network User* to obtain clarifications, request additional information or to discuss changes to the request, and review possible remedial actions to achieve compliance.

The *Regulatory Authority* may initiate at its own initiative, or at the request of a *DNSP* or in view of a *Distribution Network User* complaint, a review of any existing *Derogations*, and any *Derogations* under consideration where a relevant and material change in circumstance has occurred.

The *Regulatory Authority* may also seek the views and advice of an *Independent Expert* on the proposed *Derogation*, as set out in Section 3.12 of this chapter

3.10.3 Derogation Reporting

Every three months, the *Regulatory Authority* shall report:

(a) The list of *Derogations* requested during the last quarter, and the status of each request;
(b) The list of approved *Derogations* during the last quarter indicating type of *Derogation* and party; and
(c) For each approved *Derogation*, the progress of remedial actions in achieving compliance.

3.10.4 Derogation Register

The *Regulatory Authority* shall:

(a) Keep a register of all *Derogations* that have been granted to *DNSP*, and *Generation Licensees*, identified by name.

(b) Keep a register of all *Derogations* which have been granted to *Distribution Network Users*, identifying *User* name, the relevant provision of this *ENDGC*, a record of the completed mitigation and the period of the *Derogation;* and

(c) Publish a current register of all *Derogations* that have been granted to *DNSP* and *Distribution Network Users* on the *Regulatory Authority* website, the relevant provision of the *ENDGC*, the period of the *Derogation* and a record of the completed mitigation, if applicable.

3.10.5 Transitional Provisions

Transitional Provisions are intended to facilitate compliance and reduce the need for *Derogation* requests to suspend obligations under *ENDGC* provisions.

Transitional Provisions are provisions of the *ENDGC* approved by the *Regulatory Authority* that shall not apply either in whole or in part to some or all *Users*. They differ from Derogation in that:

(a) They cover potentially many *Users*

(b) They can be sought by a group of *Users* with similar needs to suspend obligations

(c) In appropriate circumstances, the *Regulatory Authority* can initiate a Transitional Provision

Situations which might require the use of Transitional Provisions include, but not limited to:

(a) The effective date of the *ENDGC* and its impact on requirements, such as multiple old *Generators* that need equipment upgrade in order to reach compliance

(b) Discovery of a common-mode problem with equipment

Transitional Provisions may require a plan of how the affected Users are going to reach compliance, or reasons why they should be permanently exempt.

3.11 DISPUTE RESOLUTION

If a *Dispute* arises between *the Regulatory Authority* and any *User* or between *Users* in connection with, or arising out of, the interpretation, implementation or breach of any provision in this *ENDGC*, any *Party* may issue to the other *Party* a written notice (the "*Dispute Notice*") outlining the matter in *Dispute*.

Dispute resolution may include a request to the *Regulatory Authority* to refer the matter to the *ENDGCRC* to consider the disputed *ENDGC* provisions and offer recommendations on resolution of the *Dispute*.

Settlement of *Dispute* shall be handled as described in PART SEVEN SETTLEMENT OF DISPUTE, "COUNCIL OF MINISTERS REGULATION TO PROVIDE FOR THE REGULATION OF ENERGY OPERATIONS".

3.12 INDEPENDENT EXPERT OPINION

If any matter is referred to an Independent Expert in accordance with the description in Chapter 4 (Governance), the Independent Expert shall be appointed by the *Regulatory Authority* as appropriate. Such person shall be an expert with specialised skills in the matter under consideration and must not have any material relationship with any of the *Parties* to the matter. When referring a matter to an Independent Expert a written brief shall be prepared containing:

a. Expert is required to express an opinion or give advice;
b. All the relevant documentation;
c. All the relevant correspondence between *Parties*, and
d. A request that the Independent Expert drafts an opinion setting out a possible solution to the issue.

The Independent Expert shall determine the procedure to be followed for the purpose of preparing an opinion. The venue for the Independent Expert's inquiries will be agreed between the *Parties* to the matter under consideration. Modern technologies such as videoconferencing may be used to ensure that the process is as cost efficient and equitable as possible.

The Independent Expert must within fifteen (15) business days of his appointment accept submissions from the *Parties* in dispute and must state his determination of those matters within sixty (60) business days of his appointment.

Responsibility for the entire cost of the Independent Expert shall be:

a. In the case of referral pursuant to Section 3.9 in this chapter, *Party* or *Parties* seeking revision of the *ENDGC* shall equally divide the entire cost;
b. In the case of referral pursuant to Section 3.10 in this chapter, the *Party* or *Parties* seeking *Derogation* shall equally divide the entire cost;
c. In the case of referral pursuant to Section 3.11 in this chapter, the disputing Parties shall equally divide the entire cost.

3.13 ENDGC INTERPRETATION

In the event that any *User* requires additional interpretation of the wording or application of any provision of the *ENDGC*, they may make a request to the *Regulatory Authority* for such interpretation. Provided that the request is reasonable, the *Regulatory Authority* shall provide the *User* with an interpretation of the relevant provision. In the event that a *User*, acting reasonably,

deems that an interpretation provided by the *Regulatory Authority* is unreasonable or inappropriate, the matter shall be resolved as provided in Section 3.11 Dispute Resolution of the *ENDGC*.

3.14 HIERARCHY

In the event of ANY conflict between the provisions of the *ENDGC* and any contract, bilateral agreement or arrangement between a *Transmission Licensee, Distribution Licensee,* or other *Users*, the provisions of the *ENDGC* shall prevail unless the *ENDGC* expressly provides otherwise.

In the event of any inconsistency between the *ENDGC* and the *ENTGC*, the latter shall prevail to the extent of such inconsistency unless the contrary intention is explicit in the *ENDGC*.

3.15 CONFIDENTIALITY

All data relating to and exchanged among *Parties* concerning the *ENDS* shall be considered to be *Confidential Information*. The *Regulatory Authority* shall consult with the *DNSPs and Users* in regard to the publication of any of the data exchanged. Aggregate data may be made available when requested by a *User*. These data shall be used only for the purpose specified in the request and shall be treated by the *User* as confidential. All such disclosure of *Confidential Information* shall be subject to a written Confidentiality Agreement duly signed by the *DNSPs* and *Users*. Such *Confidential Information* shall not be disclosed to other parties without the express written consent of the *Parties* to the Confidentiality Agreement.

3.15.1 Confidential Information

(a) Each *Party* shall use all reasonable endeavours to keep confidential any *Confidential Information* which comes into the possession or control of that *Party* or of which the *Party* becomes aware. The information owner may request the receiver of information to enter into a Confidentiality Agreement before information established to be confidential is provided.

(b) A *Party* shall:

1. Not disclose *Confidential Information* to any person except as permitted by the *ENDGC*.
2. Only use or reproduce *Confidential Information* for the purpose for which it was disclosed or another purpose contemplated by the *ENDGC*.
3. Not permit unauthorised persons to have access to *Confidential Information.*

(c) Each *Party* shall use all reasonable endeavours to:

1. Prevent unauthorised access to *Confidential Information* which is in the possession or control of that *Party;*

2. Ensure that any person to whom he discloses *Confidential Information* observes the provisions of this Section 3.15.1 in relation to that information; and
3. Control unauthorised access to *Confidential Information* and ensure secure information exchange. *Parties* shall report any leak of information that is governed by a confidentiality agreement as soon as practicable after they become aware of the leak, and shall provide the information owner with all reasonable assistance to ensure its recovery or destruction (as deemed appropriate by the information owner.

3.15.2 Exceptions

This section does not prevent:

(a) The disclosure, use or reproduction of information if the relevant information is at the time generally and publicly available other than as a result of breach of confidence by the *Party* who wishes to disclose, use or reproduce the information or any person to whom the *Party* has disclosed the information;

(b) The disclosure, use or reproduction of information to the extent required by law or by a lawful requirement of:
   1. Any government or governmental body, authority or agency having jurisdiction over a *Party* or his related bodies corporate; or

(c) The disclosure, use, or reproduction of information if required in connection with legal proceedings.

3.15.3 Application of Confidentiality to the *Regulatory Authority*

For the purpose of Section 3.15, other than Section 3.15.4, *Party* includes the *Regulatory Authority* and any council, committee or other body established by the *Regulatory Authority* under the *ENDGC*.

3.15.4 Indemnity to the Regulatory Authority

Each *Party* indemnifies the *Regulatory Authority* against any claim, action, damage, loss, liability, expense or outgoing which the *Regulatory Authority* pays, suffers, incurs, or is liable for in respect of any breach by that *Party* or any officer, *Agent* or employee of that *Party* of this Section 3.15.4 of the *ENDGC*.

3.15.5 Party Information

Each *Party* shall develop and, to the extent practicable, implement a policy to protect information that he acquires pursuant to his various functions from use or access which is contrary to the provisions of the *ENDGC*.

3.15.6 Information on Ethiopia National Distribution Code Bodies

The *Regulatory Authority* shall develop and implement policies concerning:

(a) The protection of information which *ENDGC* bodies acquire pursuant to their various functions from use or access by *Parties* or *ENDGC* bodies which is contrary to the provisions of the *ENDGC*; and

(b) The dissemination of such information where appropriate to *Parties* and other interested parties.

3.16 CONSTRUCTION OF REFERENCES

3.16.1 Preamble, Table of Contents and Headings

The Preamble, table of contents, and headings are inserted for information and convenience only and shall not be used in construing the provisions of the *ENDGC*.

3.16.2 Cross References

A cross-reference to another document or part of the *ENDGC* shall not of itself impose any additional or further or co-existent obligation or confer any additional or further or co-existent right in the part of the text where such cross-reference is contained.

3.16.3 Definitions

(a) Terms and expressions printed in italics and beginning with capital letters are listed in the Glossary and Definitions Chapter and shall, unless the context otherwise requires or is not consistent therewith, bear the respective meaning set out therein. However, if there are instances in which the terms are not capitalised or italicised, these meanings still hold.

(b) Terms not herein defined shall have the meaning ascribed thereto in the Oxford English Dictionary.

(c) Where the Glossary and Definitions refers to any word or term which is more particularly defined in a part of the *ENDGC*, the definition in that part of the *ENDGC* will prevail over the definition in the Glossary and Definitions in the event of any inconsistency.

3.16.4 Figures

Figures are provided in some chapters of the *ENDGC* for convenience and to illustrate a process. In case of any discrepancy between the text and figures regarding any provision of the *ENDGC*, the text shall prevail.

3.16.5 Gender, Singular and Plural

Unless the context otherwise requires, the singular shall include the plural and vice versa, and references to any gender shall include the other gender.

3.16.6 Include and Including

References to the words "include" or "including" are to be construed without limitation to the generality of the preceding words.

3.16.7 Mandatory Provisions

The word "shall" refers to a rule, procedure, requirement, or any other provision of the *ENDGC* that requires mandatory compliance.

3.16.8 Person or Entity

References to a person or entity shall include any individual and any other entity, in each case whether or not having a separate legal personality.

3.16.9 References

References to clauses, provisions or to a particular paragraph, sub-paragraph or Appendix are, unless the context otherwise requires, references to that clause, provision, paragraph, sub-paragraph, or Appendix in or to that part of the *ENDGC* in which the reference is made.

3.16.10 Written and in Writing

Any references to "in writing" or "written" include typewriting, printing, lithography, and other modes of reproducing words in a legible and non-transitory form.

3.17 LANGUAGE

This *ENDGC* is written in English. In case of any discrepancies between the English version and a version translated into any other language, the English version shall prevail.

4 GOVERNANCE

4.1 INTRODUCTION

The objective of this Governance chapter is to describe the provisions necessary for the overall administration and review of the various aspects of the *ENDGC*. This chapter also summarizes the main documents and organizations that provide the authority governing the planning, construction, and operation of the *ENDS*.

The Code requirements shall be applied in conjunction with the licenses issued to *Generation Licensees*, *TNSP* and *DNSP* and regulations that relate to the power sector of Ethiopia adopted by the *Regulatory Authority* and the *MOWIE*. All *Distribution Licenses* and agreements concluded after implementation of the *ENDGC* shall include the obligation of parties to comply with *ENDGC* requirements.

This chapter also describes the methodology that will be used to:

a. To ensure that all *Distribution Network Users* are represented in reviewing and making recommendations to the development and revision of the *ENDGC* requirements;

b. Facilitate the monitoring and auditing of compliance with the *ENDGC*;

c. To specify the processes used for the settlement of disputes.

4.2 GOVERNANCE DOCUMENTS

The primary laws defining governance are Ethiopia's Energy Proclamation 810/2013, Council of Ministers Regulation No. 302/2013, and 303/2013 that restructured the vertically integrated *EEPCO* and established the *EEP* and *EEU;* and Regulation No. 308/2014 that established the *Regulatory Authority* and its core functions in the technical, legal, economic, and operational areas. Ethiopia's National Energy Policy, *EEA* Summary Guide to Investment, Ethiopia's Climate Resilient Green Economy, *EEA* Pricing Procedure for Interconnected Systems (ICS) and Large Isolated Systems No. 1/2005, and *EEA* Pricing Procedure for Small and Very Small Self-contained Systems (SCS) No. 2/2005, and *EEA* Draft Directives Electricity Operations submitted to the Ministry of Mines and Energy – March, 2001. Growth and Transformation Plan (GTP) have also been reviewed for defining the Governance and all Chapters of the *ENTGC* and *ENDGC.*

The organization with the governance functions includes the *Regulatory Authority*, the *ENTGC, ENDGC, ENTGCRC,* and the *ENDGCRC.*

4.3 ETHIOPIA NATIONAL DISTRIBUTION SYSTEM GRID CODE REVIEW COMMITTEE (ENDGCRC)

The *Regulatory Authority* shall establish, maintain and maintain as a standing committee the *ENDGCRC* which shall be governed by the provisions of the *ENDGC* in Section 4.3.4 of this chapter. The *Regulatory Authority* is responsible for the review of the operations and revision of the *ENDGC.* The *ENDGCRC* shall not have decision making authority and the *Regulatory Authority* shall not be bound by its deliberations or recommendations.

4.3.1 Role of the ENDGCRC

The *ENDGCRC* shall:

(a) Keep the *ENDGC* and its working under review;

(b) Ensure that the *ENDGC* is consistent in its approach and is developed to reflect changes in *Prudent Utility Practice* and technology;

(c) Review and discuss all proposals for amendments to the *ENDGC* which the *Regulatory Authority, ENTSO, Transmission Licensees, Distribution Licensees* or *Distribution Network Users* submit to the Distribution Code Review Committee for consideration from time to time;

(d) Present recommendations to the *Regulatory Authority* as to amendments to the *ENDGC* that the *ENDGCRC* considers warranted and the reason for such changes;

(e) Review existing standards relevant to the operation of the *ENDS* and to make modifications or proposals for new standards in relation to the operation of the *ENDS*; and

(f) Issue guidance in relation to the *ENDGC* and its implementation, performance, and interpretation.

4.3.2 Composition of the ENDGCRC

The *ENDGCRC* shall consist of the following Members:

(a) A *Chairperson* appointed by the *Regulatory Authority*;

(b) One person representing the *Regulatory Authority*;

(c) One person representing the *Regional Control Centre;*

(d) One person representing public *Transmission Licensees* and one person representing private *Transmission Licensees*;

(e) One person representing public *Distribution Licensees* and one person representing private *Distribution Licensees*;

(f) One person representing the public *Generation Licensees* with *Generating Plants* connected to the *Distribution System* and one person representing private *Generation Licensees* with *Generating Plants* connected to the *Distribution System.*

In the case that any of the above categories include more than one entity, the constituents shall form a caucus and appoint a representative.

All appointments are subject to approval by the *Regulatory Authority* with regard to required minimum qualifications for *Members* provided in Section 4.3.5.

In the case that any of the above categories contain no entities, the position will remain unfilled.

4.3.3 Conduct of Business

The *ENDGCRC* shall establish and comply at all times with its own rules and procedures governing the conduct of its business as approved by the *Regulatory Authority*.

If the *ENDGCRC* is unable to reach a unanimous or consensus agreement on any matter presented before it, it shall report the cause of disagreement and the views held by the respective members of the *ENDGCRC* to the *Regulatory Authority.*

4.3.4 Constitution and Rules of the Distribution Code Review Committee

4.3.4.1 Committee Name

The Committee charged with making recommendations to the *Regulatory Authority* on the review of

the operation and revision of *ENDGC* shall be called the *ENDGCRC* and shall be governed by the provisions set out in this section of the *ENDGC*.

4.3.5 Distribution Code Review Committee Member Qualifications

Due to the technical nature of many of the duties and responsibilities of *ENDGCRC Members*, any person that is being considered as a *ENDGCRC Member* must meet the following minimum experience and qualifications;

4.3.5.1 Chairperson

(a) Minimum of ten (10) years of electric industry experience in a technical capacity.

(b) Minimum of seven (7) years of energy sector regulatory compliance oversight experience.

4.3.5.2 Committee Member

(c) Minimum of seven (7) years of electric industry experience in a technical capacity.

(d) Minimum of three (3) years of experience in regulatory compliance for an electric utility, *Regulatory Authority* or an *IPP*.

4.3.6 Term of Office

The term of office of a *Member* shall be three years from the date of his or her appointment. A *Member* may resign, be reappointed replaced or removed in accordance with the provisions set forth for the governance of the *ENDGCRC*.

The *Regulatory Authority* has the right to modify the term of office during the initial formation of the *ENDGCRC* to assure that incumbent *Member*'s terms do not expire at the same time. This will assure that the *ENDGCRC* has a consistent mix of incumbents and new *Members*.

4.3.7 Appointment by the Regulatory Authority

If at any time any person entitled to appoint a *Member* or *Members* has not made an appointment and/or is in disagreement as to whom to appoint and as a result no *Member* represents that entity, the *Chairperson* shall notify the *Regulatory Authority*. The *Regulatory Authority* shall have the right, until the relevant entity has made an appointment, to appoint a *Member* on behalf of that entity. The appointed *Member* must be from an entity from the corresponding category as described in Section 4.3.2. In the event that the *Regulatory Authority* does not exercise this right, the *ENDGCRC* shall be regarded as complete in the absence of that *Member*.

4.3.8 Nature of Member

No person other than an individual shall be appointed a *Member* or his alternate.

4.3.9 Retirement of Members

If a *Member* chooses to retire before the end of their term, written notification shall immediately be given to the *Chairperson*. The *Chairperson* shall notify the *Party* that appointed the retiring *Member*, and by notice in writing to the *Chairperson*, the said *Party* shall indicate its wish to appoint a new *Member*. Should the position of a *Member* become vacant, the *Party* appointing him must appoint a replacement within twenty-five (25) calendar days.

Such notifications for appointment must be delivered to the *Chairperson* at least twenty-one (21) days in advance of the meeting of the *ENDGCRC* from the person or group of persons represented by each *Member.*

4.3.10 Alternates

Each entity shall have the power to appoint any individual to be an Alternate to the *Member*, and may at its discretion, remove an Alternate *Member* so appointed. An entity shall not appoint another Member as an Alternate. Any appointment or removal of an alternate *Member* shall, unless the *Chairperson* otherwise agrees, be effected by notice in writing executed by the appointer and delivered to the Secretary or tendered at a meeting of the *ENDGCRC*. If his appointer so requests, an alternate *Member* shall be entitled to receive notice of all meetings of the *ENDGCRC* or of sub-committees or working groups of which his appointer is a *Member*. He shall also be entitled to attend and vote as a *Member* at any such meeting at which the *Member* appointing him is not personally present and at the meeting to exercise and discharge all the functions, powers and duties of his appointer as a *Member*. For the purpose of the proceedings at such meetings, the provisions of the *ENDGC* shall apply as if the alternate appointed were a *Member*. An alternate shall have all the rights and obligations of a *Member* including voting rights.

4.3.11 Ceasing to Act

An alternate *Member* shall cease to be an alternate *Member* if his or her appointer ceases for any reason to be a *Member*.

4.3.12 References Include Alternates

References to a *Member* shall, unless the context otherwise requires, include his duly appointed alternate.

4.3.13 Representation and Voting

4.3.13.1 Representation

The *Chairperson* and every *Member* shall be entitled to attend and participate in every meeting of the *ENDGCRC*. One adviser (or such greater number as the *Chairperson* shall permit) shall be entitled to attend any meeting of the *ENDGCRC* with each *Member.*

4.3.13.2 Voting

The *ENDGCRC shall* seek to achieve a unanimous consensus agreement among all voting members. If the Committee is unable to reach unanimous consensus on an item, a simple majority voting method will be used. If there is a tie after voting, the *Chairperson* will be allowed to cast a tie-breaking vote.

4.3.14 Removal

Any entity entitled to appoint a *Member*, including the *Chairperson*, may at any time replace that *Member* or the *Chairperson*, as the case may be, from committee and appoint another person in his place. An entity will only have the right to remove from the committee the person that it or they have appointed, and will have no right to remove from office the *Chairperson* or any other Member, as the case may be, appointed by another person. In the event of disagreement amongst persons entitled to appoint a Member, the relevant provisions of Section 4.3.7 "Appointment by *Regulatory Authority*" shall apply with any necessary changes. Whenever any individual Member or the *Chairperson* changes, the entity entitled to appoint that Member or the *Chairperson* shall notify the Secretary in writing within seven (7) days of the change taking effect.

4.4 THE CHAIRPERSON POSITION

4.4.1 Appointment/Removal

The *Regulatory Authority* may at any time replace the *Chairperson*. Upon retirement or removal by the *Regulatory Authority* of the first and each successive Chairperson, the *Regulatory Authority* shall appoint a person to act as *Chairperson*.

4.4.2 Alternate Chairperson

The *Chairperson* shall preside at every meeting of the *ENDGCRC* at which he is present. If the *Chairperson* is unable to be present at a meeting but has appointed an alternate, such alternate shall act as *Chairperson*. If neither the *Chairperson* nor his alternate is present within half an hour after the time appointed for holding the meeting, the *Members* present appointed by the *Regulatory Authority* may appoint one of their number to act as *Chairperson* of the meeting; such appointee shall not however, be treated as the *Chairperson*'s alternate and shall not be entitled to cast the *Chairperson*'s vote.

4.5 THE SECRETARY POSITION

4.5.1 Appointment

The *Regulatory Authority* shall have power to appoint and dismiss a Secretary and such other staff for the *ENDGCRC* as it may deem necessary. The *Regulatory Authority* shall notify each *Member* of the identity and address for correspondence of the Secretary as soon as reasonably practicable after the appointment of the first Secretary and, subsequently after the appointment of any new

Secretary. The Secretary may, but need not, be a *Member* but shall not be a *Member* by virtue only of being Secretary. The Secretary shall have the right to speak at meetings but, unless they are a *Member*, they have no right to cast a vote at any meeting.

4.5.2 Duties

The Secretary's duties shall be to attend to the day to day operation of the *ENDGCRC* and, in particular, to:

(a) attend to the requisition of meetings and to serve all requisite notices;

(b) maintain a register of names and addresses of *Members* and alternates as appointed from time to time; and

(c) keep minutes of all meetings.

4.5.3 Registers

The Secretary shall make available the registers of names and addresses and minutes for inspection by the *Regulatory Authority*, *Members*, and Member Transmission and *Distribution Licensees*.

4.5.4 Group Representative's Addresses

Each Member shall from time to time communicate his address to the Secretary and all notices sent to such address shall be considered as having been duly given.

4.6 MEETINGS

4.6.1 Date and Venue

The *ENDGCRC* shall hold meetings quarterly at regular scheduled times as the Committee may decide.

4.6.2 Further Meetings

The *Chairperson* or any other *Member* may request the Secretary to requisition further meetings by giving a twenty-one (21) day notice to the Secretary. The notice shall be in writing and contain a summary of the agenda of the business that it is proposed will be conducted. The Secretary shall proceed to convene a meeting of the *ENDGCRC* within seven (7) days of the date of expiry of such notice.

4.6.3 Notice of Meetings

4.6.3.1 Notice by Chairperson

All meetings shall be called by the *Chairperson* on at least fourteen (14) days written notice (exclusive of the day on which it is served and of the day for which it is given), or by shorter notice if so agreed in writing by all *Members*. The *Chairperson* shall provide notice of the meeting to

Consumer organizations, to allow their representatives to observe the meeting.

4.6.3.2 Details in Notice

The notice of each meeting shall contain the time, date and venue of the meeting, and an agenda.

4.6.3.3 Failure to Give Notice

The accidental omission to give notice of a meeting or the non-receipt of notice of a meeting by a person entitled to receive notice shall not invalidate the proceedings at that meeting.

4.6.3.4 Proposal for Agenda

By notice to the Secretary, any *Member* can request additional matters to be considered at the meeting and provided such notice is given at least ten (10) days (exclusive of the day on which it is served and of the day for which it is given) before the date of the meeting, those matters will be included in a revised agenda for the meeting. The Secretary shall circulate the revised agenda to each *Member* as soon as practicable.

4.6.4 Proceedings at Meetings

4.6.4.1 Quorum

50% plus one (1) *Member* present in person, or by their alternates, shall constitute a quorum for the conducting of business at any meeting of the committee.

4.6.4.2 Inquorate Meetings

If, within half an hour from the time appointed for holding any meeting of the *ENDGCRC*, a quorum is not present, the meeting shall be adjourned to such day, time and place as the *Secretary* may notify to *Members* within three (3) days of the adjournment.

The adjourned meeting shall not be called to take place within one week of the adjournment but may be called on less than fourteen (14) day notice.

4.6.5 Agenda

Only matters identified in the agenda shall be resolved upon at a meeting. However, this shall not prevent matters raised under the heading "Any Other Business" being discussed and if the *Chairperson* thinks fit, be resolved.

4.6.6 Validity of Acts

All acts done by any meeting of the *ENDGCRC* or of a sub-committee or working group shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of a *Member*, be as valid as if such person had been duly appointed.

4.6.7 Written Resolution

A resolution in writing signed by all *Members* shall be as valid and effective as if it had been passed at a meeting of the *ENDGCRC* duly convened and held and may consist of several documents in like form each signed by or on behalf of one or more *Members*.

4.6.8 Meeting Attendance

Members shall attend meetings in person. In special circumstances as approved by the *Chairperson*, a meeting may consist of a conference between *Members* who are not all in one place but who are able directly or by teleconference to speak to each of the others and to be heard by each of the others simultaneously. The word "meeting" shall be construed accordingly.

4.6.9 Minutes

4.6.9.1 Circulation

The Secretary shall circulate copies of the minutes of each meeting of the *ENDGCRC* to each Member as soon as practicable and in any event within ten (10) business days after the meeting has been held.

4.6.9.2 Approval of Minutes

Each *Member* shall notify the Secretary of his approval or disapproval of the minutes of each meeting within ten (10) business days of receipt of the minutes. A *Member* who fails to do so will be deemed to have approved the minutes. The approval or disapproval of the minutes aforesaid will not affect the validity of decisions taken by the *ENDGCRC* at the meeting to which the minutes relate.

4.6.9.3 Amendments

If the Secretary receives any comments on the minutes, he shall then include those aspects of the minutes upon which there is disagreement into the agenda for the next following meeting of the *ENDGCRC* as the first item for resolution.

4.6.10 Guidance from the ENDGCRC

The *ENDGCRC* may at any time, and from time to time, issue guidance in relation to the *ENDGC* and its implementation, performance and interpretation, and it may establish sub-committees and

working groups to carry out such work.

4.6.11 Sub-Committees and Working Groups

4.6.11.1 Sub-Committees

The *ENDGCRC* may establish and may co-opt such sub- committees from time to time consisting of such persons as it considers desirable, whether *Members* or not. Each sub-committee shall be subject to such written terms of reference and shall be subject to such procedures as the *ENDGCRC* may determine. The meetings of sub-committees shall so far as possible be arranged so that the minutes of such meetings can be presented to the *Members* in sufficient time for consideration before the next following meeting of the *ENDGCRC*.

4.6.11.2 Working Groups

The *ENDGCRC* may further establish working groups to advise it on any matter from time to time. Such working groups may consist of *Members* and/or others as the *ENDGCRC* may determine for the purpose.

4.6.11.3 Resolutions

Resolutions of sub-committees and working groups shall not have binding effect unless approved by resolution of the *ENDGCRC*.

4.7 VACATION OF OFFICE

The office of a Member shall be vacated if:

(a) the *Member* resigns office by notice delivered to the Secretary; or

(b) the *Member* becomes bankrupt or compounds with their creditors generally; or

(c) the *Member* becomes of unsound mind or a patient for any purpose of any statute relating to mental health; or

(d) his/her alternate fails to attend more than three consecutive meetings of the *ENDGCRC* without submitting an explanation to the *Chairperson* which is reasonably acceptable to the *Chairperson*.

4.8 MEMBER'S RESPONSIBILITIES AND PROTECTIONS

4.8.1 Responsibilities

In the exercise of its powers and the performance of its duties and responsibilities, the *ENDGCRC* shall have due regard for the need to promote the attainment of the principal duties of the *ENDGCRC*.

4.8.2 Representation

In the exercise of its powers and the performance of its duties and responsibilities as a *Member*, a *Member* shall represent the interests of the institution or entity by whom he was appointed, provided that such obligation of representation shall at all times be subordinate to the obligations of the *Member* as a *Member* of the *ENDGCRC*.

4.8.3 Reliance on Documentation

The *ENDGCRC*, each *Member* and the Secretary shall be entitled to rely upon any communication or document reasonably believed by it or him to be genuine and correct and to have been communicated or signed by the person by whom it purports to be communicated or signed.

4.9 REVISION TO THE DISTRIBUTION CODE

Any *Distribution Network User*, *ENDGCRC* Member, *DNSP*, *Transmission Licensee*, the *ENTSO*, *MOWIE*, or the *Regulatory Authority* may propose revisions to the *ENDGC*. The *Regulatory Authority* shall have sole authority to make any revisions to the *ENDGC*. Before approving any proposed revisions to the *ENDGC*, the *Regulatory Authority* will be guided by the *ENDGCRC* recommendations on the matter and any representations made by *Parties*. In considering the proposed revisions the *Regulatory Authority* may also seek the opinion of an *Independent Expert*.

The *Regulatory Authority* shall, as required, prepare and issue amended versions of the *ENDGC* containing such revisions as have been approved by the *Regulatory Authority*. All revisions to the *ENDGC* shall be recorded in the *ENDGC Revision Register*, which shall indicate the date, chapter amended and the reason for the change. An up to date *ENDGC* including all approved revisions shall be published on the *Regulatory Authority* website along with the *ENDGC Revision Register*. The revised version of the *ENDGC* shall take effect from the date on which it is published on the *Regulatory Authority* website, or such other later date as specified by the *Regulatory Authority*.

4.10 ENDGC AUDITS

4.10.1 Customer request

A *User* may request from the *DNSP*, or a *DNSP* may request from a *User*, any material in the possession or control of that participant relating to compliance with a section of the *ENDGC*. The requesting participant may not request such information in relation to a particular section of the *ENDGC* within six (6) months of a previous request made under this section in relation to the relevant section.

4.10.2 Information Requirements

A request under this section shall include the following information:

(a) Nature of the request

(b) Name of the representative appointed by the requesting participant to conduct the investigation

(c) The time or times at which the information is required

4.10.3 Withholding Information

The relevant participant may not unreasonably withhold any relevant information requested. It shall provide a representative of the requesting participant with such access to all relevant documentation, data, and records (including computer records or systems) as is reasonably requested. This information shall be treated as confidential if requested. Any request or investigation shall be conducted without undue disruption to the business of the participant.

4.11 CONTRACTING

The *ENDGC* shall comprise one of the standard documents that form part of the contract between *DNSPs* and each of their *Customers*. *DNSPs* shall contract with *Customers* for any services specified in the *ENDGC*.

4.12 REGISTRATION

4.12.1 Users

DNSPs shall ensure that agreements between *DNSPs* and *Users* after the implementation of the *ENDGC* shall include an obligation on *Users* to comply with *ENDGC* requirements.

4.12.2 Licensed Entities

The *Regulatory Authority* shall ensure that all *Licensees* comply with *ENDGC* requirements.

4.12.3 Registration of Licensees

No entity shall have access to the *ENDS* before obtaining a licence from the *Regulatory Authority* as defined in the Council of Ministers Energy Regulations document. The *Regulatory Authority* shall be responsible for creating and maintaining a register of Licensees as described in the Council of Ministers Energy Regulations document. Service-providers shall ensure that *Users* are registered as Licensees before entering into a contract for services with such *Users*.

A *User* who no longer holds a licence from the *Regulatory Authority* shall be removed from the register of Licensees.

4.13 NOTICES

4.13.1 Service of Notices

A notice is properly given under the *ENDGC* to a person if:

(a) It is personally served; or

(b) A letter containing the notice is prepaid and posted to the person at an address (if any) supplied by the person to the sender for service of notices or, where the person is a *User*, an address shown for that person in the register of *Users* to whom licences have been issued under the *Proclamation 810/2013 and other appropriate regulations,* and maintained by the *Regulatory Authority* or, where the addressee is the *Regulatory Authority*, the registered office of the *Regulatory Authority*; or

(c) It is sent to the person by facsimile or electronic mail to a number or reference which corresponds with the address referred to in Section 4.13.1(b) or which is supplied by the person to the *Regulatory Authority* for service of notices; or

(d) It is published in a newspaper with wide circulation in the area where the person is resident or in a daily newspaper circulated generally;

(e) It is communicated verbally to the person and that communication is recorded or thereafter confirmed in writing; or

(f) The person receives the notice

4.13.2 Time of Service

A notice is treated as being given to a person by the sender:

(a) Where sent by post in accordance with Section 4.13.1(b) to an address in the central business district of Addis Ababa, on the second business day after the day on which it is posted;

(b) Where sent by post in accordance with Section 4.13.1(b) to any other address, on the third business day after the day on which it is posted;

(c) Where sent by facsimile in accordance with Section 4.13.1(c) and a complete and correct transmission report is received:

(d) Where the notice is of the type in relation to which the addressee is obliged under the *ENDGC* to monitor the receipt by facsimile outside of, as well as during, business hours, on the day of transmission; and

(e) In all other cases, on the day of transmission if a business day or, if the transmission is on a day which is not a business day or is after 16h00 Hr (addressee's time), at 9h00 Hr on the following business day;

(f) Where sent by electronic mail in accordance with Section 4.13.1(c):

(g) Where the notice is of a type in relation to which the addressee is obliged under the *ENDGC* to monitor receipt by electronic mail outside of, as well as during, business hours, on the day when the notice is recorded as having been first received at the electronic mail destination; and

(h) In all other cases, on the day when the notice is recorded as having been first received at the electronic mail destination, if a business day or if that time is after 16h00 Hr (addressee's time), or the day is not a business day, at 9h00 Hr on the following business day; or

(i) Where published in a newspaper in accordance with Section 4.13.1(d), on the next day after the date of publication of the notice;

(j) In any other case, when the person actually receives the notice.

4.13.3 Counting of Days

Where a specified period (including, without limitation, a particular number of days) shall elapse or expire from or after the giving of a notice before an action may be taken neither the day on which the notice is given nor the day on which the action is to be taken may be counted in reckoning the period.

4.13.4 Reference to Addressee

In this section, a reference to an addressee includes a reference to an addressee's officers, Agents, or employees or any person reasonably believed by the sender to be an officer, Agent or employee of the addressee.

4.14 ENFORCEMENT

4.14.1 Investigations

(a) A *User* shall, if requested by the *Regulatory Authority*, supply it with information relating to any matter concerning the *ENDGC* in such form, covering such matters and within such reasonable time as the *Regulatory Authority* may request.

(b) If a *User* fails to comply with a request by the *Regulatory Authority* for information as described in Section 4.14.1(a), the *Regulatory Authority* may appoint a person to investigate the matter and to prepare a report or such other documentation as the *Regulatory Authority* may require. A *User* shall assist the person to undertake the investigation and to prepare the report or other documentation. In addition, a *User* shall, at the request of the person appointed, direct third-parties to make available such information as the person may reasonably require.

(c) The cost of the investigation and of preparing the report or other documentation prepared by the person appointed shall be met by the *User* directed to supply the information under Section 4.14.1(a) unless the *Regulatory Authority* otherwise determines.

(d) Any report or other documentation referred to in this Section 4.14.1 may be used in any proceeding involving the *Regulatory Authority* under the Proclamation 810/2013 and other appropriate regulations or for the purpose of commencing any such proceeding.

(e) The *Regulatory Authority* shall develop and implement guidelines in accordance with the *ENDGC* consultation procedures governing the exercise of the powers conferred on it by this Section 4.14.1.

(f) The guidelines referred to in Section 4.14.1(e) shall set out the circumstances that a *User* will be required to bear the cost of providing the information sought by the *Regulatory Authority* under this Section 4.14.1, including where no breach of the *ENDGC* by the relevant *User* has occurred.

4.14.2 Entry and Inspection

The *Regulatory Authority* and its authorised officers and representatives shall have such rights of entry to premises and installations as may be granted under the Proclamation 810/2013 and other appropriate regulations.

4.14.3 Function of the Regulatory Authority

The functions of the *Regulatory Authority* are set out in the Proclamation 810/2013 and other regulations as appropriate.

4.14.4 Alleged Breaches

(a) If a *User* considers that another *User* may have breached or may be breaching this *ENDGC* or any provision in their *Connection Agreement,* the aggrieved *User* may, in accordance with this *ENDGC* or the terms of their *Connection Agreement*:

1. Give notice to the person in breach to immediately take steps to remedy and/or stop the breach, as the case may be;
2. Subject to Section 4.14.4, impose any sanctions on the person in breach as provided in this *ENDGC* or their *Connection Agreement* and
3. Without limitation to his powers, use reasonable endeavours to give effect to any sanctions so imposed.

(b) If the *Regulatory Authority* considers that:

1. A *User* may have breached or may be breaching the *ENDGC*; and
2. In the circumstances and if the breach is established, it would be appropriate that a sanction or sanctions be imposed on that *User*, the *Regulatory Authority* shall notify the *User* of the alleged breach and details of the sanctions which may be imposed if the breach is established.

(c) If the *Regulatory Authority* receives written information from a *User* or any other person which alleges a breach of the *ENDGC* by a *User*, the *Regulatory Authority* shall within five (5) business days of receipt of the information determine whether, based on that information, there would appear prima facie to be a breach of the *ENDGC*.

(d) If the *Regulatory Authority* considers that a *User* may be the subject of a *disconnection* order it shall:

1. Promptly notify the *Users* which the *Regulatory Authority* considers may be affected; and

2. Without limitation to its powers, use reasonable endeavours to give effect to any arrangements notified to the *Regulatory Authority* by the *Users* for ensuring the continuation of *supply* to the relevant purchasers of electricity.

4.14.5 Sanctions

The nature of sanctions that may be imposed under the *ENDGC* and the circumstances in which a *User* or the *Regulatory Authority* may implement any sanction that has been imposed, shall be set out in regulations approved or issued by *Regulatory Authority*.

4.14.6 Regulatory Authority Action

(a) The *Regulatory Authority* may direct a *User* or any person to do or refrain from doing anything that the *Regulatory Authority* thinks necessary or desirable to give effect or assist in giving effect to any of its orders.

(b) Without limiting the generality of Section 4.14.6(a), the *Regulatory Authority* may direct a *DNSP* to *disconnect* a *User* from any *distribution system* in order to assist in giving effect to any of its orders.

(c) A *User* or any person shall comply with a direction given under Section 4.14.6(a).

4.14.7 User Action

If any partner, *Agent*, officer, or employee of a *User* does any act or refrains from doing any act which if done or not done (as the case may be) by a *User* would constitute a breach of the *ENDGC*, such act or omission shall be deemed for the purposes of this Section 4.14.7 to be the act or omission of the *User* concerned.

4.14.8 Publications

(a) The *Regulatory Authority* shall publish a report at least once every six (6) months setting out a summary for the period covered by the report of:

1. Matters which have been referred to it;
2. All its findings during that period; and
3. Any sanctions it applied under the Proclamation 810/2013 or any other regulations as applicable.

(b) In considering the circulation of a report under Section 4.14.8(a), the *Regulatory Authority* shall have regard to *ENDGC* objectives.

(c) In addition to the regular publication described in Section 4.14.8(a), the *Regulatory Authority* may publish a report on any one or more matters that have been referred to it, its findings in relation to those matters and any sanctions imposed in relation to those matters. A decision by the *Regulatory Authority* to publish a report under this Section 4.14.8(c) is a reviewable decision.

(d) No *User*, or former *User* is entitled to make any claim against the *Regulatory Authority* for any loss or damage incurred by the *User* or former *User* from the publication of any information pursuant to Section 4.14.8(a) or(c) if the publication was done in good faith. No action or other proceeding will

be maintainable by the person or *User* referred to in the publication against the *Regulatory Authority* or any person publishing or circulating the publication on behalf of the *Regulatory Authority* and this section operates as leave for any such publication except where the publication was not done in good faith.

4.14.9 System Security Directions

(a) Notwithstanding any other provisions of the *ENDGC* a *User* shall follow any direction issued by or on behalf of the *ENTSO*, which the *ENTSO* is entitled to issue in exercising his powers under the Operations Chapters of the *ENDGC* relevant to maintaining or restoring *Power System Security*.

(b) Any event or action required to be performed pursuant to a direction issued under the Operations Chapters of the *ENDGC* on or by a stipulated day is required by the *ENDGC* to occur on or by that day, whether or not a business day.

(c) Any failure to observe such a direction will be deemed to be a breach of the *ENDGC*.

(d) Any *User* who is aware of any such failure or who believes any such failure has taken place shall refer the allegation to the *Regulatory Authority* in accordance with the procedures contained in Section 4.14.4.

4.15 MONITORING AND REPORTING

4.15.1 Monitoring Objectives

a. The *Regulatory Authority* is responsible for monitoring compliance with and shall use its reasonable endeavours to ensure the effectiveness of the *ENDGC* in accordance with its objectives.

b. The *Regulatory Authority* shall undertake such monitoring as it considers necessary:
   1. To determine whether *Users* are complying with the *ENDGC*;
   2. To assess whether the dispute resolution, *ENDGC* enforcement, *ENDGC* change and other mechanisms are working effectively in the manner intended;
   3. To determine whether in its operation, the *ENDGC* is adequately giving effect to objectives specified in the *ENDGC*; and
   4. To collect, analyse, and disseminate information relevant and sufficient to enable the *Regulatory Authority* to comply with its reporting and other obligations and powers under the *ENDGC*.

c. The *Regulatory Authority* shall ensure that, to the extent practicable in light of the objectives set out in Section 4.15.1(b), the monitoring processes which it implements under this Section 4.15:
   1. Are consistent over time;
   2. Do not discriminate unnecessarily between *Users*;
   3. Are cost effective to both the *Regulatory Authority* and all *Users*; and

4. Are publicised or information relating thereto is available to any person, subject to any requirements as a result of the confidentiality obligations

4.15.2 Reporting Requirements and Monitoring Standards

a. The *Regulatory Authority* shall establish:
   1. Reporting requirements for *Users* in relation to matters relevant to the *ENDGC*; and
   2. Procedures and standards applicable to the *Regulatory Authority* and *Users* relating to information and data received by or from *Users* in relation to matters relevant to the *ENDGC*.

b. Prior to establishing requirements or standards and procedures referred to in Section 4.15.2(a), the *Regulatory Authority* shall consult with such *Users* as the *Regulatory Authority* considers appropriate. In formulating requirements or procedures and standards, the *Regulatory Authority* shall take into consideration the monitoring objectives set out in Section 4.15. The reporting requirements and standards and procedures established by the *Regulatory Authority* are reviewable decisions.

c. Subject to Section 4.15.2(d), the *Regulatory Authority* shall notify to all *Users* particulars of the requirements, procedures, and standards that it establishes under this Section 4.15.2.

d. If the *Regulatory Authority* establishes additional or more onerous requirements or procedures and standards which do not apply to all *Users* and the *Regulatory Authority* considers that notification of those matters to all *Users* would contravene the confidentiality provisions in Section 3.15, the *Regulatory Authority* shall notify only those *Users* to whom the requirements or procedures and standards apply.

e. Each *User* shall comply with all requirements, procedures and standards established by the *Regulatory Authority* under this Section 4.15.2 to the extent that they are applicable to him within the time period specified for the requirement, procedure or standard or, if no such time period is specified, within a reasonable time. Each *User* shall bear his own costs associated with complying with these requirements, procedures, and standards.

f. In complying with his obligations or pursuing his rights under the *ENDGC*, a *User* shall not recklessly or knowingly provide, or permit any other person to provide on behalf of that *User*, misleading or deceptive data, or information to any other *User* or to the *Regulatory Authority*.

g. Any *User* may ask the *Regulatory Authority* to impose additional requirements, procedures, or standards under this Section 4.15.2 on another *User* in order to monitor or assess compliance with the *ENDGC* by that *User*. When such a request is made, the *Regulatory Authority* may but is not required to impose the additional requirements, procedures, or standards. A decision by the *Regulatory Authority* to impose additional requirement procedures or standards is a reviewable decision. If the *Regulatory Authority* decides to impose additional requirements, procedures, or standards, the *Regulatory Authority* may determine the allocation of costs of any additional compliance monitoring undertaken between the relevant *Users*. *Users* shall pay such costs as allocated. In the absence of such allocation, the *User* subject to the additional requirements, procedures, or standards will bear his own costs of compliance.

h. The *Regulatory Authority* shall develop and implement guidelines in accordance with the *ENDGC* consultation procedures governing the exercise of the powers conferred on it by Section 4.15.2(g) which guidelines shall set out the matters to which the *Regulatory Authority* shall have regard prior to deciding the allocation of costs of any additional requirements, procedures or standards imposed pursuant to Section 4.15.2(g) between the relevant *Users*.

4.15.3 Use of Information

(a) Subject to confidentiality obligations set out in the Confidentiality sections of the *ENDGC*, the *Regulatory Authority* is entitled to use any data or information obtained as a result of any monitoring requirements imposed under Section 4.15.2 in pursuance of any of the *Regulatory Authority*'s powers or functions under the *ENDGC*. Without limitation, the *Regulatory Authority* may use any such information in connection with or to initiate:

1. A process to change or revise the *ENDGC*; or
2. An investigation under the *ENDGC*.

(b) A *User* may claim that the information provided to the *Regulatory Authority* is confidential in nature to the *User* or that the *User* is under an obligation to another person to maintain the confidentiality of all or part of the information. Notwithstanding that the *Regulatory Authority* may consider the claim by the *User* to be reasonable, if the *Regulatory Authority* considers that its reporting obligations set out in the *ENDGC* make the disclosure of the information necessary or desirable, the *Regulatory Authority* may disclose the information. In doing so, the *Regulatory Authority* shall use all reasonable endeavours to ensure the information is disclosed only in a manner and to the extent that, as far as practicable, protects the confidential nature of the information and in no way is the *Regulatory Authority* to be liable for publishing or disclosing any information under this Section 4.15.3.

(c) Prior to disclosing in accordance with Section 4.15.3(b) information which a *User* claims is confidential, the *Regulatory Authority* decision to disclose the information.

(d) Any decision by the *Regulatory Authority* under Section 4.15.3(b) to disclose information that is claimed by a *User* to be confidential is a reviewable decision and the *Regulatory Authority* shall not disclose the information until twenty-eight (28) days after it has provided written notice to the relevant *User* that it intends to disclose the information.

4.15.4 Reporting

(a) Not later than 31 December in each calendar year, the Regulatory Authority shall prepare and give an annual report for the previous Financial Year to all Users and interested parties. The annual report shall include:

1. The *Regulatory Authority*'s assessment of the extent to which the operation of the *ENDGC* during that period met the *ENDGC* objectives and of the strategic development of the *ENDGC* to meet industry objectives;
2. The *Regulatory Authority*'s audited accounts for the period covered by the report;
3. A summary of, and reasons for, any changes to the *ENDGC*;
4. A summary of identified material breaches of the *ENDGC* and the actions taken in response, including particulars of any sanctions imposed;

5. A summary of any disputes referred to the *Regulatory Authority* or involving the *Regulatory Authority* as a *Party*;
6. A summary of material matters in relation to the dispute resolution under the *ENDGC* (without identifying the parties); and
7. The *Regulatory Authority's* assessment of the matters set out in Section 4.15.1(b) which it is required to monitor.

b. In addition to the annual report described in Section 4.15.4(a), the *Regulatory Authority* may, if it considers it appropriate, provide an interim report to *Users* and interested parties on any one or more of the matters that should be contained in the annual report.

4.15.5 Recovery of Reporting Costs

Where, under the *ENDGC*, the *Regulatory Authority* is entitled or required to publish or give information, notices or reports to any *User* or any other person, unless the context otherwise requires, the *Regulatory Authority* (as the case may be) shall charge those persons a fee at cost for providing them with a copy of the information or report.

5 CONNECTIONS

5.1 PROCEDURES FOR CONNECTION OR MODIFICATION

5.1.1 Application

5.1.1.1 Application for Connection

Any *Distribution Network User* seeking a new or modified connection to the *Distribution System* will submit to the *DNSP* a Request for Connection Application. Suitable forms shall be provided by the *DNSP*, depending on the required Connection Capacity and the nature of the Distribution Network User's Equipment to be connected.

5.1.1.2 Application for Generating Plant Connection

Any *Distribution Network User* seeking to connect a *Generating Plant* to the *Distribution Network System* will submit to the *DNSP* a Request for *Generating Plants* Connection Application. Suitable forms shall be provided by the *DNSP*.

5.1.2 Distribution System Requirements

The *DNSP* shall furnish relevant *Distribution Network System* specifications and requirements to the applicant to assist them in the planning and procurement of equipment for their new or modified connection.

5.1.3 Application Requirements

(a) *Distribution Network Users* shall contact the *DNSP* in advance if it is proposing to make any significant change to the connection, electric lines or electrical equipment, install or operate any generating equipment or do anything else that could affect the *Distribution System* or require alterations to the connection.

(b) *Distribution Network Users* shall provide the *DNSP* with any information requested about the nature, or use by the Distribution Network User, of electrical equipment on the *Distribution Network User's* premises. The *DNSP* will only ask for information that is needed by it in relation to its Distribution Licence, distribution concession or the *ENDGC*.

(c) If the *DNSP* should determine that more detailed information is required, the *Distribution Network User* shall provide it upon request. The *DNSP* will only ask for information that is needed in relation to its Distribution Licence or the *ENDGC*.

(d) *Distribution Network Users* shall make available to the *DNSP* all documentation submitted for approval by local authorities, and proof of the local authorities approval. All single line diagrams as discussed below shall be signed by a registered *Professional Engineer*.

5.1.4 Small Connections (up to 150 kVA at up to 400 V)

For new or modified Small Connections, assess whether a proposed connection is acceptable, and determine the necessary supply arrangements, from analysis of the following limited Standard Planning Data provided by the *Distribution Network User*:

(a) The requested Connection Capacity in kVA;

(b) Type and electrical loading of equipment to be connected, e.g. number and size of motors, cookers, electrical space and water electrical heating, air conditioning, refrigeration; and

(c) The date when the new or modified connection is required.

The *DNSP* shall have an efficient process and procedure for the review and approval of these Small Connections.

5.1.5 Medium Connections (> 150 kVA up to 5 MVA at 15 kV or 33 kV)

For new or modified Medium Connections, the required Standard Planning Data provided by the *Distribution Network User* will include:

(a) Expected *Connection Point* to the *Distribution System*; geographical and electrical

(b) The date when connection is required

(c) Single line diagrams of existing and proposed arrangements of main plant and apparatus showing equipment rating and operating parameters

(d) Type and electrical loading of equipment to be connected, e.g. number and size of motors, electrical heating, air conditioning, refrigeration, etc.

(e) For all types of load:
   1. Requested Connection Capacity (kVA);
   2. Maximum Active Power Demand (kW); and
   3. Maximum Reactive Power requirements (kvar)

(f) For Fluctuating Loads:
   1. The Rate of Change of Demand;
   2. The Switching Interval; and
   3. The Magnitude of the Largest Step Change

(g) The maximum phase unbalance which the Demand would be expected to impose on the *Distribution Network System*.

(h) The maximum flicker and harmonic content which will be imposed on the *Distribution Network System.*

(i) Details of any load management scheme to be applied by the *Distribution Network User* on the *Distribution Network User System*.

(j) Three-phase short circuit in-feed from all sources within the *Distribution Network User's* System, based on Generation Set sub-transient reactance and the minimum zero phase sequence impedance of the *Distribution Network User's* System.

(k) Reactive Power switching arrangements:

1. Rated Capacity (Mvar);
2. Rated Voltage (kV);
3. Type (e.g., shunt inductor, shunt capacitor, static var compensator); and
4. Operation and control details (e.g. fixed or variable, automatic, or manual)

(l) Grounding arrangements

(m) Standard load profiles

(n) In the cases the *Distribution Network User* is connected to the *Distribution System* through a step up transformer:

1. Rated MVA;
2. Rated Voltage (kV);
3. Winding Arrangement;
4. Positive and Zero Sequence Resistance and Reactance;
5. Tap Changer Range, Step Size and Type (on-load/off-load); and
6. Basic Lightning Impulse Insulation Level (kV).

5.1.6 Large Connections (> 5 MVA up to 20 MVA at 33 kV)

For new or modified Large Connections the Standard Planning Data supplied by the *Distribution Network User* will include:

(a) Load data

(b) Type of load and control arrangements (e.g. controlled rectifier or large motor drives and type of starter employed)

(c) Maximum load on each phase at the time of Peak Demand

(d) Demand profile (48 x half hour average estimates) for Active and Reactive Power Demand for the day of *Distribution System* Peak Demand and for the day of the Transmission System Peak Demand

(e) In relation to Fluctuating Loads:

1. The rates of change of Demand (Active Power and Reactive Power) both increasing and decreasing;
2. The shortest repetitive time interval between fluctuations in Demand, Active Power and Reactive Power;
3. The magnitude of the largest step changes in Active Power and Reactive Power, both increasing and decreasing;

4. Sensitivity of Demand to fluctuations in voltage and frequency of supply at the time of Peak Demand.

(f) Equipment Data

1. Circuit parameters (positive and zero sequence resistance and reactance; positive and zero sequence shunt subsistence) of the overhead lines and/or underground cables from the *Distribution Network User*'s substation to the *Connection Point* in the *Distribution System*.
2. for the switchgear, including circuit breakers, Load break switches, and disconnect switches at the *Connection Point* and at the substation of the *Distribution Network User* (if they are different):
    a. Rated voltage (kV);
    b. Rated current (A);
    c. Rated symmetrical RMS short-circuit current (kA); and
    d. Basic Lightning Impulse Insulation Level (kV).

5.1.7 Generation Connections

Distribution Network Users seeking connection of a *Generating Plant* to the *Distribution System* shall use the following procedures. This section applies both to conventional *Generating Plants* and *Renewable Power Plants*

5.1.7.1 Small Generating Plant (less than 150 kVA)

(a) *Distribution Network Users* seeking to connect a Small *Generating Plant* shall provide the following information:

1. Inverter Manufacturer
2. Model Number
3. Nameplate Rating (kW) (kVA) (AC Volts)
4. Single or Three phase
5. System Design Capacity (kW) (kVA)
6. Prime Mover: Photovoltaic/Turbine/Fuel Cell/Other
7. Energy Source: Solar/Wind/Hydro/Other
8. A single-line diagram of the *Generating Plant*.

(b) The *DNSP* s will use the following screens to assess a Small *Generating Plant* connection application:

1. For connection of a *Generator* to a radial distribution circuit, the *Generating Plant* aggregated with all other generation capable of exporting energy on a line section

will not exceed 15 percent of the line section's annual peak load as most recently measured at the substation or calculated for the line section. A line section is that portion of the radial distribution circuit to which the *Distribution Network User* seeks to connect and is bounded by automatic sectionalizing devices or the end of a distribution line.

2. If the *Generating Plant* is to be connected on single-phase shared secondary, then the aggregate generation capacity on the shared secondary, including the *Generating Plant*, will not exceed twenty (20) kilovolt-amps (kVA).
3. If the *Generating Plant* is single-phase and is to be connected on a transformer center tap neutral of a two hundred and thirty (230) volt service, its addition will not create an imbalance between the two sides of the two hundred and thirty (230) volt service of more than twenty (20) percent (%) of nameplate rating of the service transformer.

5.1.7.2 Medium Generating Plant (150 kVA – 10 MVA)

As appropriate for the size and type of *Generating Plant*, *Distribution Network Users* seeking to connect a Medium *Generating Plant* shall provide the following information:

(a) Generating Plant Specifications

1. Prime Mover: PV/Reciprocating Engine/Fuel Cell/Gas Turbine/Steam Turbine/Micro turbine
2. Energy Source: Solar / Wind / Hydro / Diesel / Natural Gas / Fuel Oil / Other
3. Type of *Generating Plant*: Inverter / Synchronous / Induction
4. Nameplate Rating: kW or kVA
5. Applicant Load: kW (if none, so state)
6. Typical Reactive Load if known
7. Maximum Physical Export Capability Requested: kW

(b) Individual *Generating Plant* Data

1. Manufacturer, Model Name and Number
2. Version Number
3. Nameplate Output Rating in kW
4. Nameplate Output Power Rating in kVA
5. Rated *Power Factor*: Leading / Lagging
6. Total Number of *Generating Plants* to be Connected
7. Elevation
8. List of adjustable set points for the protective equipment or software

(c) Inverter-Based Generating Plant

1. Inverter Manufacturer, Model Name and Number
2. Maximum design fault contribution current: Instantaneous or RMS

3. Harmonics Characteristics
4. Start-Up Requirements
5. Rotating Machines (of any type)
6. RPM Frequency
7. Neutral Grounding Resistor (where applicable)

(d) Synchronous Generators

1. Direct Axis Synchronous Reactance, Xd
2. Direct Axis Transient Reactance, X' d
3. Direct Axis Sub transient Reactance, X" d
4. Negative Sequence Reactance, X2
5. Zero Sequence Reactance, X0
6. KVA Base
7. Field Volts
8. Field Amperes
9. Provide appropriate block diagram of excitation system, *Governor System* and power system stabiliser (PSS). A PSS may be determined to be required by applicable studies. A copy of the manufacturer's block diagram may not be substituted.

(e) Induction Generators

1. Motoring Power (kW)
2. I2t or K (Heating Time Constant):
3. Rotor Resistance, Rr
4. Rotor Reactance, Xr
5. Stator Resistance, Rs
6. Stator Reactance, Xs
7. Magnetising Reactance, Xm
8. Short Circuit Reactance, Xd
9. Exciting Current
10. Temperature Rise
11. Frame Size
12. Design Letter
13. Reactive Power Required in var (No Load)
14. Reactive Power Required in var (Full Load)
15. Total Rotating Inertia, H: per Unit on a kVA Base

(f) Transformer and Protective Relay Specifications

1. Will a transformer be used between the *Generating Plant* and the *Connection Point*?
2. Will the transformer be provided by the Connection *Customer*?

3. Transformer Data: (where applicable, for Connection *Customer*-Owned Transformer)
4. Size: kVA
5. If three phase:
    a. Transformer Primary: _____Volts _____Delta _____Wye _____Wye Grounded
    b. Transformer Secondary: ____Volts _____Delta _____Wye _____Wye Grounded
    c. Transformer Tertiary: _____Volts _____Delta _____Wye _____Wye Grounded.

(g) Transformer Fuse Data (where applicable for Connection *Customer*-Owned Fuse)

1. Manufacturer
2. Type
3. Size
4. Speed
5. Attach fuse manufacturer's Minimum Melt and Total Clearing Time-Current Curves

(h) Connecting Circuit Breaker (where applicable)

1. Manufacturer
2. Type
3. Load Rating (Amps)
4. Interrupting Rating (Amps)
5. Trip Speed (Cycles)

(i) Connection Protective Relays (where applicable)

1. If microprocessor, provide a list of functions and adjustable set points (min/max)
2. Discrete Components (where applicable)
3. Manufacturer
4. Type
5. Style/Catalogue Number
6. Proposed Setting
7. Copy of any Proposed Time-Overcurrent Coordination Curves

(j) *Current Transformer* Data (where applicable)

1. Manufacturer
2. Type
3. Accuracy Class
4. Proposed Ratio Connection
5. Copy of Manufacturer's Excitation and Ratio Correction Curves

6. Potential Transformer Data (where applicable)

(k) Attach copy of site electrical single-line diagram showing the configuration of all Generating Plant equipment, current and potential circuits, and protection and control schemes. This single-line diagram must be signed and stamped by a licensed Professional Engineer if the Generating plant is larger than 200 kW.

(l) Auxiliaries Data

1. Normal unit--supplied auxiliary Load for each *Generating Plant Unit* at rated MW output; and
2. Each *Generating Plant Unit* auxiliary Load other than (a) above and where the station auxiliary Load is supplied from the *Distribution System*.

(m) *Generating Plant* Flexibility Performance Data, as applicable

1. Existence of Black Start Capability
2. Rate of Loading following Shutdown
3. Rate of Load Reduction from normal rated MW; and
4. Regulating range

5.1.7.3 Large Generating Plants (Greater than 10 MVA)

As appropriate for the size and type of Generating Plant, Distribution Network Users seeking to connect a Larger *Generator* shall provide the following information:

(a) *Generating* Specifications

1. Prime Mover: PV/Reciprocating Engine/Fuel Cell/Gas Turbine/Steam Turbine/Micro turbine
2. Energy Source: Solar / Wind / Hydro / Diesel / Natural Gas / Fuel Oil / Other
3. Type of *Generating Plant*: Inverter / Synchronous / Induction
4. Nameplate Rating: kW or kVA
5. Applicant Load: kW (if none, so state)
6. Typical Reactive Load if known
7. Maximum Physical Export Capability Requested: kW

(b) Individual *Generating Plant* Data

1. Manufacturer, , Model Name and Number
2. Version Number
3. Nameplate Output Rating in kW
4. Nameplate Output Power Rating in kVA
5. Rated *Power Factor*: Leading / Lagging
6. Total Number of *Generating Plant Units* to be Connected
7. Elevation
8. List of adjustable set points for the protective equipment or software.

(c) Inverter-Based Generating Plant

1. Inverter Manufacturer, Model Name and Number
2. Maximum design fault contribution current: Instantaneous or RMS
3. Harmonics Characteristics
4. Start-Up Requirements
5. Rotating Machines (of any type)
6. RPM Frequency
7. Neutral Grounding Resistor (where applicable)

(d) Synchronous Generators

1. Direct Axis Synchronous Reactance, Xd
2. Direct Axis Transient Reactance, X' d
3. Direct Axis Sub transient Reactance, X" d
4. Negative Sequence Reactance, X2
5. Zero Sequence Reactance, X0
6. KVA Base
7. Field Volts
8. Field Amperes
9. Provide appropriate block diagram of excitation system, *Governor System* and power system stabilizer (PSS). A PSS may be determined to be required by applicable studies. A copy of the manufacturer's block diagram may not be substituted

(e) Induction Generators

1. Motoring Power (kW)
2. I2t or K (Heating Time Constant):
3. Rotor Resistance, Rr
4. Rotor Reactance, Xr
5. Stator Resistance, Rs
6. Stator Reactance, Xs
7. Magnetizing Reactance, Xm
8. Short Circuit Reactance, Xd
9. Exciting Current
10. Temperature Rise
11. Frame Size
12. Design Letter
13. Reactive Power Required in var (No Load)
14. Reactive Power Required in var (Full Load)
15. Total Rotating Inertia, H: per Unit on a kV Base

(f) Transformer and Protective Relay Specifications

1. Will a transformer be used between the *Generating Plant* and the *Connection Point*?
2. Will the transformer be provided by the Connection Customer?
3. Transformer Data: (where applicable, for Connection Customer-Owned Transformer)
4. Size: kVA
5. If three phase:
    a. Transformer Primary: _____Volts _____Delta _____Wye _____Wye Grounded
    b. Transformer Secondary: ____Volts _____Delta _____Wye _____Wye Grounded
    c. Transformer Tertiary: _____Volts _____Delta _____Wye _____Wye Grounded

(g) Transformer Fuse Data

1. Manufacturer
2. Type
3. Size
4. Speed
5. Attach fuse manufacturer's Minimum Melt and Total Clearing Time-Current Curves

(h) Connecting Circuit Breaker (where applicable)

1. Manufacturer
2. Type
3. Load Rating (Amps)
4. Interrupting Rating (Amps)
5. Trip Speed (Cycles)

(i) Connection Protective Relays (where applicable)

1. If microprocessor, provide a list of functions and adjustable set points (min/ max)
2. Discrete Components (where applicable)
3. Manufacturer
4. Type
5. Style/Catalogue Number
6. Proposed Setting
7. Copy of any Proposed Time-Overcurrent Coordination Curves

(j) Current Transformer /Potential Transformer Data (where applicable)

1. Manufacturer
2. Type
3. Accuracy Class
4. Proposed Ratio Connection

5. Copy of Manufacturer's Excitation and Ratio Correction Curves

(k) Attach copy of site electrical single-line diagram showing the configuration of all *Generating Plant* equipment, current and potential circuits, and protection and control schemes. This single-line diagram must be signed and stamped by a licensed Professional Engineer.

(l) Auxiliaries Data

1. Normal unit-supplied auxiliary Load for each *Generating Plant Unit* at rated MW output; and
2. Each *Generating Plant Unit* auxiliary Load other than (a) above and where the station auxiliary Load is supplied from the *Distribution System.*

(m) *Generating Plant* Flexibility Performance Data, as applicable

1. Existence of Black Start Capability
2. Rate of Loading following Shutdown
3. Rate of Load Reduction from normal rated MW; and
4. Regulating range

5.1.8 Processing of Applications

(a) The *DNSP* shall verify the application and the enclosed documents at the time of receipt of application. Written acknowledgment shall be issued immediately. The acknowledgement indicates the date of proposed inspection (not later than 7 days in electrified areas, and two weeks in un-electrified areas) if the application is complete, otherwise the short comings will be explained in writing.

(b) Processing of applications shall include any necessary studies and analysis and the communication of a final determination to the User. Processing of applications shall begin upon submission of an accurate and complete application by the *User*.

(c) (c) Any *Distribution Network User* applying for connection or a modification of an existing connection to the Distribution System shall take all necessary measures to ensure that its proposed connection or Modification fulfills all the technical requirements of the *ENDGC*, and shall not result in the degradation of the *Distribution System*.

5.1.9 System Impact Studies

Based on the data supplied by the *Distribution Network User* applicant, the *DNSP* shall conduct Distribution Impact Studies it considers appropriate, to evaluate the impact of the proposed connection or modification to an existing connection on the *Distribution System*. The evaluation should include:

(a) Impact of short circuit in feed to the Distribution Equipment;

(b) Capacity increase impacts on distribution equipment;

(c) Coordination of Protection System; and

(d) Impact of *Distribution Network User* development on Power Quality

Upon request of the *Distribution Network User*, the *DNSP* shall provide to the *Distribution Network User* adequate and sufficient information as appropriate regarding the *Distribution System* to enable the *Distribution Network User* to plan and prepare for a reliable connection to the *Distribution System*. For a Generating Plant to satisfy the grid connection requirements, such information includes voltage level, frequency, short circuit, reactive power, earth fault protection, low voltage ride through, and remote control capability.

During the *Application for Connection* process, based on the results of the Impact Studies, the *DNSP* will propose and agree with the *Distribution Network User* the voltage level and point in the *Distribution System* to which a *Distribution Network User* will be connected in accordance with its normal practice for the type of load to be supplied. The *DNSP* may on occasion specify a different *Connection*

Point or connection voltage from normal in order to avoid potential disturbance caused by the *Distribution Network User's* Equipment to other *Distribution Network Users* of the *DNSP* or for other technical reasons or may agree alternative methods for minimizing the effects of disturbing loads.

5.1.10 Application Approval

(a) After processing the application submitted by the Distribution Network User, the DNSP shall inform the Distribution Network User whether the proposed Distribution Network User connection is acceptable or not.

(b) New connection applications in an electrified area in compliance with statutory requirements and in conformity with proclamations will not be refused under any circumstances.

(c) New connection will not be released if there is problem in relation to Right of Way, acquisition of land and overall network capacity. However the DNSP will notify the reason for the delay to the applicant.

(d) If any information furnished in the application is found wrong or the installation is defective, DNSP will not sanction the load and will intimate the applicant the short comings or reasons thereof in writing within 7 days of the discovery.

(e) If the DNSP identifies any degradation in system performance or a violation of technical requirements which can be remedied with system improvements, the application will be approved upon completion of the improvements, and the DNSP shall inform the applicant of the finding and make available the associated information.

(f) The DNSP shall include in its notification details of the modifications required to make the Distribution Network User's application acceptable to the DNSP. The DNSP shall report this situation to the Regulatory Authority.

(g) The standard time taken by the DNSP to process the service shall be or less (provided that the requested fees amount is paid) than the following:

1. Up to 150 kVA, 400V load - 45 days

2. Up to 5 MVA, 15 kV load - 60 days

3. Up to 10 MVA, 33KV load - 120 days

5.1.11 Connection Agreement

The acceptance by the *Distribution Network User* of the *DNSP* proposal shall lead to the signing of a *Connection Agreement* or an amended *Connection Agreement*. If the *DNSP* and the *Distribution Network User* cannot agree on the proposed connection or modification to an existing connection, the *Distribution Network User* shall have the right to bring the matter before the *Regulatory Authority* for resolution.

Before entering into a *Connection Agreement* and before connecting a *Distribution Network User's* System at a *Connection Point*, it will be necessary for the *DNSP* to be satisfied that the *Distribution Network User's* System at the boundary with the *Distribution System* will comply with all appropriate requirements of the *ENDGC*.

The *Connection Agreement* may include, and shall not be limited to, the following provisions for the submission of information and reports: Safety Rules, Test and Commissioning programs, Electrical Diagrams, statement of readiness to connect, and certificate of approval to connect. The information requirements shall be governed by the *Connection Agreement* between the *DNSP* and the *Distribution Network User.*

If a *Connection Agreement* or an amended *Connection Agreement* is requested, the *Distribution Network User* shall submit to the *DNSP* the Standard Planning Data describing the proposed *Distribution Network User* development.

Any *Distribution Network User* seeking to modify an existing connection to the *Distribution System* shall request an amended *Connection Agreement* with the *DNSP* prior to any modification to the *Distribution Network User's* System. The amended *Connection Agreement* shall include provisions for the submission of additional information required by the *DNSP*.

5.1.12 Submittal of Information Prior to the Commissioning Date

Distribution Network Users shall be required to submit the information listed in items (a) through (h) below prior to the Commissioning date, pursuant to the terms and conditions and schedules specified in the Connection Agreement. The *Distribution Network Users* connected at Low Voltage shall be required to submit only the items in (a).

(a) Specifications of major Equipment not included in the Standard Planning Data and Detailed Planning Data;

(b) Details of the Protection arrangements and settings;

(c) Electrical Diagrams of the *Distribution Network User*'s Equipment at the *Connection Point*;

(d) Information that will enable the *DNSP* to prepare the *Connection Point* Drawings;

(e) Copies of all Safety Rules and Local Safety Instructions applicable to the *Distribution Network User*'s Equipment;

(f) A list of the names and telephone numbers of authorised representatives, including the confirmation that they are fully authorised to make binding decisions on behalf of the *Distribution Network User* for Significant Incidents;

(g) Proposed Maintenance Programme; and

(h) Test and Commissioning procedure for the *Connection Point* and the *Distribution Network User* Development.

Distribution Network Users connected at Low Voltage shall be required to submit only the items in (a); *Distribution Network Users* connected at Medium and High Voltage shall be required to submit all of the specified information.

5.1.13 Commissioning of Equipment and Connecting to Distribution System

Upon completion of the *Connection Agreement*, installation of the equipment at the *Connection Point*, the *Distribution Network User* shall be subjected to the testing and commissioning procedures developed by the *Distribution Network User*, approved by the *DNSP,* and certified by the *Regulatory Authority*. Equipment at connections points shall be subject to re-testing every four (4) years.

(a) The Distribution Network User shall submit to the DNSP a statement of readiness to connect, which shall include a certified testing and commissioning report.

(b) Work completion and Test Certificate shall be given by the authorized/licensed electrical contractor for requested load more than 7.5 kw (3 phase and above) in the DNSP prescribed format. For single phase load less than 7.5 KW, self-certified test report shall be provided by the Distribution Network User applying for connection.

(c) The DNSP shall be entitled to witness the tests.

(d) The DNSP shall withhold agreement to energize the Distribution Network User's Equipment where test results do not demonstrate compliance with the ENDGC.

(e) Upon acceptance of the *Distribution Network User's* statement of readiness to connect, the *DNSP* shall, issue a certificate of approval to connect. The physical connection to the *Distribution System* shall be made only after the certificate of approval to connect has been issued by the *DNSP* to the *Distribution Network User*.

5.1.14 Ownership Boundaries

(a) The points at which supply is provided between the Distribution System and Distribution Network Users will be agreed between the DNSP and the Distribution Network User as required. For MV connections, including connections between the DNSP and the Distribution Network User, and where necessary bus bar connected supplies at LV, the Connection Points will be subject to specific agreement between the parties in each case.

(b) The respective ownership of Plant or Apparatus will be recorded in a written agreement between the DNSP and the Distribution Network User as required. In the absence of a separate agreement between the parties to the contrary, construction, commissioning, control, operation, and maintenance responsibilities shall be the responsibility of the owner of the Plant or Apparatus.

(c) Where there are supplies to Generating Plants connected to the Distribution System that operate in parallel with the Distribution System and all supplies at MV, the DNSP with the Distribution Network User's agreement, will prepare a Site Responsibility Schedule, included in the Connection Agreement, an Operating Diagram showing the agreed Ownership Boundary.

(d) The Site Responsibility Schedule shall detail the demarcation of responsibility for safety of persons carrying out work or testing at sites having a Connection Point to the Distribution System and/or circuits that cross an Ownership Boundary at any point.

(e) Copies of these documents will be retained by the DNSP and the Distribution Network User. Changes in the boundary arrangements proposed by either party must be agreed in advance and will be recorded on the DNSP's Operation Diagrams.

5.1.15 Electrical Diagrams and Drawing Requirements

The *DNSP* shall specify the procedure and format to be followed in the preparation of the Electrical Diagrams and/or *Connection Point* Drawings as required for any *Connection Point*. The *Distribution Network User* shall prepare and submit to the *DNSP* an Electrical Diagram and/or *Connection Point* Drawings for all the Equipment on the *Distribution Network User's* side of the *Connection Point*, in accordance with the schedule specified in the *Connection Agreement* or amended *Connection Agreement*. The *DNSP* shall provide the *Distribution Network User* with an Electrical Diagram for all the equipment on the *DNSP*'s side of the *Connection Point*, in accordance with the schedule specified in the *Connection Agreement* or amended *Connection Agreement*.

5.1.15.1 Preparation of Electrical Diagrams

Where the *Connection Point* is at the *Distribution Network User's* site, the *Distribution Network User* shall prepare and distribute a composite Electrical Diagram and *Connection Point* Drawing for the entire *Connection Point*. Otherwise, the *DNSP* shall prepare and distribute the composite Electrical Diagram and *Connection Point* Drawing for the entire *Connection Point*.

The Electrical Diagrams and the *Connection Point* Drawing shall provide an accurate record of the layout and circuit connections, ratings and identification of Equipment, and related apparatus and devices at the *Connection Point*. The *Connection Point* Drawing shall represent, as closely as possible, the physical arrangement of the Equipment and their electrical connections. If possible, all the Equipment at the *Connection Point* shall be shown in one Electrical Diagram. When more than one Electrical Diagram is necessary, duplication of identical information shall be minimized. The Electrical Diagrams shall represent, as closely as possible, the physical arrangement of the Equipment and their electrical connections.

5.1.15.2 Changes to Electrical Diagrams and Connection Point Drawing

Where the *DNSP* or a *Distribution Network User* decides to add new Equipment or change an existing Equipment Identification, the *DNSP* or the *Distribution Network User*, as the case may be, shall provide the other party with a revised Electrical Diagram and *Connection Point* Drawing, at least one (1) month prior to the proposed addition or change.

Where the modification involves the replacement of existing Equipment, the revised Electrical Diagram and/or *Connection Point* Drawing, as appropriate, shall be provided to the other party in accordance with the schedule specified in the amended *Connection Agreement*. The revised Electrical Diagram and/or *Connection Point* Drawing shall incorporate the new Equipment to be added, the existing Equipment to be replaced or the change in Equipment Identification.

5.1.15.3 Validity of Electrical Diagrams and Drawings

The composite Electrical Diagram prepared by the *DNSP* or the *Distribution Network User* shall be the Electrical Diagram to be used for all operational and planning activities associated with the *Connection Point*.

If a *Dispute* involving the accuracy of the composite Electrical Diagram arises, a meeting between the *DNSP* and the *Distribution Network User* shall be held as soon as possible, to resolve the *Dispute*.

5.2 TECHNICAL REQUIREMENTS AT CUSTOMER CONNECTION POINT

5.2.1 Supply Quality Standards

The *DNSP* shall plan and operate its *Distribution System* to ensure that at any *Distribution Network User's Connection Point*, the Supply Quality Standards specified in the Performance Standards Chapter are complied with. Supply Quality Standards shall comply with the IEC 61000 family. *Distribution Network Users* seeking connection to the *Distribution System* or modification of an existing connection shall ensure that their equipment does not suffer damage as a result of unscheduled outages that can occur on the *Distribution System* from time to time.

5.2.2 Frequency Variations

The DNSP shall ensure that within the power system frequency range of 48.75 to 51.25 Hz all of its' power system equipment will remain in service unless that equipment is required to be switched to give effect to load shedding or is required by the ENTSO to be switched for operational purposes. Facilities shall not be required to operate in a sustained manner outside the range of the normal operating frequency excursion band but should remain in service for three (3) seconds in the range of 48.0 Hz to 52 Hz. The ENTSO may use load shedding facilities to aid recovery of frequency to within the normal frequency tolerance band.

5.2.3 Voltage Levels

Nominal and Operational Voltages on the *Distribution System* are shown in Table 5-1.

Table 5-1: Distribution Nominal Voltages

Distribution Nominal Voltages	
Low Voltage (LV)	230 volts - phase to neutral
	400 volts – phase to phase
Medium Voltage (MV)	15000 volts (15kV)
	33000 volts (33kV)
	45000 volts (45 kV)
High Voltage (HV)	66000 volts (66kV)

5.2.4 Voltage Variations

The Long Duration Voltage Variation at any *Connection Point* during Normal Conditions shall be within the limits indicated in the Performance Standards Chapter and reproduced in the following table. For the purpose of this section, Voltage Variation shall be defined as the deviation of the root-mean-square (RMS) value of the voltage from its nominal value, integrated through a fifteen (15) minutes period, and expressed as a percentage.

Table 5-2: Voltage Variations

Voltage Level in kV	Steady State Change
Less than 1.0 kV	± 6 % to **Urban Consumers** ± 10 % to **Rural Consumers**
1.0 kV and above	± 5 %

5.2.5 Transient and Short Duration Voltage Variations

A Short Duration Voltage Variation shall be defined as a variation of the RMS value of the voltage from nominal voltage for a time greater than one-half cycle of the power Frequency but not exceeding one minute.

Transient Voltages shall be defined as the high-frequency overvoltage that is generally shorter in duration compared to the Short Duration Voltage Variations.

Under fault and circuit switching conditions, the rated frequency component of voltage may fall or rise transiently. The fall or rise in voltage will be affected by the method of earthing of the neutral point of the *Distribution System* and voltage may fall transiently to zero at the point of fault. The *Distribution System* and the *Distribution Network User* System shall be designed and operated to include devices that will mitigate the effects of transient overvoltages on the *Distribution System* and the *Distribution Network User* System. The *DNSP* and the *Distribution Network User* shall take into account the effect of electrical transients when specifying the insulation of their electrical Equipment.

5.2.6 Voltage Unbalance

A *DNSP* or *Distribution Network User* shall balance the current drawn in each phase at each of its *Connection Points* so as to achieve average levels of negative sequence *voltage* at all *Connection Points* that are equal to or less than the values set out in Table 5-3 below, provided that at any nominal *voltage* the negative sequence *voltage* averaged over any one minute period shall not exceed two percent (2%) in any hour.

Table 5-3: Negative Sequence Voltage Levels

Nominal Voltage (kV)	Averaging Time	Maximum Negative Sequence *Voltage* (%)	
		Normal Conditions	Single Contingency
> 100	30 minutes	0.5	0.7
	10 minutes	1.0	1.0
10-100	10 minutes	1.3	1.3
<10	10 minutes	2.0	2.0

It is not a breach if larger negative sequence voltages occur for a short period resulting from a fault, single pole interruption, line switching, transformer *Energization*, series or shunt *Capacitor Bank Energization* or *Shunt Reactor Energization* within the power system.

5.2.7 Harmonics

The *DNSP* s shall ensure that the Individual and Total Harmonic Contents of the low voltage at any *Connection Point* shall not exceed the limits prescribed in Table 5-4a.

Table 5-4a: Harmonics for Low Voltage Connection

Harmonic Order (n)	LV (below 400 volts)
(odds non-multiples of 3)	
5	6.0
7	5.0
11	3.5

13	3.0
(odds multiples of 3)	
3	5.0
9	1.5
15	0.4
21	0.3
>21	.2
(even)	
2	2.0
4	1.0
6 to 24	0.5
Total Harmonic Distortion (THD):	8%

The *DNSPs* shall ensure that the Individual Total Harmonic Contents of the medium voltage at any Connection Point shall not exceed the limits prescribed in Table 5-4b in accordance with the "Quality of Service Code for Ethiopia.

Table 5-4b: Harmonics for Medium Voltage Connections

Voltage Level	Acceptable Harmonic Distortion Levels
33 kV	Total Harmonic Distortion not exceeding 5% with no individual harmonic greater than 3%
15 kV	Total Harmonic Distortion not exceeding 10% with no individual harmonic greater than 3.0%

Distortion of the System voltage waveform, caused by certain types of equipment, may result in annoyance to *Distribution Network Users* or damage to connected apparatus. In order to limit these effects, *Distribution Network Users'* equipment connected to the *Distribution System* shall comply with the emission limits generated by total *Distribution Network User's* connected equipment at the *Connection Point* and shall not exceed the limits prescribed in Table 5-5.

Table 5-5: Emission Limits

Harmonic Order (n)	Low Voltage Contracted Power less than 10 kW A	Low Voltage Contracted Power greater than 10 kW %	Medium Voltage %
(odds non multiples or 3)			
5	2.28	12	12

7	1.54	8.5	8.5
11	0.66	4.3	4.3
13	0.42	3.0	3.0
17	0.26	2.7	2.7
19	0.24	1.9	1.9
23	0.20	1.6	1.6
25	0.18	1.6	1.6
> 25	4.5/n	0.8 +0.8*25/n	0.8 +0.8*25/n
(odds multiples or 3)			
3	4.6	16.6	16.6
9	0.8	2.2	2.2
15	0.3	0.6	0.6
21	0.21	0.4	0.4
> 21	4.5/n	0.3	0.3
(even)			
2	2.16	10.0	10.0
4	0.86	2.5	2.5
6	0.60	1.0	1.0
8	0.46	0.8	0.8
10	0.37	0.8	0.8
12	0.31	0.4	0.4
> 12	3.68/n	0.3	0.3
Total	240 V **Distribution Network Users**: 5 A 400 V **Distribution Network Users**: 14 A	20.0%	20.0%

Under certain circumstances, the *DNSP* may agree to other limits or levels.

Measurements may be taken by the *DNSP* at the *Distribution Network User's Connection Point* and will continue for at least 24 hours and taken at ten (10) minute intervals.

In the event that the *Distribution Network User's* equipment operates outside the above specified limits causing annoyance or other injurious effects either to another *Distribution Network User* or to the *Distribution System*, the *DNSP* shall give reasonable notice to remedy the defect and the *Distribution Network User* shall remedy the defect at its own expense. In determining the period of notice, the *DNSP* shall have regard to the nature and degree of non-compliance, the nature and degree of annoyance or other injurious effects as well as the prescriptions stated in the Distribution Performance Standards. The *DNSP* shall have the right to disconnect the *Distribution Network User's* equipment in the event that the *Distribution Network User* does not comply with such notice.

5.2.8 Flicker

The Flicker Severity at the *Connection Point* of any *Distribution Network User* shall not be above the maximum values stated in IEC 61000-3 Standard for more than 3 % of the measured period.

The maximum emission limits produced by any *Distribution Network User* shall be below the maximum values stated in IEC 61000-3 Standard.

In the event that the *Distribution Network User's* Equipment operates outside the above specified limits causing annoyance or other injurious effects either to another *Distribution Network User*, or to the *Distribution System*, the *DNSP* shall give reasonable notice to remedy the defect and the *Distribution Network User* shall remedy the defect at its own expense. In determining the period of notice, the *DNSP* shall have regard to the nature and degree of non-compliance, the nature and degree of annoyance or other injurious effects as well as the prescriptions stated in the Distribution Performance Standards. The *DNSP* shall have the right to disconnect the *Distribution Network User's* Equipment in the event that the *Distribution Network User* does not comply with such notice.

5.2.9 Grounding Requirements

The method of Grounding at the *Distribution Network User's* system shall comply with the Grounding standards and specifications of the *DNSP*. The *DNSP* shall supply to the *Distribution Network User* these standards when applying for connection. Where there are multiple sources of power, the *Distribution Network User* shall ensure that the effects of circulating currents with respect to the grounded neutral are either prevented or mitigated.

5.2.10 Equipment Short Circuit Rating

The *DNSP* shall inform the *Distribution Network User* of the design maximum Short Circuits Levels of the *Distribution System* at the *Connection Point*. The *Distribution Network User* shall consider the design maximum Short Circuits Levels at the *Connection Point* in the design and Operation of the *Distribution Network User System*.

5.2.11 Monitoring and Control Equipment Requirements

The *DNSP* and the *Distribution Network User* shall agree on the mode of monitoring and control. Where required, the *DNSP* shall provide, install, and maintain a telemetry outstation and all associated Equipment needed to monitor the *Distribution Network User* System. Where the Distribution Network User consents that the *DNSP* shall control the switchgear in the Distribution Network User's system, the *DNSP* shall install the necessary control outstation, including the control interface for the switchgear.

5.2.12 Equipment and Maintenance Standards

All Equipment at the *Connection Point* shall comply with the requirements of the *IEC* Standards or their equivalent Ethiopian national standards. All equipment at the *Connection Point* shall be

designed, manufactured, and tested in accordance with the quality assurance requirements of the ISO9000 family.

All Equipment at the *Connection Point* shall be operated and maintained in accordance with Prudent Industry Practice and in a manner that shall not pose a threat to the safety of any personnel or cause damage to the equipment of the *DNSP* or the *Distribution Network User*.

The *DNSP* shall maintain an appropriate log containing the test results and maintenance records relating to its equipment at the *Connection Point* and shall make this log available when requested by the *Distribution Network User* or the *Regulatory Authority*.

The *Distribution Network User* shall maintain a log containing the test results and maintenance records relating to its equipment at the *Connection Point* and shall make this log available when requested by the *DNSP*.

5.2.13 Power Factor

All MV *Distribution Network Users* consuming electricity of twenty five (25) kW and above for industrial or commercial purpose shall maintain a *Power Factor* not less than 0.95 lagging or leading at the *Connection Point*, unless a different value have been agreed to in the *Connection Agreement*. The *Users* shall be subject to actions as stipulated in Item No. 63 of the "Final English Draft Energy Operation Regulation – Version (2)" , if found in violation of the power factor requirements

The *DNSP* shall correct feeder and substation feeder bus Reactive Power Demand to a level which will economically reduce feeder loss. The *Distribution System* shall be designed to have a *Power Factor* of not less than 0.95 at each *Connection Point* with the Transmission System unless a different value has been agreed to in the *Connection Agreement*.

5.2.14 Under Frequency Relays for Automatic Load Shedding

The *Connection Agreement* or amended *Connection Agreement* shall specify the manner in which Demand subject to Automatic Load Shedding will be split into discrete MW blocks to be actuated by Under Frequency Relays.

5.3 TECHNICAL REQUIREMENTS FOR CONVENTIONAL GENERATING PLANTS

The *Generating Plants* connected to the *Distribution System*:

(a) Shall be capable of supplying its Reactive Power outputs, as specified in the *Generating Plant's* declared data, within the Voltage Variation specified in this *ENDGC*, during Normal Conditions.

(b) Shall meet the requirements for Voltage Unbalance as specified in this *ENDGC*.

(c) With a size of five hundred (500) kW or larger shall also be required to withstand without tripping, the unbalance loading during clearance by the Backup Protection of a close-up phase-to-phase fault on the *Distribution System*.

(d) Shall meet the requirements for preventing Unintended Islanding Operation in ANSI/IEEE Standard 1547-2003 and KS IEC 62116-2008.

(e) Large synchronous generators above ten (10) MW shall have the same fault ride-through requirements as the RPPs described under Section 5.4.1 Fault Ride-through Requirements for RPPs

5.3.1 Embedded Generator

The *Generating Plants* connected to the *Distribution System* (*Embedded Generators*) shall be connected at the voltage level agreed to by the *DNSP*, based on the *Distribution System* Impact Studies and in accordance with the *ENDGC* Performance Standards. The *Connection Point* shall be controlled by a Circuit Breaker that is capable of interrupting the maximum short circuit current at the *Connection Point*. Means shall also be provided for Circuit Breaker isolation for maintenance purposes.

5.3.2 System Frequency

The *Generating Plants* connected to the *Distribution System* shall be capable of continuously supplying its Active Power output, as specified in the *Generating Plant's* declared data, within the System Frequency range specified in the *ENDGC*. Any decrease of power output occurring in the Frequency range of 48.75 to 51.25 Hz shall not be more than the required proportionate value of the System Frequency decay.

In situations where the System frequency momentarily rises up to the value of 51.5 Hz or falls up to the value to 48.5 Hz, *Generating Plants* connected to the *Distribution System* shall remain in synch with the *Distribution System*, unless something different has been agreed in the *Connection Agreement*.

The *Distribution Network User* shall decide whether or not to disconnect its *Generating Plant Unit* from the *Distribution System* for *frequency excursions outside the range of 51.5 Hz and 48.5 Hz.*

5.3.3 Protection System Coordination

The Protection of *Generating Plants* connected to the *Distribution System* and associated equipment shall be designed, coordinated, and tested to achieve the desired level of speed, sensitivity, and selectivity in fault clearing and to minimize the impact of faults on the *Distribution System*. The *DNSP* and the *Generation Licensee* shall be solely responsible for the Protection System of the electrical Equipment and facilities at their respective sides of the *Connection Point*. Table 5-6 and 5-7

summarize typical protection requirements of *Generating Plants* of different types and sizes. As protection requirements could widely vary depending on the *Generating Plants* and *Distribution System* characteristics, the information on the tables shall be used only as a guide. Detailed protection schemes should be arranged between the *DNSP* and the *Distribution Network User*, and stated in the *Connection Agreement*.

Table 5-6: Protection for Single Phase Generating Plants

Interconnection Control, Protection and Safety **Equipment**[1] YES denotes a requirement for this *Guideline*	
Generation Size	
50 kW or less[3]	
Interconnection Disconnection Device	YES
Generator Disconnect Device	YES
Under-voltage Trip	YES
Over-voltage Trip	YES
Over & Under Frequency Trip	YES
Over-current Trip	YES
Synchronizing Control[2]	Manual or Automatic
Synch-Check[2] (At the *Connection Point*)	YES
Prevention of Unintended Islanding Operation (Loss of mains) in ANSI/IEEE Std. 1547-2003	YES

Notes:

[1]. Exporting power to the *Distribution System* may require additional operational/Protection devices and will require coordination of operations with the *DNSP*.

[2]. For synchronous and other types of Generating Plants with standalone capability.

[3]. For single-phase Generators larger than 50 kW, consult with *DNSP* on the required interconnection control, Protection and safety equipment. Requirements for systems larger than 50 kW will include the requirements in this table and others as specified by the *DNSP*.

Table 5-7: Protection for Three-Phase Generating Plants

Interconnection Control, Protection and Safety **Equipment**[8]

YES denotes a requirement for this *Guideline* - All devices are three-phase unless otherwise specified.					
Generators Size Classifications	Small	Medium			Large
Device	<50 kW	50 - 499 kW	500 - 2000 kW	2001 - 10000 kW	>10000 Kw
Interconnect Disconnect Device	YES	YES	YES	YES	YES
Generator Disconnect Device	YES	YES	YES	YES	YES
Synchronizing Control[1] Manual (M) or Automatic (A)	M or A	M or A	A	A	A
25 Synch-Check (at the *Connection Point*)	YES	YES	YES	YES	YES
Automatic Voltage Regulation (AVR)[1]	NO	NO	NO	YES	YES
Undervoltage	YES	YES	YES	YES	YES
Overvoltage	YES	YES	YES	YES	YES
Neutral Overvoltage[2]	YES[3]	YES	YES	YES	YES
Instantaneous/Timed Over current	YES[4]	YES[4]	YES[4]	YES[4]	YES[4]
Instantaneous/Timed Neutral Over current	YES[3]	YES	YES	YES	YES
Over and Under Frequency	YES	YES	YES	YES	YES
Directional Power	YES[5]	YES[5]	YES[5]	YES[5]	YES[5]
Inter-trip or Equivalent Relay	NO	YES[6]	YES[6]	YES[6]	YES[6]
Telemetry Data Communication	NO	NO	YES[7]	YES[7]	YES
Prevention of Unintended Islanding Operation (Loss of mains)	YES	YES	YES	YES	YES

Notes:

1. For synchronous and other types of *Generators* with standalone capability.
2. Only required for *Generators* that have their interconnection transformer's primary winding ungrounded. Used in conjunction with 3 PT's in broken delta configuration rated for line-to-line voltage for detecting ground faults on the *Distribution System*.
3. May not be required if the *Generator* is an inverter type voltage-following **System** of less than 50 kW aggregate. In this case, the *DNSP* will inform the Power Producer if this Protection is required.
4. A timed over current relay with voltage restraint may also be required to prevent nuisance trips.
5. Only required for non-exporting or export limited *Generators*.
6. Transfer trip or equivalent protective relay function required for all synchronous *Generators* rated 500 kW and larger with export capability. May also be required for exporting synchronous *Generators* under 500 kW, depending upon characteristics of the distribution circuit.
7. System Controller requirement for all *Generators* 5 MW and larger. The *DNSP* may also require telemetry for smaller *Generators* depending upon location and distribution circuit characteristics.
8. Exporting to *Distribution System* may require additional operational/protection devices and will require coordination of operations with the *DNSP*.

A fault or maintenance outage could result in the disconnection of the *Generating Plant* connected to the *Distribution System* together with an associated section of the *Distribution System*, from the remainder of the power system. Unless explicitly arranged with the *DNSP*, and clearly stated on the *Connection Agreement* or amended *Connection Agreement*, the *Generating Plant* connected to the *Distribution System* should never supply load and/or maintain voltage in any part of the *Distribution System* if this part is isolated from the Transmission System, and if the *Generating Plant* is capable

of maintaining this voltage because it is equipped with synchronous or self-excited asynchronous *Generating Plants* , the *Generation Licensee* shall install adequate protection devices (that could include inter-tripping schemes) to assure the disconnection either of the *Generating Plant* or the whole *Generation Licensee's* facilities at the *Connection Point*.

In case the *Distribution Network User* facilities are connected to a feeder of the *DNSP* equipped with auto-reclosing, the protection System and switching arrangements should be designed to separate the *Generating Plant* (or the *Generating Plant* and other *Distribution Network User's* facilities below the *Connection Point*) following the first *DNSP*'s Main Breaker, Recloser or Sectionalizer opening, and to remain disconnected until the system has completely restored.

5.3.4 Reactive Power

The *Generating Plant* connected to the *Distribution System* shall be capable of supplying its Reactive Power outputs, as specified in the *Generator's* declared data, within the voltage variation specified in this Code, during normal conditions.

The *Generating Plant* connected to the *Distribution System* that are providing *Ancillary Services* for Reactive Power supply shall be capable of contributing to Voltage Control by continuous regulation of the Reactive Power supplied to the *Distribution System*. The *Generating Plant* connected to the *Distribution System* providing *Ancillary Services* for Reactive Power supply shall be fitted with a continuously acting automatic excitation control System to control the terminal voltage without instability over the entire operating range of the *Generating Plant* connected to the *Distribution* System. The performance requirements for excitation control facilities, including power System stabilizers, where necessary for System operations shall be specified in the Distribution *Connection Agreement* or Amended *Connection Agreement*.

5.3.5 Black Start

The *Generation Licensees* with a *Generating Plant* connected to the *Distribution System* shall specify in its application for a connection or modification if it has a Black Start capability. In the case the *Generation Licensee* wishes to provide *Ancillary Services* for Black Start to the *ENTSO*, it shall develop and sign the necessary agreements with it, and comply with the *ENDGC*.

5.3.6 Islanding

Intentional islanding of the *Generating Plant* shall be permitted to provide uninterrupted service to local *Customers* during an outage. Protection system must be capable of providing protection in normal as well as islanding mode.

5.4 TECHNICAL REQUIREMENTS FOR RENEWABLE POWER PLANTS (RPP)

The renewable resources in the context of Ethiopia include wind, solar, geo thermal, hydroelectric, biomass, biogas, and landfill gas power plants. The requirements for conventional power plants in

Chapter 6 cover large hydroelectric sources, geothermal, biomass, biogas, and landfill gas plants. This section focuses mainly on variable intermittent renewable resources so that they will be able to contribute to the stability of the *ENDS*. Requirements for small hydroelectric power plants are addressed in this chapter as appropriate. The *RPP* shall be able to:

(a) Withstand frequency and voltage deviations at the POC under normal and abnormal operating conditions described in this grid connection code while reducing the active power as little as possible.

(b) Support network frequency and voltage stability in line with the requirements of this grid connection code.

The following sections describe the normal and abnormal operating conditions and requirements for tolerance and frequency of RPP voltage deviations or *RPPs* connected to the *ENDS*.

5.4.1 Normal Operating Conditions

RPPs connected to the *ENDS* range from small or micro turbines at home, small businesses, agricultural farms lands, to several large wind turbines at a large energy user facilities. The *RPPs* of size less than one (1) MVA can be connected to single or multi-phase (i.e., two- or three-phase connection at the POC) supplies. In case of multi-phase supply connections, the difference in installed capacity between phases may not exceed 4.6 kVA per phase.

(a) *RPPs* of size higher than one (1) MVA shall be capable of operating continuously within the POC voltage range (i.e., 0.9 p.u. - 1.1 p.u. at 66 kV, and 0.9 – 1.08 p.u. at voltage below 66 kV).

(b) *RPPs* larger than one (1) MVA shall only be allowed to connect to the *ENDS*, at the earliest, 3 seconds after the following condition are met:

1. The voltage at the POC is within the maximum and minimum allowable limits as established in item (a) above; and
2. The frequency in the *ENDS* is within the range of 49.0Hz and 50.2Hz, or otherwise as agreed with the *Regional Control Center* and/or the *ENTSO*.

(c) *RPPs* less than one (1) MVA shall only be allowed to connect to the *ENDS* grid, at the earliest, 60 seconds after the following conditions have been satisfied:

1. The voltage at the POC is in the range -15% to +10% around the nominal voltage; and
2. The frequency in the *ENDS* is within the range of 49.0Hz and 50.2Hz, or otherwise as agreed with the *Regional Control Center* and/or the *ENTSO*.

(d) The nominal frequency of the *ENDS* is 50 Hz and is normally controlled within the limits as defined in the *ENDGC*. The *RPP* shall be designed to be capable of operating for the minimum operating range illustrated in Figures 5-1 and Figure 5-2 (during a system frequency disturbance).

(e) When the frequency on the *ENDS* is higher than 51.5 Hz for longer than 4 seconds, the *RPP* shall be disconnected from the grid. When the frequency on the *ENDS* is less than 47.0 Hz for longer than 200ms, the *RPP* may be disconnected. The *RPP* shall remain connected to the *ENDS* during rate of

change of frequency of values up to and including 1.5 Hz per second, provided the network frequency is still within the minimum operating range indicated in Figures 5-1 and 5-2.

Figure 5-1: Minimum frequency operating range for RPP

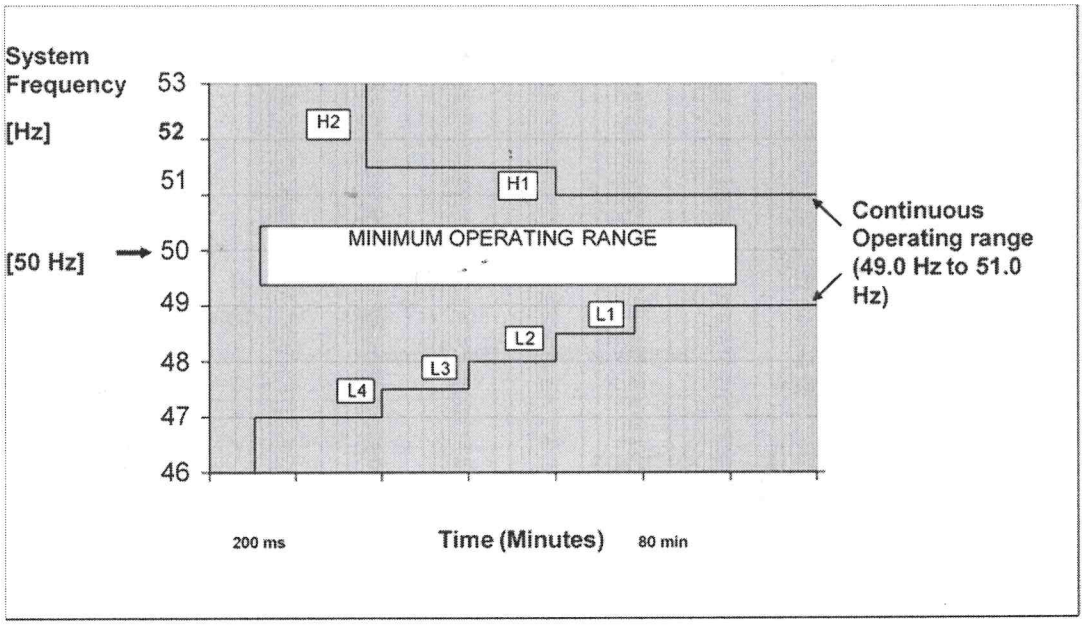
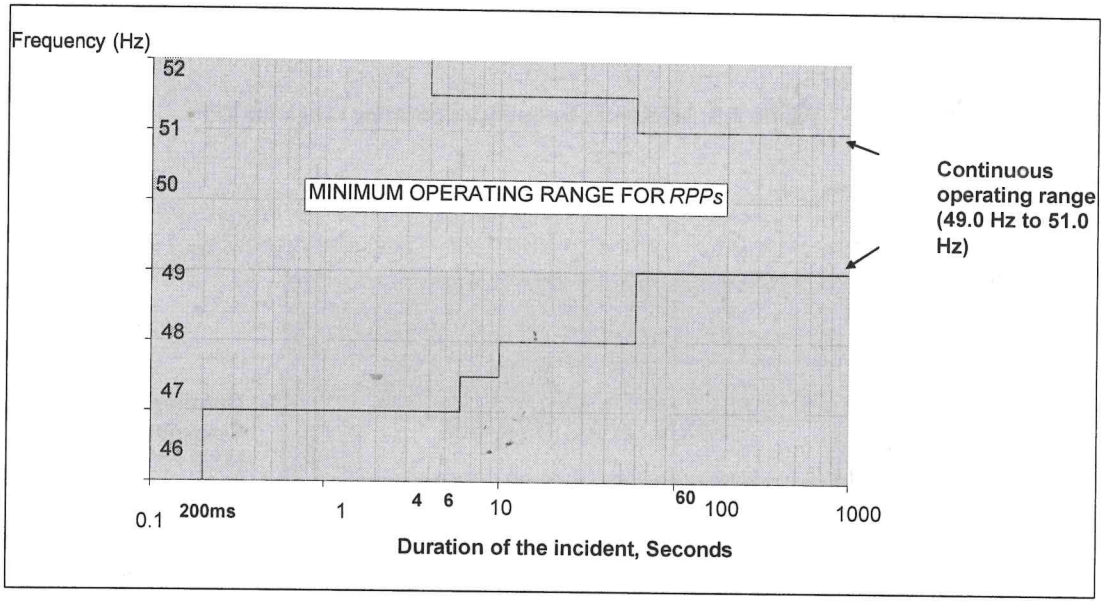


Figure 5-2: Minimum frequency operating range of RPP (during a system frequency disturbance)



5.4.2 Abnormal Operating Conditions

(a) The *RPP* shall be able to withstand sudden phase jumps of up to 20°at the POC without disconnecting or reducing its output. The *RPP* shall, after a settling period, resume normal production not later than 5 sec after the operating conditions in the POC have reverted to the normal operating conditions.

(b) *RPPs* of size 0 – 100 kVA shall be able to withstand and fulfill, at the POC, voltage ride through conditions as illustrated in Figure 5-3. The maximum disconnection times for these *RPPs* will be as per Table 5-8.

Table 5-8: Maximum disconnection times for RPPs (0 -100 kVA)

Voltage range (at the POC)	Maximum trip time [Seconds]
V < 50 %	0,2 s
50 % ≤ V < 85 %	2 s
85 % ≤ V ≤ 110 %	Continuous operation
110 % < V < 120 %	2 s
120 % ≤ V	0,16 s

(c) *RPPs* over 100 kVA shall be able to withstand and fulfill, at the POC, voltage conditions described in this section and as shown in Figures 5-4, 5-5, 5-6 and 5-7 below. The Area D is only applicable to *RPPs* above 20 MVA

(d) The *RPP* shall withstand voltage drops and peaks, as indicated in Figure 5-4, 5-5, 5-6, and supply or absorb reactive current as shown in Figure 5-7 without disconnecting.

(e) The *RPP* shall be able to withstand voltage drops to zero, measured at the POC, for a minimum period of 0.150 seconds without disconnecting, as shown in Figures 5-4, 5-5, 5-6 with exception for synchronous generators (size 1 – 20 MVA) during symmetrical 3 phase faults.

(f) The *RPP* (20 MVA and above) shall be able to withstand voltage peaks up to 120% of the nominal voltage, measured at the POC, for a minimum period of 2 seconds without disconnecting, as shown in Figures 5-4, 5-5, 5-6.

(g) Figures 5-4, 5-5, 5-6 shall apply to single phase/two phase/three phase symmetrical or asymmetrical faults. The bold lines in Figures 5-4, 5-5, 5-6 in shall represent the minimum voltage of all the phases.

(h) If the voltage reverts to area A during a fault sequence, subsequent voltage drops shall be regarded as a new fault condition. If several successive fault sequences occur within area B and evolve into area C, disconnection shall be allowed as shown Figures 5-4, 5-5, and 5-6.

(i) In connection with symmetrical fault sequences in areas B and D of Figures 5-4, 5-5, and 5-6, the *RPP* (other than synchronous generating units) shall have the capability of controlling the reactive current, as indicated in Figure 5-7. The following requirements shall be complied with:

1. Area A: The *RPP* shall remain connected to the network and uphold normal operation

2. Area B: The *RPP* shall remain connected to the network. Additionally,

    a. *RPPs* (100 kVA – 1 MVA) shall not inject any reactive current into the network

    b. *RPPs* above one (1) MVA shall provide maximum voltage support by supplying a controlled amount of reactive current so as to ensure that the *RPP* assists in stabilising the voltage as illustrated in Figure 5-7;

    c. Inverter driven *RPPs* of above one (1) MVA shall have the capability of disabling reactive current support functionality at the request of *ENTSO*

3. Area D: The *RPP* shall remain connected to the network and provide maximum voltage support by absorbing a controlled amount of reactive current so as to ensure that the *RPP* helps to stabilise the voltage within the design capability offered by the *RPP*, see Figure 5-7.

4. Area E (Figure 5-7): Once the voltage at the POC is below 20%, the *RPP* shall continue to supply reactive current within its technical design limitations so as to ensure that the *RPP* helps to stabilise the voltage. Disconnection is only allowed after conditions of Figures 5-4, 5-5, and 5-6 have been fulfilled.

(j) Control shall follow Figure 5-7 so that the reactive current follows the control characteristic with a tolerance of ±20% after 60 msec.

(k) The supply of reactive power has first priority in area B, while the supply of active power has second priority. Active power shall be maintained during voltage drops, but a reduction in active power within the *RPP's* design specifications is required in proportion to voltage drop for voltages below 85%.

(l) Upon clearance of fault each *RPP* shall restore active power production to at least 90% of the level available immediately prior to the fault within 1 second.

Figure 5-3: Voltage Ride through Capability for RPPs 100 kVA or less

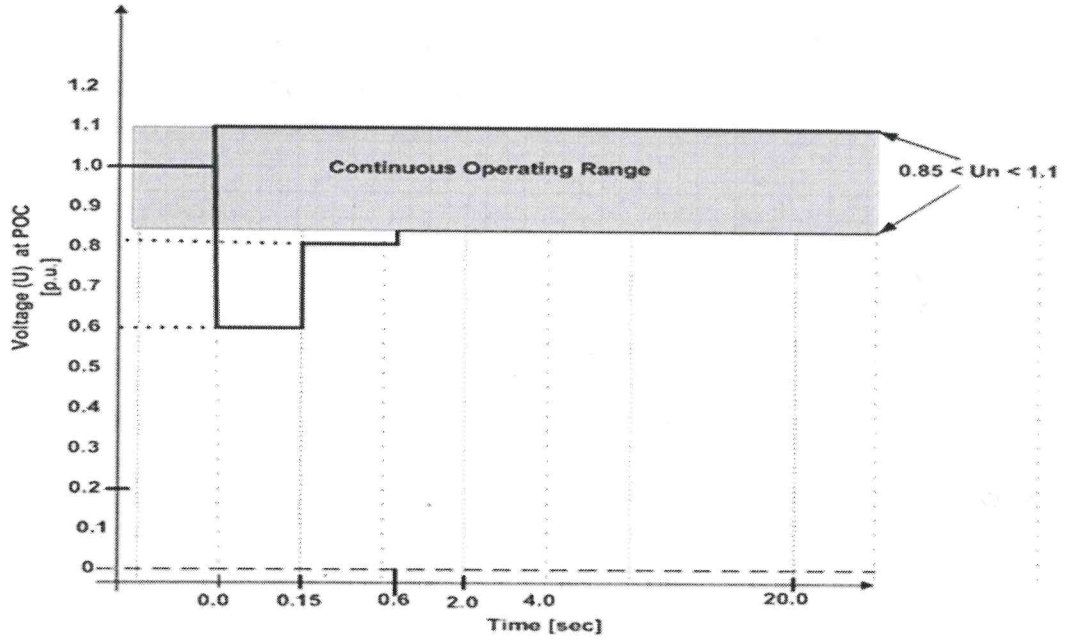


Figure 5-4: Voltage Ride through Capability for the RPPs (> 100 kVA) with non-synchronous machines

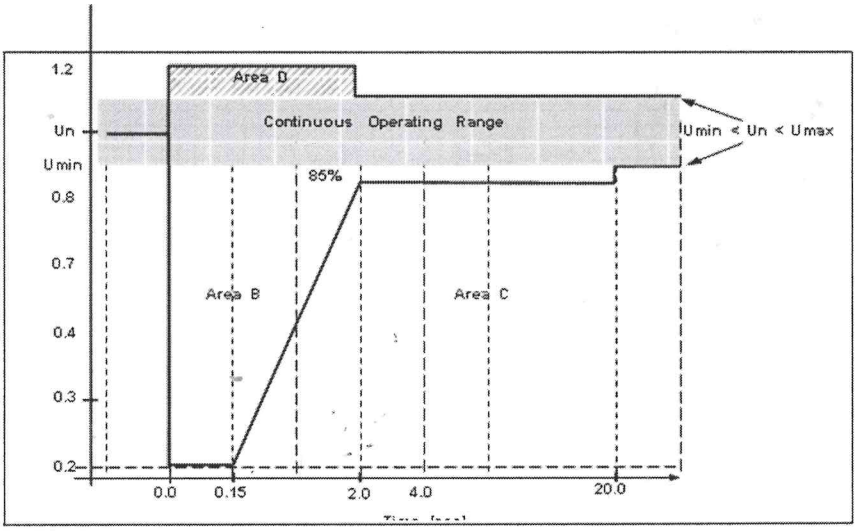


Figure 5-5: Voltage Ride through Capability for the RPPs (>1 MVA) with synchronous machines

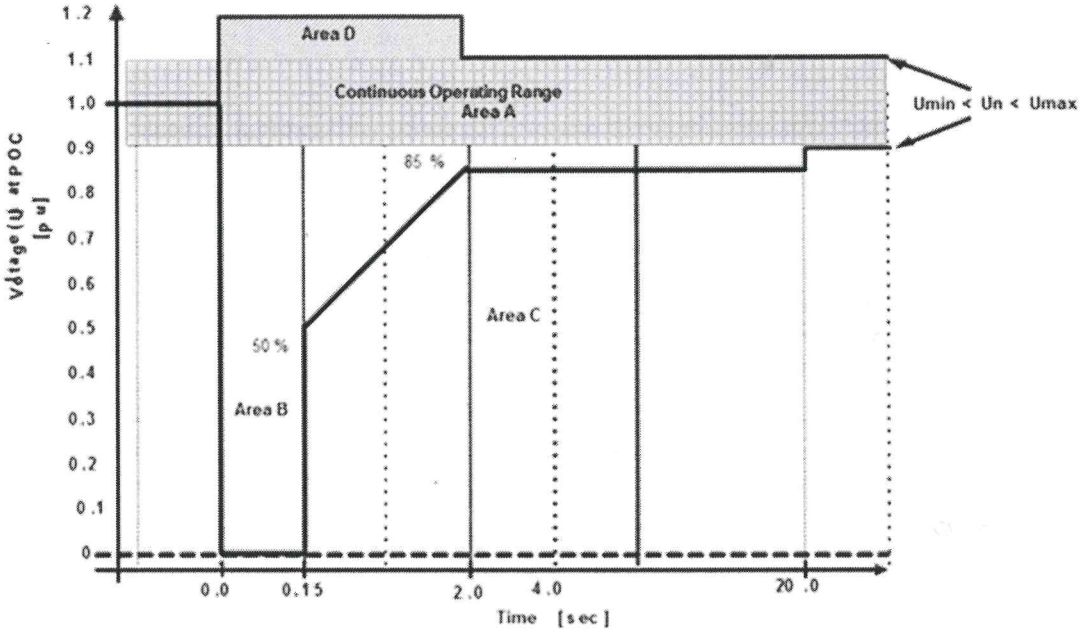


Figure 5-6: Voltage Ride through Capability for the RPPs (1-20 MVA), synchronous machine (3 phase faults only)

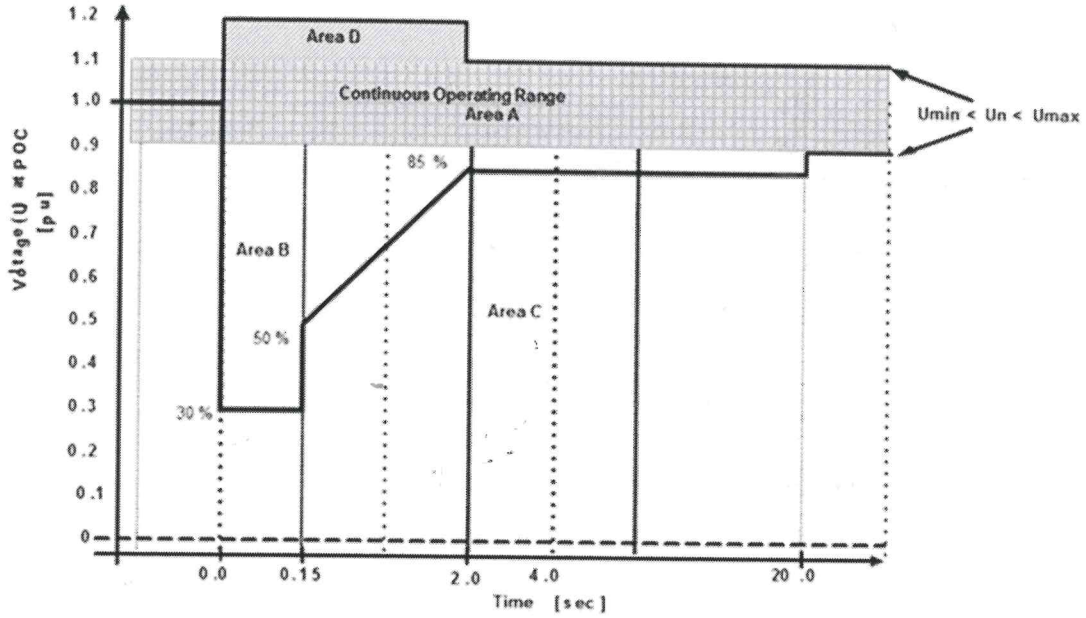
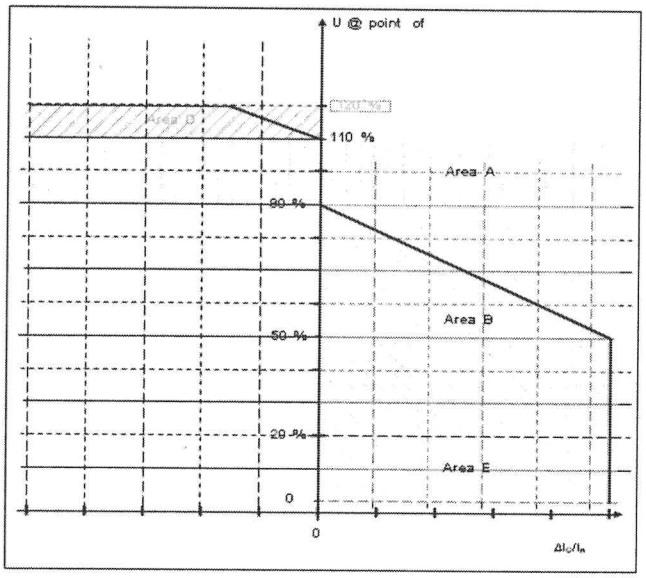


Figure 5-7: Requirements for Reactive Power Support, IQ, during voltage drops or peaks at the POC



5.4.3 Frequency Response

In case of frequency deviations in the *ENDS*, *RPPs* shall be designed to be capable to provide power-frequency response in order to stabilise the grid frequency

Frequency response can be achieved through decreasing G*enerating Plant* power output when frequency exceeds the upper bound of a specified acceptable frequency range, and by increasing *Generating Plant* power output when frequency falls below the lower bound of the specified range. Thus the *RPP* must operate at a level below its instantaneous available capacity, if it is to provide both upward and downward frequency regulation capability.

The frequency response system of *RPPs* shall have the capabilities set out in the power frequency response curve agreed with the *ENTSO* and *Regional Control Centre*.

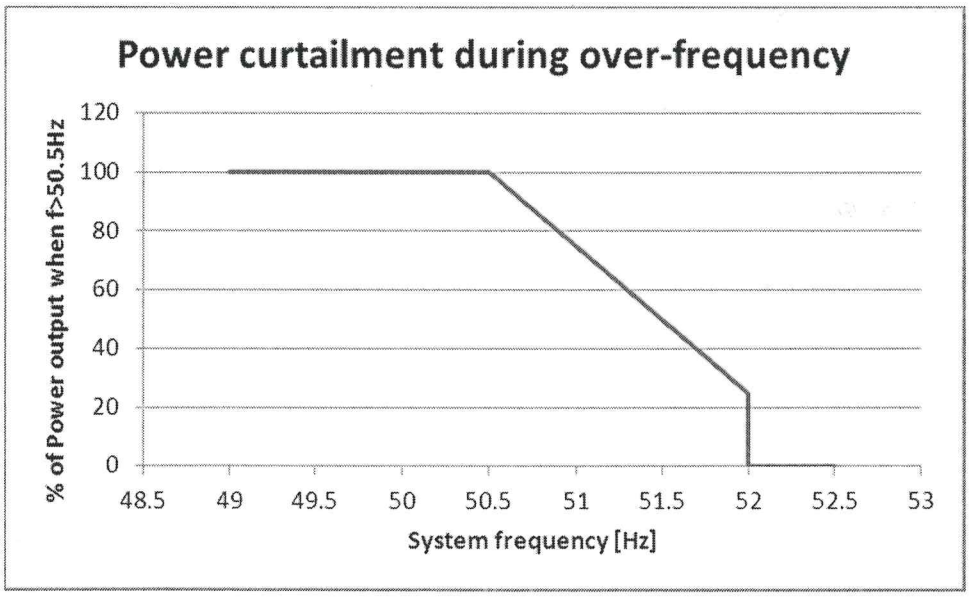
5.4.3.1 Power- Frequency Response Curve for RPP

(a) During high frequency operating conditions, *RPPs* shall be able to provide mandatory active power reduction requirement in order to stabilise the frequency in accordance with Figure 5-8 below. The metering accuracy for the grid frequency shall be ± 10 mHz or better.

(b) As shown in Figure 5-8, The *RPP* shall reduce the active power as a function of the change in frequency when the frequency on the *ENDS* exceeds 50.5 Hz

(c) The *RPP* shall be tripped to protect the *ENDS* once the frequency exceeds 51.5 Hz for more than 4 seconds

Figure 5-8: Power curtailment during over-frequency for RPPs



5.4.3.2 Power- Frequency Response Curve for RPP (20 MVA and larger)

(a) *RPPs* shall be capable of providing power-frequency response as shown in Figure 5-9

(b) Except for the mandatory high frequency response (above 50.5 Hz), the *RPP* shall not perform any frequency response function. There shall be no PDelta, dead-band and control-band functions implemented without having entered into a specific agreement with the *DNSP*, *Regional Control Center*, and/or the *ENTSO*. PDelta is the amount of active power by which the available active power has been reduced in order to provide reserves for frequency stabilisation.

(c) It shall be possible to set the frequency response control function for all frequency points shown in Figure 5-9. It shall be possible to set the frequencies fmin, fmax, as well as f1 through f6 to any value in the range of 47 - 52 Hz with a minimum accuracy of 10 mHz.

(d) The purpose of frequency points f1 through f4 is to form a dead band and a control band for *RPPs* contracted for primary frequency response. The purpose of frequency points f4 through f6 is to supply mandatory critical power/frequency response.

(e) The *RPP* shall be equipped with the frequency control droop settings as illustrated in Figure 5-9. Each droop setting shall be adjustable between 0% and 10%. The actual droop setting shall be as agreed with the *ENTSO*.

(f) The *ENTSO* shall decide and advise the *RPP* on the droop settings required to perform control between the various frequency points.

(g) If the active power from the *RPP* is regulated downward below the unit's design limit Pmin, individual *RPP* units shut down is allowed.

(h) The *RPP* (excluding photovoltaic solar) shall have the capability of providing a PDelta of not less than 3% of Pavailable.

(i) It shall be possible to activate and deactivate the frequency response control function in the interval from fmin to fmax.

(j) If the frequency control set point (i.e., PDelta) is to be changed, such change shall be commenced within two seconds and completed no later than 10 seconds after receipt of an order to change the set point.

(k) The accuracy of the control performed (i.e. change in active power output) and of the set point shall not deviate by more than ±2% of the set point value or by ±0.5% of the rated power, depending on which yields the highest tolerance.

(l) The default settings for fmin, fmax, f4, f5 and f6 shall be as shown in Table 5-9, unless otherwise agreed upon between the *ENTSO* and the RPP generator. Settings for f1, f2 and f3 shall be as agreed with the *ENTSO*.

The *Regional Control Center* and/or the *ENTSO* shall give the *RPP* a minimum of two (2) weeks if changes to any of the frequency response parameters (i.e. f1 through f6) are required. The *RPP* shall confirm with the *Regional Control Center* and/or the *ENTSO* that requested changes have been implemented within two (2) weeks of receiving the request from the *Regional Control Center* and/or the *ENTSO*.

Figure 5-9: Frequency response requirement for RPPs of size above 20 MVA

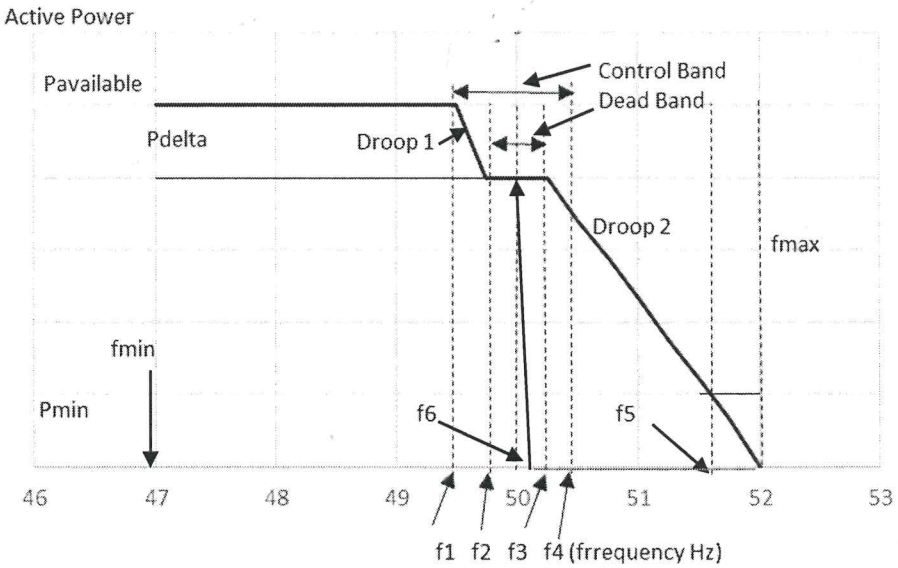


Table 5-9: Frequency Default Settings

Parameter	Magnitude (Hz.)
f_{min}	47
f_{max}	52
f_1	As per agreement
f_2	As per agreement
f_3	As per agreement
f_4	50.5
f_5	51.5
f_6	50.2

5.4.4 Reactive Power Capability

5.4.4.1 RPPs below 1 MVA

(a) *RPPs* (up to 100 kVA) shall operate at unity power factor measured at POC, unless otherwise specified by the *DNSP*, the *Regional Control Center* and/or the *ENTSO*.

(b) *RPPs* (100 kVA – 1 MVA) shall be designed with the capability to supply rated power (Pn) (MW) for power factors ranging between 0.95 lagging and 0.95 leading, measured at the POC available from 20% to 100% of rated power (Pn).

(c) *RPPs* shall be able to operate according to a power factor characteristic curve, which will be determined by the *DNSP,* the *Regional Control Center*, and or the *ENTSO.*

(d) The default power factor setting shall be unity power factor, unless otherwise specified by the *DNSP,* the *Regional Control Center*, and or the *ENTSO.*

5.4.4.2 RPPs (1 – 20 MVA)

(a) *RPPs* of in this category shall be designed with the capability to operate in a voltage (V), power factor or reactive power control modes as described in Section 5.4.5 Reactive Power and Voltage Control. The actual operating mode (voltage, power factor or reactive power control) as well as the operating point shall be as per agreement with the *DNSP*.

(b) When operating between 5% and 100% of rated power Pn (MW) the *RPPs* in this category shall have the capability of varying reactive power (Mvar) support at the POC within the reactive power capability ranges as defined by Figure 5-10, where Qmin and Qmax are voltage dependent as defined by Figure 5-12.

(c) At nominal voltage, the required *RPP* reactive power capability (measured at the POC) shall be as shown in Figure 5-11.

(d) When operating below 5% of rated power Pn (MW), there is no reactive power capability requirement, however the *RPP* can only operate within the reactive power tolerance range not exceeding +-5% of rated power; that is within Area A,B,C and D in Figure 5-11.

Figure 5-10: Reactive power requirements for RPPs (1 - 20 MVA) at POC

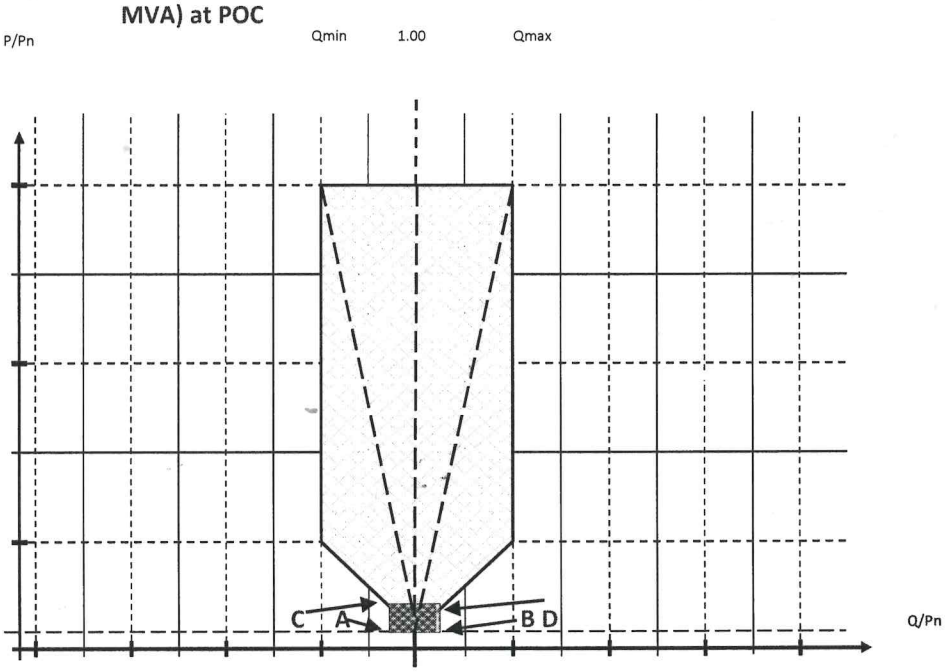


Figure 5-11: Reactive power requirements for RPPs (1 - 20 MVA) at POC

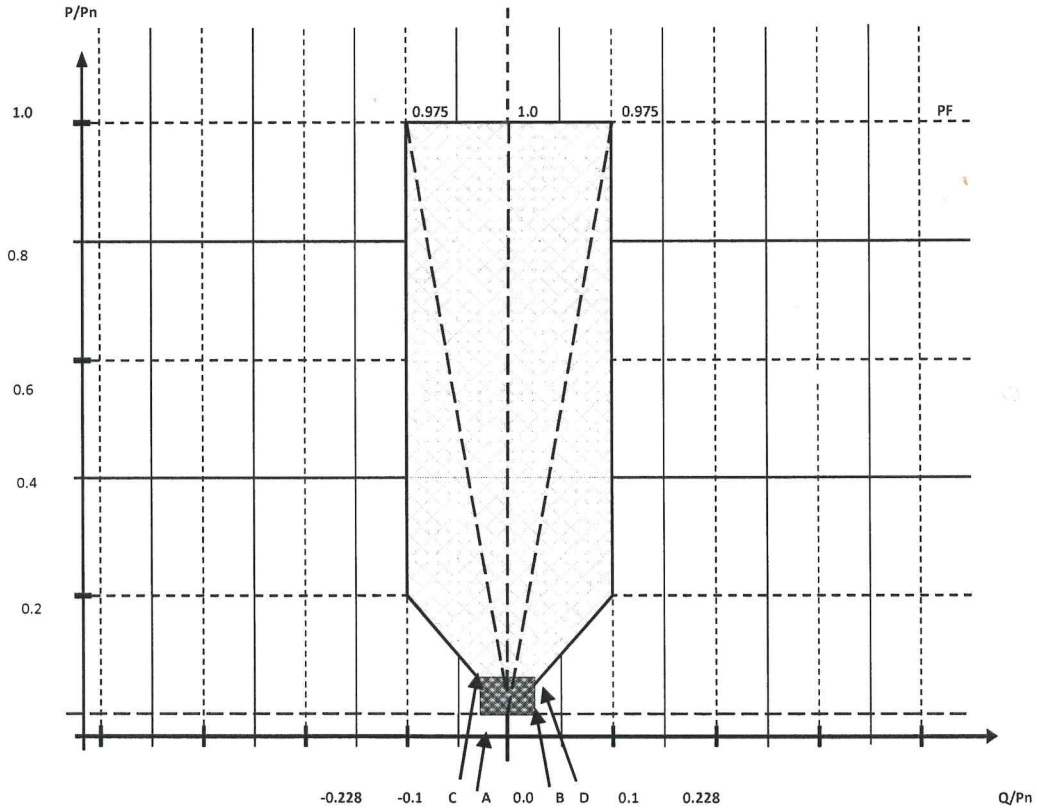
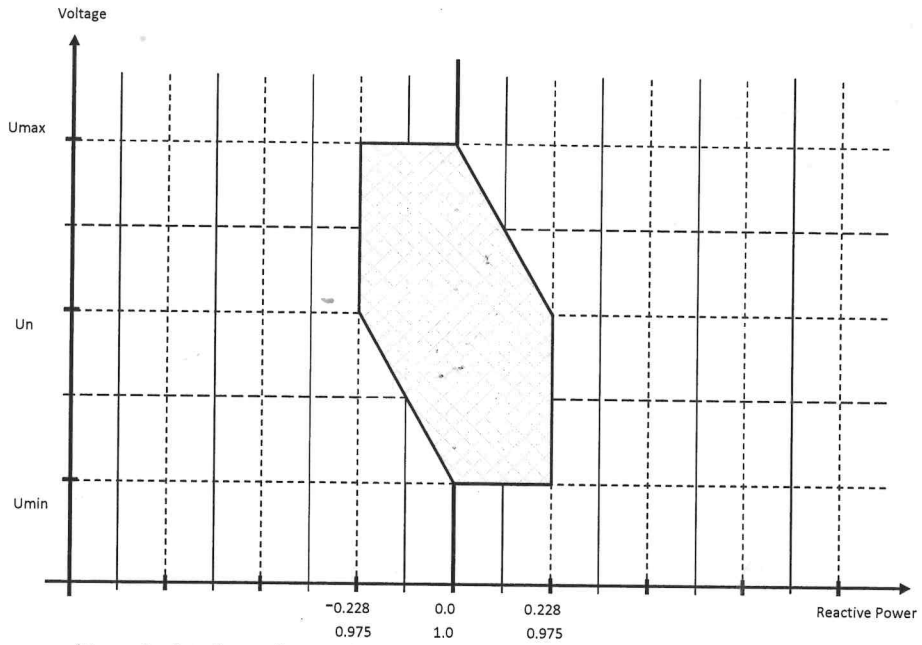


Figure 5-12: Requirements for reactive power and voltage control range for RPPs (1 - 20 MVA)



(Umax in the above diagram is 1.0985 p.u., and Umin is 0.9 p.u.)

5.4.4.3 RPPs (> 20 MVA)

(a) *RPPs* in this category shall have the capability to operate in a voltage, power factor or, reactive power control modes. The actual control operating mode as well as operating point shall be agreed with the *DNSP.*

(b) When operating between 5% and 100% of rated power Pn (MW) the *RPP* shall have the capability of varying reactive power support at the POC within the reactive power capability ranges as defined by Figure 5-13, where Qmin and Qmax are voltage dependent as defined by Figure 5-14.

(c) At nominal voltage, the required *RPP* reactive power capability (measured at the POC) shall be as shown in Figure 5-15.

(d) When operating below 5% of rated power Pn (MW), there is no reactive power capability requirement, however the *RPP* can only operate within the reactive power tolerance range not exceeding +-5% of rated power; that is within Area A,B,C and D in Figure 5-14.

Figure 5-13: Reactive power requirements for RPPs (>20 MVA) at the POC

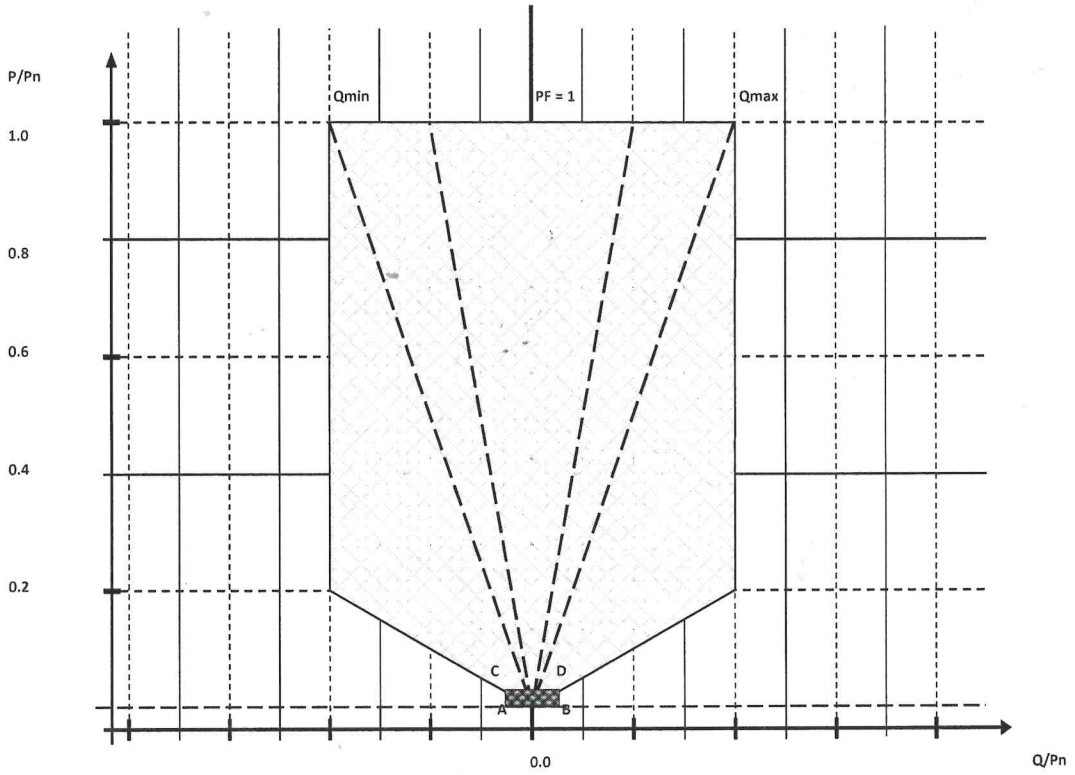


Figure 5-14: Reactive power requirements for RPPs (>20 MVA) at the POC

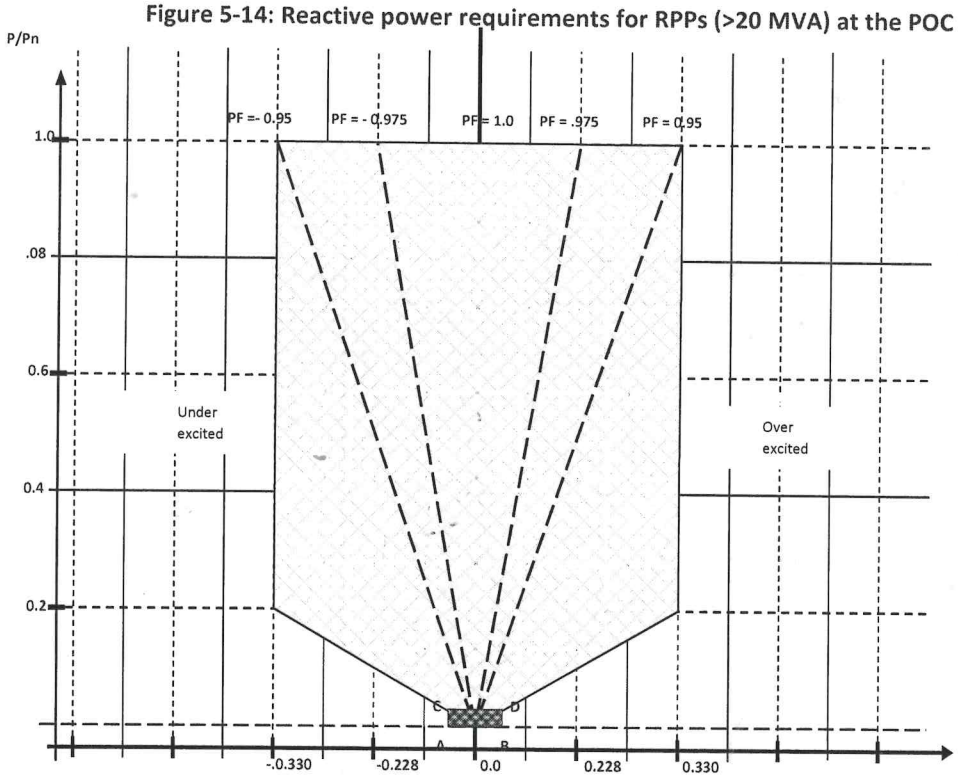
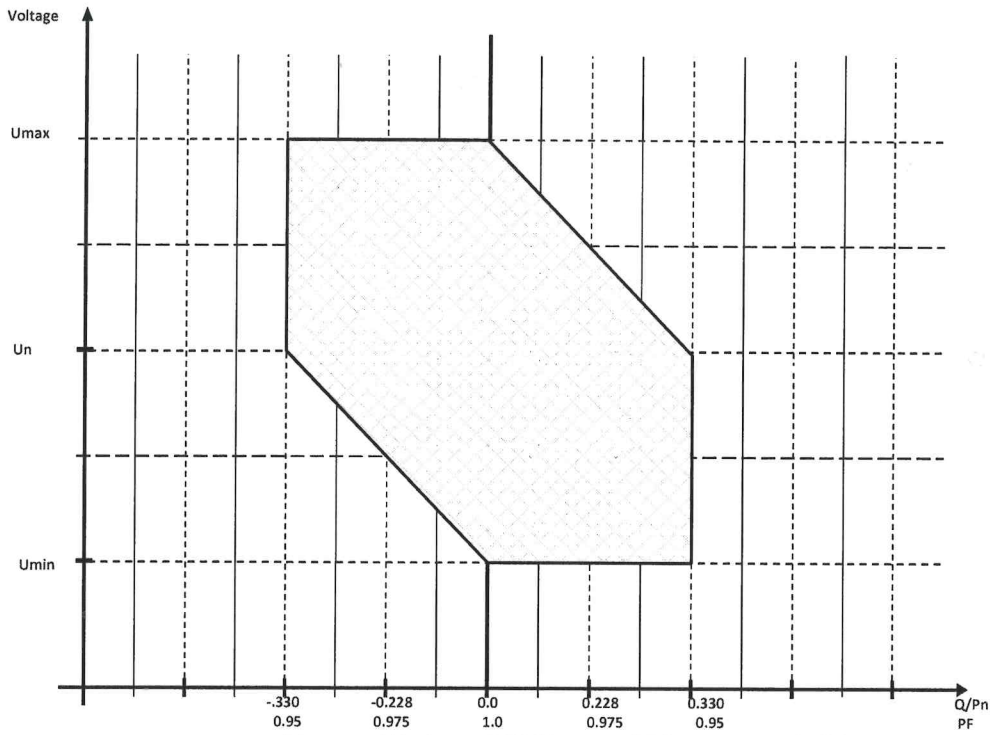


Figure 5-15: Requirements for reactive power and voltage control range for RPPs (>20 MVA)



(Umax and Umin are 1.0985 p.u. and 0.9 p.u. respectively)

5.4.5 Reactive Power, Power Factor, and Voltage Control

The following requirements shall apply to those *RPPs* above one (1) MVA, having contractual agreement with the *TNSP* for providing reactive power/power factor/voltage control:

(a) The *RPP* shall be equipped with reactive power control functions capable of controlling the reactive power supplied by the *RPP* at the POC as well as a voltage control function capable of controlling the voltage at the POC via orders using set points and gradients.

(b) The reactive power and voltage control functions are mutually exclusive, which means that only one of the following three functions can be activated at a time.

1. Voltage control
2. Power factor control
3. Reactive power control

(c) The control function and applied parameter settings for reactive power and voltage control functions shall be determined by the *DNSP* in collaboration with the *Regional Control Center* and/or the *ENTSO*, and implemented by the *RPP*. The agreed control functions shall be documented in the operating agreement.

5.4.5.1 Reactive Power Control

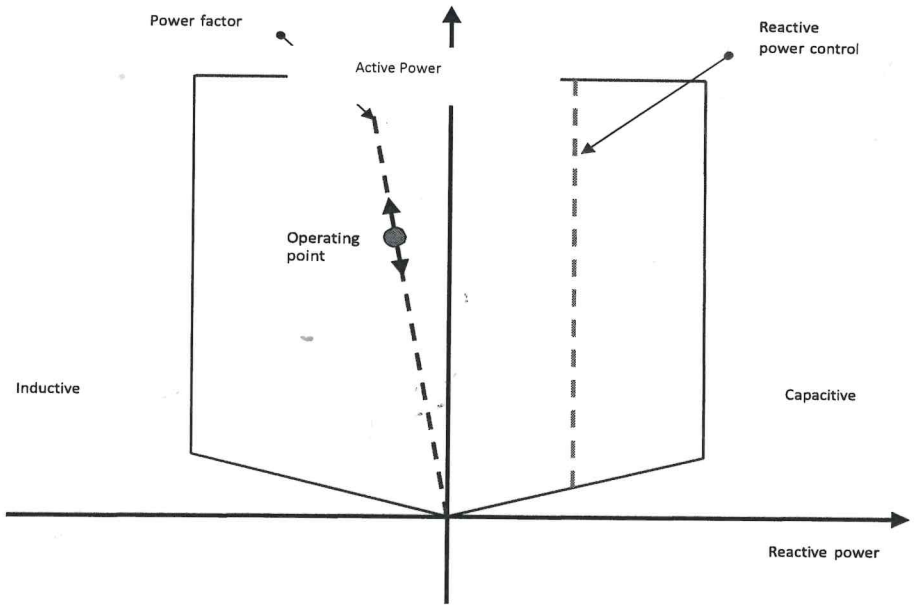
Reactive power control is a control function controlling the reactive power supply and absorption at the POC independently of the active power and the voltage. This control function is shown in Figure 5-16 as a vertical line.

(a) If the reactive power control set point is to be changed by the *DNSP,* the *Regional Control Center* and/or the *ENTSO*, the *RPP* shall update its echo analog set point value in response to the new value within two seconds. The *RPP* shall respond to the new set point within thirty (30) seconds after receipt of an order to change the set point.

(b) The accuracy of the control performed and of the set point shall not deviate by more than ±2% of the set point value or by ±0.5% of maximum reactive power, depending on which yields the highest tolerance.

(c) The *RPP* shall be able to receive a reactive power set point with an accuracy of at least one (1) kVar.

Figure 5-16: Reactive power control functions for the RPP



5.4.5.2 Power Factor Control

Power Factor Control controls the reactive power proportionally with respect to the active power at the POC. This is shown in Figure 5-16 by a line with a constant gradient.

(a) If the power factor set point is to be changed by the *DNSP*, the *Regional Control Center* and/or the *ENTSO*, the *RPP* shall update its echo analog set point value to in response to the new value within two seconds. The *RPP* shall respond to the new set point within thirty (30) seconds after receipt of an order to change the set point.

(b) The accuracy of the control performed and of the set point shall not deviate by more than ±0.02.

5.4.5.3 Voltage Control

Voltage control is used for controlling the voltage at the POC.

(a) If the voltage set point is to be changed, such change shall be commenced within two (2) seconds and completed no later than 30 seconds after receipt of an order to change the set point.

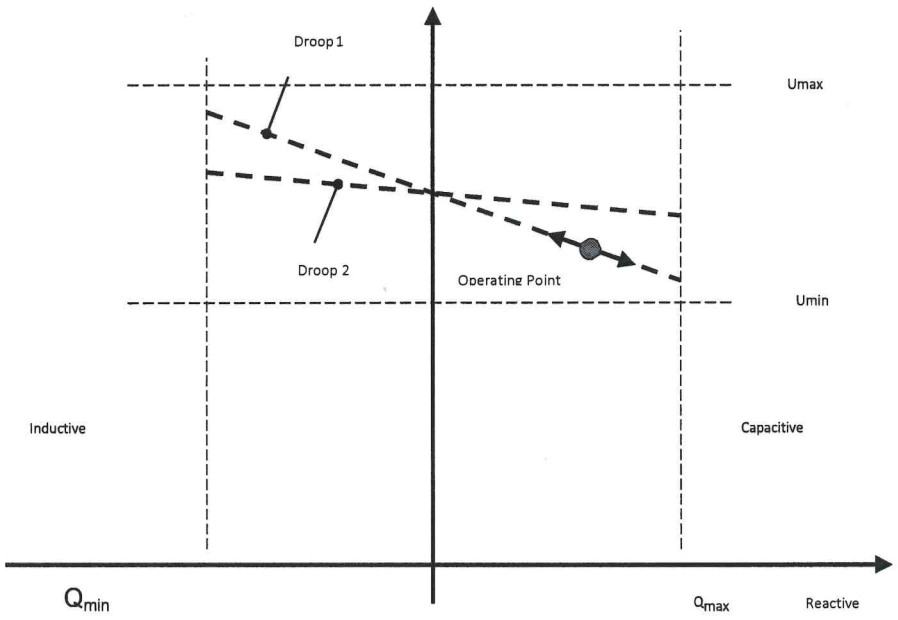
(b) The accuracy of the voltage set point shall be within ±0.5% of nominal voltage, and the accuracy of the control performed shall not deviate by more than ±2% of the required injection or absorption of reactive power according to droop characteristics as defined in Figure 5-17.

(c) The individual *RPP* shall be able to perform the control within its dynamic range and voltage limit with the droop configured as shown in Figure 5-17. In this context, droop is the voltage change (p.u.) caused by a change in reactive power (p.u.).

(d) When the voltage control has reached the *RPP's* dynamic design limits, the control function shall await possible overall control from the tap changer or other voltage control functions.

(e) Overall voltage coordination shall be handled by the *DNSP* in collaboration with the *Regional Control Center* and/or the *ENTSO*.

Figure 5-17: Voltage control functions for the RPP



(Umax and Umin are 1.0985 p.u. and 0.9 p.u. respectively)

5.4.6 Power Quality

(a) The *RPP* shall monitor the power quality parameters (i.e., flicker, harmonics, and unbalanced voltages) and provide report to the *DNSP,* the *Regional Control Center* and/or the *ENTSO* as appropriate. The *RPP* shall use IEC standards for calculating harmonics (IEC 61000-4-7) and flicker (IEC 61000-4-15). The *RPP* shall follow IEC 61000-4-30 Class A power quality monitoring standard that defines the methods for measurement and interpretation

of results for power quality parameters in AC power supply systems. The reporting will be done to prove compliance at the POC against the *DNSP* requirements as per the Purchase Power Agreement (PPA).

(b) Voltage and current quality distortion levels emitted by the *RPP* at the POC shall follow international standards such as IEC 61000-3-2:2018 (limitation of harmonic currents injected into the public supply system).

(c) The *RPP* shall also be compliant with IEEE 519-2014 (Recommended Practice and Requirements for Harmonic Control in Electric Power Systems), IEEE 1547 (Standard for Interconnecting Distributed Resources with Electric Power Systems), IEEE C-2 (Emergency Shutoff and National Electric Safety), IEC 62281 (Safety of primary and secondary lithium cells and batteries during transport), IEC 62897 (Stationary Energy Storage Systems with Lithium Batteries – Safety Requirements – under development), IEC 62932-2-2 (Flow Battery Systems For Stationary Applications – Part 2-2: Safety requirements), IEC 61850 (Communications networks and management systems), and IEC 60529 (Buildings, enclosures and protection from the elements).

(d) In addition, the *RPP* shall ensure that the *RPP* is designed, configured and implemented in such a way that the specified and agreed upon emission limit values are not exceeded.

(e) The *DNSP* will manage any voltage harmonic compatibility level exceedances due to the network harmonic impedance at the POC being more than 3 times the base harmonic impedance for the range of reference fault levels at the POC in line with its license conditions. The 3 times base harmonic impedance is calculated using the following equation: $\mathbf{Z(h) = 3*(v^2/s)*h}$, where h is the harmonic number, V is the nominal voltage (line-to-line) in kV, and S is the fault level in MVA. The angle of the network harmonic impedance is such that the impedance may range from fully inductive to fully capacitive

(f) In order to assist with the maximum resonance of 3 times as per item (e) above, no *RPP* may connect equipment (e.g. shunt capacitor banks) that will cause a resonance of more than 3 times at the POC at any frequency.

(g) The *TNSP* and *DNSP* shall use reasonable effort to furnish the *RPP* with a reliable and continuous connection for the delivery of electrical energy up to the POC. The network operators do not guarantee that the continuity and voltage quality of the connection will always be maintained under all contingencies. It is therefore incumbent upon the *RPP* to take adequate measures to protect the *RPP* facility against any losses and/or damage arising from frequency deviations, connection/supply interruptions, voltage variations (including voltage dips), voltage harmonics, voltage flicker, voltage unbalance, voltage swells and transients, undervoltages and overvoltages in the connection. It is also incumbent upon the *RPP* to take such necessary measures so as not to cause any damage to the *ENTS* and *ENDS*.

(h) Harmonic distortion generated by PV generators is below the standards in a distribution network which has only house loads. Moreover, if the Photovoltaic generators are located near the transformer, the harmonic distortion becomes even lower. In addition, installing Photovoltaic systems close to the transformer helps to control voltage rise in the distribution lines.

5.4.7 Protection and Fault Levels

(a) Protection functions shall be available to protect the *RPP* and to ensure a stable *ENDS*.

(b) The *RPP* shall be equipped with the necessary protection functions to protect itself against damage due to faults and incidents in the *ENDS*.

(c) The *RPP* (<1 MVA) shall be equipped with effective detection of islanded operation in all system configurations and capability to shut down generation of power in such condition within 0.2 seconds. Islanded operation with part of the *ENDS* is not permitted unless specifically agreed with the *DNSP.*

(d) The *RPP* (>1 MVA) shall be equipped with effective detection of islanded operation in all system configurations and capability to shut down generation of power in such condition within 2 seconds. Islanded operation with part of the *ENDS* is not permitted unless specifically agreed with the *DNSP*.

(e) The *DNSP*, the *Regional Control Center*, and/or the *ENTSO* may request that the set values for protection functions be changed following commissioning if it is deemed to be of importance to the operation of the *ENDS*. However, such change shall not result in the *RPP* being exposed to negative impacts from the *ENDS* lying outside of the design requirements.

(f) The *DNSP* shall inform the *RPP* generator of the highest and lowest short-circuit current that can be expected at the POC as well as any other information about the *ENDS* as may be necessary to define the *RPP's* protection functions.

5.4.8 Active Power Constraint Functions

RPPs larger than 100 kVA may be subject to curtailment of active power output for reasons of system security as determined by the *DNSP*, *Regional Control Center* and/or the *ENTSO, DNSP.* In case of curtailment, *RPP* shall be capable of:

(a) Operating at a reduced level if active power has been curtailed by the *ENTSO*, or the *Regional Control Center* for network or system security reasons

(b) Receiving a telemetered MW Curtailment set point sent from the *ENTSO*, or the *Regional Control Center*. Power curtailment actions shall be in agreement with all the parties involved.

(c) Being equipped with constraint functions (i.e. supplementary active power control functions) to avoid imbalances and/or overloading of the *ENDS* as indicated in Figure 5-18. The required constraint functions include: Absolute Production Constraint; Delta Production Constraint; and Power Gradient Constraint. Each of these are described in the following sections. Delta Production Constraint and Power Gradient Constraint are not needed for small hydro power plant.

5.4.8.1 Absolute Power Constraint

An Absolute Production Constraint is used to constrain the output active power from the *RPP* to a predefined power MW limit at the POC. This is typically used to protect the *ENDS* against overloading.

(a) If the set point for the Absolute Production Constraint is to be changed, the *RPPs* (excluding small hydro power plants) shall commence such change within two (2) seconds and the change shall be completed within thirty (30) seconds after receipt of an order to change the set point.

(b) For *RPPs*, other than small hydro power plants, the accuracy of the control performed and of the set point shall not deviate by more than ±2% of the set point value or by ±0.5% of the rated power, depending on which yields the highest tolerance.

(c) For small hydro power plants, if the set point for the Absolute Production Constraint is to be changed, such change shall be commenced with five (5) seconds. The *RPP* shall complete the change in the minimum time and to the highest accuracy achievable within its technical design limitations

5.4.8.2 Delta Production Constraint

A Delta Production Constraint is used to constrain the active power from the *RPP* to a required constant value in proportion to the possible active power. A Delta Production Constraint is typically used to establish a control reserve for control purposes in connection with frequency control.

(a) If the set point for the Delta Production Constraint is to be changed, such change shall be commenced within two (2) seconds and completed no later than thirty (30) seconds after receipt of an order to change the set point.

(b) The accuracy of the control performed and of the set point shall not deviate by more than ±2% of the set point value or by ±0.5% of the rated power, depending on which yields the highest tolerance.

5.4.8.3 Power Gradient Constraint

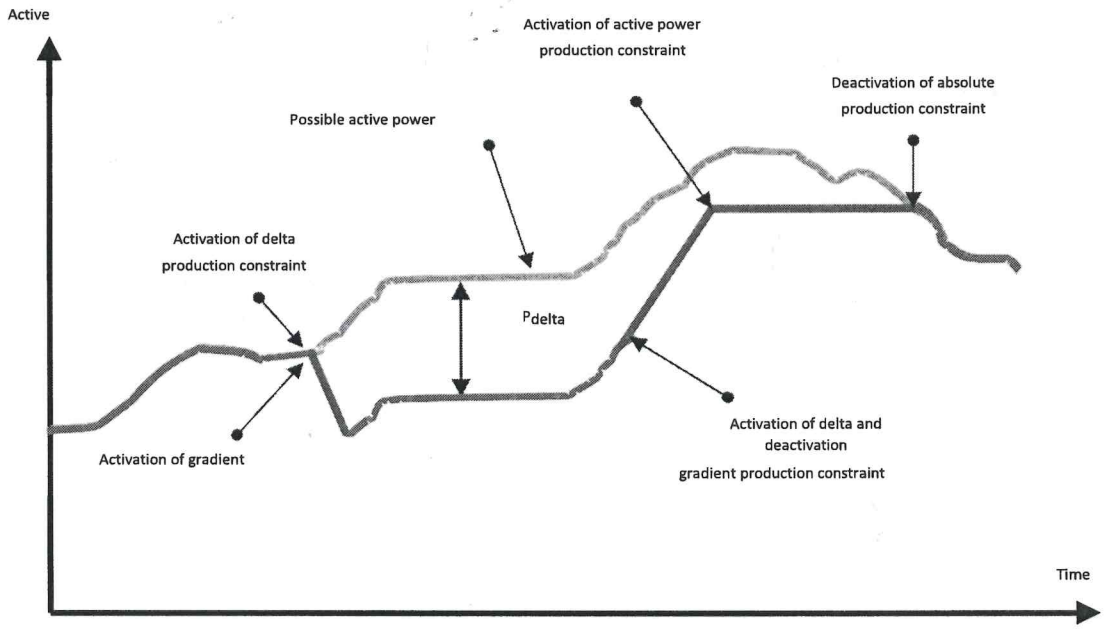
A Power Gradient Constraint is used to limit the maximum ramp rates by which the active power can be changed in the event of changes in primary renewable energy supply or the set points for the *RPP*, taking into account the availability of primary energy to support these gradients. A Power Gradient

Constraint is typically used for reasons of system operation to prevent changes in active power from impacting the stability of the *ENTS* or the *ENDS*.

(a) If the set point for the Power Gradient Constraint is to be changed, such change shall be commenced within two (2) seconds and completed no later than thirty (30) seconds after receipt of an order to change the set point.

(b) The accuracy of the control performed and of the set point shall not deviate by more than±2% of the set point value or by ±0.5% of the rated power, depending on which yields the highest tolerance.

Figure 5-18: Active power control functions for a RPP



5.4.9 Control Function Requirements

RPPs shall be equipped with the control functions specified in Table 5-10. The purpose of the various control functions is to ensure overall control and monitoring of the *RPP's* generation. The *RPP* control system shall be capable of controlling the ramp rate of its active power output with a maximum MW per minute ramp rate set by the *DNSP,* the *Regional Control Center* and/or the *ENTSO*.

5.4.9.1 Ramp Rates

The ramp rate settings shall be applicable for all ranges of operation including positive ramp rate during start up, positive ramp rate only during normal operation and negative ramp rate during controlled shut down. They shall not apply to frequency regulation. The ramp characteristics shall be as follows:

(a) The *RPP* control system shall be capable of controlling the ramp rate of its Active Power output with a maximum MW per minute ramp rate set by the *Regional Control Centre* and/or the *ENTSO*.

(b) There shall be two (2) maximum ramp rate settings. The first ramp rate setting shall apply to the MW ramp rate averaged over one (1) minute. The second ramp rate setting shall apply to the MW per minute ramp rate averaged over ten (10) minutes.

(c) These ramp rate settings shall be applicable for all ranges of operation including start up, normal operation and shut down. It is recognized that falling wind speed, rapidly changing cloud conditions, or frequency response may cause either of the maximum ramp rate settings to be exceeded.

(d) Power output of Solar Power Generating Plant has to be reduced in steps of 10% per minute, under any operating condition and from any working point to a maximum power value (target value) which could correspond also to one hundred percent (100%) power reduction, without disconnection of the *RPP* from the network.

(e) It shall be possible to vary each of these two maximum ramp rate settings independently over a range between one (1) and thirty (30) MW per minute. The *RPP* control system shall have the capability to set the ramp rate in MW per minute averaged over both one (1) and ten (10) minutes.

(f) The *RPP* operator, the *Regional Control Centre*, and/or the *ENTSO* shall agree on a procedure for setting and changing the ramp rate control.

(g) The RPP generator shall not perform any frequency response or voltage control functions without having entered into a specific agreement to this effect with the *DNSP*.

Table 5-10 Control Function of RPP

Control function	100 KVA – 1 MVA	1 - 20 MVA	>20 MVA
Frequency control	-	-	X
Absolute production constraint	X	X	X
Delta production constraint	-	-	X
Power gradient constraint	X	X	X
Q control	-	X	X
Power factor control	-	X	X
Voltage control	-	X	X

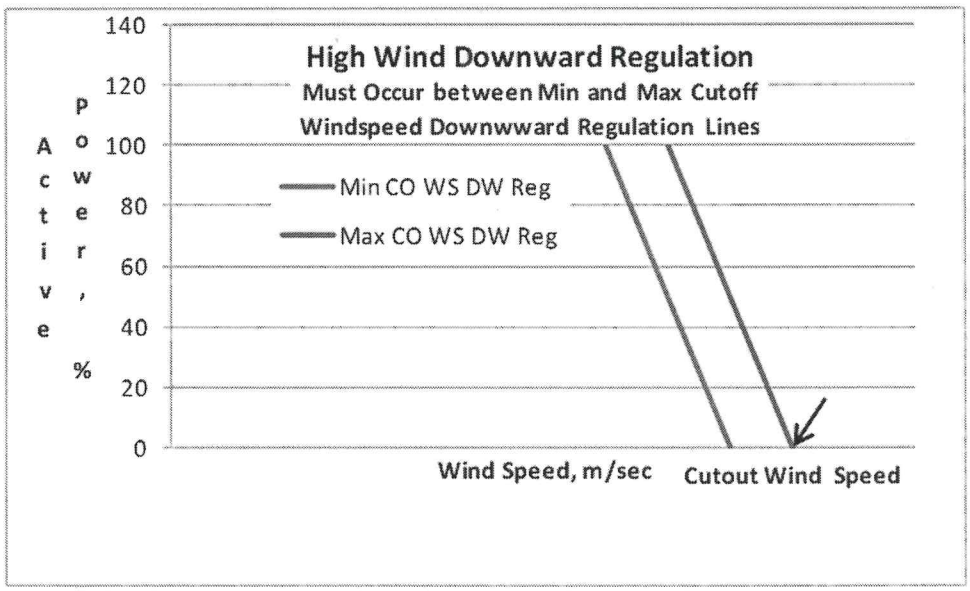
5.4.9.2 High Wind Curtailment

(a) The wind power *Generating Plant* shall remain connected to the *ENDS* at average wind speeds below a predefined cut-out wind speed. The cut-out wind speed shall as a minimum be twenty five (25) m/s, based on the wind speed measured as an average value over a ten (10) minute period. To prevent instability in the *Distribution System*, the *Wind Turbine Generating Plant* shall be equipped with an automatic downward regulation function making it possible to avoid a temporary interruption of the Active Power production at wind speeds close to the cut-out wind speed.

(b) It shall be possible to continuously downward regulate the *Active Power* supplied by the *RPP* to an arbitrary value in the interval from one hundred (100) percent (%) to at least forty (40) percent (%) of the rated power. When downward regulation is performed, the shutting-down of individual *Wind Turbine Generating Plant* is allowed so that the load characteristic is followed as well as possible.

(c) Downward regulation shall be performed as continuous or discrete regulation. Discrete regulation shall have a step size of maximum 25% of the rated power within the area between the slanted lines shown in Figure 5-19 Illustrative High Wind Downward Regulation Chart. When downward regulation is being performed, the shutting down of individual Wind Turbine Generating Plant units is allowed. The downward regulation band shall be agreed with the *TNSP* upon commissioning of the Wind Turbine Generating Plant units.

Figure 5-19: Illustrative High Wind Downward Regulation Chart



5.4.10RPP System Reserve Requirement

Increasing penetration of wind and photovoltaic generation, and to a limited extent other *RPPs*, can increase the need for various kinds of reserves. The variability of their output requires higher levels of

both planning and operating reserves to offset the greater chance of being or going off-line when needed. They also contribute little or no inertia to the system, increasing the need for frequency regulation, which may lead to a need for higher levels of Regulating and Spinning Reserve. These factors shall be taken into account in establishing both planning and operating reserve requirements. In general, *RPPs* shall:

(a) Maintain as a minimum two different set levels of spinning reserve within the design margins.

(b) Maintain a spinning reserve set level within ±2% of the capability registered with the *DNSP*, the *Regional Control Center* and/or the *ENTSO* for at least one hour.

5.4.11 RPP Hourly MW Production Forecast Requirement

Each *RPP* with a Generation License shall have the capability to produce and submit to the *Regional Control Center* and/or the *ENTSO* the day ahead and week-ahead hourly MW production forecast as follows:

(a) Day ahead and week ahead available MW and forecast MW for each hour

(b) Available MW and forecast MW for the next 6 hours updated hourly 10 to 20 minutes before the hour

(c) Available Mvar for the next 6 hours updated hourly 10 to 20 minutes before the hour

The above data shall be submitted as per the agreement between the *RPP* and the *DNSP* by means of an electronic interface in accordance with the requirements of the *Regional Control Center* and/or the *ENTSO*'s data system.

5.4.12 RPP Data Requirement

The *RPP* shall make the following signals available for the *Regional Control center* and/or the *ENTSO*:

(a) Actual MW at the POC

(b) Actual ramp rate of the generating plant

(c) Reactive power import/export at the POC

(d) Current sent out

(e) Power factor

(f) Voltage output

(g) Frequency

(h) Breaker status

(i) Isolator status

(j) Supervisory switch status

(k) Plant islanded

(l) Plant shutdown

(m) Plant trip on loss of grid detection

(n) Frequency Response System mode status indication (ON/OFF)

Other data requirements are described in the following sections.

5.4.12.1 RPP Meteorological Data Requirement

RPPs (excluding small hydro power plant) shall make the following signals available for the *Regional Control Center* and/or the *ENTSO*:

(a) Wind speed (within 75% of the hub height) – measured signal in meters/second (for wind power generating plant only)

(b) Wind direction (within 75% of the hub height) – measured signal in degrees from true North (0-359) (for wind power generating plant only)

(c) Air temperature- measured signal in degrees centigrade (-20 to 50)

(d) Air pressure- measured signal in millibar (800 to 1400)

(e) Air density (for wind power generating plant only)

(f) Diffuse Solar radiation (for solar power plants only)

(g) Direct Solar radiation (for solar power plants only).

The meteorological data signals shall be provided by a dedicated Meteorological Mast located at the *RPP* site or, where possible and preferable to do so, data from a means of the same or better accuracy. In the case of wind power generating plants, the Meteorological Mast shall be located at a position that optimizes the predictability of the output of the plant.

Energy resource conversion data for the facility (e.g. MW / wind speed) for the various resource inputs shall be provided to enable the *Regional Control Center* and/or the *ENTSO* to derive a graph of the full

range of the facilities output capabilities. An update shall be sent to the *Regional Control Center* and/or the *ENTSO* following any changes in the output capability of the facility.

The meteorological data shall be provided from a number of individual Meteorological Masts (or where possible and preferable, from a source of the same or better reliability for groups of wind turbines), where the wind turbines are widely dispersed over a large geographical area and rather different weather patterns are expected for different sections of the *RPP*. Wind turbines within an individual group are expected to demonstrate a high degree of correlation in Active Power output at any given time. The actual signals required shall be specified by the *Regional Control Center* and/or the *ENTSO*. There shall be at least one Meteorological Mast for every 10x10 square km area of the facility.

5.4.12.2 RPP Active Power Constraint Data Requirement

The *RPP* shall make the following signals available to the *Regional Control Center* and/or the *ENTSO*:

(a) Curtailment mode status (ON/OFF) as a single bit point

(b) Curtailment in progress as a single bit point

(c) Curtailment set point feedback

(d) Curtailment mode state (Not ready/Ready) as a single bit point

(e) Delta Production Constraint mode (ON/OFF) as a single bit point

(f) Delta Production Constraint set point feedback

(g) Delta Production Constraint mode (Not ready/Ready) as a single bit point

(h) Power Gradient Constraint mode (ON/OFF) as a single bit point

(i) Up Ramp rate set point feedback

(j) Down Ramp rate set point feedback

(k) Power Gradient Constraint mode (Not ready/Ready) as a single bit point

5.4.12.3 RPP Reactive Power and Voltage Control Data Requirement

The *RPP* shall make the following signals available for the *Regional Control Center* and/or the *ENTSO*:

(a) Reactive power control mode (ON/OFF) as a single bit point

(b) Reactive power control set point/raise or lower command

(c) Reactive power lower limit

(d) Reactive power upper limit

(e) Reactive power control mode (Not ready/Ready) as a single bit point

(f) Power factor control mode (ON/OFF) as a single bit point

(g) Power factor control set point/raise or lower command

(h) Power factor control set point feedback

(i) Power factor control mode (Not ready/Ready) as a single bit point

(j) Voltage control mode (ON/OFF) as a single bit point

(k) Voltage control set point/raise or lower command

(l) Voltage control mode set point feedback

(m) Voltage control mode (Not ready/Ready) as a single bit point

5.4.13 PROVISION FOR DATA AND ELECTRICAL DYNAMIC SIMULATION MODELS

(a) The *DNSP*, the *Regional Control Center*, and/or the *ENTSO* require suitable and accurate dynamic models, in the template specified by the requesting party applying for a connection to the *ENDS*, in order to assess reliably the impact of the *RPP* proposed installation on the dynamic performance and security and stability of the power system.

(b) The required dynamic models must be able to replicate the performance of the *RPP* facility or individual units for analysis of the following network aspects:

1. RPP impact on network voltage stability
2. *RPP* impact on quality of supply at POC
3. *RPP* switching transients impact on network performance
4. *RPP* impact on breakers transient recovery voltage
5. *RPP impact on network insulation co-ordination requirements*
6. *RPP* impact on network protection co-ordination
7. *RPP* Fault Ride Through (FRT) capability for different types of faults and positions
8. RPP response to various system phenomena that includes:

a. Switching on the network

b. Power swings

c. Small signal instabilities

(c) Generic models can be accepted on condition that they represent *RPP* performance with frequency spectrum from 0 to 1 kHz with accuracy level better that ±5%.

(d) Other models can be accepted as agreed upon by the *DNSP*, the *Regional Control Center* and/or *ENTSO.*

RPP data exchange should follow the steps as described in the sections below:

5.4.13.1 Application for Connection

During application for connection, the *RPP* shall submit the following information to the *DNSP* and/or the ENTSO:

(a) Physical location (including the GPS coordinates)

(b) Site plan

(c) Number of wind turbines or units to be connected

(d) MW output per turbine or unit

(e) Initial phase MW value

(f) Final phase MW value and timelines

(g) Any other information that the service provider may reasonably require

5.4.13.2 Detail Design

For the detailed *RPP* design, the *DNSP* and/or the *ENTSO* shall make available to the *RPP* the following information:

(a) Point of Connection and the Point of Common Coupling (PCC) including the nominal voltages

(b) Expected fault levels

(c) The *DNSP's* connection between the Point of supply and the *RPP*

(d) The bus bar layout of the Point of Common Coupling (PCC) and POC substations

(e) The portion of the *DNSP's* grid that will allow accurate and sufficient studies to design the *RPP* to meet the requirements of the *ENDGC*. This information shall include:

1. Positive and zero sequence parameters of the relevant DNSP's transformers, reactors, capacitors and other relevant equipment
2. The connection of the various lines transformers, reactors, and capacitors etc.

5.4.13.3 Pre-Commissioning

After detail designing is complete, prior to commissioning, the *RPP* shall provide information that includes:

(a) Selected *RPP* technology data

(b) Fault ride through capability and harmonic studies test report

(c) Generic test model and dynamic modelling data per wind turbine or unit as from the type approval and tests result

5.4.13.4 Post -Commissioning

After commissioning and optimization, the *RPP* shall provide the following information:

(a) A validated *RPP* electrical dynamic simulation model using commissioning test data and measurements

(b) Test measurement data in the format agreed between the *RPP* and the *DNSP/ENTSO* as applicable

(c) As built drawing of the system

6 PLANNING

6.1 DISTRIBUTION PLANNING RESPONSIBILITY

The *DNSP* shall be responsible for Distribution Planning, including:

(a) Forecasting the future Demand on its *Distribution System* operating area;

(b) Analyzing the impact of the connection of new facilities such as *Generator* connected to the *Distribution System*, Loads, distribution lines, or substations.

(c) Planning the expansion of the *Distribution System* to ensure its adequacy to meet forecast Demand and the connection of new Generation Connected to the *Distribution System*, Loads ; and

(d) Identifying and mitigating deficiencies in Supply Quality, Power Quality and System Losses in the *Distribution System*.

Distribution Planning shall be performed in coordination with the *ENTSO* and submitted to the *Regulatory Authority*.

6.1.1 Planning Data

The *Distribution Network Users* of the *Distribution System*, including Generation connected to the *Distribution System* and other entities that have a system connected to the *Distribution System*, shall cooperate with the *DNSP* in maintaining the Distribution Planning data.

6.1.2 5 Year Distribution Plan

The *DNSP* shall annually develop and submit to the *Regulatory Authority*, a *five (5)* Year Distribution Plan.

(a) Energy and Demand Forecasts

(b) Distribution feeder routing and sizing
   1. Detailed at above 15KV
   2. Outline for 15KV

(c) Distribution Reactive Power compensation plan

(d) Distribution Losses reduction plan

(e) Other Distribution reinforcement plans, and

(f) A summary of the technical and economic analysis to justify the ten (10) Year Distribution Plan.

6.1.3 Submission, Consolidation and Maintenance of Planning Data

(a) Any Distribution Network User applying for connection or a modification of an existing connection to the Distribution System shall submit to the DNSP the relevant Standard Planning Data and the Detailed Planning Data, in accordance with the requirements prescribed in the Distribution Connection Code in Chapter 5.

(b) When requested, Distribution Network Users shall submit to the DNSP the relevant historical planning data for the previous year and/or the forecast planning data for the ten (10) succeeding years. These shall include the updated Standard Planning Data and the Detailed Planning Data.

(c) The required Standard Planning Data shall consist of information necessary for the DNSP to evaluate the impact of any Distribution Network User development on the Distribution System.

(d) The Detailed Planning Data shall include additional information necessary for the conduct of a more accurate Distribution Planning study. This shall cover circuit parameters, switchgear, and Protection arrangements of Equipment directly connected to or affecting the Distribution System. The data shall be adequate to enable the DNSP to assess any implication associated with the Connection Points.

(e) The Standard Planning Data and Detailed Planning Data shall be submitted by the Distribution Network User to the DNSP according to the following categories:

1. Forecast Data
2. Estimated Equipment Data
3. Registered Equipment Data

(f) The Forecast Data shall contain the Distribution Network User's best estimate of the data, including Energy and Power, being projected for the ten (10) succeeding years.

(g) The Estimated Equipment Data shall contain the Distribution Network User's best estimate of the values of parameters and information pertaining to its Equipment.

(h) The Registered Equipment Data shall contain validated actual values of parameters and information about the Distribution Network User's Equipment, usually required at the time of connection.

6.1.4 Energy and Demand Forecast

All *Distribution Network Users* with Medium Connections larger than one (1) MVA and all Large Connections at Medium or High Voltage shall annually provide the *DNSP* with its Energy and Demand Forecasts at each *Connection Point* for the ten (10) succeeding years. The Forecast Data for the first year shall include monthly Energy and Power Forecasts, while the remaining nine (9) years shall include only the annual Energy and Power Forecasts.

In the case of *Distribution Network Users* having Generation Connected to the *Distribution System*, they shall provide the net values of Energy and Power Forecast after any deductions to reflect the

output of the *Generating Plant*. Such deductions shall be stated separately in the Forecast Data, including the projected Energy and Demand to be generated by each Unit in the *Generating Plant*.

The *DNSP* shall consolidate and maintain the Distribution planning data according to the following categories:

(a) Forecast Data;
(b) Estimated Equipment Data; and
(c) Registered Equipment Data

If there is any change to its planning data, the *Distribution Network User* shall notify the *DNSP* of the change as soon as practicable. The notification shall contain the time and date when the change took effect, or is expected to take effect, as the case may be. If the change is temporary, the time and date when the data is expected to revert to its previous registered value shall also be indicated in the notification.

The *Distribution Network User* shall give forty-eight (48) hours' notice to the *DNSP* in the event that the Connection is no longer required.

6.1.5 Distribution System Planning

The *DNSP* shall conduct Distribution Planning studies and evaluations to ensure the safety and reliability of the Distribution System in order to: evaluate the requirement of *Distribution System* reinforcement projects; assure the requirement stated under the Technical Requirements section and in the Performance Standards Chapter are met for all the *Distribution Network Users* in the *Distribution System*; and evaluate any proposed *Distribution Network User* development, which is submitted (or is expected to be submitted) in accordance with the applications and procedures stated in the Connection Code

The Distribution Planning studies shall be conducted to assess the impact on the *Distribution System* or to any *Distribution Network User* System, of the Load Forecast or any proposed Equipment change in the *Distribution System* or the *Distribution Network User* System, and to identify corrective measures to eliminate the deficiencies in the *Distribution System* or the *Distribution Network User* System.

The relevant technical studies and the required planning data specified in the following sections shall be used in conducting the Distribution Planning studies. The DNSP shall conduct distribution planning analysis which shall include:

(a) The determination of optimum patterns for feeder development, taking into account existing supply Points from the *ENTSO* and those proposed in the Transmission Master Plan;
(b) The development of optimum Distribution feeder configurations and switching controls;
(c) The development of optimum Reactive Power compensation programs; and
(d) The cost effectiveness of loss reduction measures.

6.1.5.1 Planning Study Costing Methodology

The Distribution planning studies shall be performed using lifecycle costing methods. The cost of capital and the discount rate used in such analysis shall be consistent with what is prescribed in the *Regulatory Authority* approved Tariff Methodology for the corresponding *DNSP*.

6.1.5.2 Reactive Compensation

In addition to catering for Active Power Demand, Reactive components of power requirement shall be studied and adequate measures shall be taken by installing Reactive compensation equipment at different voltage levels in a phased manner to improve power factor and cause reduction of losses.

6.1.5.3 Substation Locations

The location of distribution transformer substations shall be rationally determined with the objective of containing voltage regulation and transmission and distribution losses within permissible and reasonable limits.

6.1.5.4 Voltage Regulation

The voltage regulation in the *Distribution System* shall be maintained at the levels prescribed in the Performance Standards Code and the distribution losses in the System shall be gradually reduced over the years to meet the targeted figure set out in the Performance Standard Code.

6.1.5.5 Substation Standardization

The capacity of transformers used in the *Distribution System* and the layout of bus bars, switchgear, transformers, capacitors, earthing, lightning arrestors, control panels, station battery, fire extinguishers and other accessories required for the safe operation of the substations shall as far as practicable be standardized by the *DNSP*.

Typical hazards of an electrical switchgear include: electrical shock, burning from arc flash, and arc blast/shock wave. Standardization is therefore crucial for switchgears. All new medium voltage (*MV*) and high voltage (*HV*) AC metal enclosed switchgears and control shall follow IEC standard 62271-200 or equivalent as appropriate. Existing *MV* switchgears are expected to be compliant with old IEC 60298 standard or equivalent as approved by authorised personnel. All new low voltage (*LV*) switchgears operating below 1 kV range shall comply with IEC 61439 or equivalent. Older *LV* switchgears shall comply with IEC 60439 or equivalent as determined by the appropriate authorised personnel.

6.1.5.6 Distribution Transformer Protection

Distribution transformers shall be provided with suitable fuses or circuit breakers on the low tension side for protection against overload and short circuit.

6.2 PLANNING STUDIES

The following system studies shall be carried out by the *DNSP* in order to develop the ten (10) Year Distribution Plan:

6.2.1 Voltage Drop Studies

Voltage drop studies shall be performed to determine that the expected voltages at the *Distribution Network User's Connection Points* to comply with the requirements stated on the Technical Requirements section and in the Performance Standards specified in Chapter 9 of the *ENDGC*. It shall take into account the connection of new *Generating Plant* Connected to the *Distribution System*, the Forecasted Load, and any planned expansion, reinforcement, or development in the *Distribution System*.

6.2.2 Short Circuit Studies

Short circuit studies shall be performed to evaluate the effect on the *Distribution System* Equipment of the connection of new *Generating Plant* Connected to the *Distribution System* and other facilities that will result in increased fault duties for the *Distribution System* Equipment. These studies shall identify the Equipment that could be damaged when current exceeds the design limit of the Equipment and the Circuit Breakers and fuses which may fail when interrupting possible short circuit currents.

Three-phase short-circuit studies shall be performed for the most demanding scenario (either maximum or minimum generation) and for different system circuit configurations. Single line-to-ground fault studies shall also be performed for critical *Distribution System* nodes. These studies shall identify the most severe conditions that the *Distribution System* Equipment may be exposed to, and to determine possible constraints in fulfilling the Power Quality standards set out in the Performance Standards. Alternative *Distribution System* circuit configurations may be studied to reduce the short circuit current within the limits of existing Equipment. The results shall be considered satisfactory when the short-circuit currents are within the design limits of Equipment and the proposed *Distribution System* configurations are suitable for flexible and safe operation.

6.2.3 Load Forecast

The *DNSP* shall annually forecast the Demand for Power and Energy within the area of supply annually. The *DNSP* shall formulate its long term Load Forecast taking the previous *fiscal* year as the Base Year and projecting the Demand over the succeeding ten (10) years.

The *DNSP* shall forecast Demand using Prudent Industry Practice. In conducting this Load Forecast the *DNSP* shall consider:

(a) Energy Sales per Tariff Class, adopting a suitable methodology to assess its trend, taking into account electricity prices, the growth in population, trends on the national economy, or any other parameter the *DNSP* consider suitable to forecast it;

(b) Assumed normal growth for non-specific loads, specific and identified loads of one (1) MW and above and the effects, if any, due to Demand Side Management and loss reduction;

(c) Specific projects, either government or private sponsored (i.e. free zones, large tourist complex, etc.) that will imply the appearance of new loads in the *DNSP*'s license or concession area;

(d) *Conservation* programs, Demand side management or off-peak usage programs which the *DNSP* may be sponsoring, which are intended to reduce the *Distribution Network User's* future Energy and peak Demand;

(e) Public events that may have significant impact on demand;

(f) Expected schedules for *Generating Plants* connected to the *Distribution System*;

(g) Interconnection with adjacent *DNSP*, if exists; and

(h) Any other information under the *DNSP*'s knowledge that could have some influence in the Load Forecast.

6.2.3.1 Load Profiles

The *DNSP* shall create a data base of loads for each *Distribution Network User* category and for each distribution substation connected to its *Distribution System* and update it on an annual basis.

The *DNSP* shall develop a load research program with the objective of obtaining *Distribution Network User* load profile data that describes the usage characteristics of specific appliances, *Distribution Network Users*, and group of *Distribution Network Users*. The load research will facilitate obtaining the following information:

(a) Demand according to end use at System peak, daily, monthly, annually or seasonally;

(b) Hourly end use Demand for the day of the System Peak, monthly, annual or seasonally;

(c) Categorical diversity or coincidence factors and load factors;

(d) Categorical non-coincident peak Demands; and

(e) Total Energy consumption for each category by day, month, season or year.

6.2.3.2 Aggregate Energy Requirement at Transmission Connection Point

The *DNSP* shall compute the aggregate energy requirement at each of the *Connection Points* with the Transmission System after accounting for System losses. Based on the metering data at each *Connection Point* with the Transmission System, the Licensee shall develop load curves for the area fed by the concerned *HV/MV* substation. By compiling data from each *HV/MV* substation feeding its *Distribution System*, the Licensee shall develop a System load curve for its area of supply by applying a suitable diversity factor. By reconciling actual Energy sales figures with the metering data at each substation, approximate losses in the System may be computed for any period. This data shall be furnished to the *Regulatory Authority* as stated in the Performance Standards.

If a *Distribution Network User* believes that the cohesive forecast prepared by the *DNSP* does not accurately reflect its assumptions on the planning data, it shall promptly notify the *DNSP* of its concern. The *DNSP* and the *Distribution Network User* shall promptly meet to address the concern of the *Distribution Network User*.

6.2.4 Distribution System Reliability Studies

Distribution Reliability studies shall be performed to determine the frequency and duration of *Distribution Network User* Interruptions in the *Distribution System* in order to assure the requirements stated in the Performance Standards is met. The historical Reliability performance of the *Distribution System* shall be determined from the *Distribution System* Interruption data.

6.2.5 System Losses Studies

System Losses studies shall be performed to identify, classify, and quantify the losses in the *Distribution System* and to propose measures to gradually reduce them if technically and economically feasible. System Loss studies shall be performed to determine the effects of any *Distribution Network User* or Distribution development on the efficiency of the *Distribution System*.

7 OPERATIONS

7.1 PURPOSE AND SCOPE

The purpose of the Operating Code is:

(a) To define the operational responsibilities of the *DNP* and all *Distribution Network Users*;

(b) To specify the requirements and procedures for Load Forecast;

(c) To specify the maintenance programs for the Equipment and facilities in the *Distribution System*;

(d) To describe the Demand control strategies used for the control of the entire power system frequency and the methods used for voltage control;

(e) To specify the requirements for communication and the notices to be issued by the *DNSP* to *Distribution Network Users* and the notices to be issued by *Distribution Network Users* to the *DNSP* and other *Distribution Network Users*.

(f) To specify the procedures to be followed by the *DNSP* and *Distribution Network Users* during emergency conditions;

(g) To specify the Safety Management System criteria to be applied by the *DNSP* and *Distribution Network Users* for the co-ordination, establishment and maintenance of necessary safety precautions when work or testing is to be carried out on Plant and/or Apparatus of a *DNSP* or a *Distribution Network User*

(h) To establish a procedure for the conduct of System Tests which involve the simulation of conditions or the controlled application of unusual or extreme conditions that may have an impact on the *Distribution System* or the *Distribution Network User System*;

(i) To identify the tests and the procedures that needs to be carried out to confirm the compliance of a *Generating Plant* Connected to the *Distribution System* with its registered parameters and its ability to provide *Ancillary Services*; and

(j) To specify the requirements for Site and Equipment Identification at the *Connection Point.*

7.2 OPERATIONAL RESPONSIBILITIES

This section applies to the following:

(a) The *DNSP*

(b) Other *DNSP*s connected to the *Distribution System*, if any;

(c) *Generation Licensees* with *Generating Plants* connected to the *Distribution System* greater than or equal to one (1) MVA output or with a single *Generating Plant* over five hundred (500) kVA;

(d) Others *Generating Plants* Connected to the *Distribution System* if so instructed in the *Connection Agreement*;

(e) All *Distribution Network Users* with a contracted demand equal to or greater than four (4) MVA, unless differently stated in the *Connection Agreement*.

(f) Other *Distribution Network Users*, if so instructed in the *Connection Agreement*.

7.2.1 Distribution Network Service Provider (DNSP)

The *DNSP* shall be responsible for submitting the first Distribution Asset Management Plan to the *Regulatory Authority* after six (6) month of completion of construction work in case of newly constructed distribution network. In case of already established distribution network, the *DNSP* shall submit the plan six (6) months after issuance of license. The *DNSP's* Distribution Asset Management plan shall be resubmitted every year following the submission of the original plan. The responsibilities of the *DNSP* shall also include the following:

(a) The *DNSP* is responsible for operating and maintaining Supply and Power Quality in the *Distribution System* during Normal Conditions, in accordance with the provision indicated in the Performance Standards in Chapter 9 of the *ENDGC*, and in proposing solutions to Supply or Power Quality problems.

(b) The *DNSP* is responsible for providing and maintaining all distribution Equipment and facilities within its licensed area.

(c) The *DNSP* is responsible for preparing the Annual Maintenance Plans for the adequate maintenance of its Equipment and facilities, as is described in the *ENDGC*.

(d) The *DNSP* is responsible for designing, installing, and maintaining distribution protection that will ensure selective and timely disconnection of faulted facilities and Equipment.

(e) The *DNSP* has a responsibility for maintaining an Automatic Load Shedding scheme to meet the targets agreed to with the *ENTSO* as per the *ENTGC*.

7.2.2 Generation Licensees

The *Generation Licensee* with G*enerating Plant*s connected to the *Distribution* System shall ensure that its *Generating Plants* can deliver the capabilities declared in its *Connection Agreement*.

The G*enerating Plant*s connected to the *Distribution System* shall provide accurate and timely planning and operations data to the *DNSP*.

The Generation Licensee shall execute the instructions of the *DNSP* during emergency conditions.

7.2.3 Distribution Network Users

The responsibilities of *Distribution Network Users* shall include the following:

(a) Assisting the *DNSP* in maintaining Power Quality in the *Distribution System* during Normal Conditions by correcting any *Distribution Network User* facility that causes Power Quality problems.

(b) Ensuring that it's System will not cause any Degradation of the *Distribution System*.

(c) Undertaking all necessary measures to remedy any degradation that the *Distribution Network User* System has caused to the *Distribution System*.

(d) Executing the instructions of the *DNSP* during emergency conditions.

7.3 OPERATIONAL PLANNING

7.3.1 LOAD FORECAST

In order for the *DNSP* to operate the *Distribution System* efficiently and to ensure maximum System security, there is a need for those *Distribution Network* Users to provide loading and generation output information to the *DNSP*. The information, required to be provided by *Distribution Network Users* will enable the Licensee to comply with these requirements of the *ENDGC*.

The *ENDGC* specifies the *Transmission Licensee's* requirements for Demand forecasting for Centrally Dispatched *Generator*. This section specifies the information to be provided by other *Generator* and the *Distribution Network Users*.

This Demand forecasting information is required to enable the *DNSP* to maintain the integrity of the *Distribution System*. The *DNSP* under its *Distribution Licence* has an obligation under the *ENDGC* to provide Demand forecast information to the *ENTSO* in order that generation output can be matched with Demand.

Where Demand data is required from the *Distribution Network User*, this means the MW Demand of electricity at the *Connection Point*. The *DNSP* may, in certain cases, specify that the Demand data shall include the Mvar Demand.

7.3.2 Demand Forecast Information

Information shall be supplied by *Distribution Network Users* to the *DNSP* for the following rolling timescales is required by the *DNSP*:

(a) Operational Planning Phase – next year ahead

(b) Programming Phase – twenty-four (24) hours to eight (8) weeks ahead

(c) Control Phase – zero (0) to twenty-four (24) hours ahead

The information supplied will be as specified below:

7.3.2.1 Operational Planning Phase (next year ahead)

The *Distribution Network User* information shall be provided in every calendar year by calendar week thirty-five (35) to the *DNSP* during the Operational Planning Phase.

7.3.2.2 Programming Phase (24 hours to 8 weeks ahead inclusive)

The following information shall be provided to the *DNSP*:

(a) Schedules for the operation of a *Generating Plant* with output greater than one (1) MW on an hourly basis where the *DNSP* reasonably considers it appropriate;

(b) From the *DNSP*'s supply business, details of their proposed use of Demand Control measures aggregated to three (3) MW or more (averaged over any hour) on an hourly basis for each of the *DNSP*'s *Connection Points*;

(c) From *Distribution Network Users* and other *DNSPs* connected to the *Distribution System* whose operations are likely to result in an aggregated change in hourly demand at the *Connection Point* of greater than three (3) MW;

(d) Any other relevant Demand forecast information reasonably required by the *DNSP*.

7.3.2.3 Control Phase (0 to 24 hours ahead)

The following information shall be supplied to the *DNSP* at reasonable times to be specified by the *DNSP*:

(a) Details of any differences of greater than [2 MW] from the schedules of operation of any Generation connected to the *Distribution System* on an hourly basis.

(b) Details from each *Distribution Network User* connected to the *Distribution System* of any change in aggregated Demand at the *Connection Point* of greater than [3 MW] of the Demand.

7.4 MAINTENANCE PLANS

7.4.1 Maintenance Standards

A *DNSP* shall, in relation to the maintenance of his *Electrical Infrastructure*, adopt quality management and assurance procedures which:

(a) Comply with the laws and other performance obligations which apply to the provision of distribution services, including those contained in this Code; and

(b) Minimize the risks associated with the failure or reduced performance of assets; and

(c) Adopt prudent electricity industry practice.

(d) Comply with the directives as stated in the "Final English Draft Energy Operation Regulation", as appropriate.

7.4.2 Maintenance Plans and Time Scales

The *DNSP* shall prepare the following Distribution Maintenance Programs:

(a) Long Term Maintenance Plan; 5-Year cycle

(b) Annual Maintenance Plan

(c) Planned Outage Schedule

7.4.3 Annual Maintenance Plan

Each year, the *DNSP* shall prepare an Annual Maintenance Plan. *Distribution Network Users* and *Generation Licensees* will provide the *DNSP* with their maintenance and outage plans to include into the Annual Plan.

The Annual Maintenance Plan and its proposed outage program shall be submitted to the *Regulatory Authority* and to the *ENTSO* on a year- ahead basis one month prior to the end of the year.

The Annual Maintenance Plan shall be developed taking into account the following:

(a) The forecast Demand;

(b) The historical Maintenance Plans actually implemented;

(c) The requests by *Distribution Network Users* for changes in their maintenance schedules;

(d) The requirements for the maintenance of the Grid;

(e) The need to minimize the total cost of the required maintenance; and

(f) Any other relevant factor.

Distribution Network Users and *Generation Licensees* with *Generating Plants* connected to the *Distribution System* shall provide to the *DNSP* information regarding their provisional Maintenance Plan for the next year. The following information shall be included in the *Distribution Network User's* provisional Maintenance Program for its System or Equipment:

(g) Identification of the Equipment and the MW capacity involved;

(h) Reasons for the maintenance;

(i) Expected duration of the maintenance work;

(j) Preferred start date for the maintenance work and the date by which the work shall have been completed; and

(k) If there is flexibility in dates, the earliest start date and the latest completion date.

The *DNSP* shall advise *Distribution Network Users* or *Generation Licensees* with *Generating Plants* connected to the *Distribution System* who may be significantly affected by particular outages of Distribution plant or apparatus, of the dates and duration of the outages. If there are objections from *Distribution Network Users*, the *DNSP* and the *Distribution Network User* shall attempt to resolve the problem as provided in Section 3.11. The *DNSP* shall make all reasonable attempts to revise the Annual Maintenance Plan to address the *Distribution Network User's* concerns. However, if no reasonable and/or timely alternative exists, then the *DNSP* may take the outage despite the concerns of the Large *Distribution Network Users* or *Generation Licensees*.

7.5 VEGETATION MANAGEMENT

The objective of this chapter is to:

(a) Promote public safety in respect of fire hazards;

(b) Establish a standard of care which should be observed when managing vegetation near *Distribution Power Lines*;

(c) Reduce vegetation related interruptions to electricity *supply*;

(d) Establish communications protocol with affected persons;

(e) Minimize the impact of vegetation management on the natural environment.

7.5.1 Applicability

This section applies to *DNSP* and any other party performing tree trimming or other vegetation related tasks on or near electric distribution facilities.

7.5.2 Purpose

The purpose of this section is to establish program management requirements and prudent work practices and procedures for the pruning and clearing of vegetation in the vicinity of distribution facilities. To that end, this section sets out:

(a) Minimum standards and procedures for clearing vegetation near electric distribution facilities; and

(b) Define the roles and responsibilities for maintaining the *Clearance Space* near power lines

7.5.3 Alternatives to Vegetation Clearing

There are a number of methods of maintaining the *Clearance Space*. The most common method is pruning and clearing of vegetation. Other methods include:

(a) undergrounding of electric supply lines;

(b) Installing tree wire or aerial bundled overhead *Conductors*;

(c) Alley arm pole line framing;

(d) Selecting power line routes which avoid vegetation;

(e) Installing taller poles to obtain vertical clearance over vegetation;

(f) Educating developers and the community on selecting low height, slow growth vegetation species for new plantings

7.5.3.1 Factors Determining Options

Factors that the *DNSP* shall use in determining the most appropriate options to address the best alternative include:

(a) Public safety;

(b) *Distribution System* reliability;

(c) Capital cost of construction alternatives versus ongoing maintenance;

(d) Community *Conservation* and heritage values and visual impact;

(e) Type of vegetation and its growth characteristics; and

(f) Accessibility to the line/vegetation location for vegetation maintenance crews.

It is for the *DNSP* to determine the most appropriate method of maintaining the *Clearance Space*.

7.5.4 Vegetation Management Program

The *DNSP* shall have a written Vegetation Management Program that applies prudent power line clearing practices to reduce the risk to the public and maintain the reliability of the *Distribution System*. The components that should be included in the program are:

(a) Vegetation management principles, strategy, objective, input, output

(b) Inventory of distribution facilities requiring tree trimming, including the frequency based on species and proximity to the line;

(c) Defined process to manage and audit the vegetation around electrical infrastructure and equipment;

(d) Multi-year maintenance cycles;

(e) Annual maintenance plans; including scope, schedule and budget;

(f) Approved work practices;

(g) Targets for measuring performance;

(h) Training Program; and

(i) Community Outreach Plan

The *DNSP* should have regard to the principles of prevention of soil erosion, and the preservation of water quality, windbreaks and specific wildlife habitat.

The *DNSP* shall submit the first Distribution Vegetation Management Plan after six (6) month of completion of construction work in case of newly constructed distribution network, or, after six (6) months of issuance of license in case of already established distribution network.

The Distribution Vegetation Management Plan shall be resubmitted every year. The deadline for the resubmission of the plan for the Ethiopian fiscal year following it shall be Ginbot 30 of each year.

7.5.5 Practices and Classifications

To provide a consistent and measurable approach to pruning or clearing vegetation near *Distribution Power Lines* and to assist people to understand these concepts, the following practices and classifications shall apply:

(a) Clearance space

The clearance space varies with the type of *Distribution Power Lines* installed and the risk of fire at that location. The clearance space is designed to reduce the risk of grassland fires in rural areas and the reliability and continuity of electricity supply.

(b) Regrowth Space

The regrowth space required varies with the species of vegetation, the quality of the pruning or clearing, the micro-environment and the pruning and clearing cycle. Determining the regrowth rate is a matter of considering the factors involved. It should be assessed with the support of expert knowledge in vegetation management and following consultation with affected persons.

(c) Hazard Space

The *DNSP* shall take appropriate action in relation to trees and limbs in the hazard space to ensure the safety and reliability of the *Distribution System*. The hazard space will vary with the species of vegetation and the extent of exposure to adverse weather conditions. The hazard space should be determined with reference to these factors and assessed with the support of vegetation management and arboriculture expertise, following consultation with affected persons.

(d) Pruning and Clearing Cycle

The pruning and clearing cycle is based on practical factors which include cost, local growing conditions and the anticipated vigor of the regrowth of species involved, coupled with the use of the land, community values and the utility and amenity the vegetation provides to the area. The pruning and clearing cycle need not be the same for all areas, but will be determined according to conditions in a particular location.

(e) Suitable Vegetation Species

In some situations, vegetation cannot be pruned to the requirements of the Chapter across successive pruning and clearing cycles without destroying the vegetation's character, amenity

and utility value or encouraging vigorous regrowth. In the longer term this could cause the vegetation to become unstable, unhealthy and a hazard to the public and the *Distribution Power Lines*. This vegetation should be removed where judged appropriate following assessment of the vegetation's *Conservation* value and appropriate consultation.

Saplings whose mature height will infringe the C*learance Space* are best removed at an early stage of their growth to minimize cost and disruption to the area in the future.

Planting of suitable species by owners and occupiers will remove the potential risk to *Distribution Power Lines* and the need for costly recurrent pruning or clearing as well as retaining the amenity and utility value of vegetation to the public and environment. On public land, planting of suitable endemic species is preferred.

7.5.6 Important Vegetation

Locations recognized by relevant authorities or bodies as containing "important vegetation" require special attention. For the purposes of this chapter, "important vegetation" includes:

(a) botanical, heritage and cultural sensitive vegetation;

(b) vegetation of outstanding aesthetic value;

(c) vegetation of ecological significance; and

(d) habitat for threatened species.

Before commencement of pruning and clearing, the *DNSP* shall identify where the maintenance may be detrimental to important vegetation. The *DNSP* shall seek advice from the relevant authorities, for example the Ministry of Natural Resources and Environment, as well as land care and community groups as advised by the relevant authorities, to identify "important vegetation".

Alternative *Distribution Power Lines* routes or construction methods described in Section 7.5.3 may help to preserve "important vegetation". The manner in which this may be done needs to be decided by the *DNSP* with the support of this chapter. This should result in the most practical management arrangements and conditions that may apply.

7.5.7 Important Locations

The *DNSP* shall consult with the relevant authorities on the management of "important locations". For the purposes of this chapter "important locations" contain the following:

(a) Sites of historically or culturally important remnants or artifacts;

(b) Sites of historically or culturally important events;

(c) Sites of outstanding aesthetic value or landscape or streetscape values; or

(d) Sites of ecological significance.

7.5.8 Clearance Space

The principal determinants of the dimensions of the *Clearance Space* are protection of the public from fire start potential and ensuring continuity and reliability of supply. Accordingly, the *Clearance Space* will vary depending on the fire hazard category of the area in which the *Distribution Power Lines* is situated and factors associated with the type of *Distribution Power Lines* installed.

7.5.9 Fire Hazard Categories

The risk of fire starting and spreading varies throughout Ethiopia. To establish the *Clearance Space* required, Ethiopia is divided into two categories in which different *Clearance Space* dimensions apply:

(a) Low to moderate fire risk areas (predominantly urban); and

(b) High to very high fire risk areas (predominantly rural).

The *DNSP* shall seek advice from the *Fire Control Authority* as to the *Fire Hazard Rating* of the area within which they propose to undertake vegetation management activity.

7.5.10 Factors Affecting Dimensions of Distribution Power Line Clearance

The dimensions of the *Clearance Space are* also dependent on factors associated with the type of *Distribution Power Lines* installed and include:

(a) Line Voltage - The *voltage* level of the *Distribution Power Lines* influences the potential for electric discharge. The higher the *voltage* the greater the potential hazard, and hence the need for a greater *Clearance Space*.

(b) Conductor Type - Insulated conductors reduce the risk of electric discharge. Using aerial bundled cable or other insulated conductors reduces the necessary dimensions of the *Clearance Space.*

(c) Span Length - As the span length increases, the added weight of the line conductors cause an increase in sag. *C*onductors can sway with the wind, therefore all dimensions of the *Clearance Space* shall be greater as the span length increases.

(d) Conductor Size – The size of a *Distribution Power Line* conductor affects its weight and therefore the amount that the conductor will sag. *Distribution* power line conductors can sway with the wind therefore dimensions of the *Clearance Space* needs to increase as the size of the conductor increases.

(e) Distance along the *distribution* power line conductors from the pole - Along the *Distribution Power Line* conductors, the greatest sag occurs midway between the supporting poles. Therefore the dimensions of the *Clearance Space* should be greater at mid-span than near the pole. Maximum *Clearance Space* dimensions are to apply at the point of maximum sag.

(f) Temperature of the Conductors - Increases in the temperature of *Distribution Power Line* conductors, caused by weather line loading, increases the sag of the conductors. These factors are in a state of continual *change*, so an allowance is made in the dimensions of the C*learance Space* for the temperature of distribution power line conductors

7.5.11Consumer Responsibilities

The tariff applicable to a *Consumer* or an *Individual Contract* between a *Consumer* and a *DNSP* provides that a *Consumer* shall, at its own expense, maintain safe clearances between vegetation on the *Consumer's* property and *Electrical Infrastructure* providing supply to the *Consumer's Electrical Installation*.

7.5.12 Notification, Consultation and Negotiation

A *DNSP shall*:

(a) notify the occupiers of land, giving reasonable notice, before starting programmed pruning or clearing which will not involve *changes* to established practice. Notices should be informative, explaining why compliance with this section is necessary and stating the proposed time of the pruning and clearing. Where no one is in actual occupation of the land, notices to owners may be published in locally distributed newspapers;

(b) consult with the owner of land when the proposed pruning or clearing will change from the established practice for that location and notify the occupiers of the land where the owner and the occupiers are not the same person;

(c) when the proposed pruning or clearing will change from the established practice for that location, provide to the owner or, if not practical, the occupiers, a simple written explanation of the proposed method and extent of pruning or clearing which may include details of:

1. the use of chemicals;
2. disposal of debris resulting from pruning or clearing; (iii) avoiding transfer of noxious weeds and diseases; or
3. implementing measures to prevent bushfires from starting.

7.5.13 Emergency Clearing

In emergency situations, the *DNSP* may remove vegetation which poses an immediate risk in accordance with powers under Proclamation 810/2013.

Under emergency circumstances, pruning may be undertaken without consultation, but the *DNSP* shall notify the owner or occupiers as soon as practicable after the removal of the vegetation.

7.5.14 Disputes

Disputes with owners or occupiers or *Distribution Network Users* may arise from decisions made by a *DNSP* in carrying out vegetation management activities. The *DNSP* shall endeavor to resolve any *Dispute* in accordance with the Section 3.11 of the *ENDGC.*

Notwithstanding the nature of the *Dispute* and the need to resolve the *Dispute* in an amicable manner, the responsibility of the *DNSP* to maintain the C*learance Space* at all times cannot be compromised.

7.5.15 Training

A *DNSP* shall ensure that any of his employees undertaking vegetation management in the vicinity of its power lines, and any contractors engaged to carry out vegetation management, are appropriately trained and competent for that task.

Such training should cover the following areas:

(a) plant and weed identification;

(b) management of vegetation waste;

(c) precautions to avoid spread of weeds and plant diseases; and

(d) safe working practices near power lines.

A *DNSP* shall seek advice from the relevant authorities as to appropriate training for vegetation management.

7.6 DISTRIBUTION ASSET REGISTER

*DNSP*s shall keep a register of all *Electrical Infrastructure* and other assets forming part of the *Distribution System*, which shall include:

(a) a physical description of each item of *Electrical Infrastructure* or other asset, including type, capacity, components, characteristics, and its location in the form of maps or site plans; and

(b) annual development, maintenance, refurbishment, rehabilitation, replacement, disposal plans including forecasts of anticipated capital expenditure

(c) Plans for management of critical spare parts

(d) targets for reduction of number of asset failures that affects reliability, reduction of accidents relating to safety and/or environment, introduction of better technologies, minimization of technical losses (targets for efficiency improvement), and minimization of costs.

(e) the value of each item of electrical infrastructure and other asset, calculated in accordance with accounting standards generally accepted in Ethiopia in the electric industry.

7.7 PUBLIC LIGHTING

A *DNSP*, in liaison with the relevant local authority, shall repair or replace an item of public lighting within seven (7) business days of being notified by any person that such repair or replacement is necessary.

Data and service performance indicator for street lighting shall include:

(a) Total number of existing street lights by type

(b) Total number not working at the beginning of the reporting period (with reasons for not working)

(c) Number and percentage to be repaired during the reporting period

7.8 OUTAGE SCHEDULE

Notwithstanding any approved outage plan, the *DNSP* shall not take any circuit/equipment out of service at any interconnection without specific release from the *Regional Control Centre* and/or the *ENTSO*. This shall however, not apply under the following circumstances:

(a) If the import or export at each *Connection Point* with the *Transmission Licensee* is not affected.

(b) If removal of any circuit from service becomes necessary under emergency conditions or disconnection for violation of the *Connection Agreement*. In all cases the *ENTSO* must be kept fully informed.

(c) Maintenance of the *Distribution System* may require outages that interrupt the supply to a *Distribution Network User* or group of *Distribution Network Users*. In such cases, the *DNSP* shall notify the affected *Distribution Network Users* at least seventy-two ([72) hours in advance. Longer notice periods may be agreed between a *Distribution Network User* and a *DNSP*. The notification should contain, as a minimum, a clear indication of the zone affected by the interruption, the interruption starting date, the expected duration, and the reason of the interruption, including the Plant or Equipment to be maintained.

If the above mentioned notification procedures are not fulfilled, the interruption produced to the affected *Distribution Network Users* should be classified and accounted as Unscheduled Interruption.

7.9 CONTINGENCY PLANNING

7.9.1 Types of Contingencies

A contingency in the *Distribution System* may arise in the event of Total or Partial System Blackout of the *Distribution System*. A Contingency may also affect a part of the *Distribution System* due to local breakdowns in the *Distribution System* itself or in the apparatus of the *Transmission Licensee* at the *Connection Point*. This section lays down procedures which the *DNSP* shall follow under such contingencies to quickly and efficiently restore and maintain power supply to its *Distribution Network Users*.

These Contingencies are classified as:

(a) System Blackout (Total or Partial).
(b) Failure of equipment at the transmission *Point of Connection*.
(c) *Distribution System* failure.

7.9.2 System Blackout

Total System Blackout is a situation when all generation in the electric power system has ceased with no electricity supply from External *Interconnections*.

Partial Blackout is a situation where all generation has ceased in a part of the power system and there are no available *Interconnections* to the other parts of the power system.

(a) In case of Total System Blackout or Partial Blackout at any point of interconnection, the *DNSP* shall abide by the established black start procedures.
(b) The *DNSP* shall be responsible for sectionalizing the Distribution System into discrete, unconnected blocks of Demand. The *DNSP* shall advise the *ENTSO* regarding the amount of MW likely to be picked up when switching on each block of Demand.
(c) The DNSP shall prepare a schedule of Essential and non-Essential loads in order of priority at each Connection Point to the Transmission System to be picked up during the restoration process. The schedule is to be approved by the *ENTSO* and forwarded to the *Regulatory Authority*. Such schedule shall be updated continually. The schedule shall conform to provisions of the *ENDGC* and *ENTGC*.
(d) The DNSP shall maintain direct communications links with the *Regional Control Centre* and/or the *ENTSO* throughout the restoration process until the System is restored to normal.
(e) To coordinate activities, Distribution Network Users and the DNSP will ensure that there are suitable communication paths available and that where appropriate senior members of staff are appointed to manage these abnormal situations. The DNSP shall furnish to the *Regional Control Centre* and/or the *ENTSO* the name and designation of person/persons, along with their telephone number/s and location, authorized to deal with any contingency operations. This list shall always be kept up to date.

7.9.3 System Recovery

The *DNSP* shall segregate its total Demand into suitably sized components to allow progressive re-energization of the *Distribution System* from black start *Generating Plants*. The size of the areas of Demand of these will be determined by the *ENTSO* and will be commensurate with the size of the *Generators* being re-started.

The overall strategy of recovery will be to re-establish stable Islands of Supply and Demand and to re-synchronize these islands progressively. *Generating Plants* connected to *Distribution System* will be required to operate under the *DNSP* directives, to enable the *DNSP* to comply with the *ENDGC* and *ENTGC* and license/concession obligations.

Where there are no *Generating Plants* with a Black Start capability within *the Distribution System*, the restoration of supply may be substantially delayed while the *ENTSO* re-establishes the Transmission System from a restored island or part of the power system. The *DNSP shall* re-appraise its priorities in these situations and restore supplies in accordance with the *ENDGC* and *ENTGC* and license/concession obligations.

7.9.4 Failure of Transmission System or Equipment

In all cases that failures exist on lines or equipment of the *Transmission Licensee* that cause, or may cause, an Incident in the *Distribution System*, the *DNSP* shall immediately contact the *ENTSO* and/or the person authorized for such purpose at the substations of the *Transmission Licensee* and assess the probable time period needed for restoration and/or probable restriction on load draw from the affected substation. The *DNSP* may exercise Demand Control as necessary.

7.9.5 Distribution System Failure

Where a part of the *Distribution System* to which a *Generating Plants* is connected becomes isolated from the *Distribution System*, the *DNSP* shall decide if it is desirable for that *Generating Plant* to continue operating.

Where no facilities exist for the subsequent resynchronization with the rest of the *Distribution System*, the *DNSP* shall issue an instruction to the *Generation Licensee* to disconnect its *Generating Plants* to enable the Island Grid to be reconnected to the rest of the *Distribution System*.

7.10 DEMAND CONTROL

7.10.1 Objective and Scope

The objective of this section is to establish procedures to enable the *DNSP*, following an instruction of *ENTSO*, to achieve a reduction in Demand in order to avoid a breakdown or overloading of any part of the *Distribution System* in a manner that does not unduly discriminate against or unduly prefer anyone or group of *Distribution Network Users*.

This section applies to the *DNSP* and to *Distribution Network Users*, which in this section means *Generation Licensees* with *Generating Plants* connected at the *Distribution System*, and *Distribution Network Users*.

7.10.2 Methods of Demand Control

The term "Demand Control" is used to describe any or all of these methods of achieving a Demand Reduction:

(a) Voluntary *Distribution Network User* Demand Management initiated by *DNSP*;

(b) Automatic under frequency load shedding;

(c) *Distribution Network User* Demand reduction including Voltage Reduction;

(d) Emergency manual deep load shedding of *Distribution Network User* Demand

When instructed by the *ENTSO*, temporary load shedding shall be carried out to maintain the load generation balance. This may also be necessary due to lack of generation, loss of any circuit, equipment or any other operational contingency.

Distribution Network User Demand may be disconnected automatically at selected locations in accordance with the requirements of the *ENDGC*, in the event of a sudden fall in frequency. Such an arrangement shall be carefully coordinated as part of an overall scheme and may take into account any operational requirements or essential load.

The *DNSP* shall estimate loads that may be shed in discrete blocks at each *Connection Point* to the Transmission System in consultation with the *Distribution Network Users* as required and submit the information to the *ENTSO*. The *Distribution Network Users* shall cooperate with the *DNSP* in this regard.

Automatic disconnection by under voltage relay may be used to discriminately disconnect load in order to maintain voltage within acceptable limits, in order to avoid widespread load shedding. Deliberate reduction of voltage may be used to achieve a temporary reduction in load Demand.

In the event of a sustained period of shortfall due to any constraint in the Transmission System and/or *Distribution System*, the planned rotational load shedding may be used to share the available power among affected *Distribution Network Users*.

In addition, *Generation Licensees* with *Generating Plants* connected to the *Distribution System* may wish to disconnect, automatically or manually, from the system to which it is connected at certain frequency levels. Any such disconnection shall be discussed with and agreed upon by the *DNSP* or the *ENTSO*, as required, in accordance with the *ENDGC*.

7.10.3 Implementation of Demand Control

Deliberate reduction in System frequency may also be used to achieve a temporary reduction in load Demand in accordance with the *ENDGC*. Emergency manual load shedding may be also carried out on the *Distribution System* if so instructed by the *ENTSO*.

Where Demand Control is exercised by the *DNSP* on instruction or request from the *ENTSO* in order to safeguard the System Security, then the *DNSP* is required to respond to these requests promptly but shall liaise with and inform other *Distribution Network Users* so far as is reasonable practicable.

Where Demand Control is exercised by the *DNSP*, either instructed by the *ENTSO* or in order to safeguard the *Distribution System*, the *DNSP* shall liaise with and inform *Distribution Network Users* accordingly as far as is reasonably practicable.

Detailed load shedding procedures shall be established by the *DNSP* and a detail procedure shall be furnished to the *ENTSO* and persons in charge of downstream substations of the *DNSP*, where such load shedding has to be carried out. Where automatic load shedding will be carried out using under frequency relays the circuits involved and the amount of load to be interrupted, complete with corresponding relay settings, shall be submitted to the *ENTSO* and persons in charge of downstream substations of the Licensee as necessary.

In the event of load shedding under the *DNSP*'s planned load shedding rotations, the public shall be promptly notified of such arrangements through the media or on a website. Large *Distribution Network Users* with contract Demands of [1 MW] and above shall also be notified by telephone. Essential services such as hospitals, public water works, etc. shall be exempt from being included in the planned load shedding blocks.

Once an automatic or manual disconnection, either due to low frequency or voltage problems, has taken place, it shall not be reconnected until the *DNSP* instructs to do so in accordance with the *ENDGC*. Each *DNSP* shall abide by the instructions of the *ENTSO* with regard to reconnection without delay.

All the Standards and Procedures related with the Load Shedding, including automatic load shedding, load shedding exemption policies, rotational load shedding and Distribution Network User's communications shall be contained and documented in a Distribution Load Shedding Plan. The *DNSP* shall permanently maintain and update this document, which should be submitted to the *Regulatory Authority* for revision and approval, if instructed to do so.

7.11 SAFETY COORDINATION

7.11.1Introduction

This section specifies the Safety Management System criteria to be applied by the *DNSP* and *Distribution Network Users* for the coordination, establishment and maintenance of necessary safety precautions when work or testing is to be carried out on plant and/or apparatus of the *DNSP* or a *Distribution Network User* and where isolation, earthing, and/or some other precautions of the other's System is needed. This section does not apply to the situation where safety precautions need to be agreed solely between *Distribution Network Users*. The requirements stipulated in this section are based on Part V of the *Energy Regulation*.

7.11.2 Scope

The scope of the Safety Coordination section includes regulations governing *DNSP's* works, earthing connections, electrical lines placed above ground, underground electrical lines, and supply to customer's installations. Additional safety rules may apply if deemed necessary by the *DNSP*.

7.11.3 DNSP's Works

This section specifies the Safety Management System criteria to be applied by the *DNSP*.

7.11.3.1 Sufficiency of DNSP's Works

(a) The electric supply lines and facilities of all *DNSPs* shall:

1. be of sufficient ratings for power, insulation from likely fault current and of sufficient mechanical strength for the duty which they may be required to perform under the environmental conditions of installation and operation; and

2. be constructed, installed, protected and maintained in such a manner as to prevent danger to humans, animals and property and to prevent interruption of supply so far as is reasonably practicable.

(b) When applicable, *DNSPs* shall conform to the requirements of *ENDGC* and *ENTGC* as applicable.

(c) When a *DNSP* supplies electricity to rural community, it shall comply with the rural networks mini-grid code requirements.

7.11.3.2 Enclosed Spaces

(a) The *DNSPs* shall take precautions to prevent, so far as is reasonably practicable, danger due to the influx of water or any noxious or explosive liquid or gas into any enclosed space containing its facilities

(b) When facilities may emit noxious or explosive liquid or gas the *DNSPs* shall ensure that there are adequate mitigation mechanisms and when work is required on the facility all doors shall be kept open

(c) When the facility in an enclosed space is protected by inert gas fire suppression the *DNSPs* shall ensure that whenever work takes place within the enclosed space the fire suppression is locked off

7.11.3.3 Rotating Equipment and Other Moving Parts

(a) The rotating equipment and equipment with other moving parts of all *DNSPs* shall be constructed, installed, protected and maintained in such a manner as to prevent danger to humans, animals and property

(b) When it becomes mandatory to undertake a work on such facilities adequate precautions must be taken to ensure that it is mechanically isolated including electrically isolating associated motors and the closing inlets of steam or water or other physical sources of danger

(c) Isolators and emergency switches shall be located adjacent to the machine and provided with removable handles or locks to avoid unauthorized machine starting

(d) During maintenance, means of motor starting from remote or other mechanical effects such as vibrations shall be disabled

7.11.3.4 Low, medium, High Voltages

(a) When electricity at low, medium or high voltage is generated, transformed, switched or controlled the *DNSPs* shall:

1. Enclose any part of a ground-mounted substation in the open air, containing live facility which is not encased, by a fence not less than 2.4m high to prevent, so far as is reasonably practicable, danger or unauthorised access; and

2. Ensure that, so far as is reasonably practicable, there are at all times displayed in a conspicuous position a danger notice in English, Amharic and the local language bearing a sign of a skull and crossbones and a notice giving the name of the *DNSPs* and an address or telephone number when a person appointed by the *DNSPs* shall be in constant attendance and such other signs as may be necessary to give warning of danger having regard, inter alia, to the sitting of, the nature of and the measures taken to ensure the physical security of the *DNSPs* ' works

(b) The provisions of item (a)2 of this sub-section shall not apply to any exposed live parts of *DNSPs s'* works which are held at least 4.3m above ground by a support, or any insulated electric line attached to that support

(c) The *DNSP* shall take all reasonable precautions to minimise the risk of fire

(d) At ground-mounted substations the *DNSPs* shall provide fire buckets filled with clean dry sand, fire extinguishers, emergency exit route and first aid boxes or cupboards. In addition, an adequate number of gas masks shall be kept conspicuously at accessible locations

(e) At ground-mounted substations, instructions in English, Amharic and the local language of the area, for the resuscitation of persons suffering from electric shock shall be affixed by the *DNSPs* in a conspicuous place

(f) In every manned high voltage generator station, substation or switch station, an artificial respirator shall be provided and kept in good working condition

(g) Copies of the instructions referred to in item (e) of this sub-section shall be supplied on demand by the *DNSPs* at a price to be fixed by directives issued by the Authority

(h) When the *DNSPs* equipment is exposed to damage from lightning, adequate means for diverting to earth any such electrical surges must be provided

7.11.3.5 Protective Measures

The *DNSPs* shall apply protective devices to every system which, so far as is reasonably practicable, prevent any current, including leakage to earth, from flowing in any part of a system for such a period that part of the system can no longer carry that current without danger

7.11.3.6 Precaution Measures

(a) The *DNSPs* shall make arrangements which ensure, so far as is reasonably practicable, that:

1. Every low voltage electric line shall be protected against danger arising from accidental contact with or leakage from any medium or high voltage electric line; and

2. Where voltage is transformed no danger shall be caused as a result of a system becoming charged above its normal voltage by leakage from or contact with the *DNSPs'* systems at the higher voltage

(b) The *DNSPs'* works shall be so arranged with fusible cut-outs or automatic switching devices so located as to restrict the number of customers affected by any fault in the *DNSPs* works'

(c) The *DNSPs* shall, at all times, take all practicable steps to avoid interruptions of supply resulting from its own acts

7.11.4 Inspection of DNSP's Works

(a) The *DNSPs* shall take all reasonable practicable steps for inspection on its installations and works to ensure compliance with this regulation

(b) A record of such inspections, including any recommendations arising therefrom, shall be maintained for a period of not less than 10 years

7.11.5 Earthing Connections

7.11.5.1 Continuity of the Supply Neutral Conductor and Earthing Connections

(a) The *DNSP* shall, in the design, construction, maintenance and operation of its system, take all reasonable precautions to ensure continuity of the supply neutral conductor

(b) No fuse or automatic switching device shall be inserted in any supply neutral conductor other than that required for the operation of switching devices, instruments, control or telemetering equipment

(c) When the *DNSP* is unable to provide *TNCS* systems the customer shall provide its own earthing system and for single phase both neutral and phase shall be disconnected

7.11.5.2 General Requirements with Earthing Connections

(a) The *DNSP*, in respect of its works, shall ensure that:

1. Every high voltage system shall be connected with the earth at or as near as is reasonably practicable to the source of voltage in the system, provided where there is more than one source of voltage in the system the connection to the earth need only be made at one such point

2. Every low voltage supply system shall be connected with earthing system as described in this subsection (items b and c below)

3. So far as is reasonably practicable, no system shall become disconnected from the earth in the event of fault

4. No conductor which connect a supply neutral conductor with the earth, and any facility used in a high voltage system with earth: shall be interconnected unless the combined resistance to earth does not exceed 1 ohm; or be connected to separate the earth electrodes unless any overlap between the resistance areas of those electrodes is not sufficient to cause danger, and

5. Where the medium or high voltage system is connected with the earth through a continuously rated arc suppression coil, an automatic warning shall be given to the *DNSP* of any fault which causes the arc suppression coil to operate

(b) The supply neutral conductor shall be connected with earth at or as near as is reasonably practicable to the source of voltage, and subject to sub-section 7.11.6.6 of this regulation no other such connection shall be made

(c) The external conductor of any electric line comprising concentric conductors shall be connected with the earth

7.11.5.3 Protective Multiple Earthing

(a) The *DNSP* shall not connect or permit the connection of, or continue, a supply to any part of a customer's installation where the supply neutral conductor is, or is intended to be used to connect any circuit protective conductor in that part of the customer's installation with earth unless s/he is satisfied, so far as is reasonably practicable, that:

1. The supply neutral conductor is connected with earth at a point no nearer to the source of voltage than the junction of the distributing main with the service line connecting it with the customer's installation which both uses the supply neutral conductor as its connection with earth and is the nearest such installation to the end of the distributing main;

2. The supply neutral conductor is connected with earth at such points as may be necessary to ensure that the resistance to earth of the supply neutral conductor: does not anywhere exceed 5 ohms; and is such that the fuses or automatic switching devices protecting the high voltage side of any transformer will operate if any fault in it causes the low voltage side to become charged at a higher voltage unless the high voltage side of the transformer is connected with earth through a continuously rated arc suppression coil; and

3. The supply neutral conductor has a copper equivalent cross-sectional area of: in the case of three phase four wire, two phase three wire or single phase three wire distributing main, when measured anywhere, not less than one half the copper equivalent cross-sectional area of the phase conductor at the same point, except where harmonic content is greater than 10%; or in the case of a single phase two wire distributing main, when measured anywhere, not less than the copper-equivalent cross-sectional area of the phase conductor at the same point

(b) Any connection with earth as required by the E*NDGC* may be made by connecting the supply neutral conductor of another distributing main

(c) Any metalwork on the customer's premises which

1. Is in, or may reasonably be expected to come into electrical contact with earth; and

2. Is so situated such that any person, livestock or domestic animal could simultaneously touch: any such metalwork, or any metalwork in electrical contact therewith; and any exposed metalwork forming part of the customer's installation but not normally carrying an electric current, or any metalwork in electrical contact therewith shall be connected to the earthing terminal

(d) The minimum copper equivalent cross-sectional area of any bonding conductor mentioned in item (c) above shall not be less than:

1. For copper equivalent cross-sectional area of supply neutral conductor of 35 mm2 or less the minimum copper equivalent cross-sectional area of bonding conductor shall be 10 mm2
2. For copper equivalent cross-sectional area of supply neutral conductor of over 35 but not more than 50 mm^2 the minimum copper equivalent cross-sectional area of bonding conductor shall be 16 mm^2
3. For copper equivalent cross-sectional area of supply neutral conductor of over 50 but not more than 95 mm^2 the minimum copper equivalent cross-sectional area of bonding conductor shall be 25 mm^2
4. For copper equivalent cross-sectional area of supply neutral conductor of over 95 but not more than 150 mm^2 the minimum copper equivalent cross-sectional area of bonding conductor shall be 35 mm^2, and
5. For copper equivalent cross-sectional area of supply neutral conductor of over 150 mm^2 the minimum copper equivalent cross-sectional area of bonding conductor shall be 50 mm^2

(e) Where the bonding conductor is attached to a pipe or metalwork entering a building that connection shall be made as close to the point of entry as is reasonably practicable for the purpose of avoiding the risk of electric shock

7.11.5.4 Earthing of Metalwork

(a) Subject to item (b) below, any metalwork enclosing, supporting or otherwise associated with a *DNSP's* works and which is not intended to serve as a phase conductor shall, where necessary to prevent danger, be connected with earthing system.

(b) Item (a) of this of this sub-section shall not apply:

1. To any metalwork attached to, or forming part of, a wooden or non-electrically conducting support the design and construction of which are such as to prevent, so far as is reasonably practicable, danger within 3m of the ground from failure of insulation; or

2. To any wall-mounted metal bracket carrying an overhead line not connected with the earth where the line is both supported by an insulator and the part of the line in contact with the insulator is itself surrounded by insulation

7.11.6 Electrical Lines placed above Ground

7.11.6.1 Restrictions on Placing Electrical Lines above Ground

(a) No *DNSP* shall use any electric lines, wires, cables or supports above ground which do not comply with this part of the regulations

(b) The provision of item (a) of this sub-section shall not apply for those in a generating station or substation or forming part of a customer's installation

7.11.6.2 Minimum Height of Overhead Lines

(a) Subject to item (c) of this sub-section, the height above ground of any overhead line, or a wire or cable attached to a support carrying any overhead line, at the maximum likely temperature of that line, shall not be less than that specified in this sub-section

(b) No conductor of an overhead line erected and accessible to pedestrians, urban areas and road/rail crossing, telecommunication lines and power lines of low voltage up to 1kv shall, at any part thereof, be at a height less than:

1. for 0.4kv: for pedestrians 5m, for urban areas and road/rail crossing 6m, for telecommunication lines 0.5m, for low voltage up to 1kv power lines 1.0m
2. for 15kv and 33kv: for pedestrians 6m, for urban areas and road/rail crossing 7m, for telecommunication lines 2.5m, for low voltage up to 1kv power lines 2.5m
3. for exceeding 33kv but not exceeding 66kv: for pedestrians 6.5m, for urban areas and road/rail crossing 7.5m, for telecommunication lines 2.5m, for low voltage up to 1kv power lines 2.5m
4. for 66kv: for pedestrians 6.5m, for urban areas and road/rail crossing 8m, for telecommunication lines 2.5m, for low voltage up to 1kv power lines 2.5m

(c) The values stated under item (b1-b8) above shall apply for 2600 metres altitudes above sea level; provided, however, that appropriate corrective factors for other altitudes and the proper implementation thereto shall be determined through directives to be issued by the Authority.

(d) This sub-section does not apply to any overhead line at a point where it is not over a road accessible to vehicular traffic and which is:

1. Surrounded by insulation; or
2. Not surrounded by insulation and at least 4.3 metres above ground and connects apparatus mounted on a support to any overhead line; or
3. Is connected with the earth.

(e) The growing of trees under overhead lines shall not be allowed.

7.11.6.3 Clearance from Building, Trees, and Structures

(a) Every overhead line shall be so placed that it shall not, so far as is reasonably practicable, come so close to any building, tree or structure, as to cause danger

(b) The Authority may issue directives for the proper implementation of the provision of item (a) in the sub-section as above

7.11.6.4 Position, Insulation and Protection of Electric Lines

(a) For the purpose of this sub-section an electric line placed above ground which is connected to any source of voltage shall be considered to be ordinarily reached by hand from any scaffolding, ladder or other construction erected or placed on, in, against or near to a building or structure, but shall not be considered to be so accessible during such reasonable period during or after erection or placing as may be necessary to arrange for the protection of that line if that was the purpose, or part of the purpose, of the erection or placing.

(b) Any part of an electric line placed above ground which is not connected with earth and which is ordinarily accessible shall be:

1. De-energized
2. So insulated that it is protected, so far as is reasonably practicable, against mechanical damage or interference; or
3. Adequately protected to prevent danger

(c) Nothing in this sub-section shall require the *DNSP* to insulate or protect any part of any electric line placed above ground which, but for the provisions of item (a) of this sub-section, would not be required to be insulated or protected, unless:

1. It has been given reasonable notice of the erection of the building or structure which would cause that line to become accessible; and

2. Unless otherwise agreed, the person responsible for the erection of that building or structure which would cause that line to become accessible shall have paid, or undertaken to pay, the reasonable cost of the insulation of the line

(d) Nothing in this sub-section shall be taken to allow the application of temporary insulation to any electric line other than a low voltage line.

7.11.6.5 Precautions against Access

(a) Every support carrying a medium or high voltage overhead line shall, if the circumstances reasonably require, be fitted with devices to prevent, so far as is reasonably practicable, any unauthorised person from reaching a position at which any such line would be a source of danger.

(b) The *DNSP* shall attach and keep attached a danger notice in English, Amharic and the local language of the area depicting a skull and cross-bones to supports carrying high voltage overhead lines and placed in such positions as are necessary to give due warning of danger in all the circumstances

7.11.6.6 Insulators in Stay Wires

Every stay wire which forms part of or is attached to any non-electrically conducting support carrying a bare live electric line shall be fitted with an insulator no part of which shall be less than 3 meters above ground or above the normal height of any such line attached to that support

7.11.6.7 Unused Overhead Lines

Where an overhead line ceases to be used as an electrical supply line, the *DNSP* shall maintain it in a safe mechanical condition or remove it

7.11.7 Underground Electrical Lines

7.11.7.1 General Restrictions

(a) No *DNSP* shall supply electricity through underground lines which do not comply with this section

(b) The provision of item (a) of this sub-section shall not apply for those in a generating station or substation or forming part of a customer's installation

7.11.7.2 Protective Screens

(a) Conductors which are placed underground and are not connected with earth shall be insulated from earth

(b) The protection referred to in item (a) of this sub-section shall comprise in respect of:

1. Joints or terminations of a conductor in a low voltage system, some form of mechanical protection; and

2. Any other part of a conductor, an electrically continuous metallic screen connected with the earth, so placed as to ensure that, so far as is reasonably practicable, any tool or device likely to be used in the vicinity shall make contact with that protection or screen before it can make contact with the conductor

(c) A supply neutral conductor may be combined in a single device or arrangement with either or both of:

1. A metallic screen or armouring

2. Other protective material

7.11.7.3 Installation of Underground Cables

(a) Every underground cable shall be placed at such depth as to avoid, so far as is reasonably practicable, any damage or danger by reason of such uses of the land which can reasonably be expected when the cable is placed underground

(b) The details of installation of underground cable shall be prescribed by directives to be issued hereunder by the Authority

(c) In addition to satisfying the requirements of Article (a) DNSP shall ensure, so far as is reasonably practicable, that conductors below ground used in a DNSP's medium or high voltage system but not connected with earth be laid in such a manner (whether in pipes or ducts or so overlaid at such a distance above the conductor by protective tiles or warning tape or some other protective or warning device or otherwise) that any person excavating the ground above the conductor will receive a warning of its presence

7.11.7.4 Underground Map of *DNSP*'s Works

(a) This sub-section applies in respect of *DNSP*'s works placed below ground other than works placed in land under the control of the *DNSP*

(b) Any *DNSP* shall make, so far as is reasonably practicable, and keep up to date a map or series of maps indicating the position and depth below surface level of all its works

(c) On request by any person who can show reasonable cause for requiring to inspect any part of the map the *DNSP* shall provide a copy of the relevant part of the map

(d) Nothing in this sub-section shall require the inclusion on a map prepared for the purposes of item (b) of this sub-section of information relating to the position and depth below surface level of *DNSP*'s works which were placed underground before the coming into force of this regulation where it would not be reasonably practicable to obtain such information

7.11.8 Supply to customer's installations

7.11.8.1 *DNSP*'s Works on Customer Premises

(a) The *DNSP* shall ensure that all its works on a customer's premises which are not under the control of the customer are:

1. Suitable for their respective purposes
2. Installed and maintained so as to prevent danger, and
3. Protected by a suitable fusible cut-out or automatic switching device as close as reasonably practicable to the supply terminals

(b) The standard of construction and installation to be adopted in complying with item (a) of this sub-section shall be no lower that imposed by sub-section 7.11.7.2 of the *ENDGC*

(c) Every cut-out or automatic switching device mentioned in item (a)3 of this sub-section on premises not under *DNSP*'s control shall be enclosed in a locked or sealed panel

(d) Any electric line which forms part of a *DNSP's* works and which is taken into a building at a point below the level of the ground shall be so installed as to prevent the influx of any noxious or explosive liquid or gas at the point of entry

(e) The *DNSP* shall mark permanently the separate conductors of electric lines connected to supply terminals as close as practicable to those terminals to show the phase of each conductor including neutral and earth conductors and, where appropriate, phase rotation.

(f) The customer shall take precautions for the safe custody of the equipment in its premises belonging to the *DNSP*

7.11.8.2 Provision of Earthing Terminal

(a) The *DNSP* shall provide an earthing terminal for use by the customer for *TNS* or *TNCS* supply systems

(b) In *TT* systems the customer shall provide his/her own earthing means

7.11.8.3 General Conditions for Customers

(a) No *DNSP* shall be compelled to commence or to continue to give a supply to any customer unless he is reasonably satisfied that each part of the customer's installation is so constructed, installed and used, so far as is reasonably practicable, as to prevent danger and not to cause undue interference with *DNSPs'* systems or with the supply to others

(b) Any customer's installation which complies with the provisions of building electrical installation code shall be deemed to comply with the requirements of this sub-section as to safety

7.11.8.4 Discontinuance of Supply in Certain Circumstances

(a) Where a *DNSP*, after making such examination as the circumstances permit, has reasonable grounds for supposing that a customer's installation or any part of it, including any *DNSP*'s works situated in the customer's side of the supply terminals, fails to fulfill any relevant requirement of items (b) to (g) of this sub-section shall apply

(b) Where, in an emergency, the *DNSP*is satisfied that immediate action is justified in the interest of safety, he may, without prior notice, discontinue the supply to the customer's installation and notice in writing of the disconnection and the reasons for it shall be given to the customer as soon as practicable

(c) Subject to item (c) 2 below, the *DNSP* may, by notice in writing specifying the grounds, require the customer within such reasonable time as the notice shall specify to comply with one or both of the following:

1. to permit a person duly authorised by the *DNSP* in writing to inspect and test the customer's installation or any part of it at a reasonable time

2. to take, or desist from, such action as may be necessary to correct or avoid undue interference with *DNSP*'s supplies or apparatus or with supplies to, or apparatus of, other customers

(d) In any of the circumstances specified in item (e) of this sub-section the *DNSP* may, on the expiry of the period specified in the notice referred to in item (c) of this sub-section,

discontinue the supply to the customer's installation and shall give immediate notice in writing to the customer of the discontinuance

(e) The circumstances referred to in item (d) of this sub-section are that:

1. After service of the notice under item (c) 1 of this sub-section, the customer does not allow into the facilities for inspection or testing

2. In any other case after such a test or inspection the person authorised makes a report confirming that the customer's installation (or any part of it) fails to fulfill any relevant requirement of this subsection in *ENDGC*, or

3. The customer fails to show to the reasonable satisfaction of the licensee within the period so required that the matter complained of has been remedied or is the responsibility of the *DNSP*

(f) Any difference between the customer and the *DNSP* in relation to the grounds or the period specified in any notice of the kind mentioned in item (c) 2 of this sub-section shall be determined by the *Regulatory Authority*

(g) The *DNSP* shall not discontinue the supply in pursuance of item (d) of this sub-section pending the determination of any difference of the kind mentioned in item (f) of this sub-section and shall not discontinue the supply to the whole of the customer's installation where it is reasonable to disconnect only a portion of that installation in respect of which complaint is made

(h) Where in pursuance of this sub-section a *DNSP* has disconnected the supply to a customer's installation (or any part of it) the licensee shall not recommence the supply unless:

1. He is satisfied in respect of the customer's installation that the relevant requirements of this sub-section have been fulfilled; or

2. It has been determined by the *Regulatory Authority* that the *DNSP* is not entitled under this sub-section to decline to recommence the supply

7.11.8.5 DNSP to Provide Continuous Electric Supply

(a) From the time when any *DNSP* begins to supply it shall, unless otherwise agreed with the customer, maintain the supply provided that:

1. For the purposes of testing or for any other purpose connected with the discharge of *DNSP*' functions, or

2. In the case of accident or force majeure or a shortage of generation leading to load shedding affecting or liable to affect the proper maintenance of the supply

(b) The supply may be discontinued by the *DNSP* for such period as may be necessary but no longer, subject to not less than 48 hours' notice being given by the *DNSP* to all customers likely to be affected by the discontinuance; provided, however, that the *DNSP* may not be obliged to provide 48 hours' notice in case of accident, force majeure or load shedding as a result of a shortage of generation

7.11.8.6 Electricity Consumption

(a) The *DNSP* shall install electricity consumption meter that meet all requirements regarding metering performance and accuracy set in the national standard or in its absence IEC standard or equivalent

(b) Electricity consumption meters shall be calibrated according to the appropriate load accuracy prior to their installation in customers' premises and recalibrated every five (5) years thereafter

(c) The *DNSP* shall allow customers to choose between prepaid and post-paid meter before such installations, and shall install electricity consumption meter that meet all requirements regarding metering performance and accuracy set in the national standard or in its absence IEC standard or equivalent

7.11.8.7 Prohibitions

No electrical installation work including additions, alterations, repairs and adjustments to existing installations, except such replacement of lamps, fuses, fans, switches, low voltage domestic appliances and fittings as in no way alter its capacity or character, shall be carried out in the premises of the customer except by certified person

7.11.9 Electric Power Industry Safety Code

A *DNSP* and *Distribution Network Users* shall, in respect of *Electrical Infrastructure* installed into the *Distribution System* or any replacement or modification of existing electrical infrastructure on or after the commencement date, comply with the Electric Power Industry Safety Code.

If the provisions of the *ENDGC* are inconsistent with a provision of the Electric Power Industry Safety Code, the provision of the *Electric Power Industry Safety Code* is to prevail to the extent of the inconsistency.

7.11.10 Operational Safety

7.11.10.1 Approved Safety Management Systems

In order to address the need for a Safety Management System specifying the principles and procedures to be applied at Operational Boundaries to ensure the health and safety of all who are liable to be working or testing on the *Distribution System* or on Plant and Apparatus connected to it, will be established by the *DNSP* and Distribution Network Users. For interfaces involving *MV* and *HV* systems, this shall include the provision for Control Person(s), a system of documentation and the establishment of Safety Precautions.

Safety Management System must include the provision for written authorization of personnel concerned with the control, Operation, work or testing of Plant and Apparatus forming part of, or connected to, the *Distribution System*. Each individual Authorization shall indicate the class of Operation and/or work permitted and the section of the System to which the authorization applies.

The *DNSP* and every *Distribution Network User* shall at all times have nominated a person or persons to be responsible for the co-ordination of safety pursuant to this *ENDGC*, those persons being referred to in the *ENDGC* as Control Persons. (Under the conditions of the *DNSP*'s Safety Rules a Control Person may either be at the *DNSP*'s *Regional Control Centre* and/or the *ENTSO* or be a person authorized who is at the site or location of the *Connection Point*).

7.11.10.2 Procedures

The *DNSP* and a *Distribution Network User* relating to the place where Safety Precautions are required to contact each other to coordinate the Safety Precautions and the persons responsible to assure the precautions are followed and to ensure that only one person is responsible for any item of Plant and Apparatus at any one time. The operational procedures shall be in accordance with the Safety Management System agreed between the *DNSP* and the *Distribution Network User(s).*

7.11.10.3 System of Documentation

A system of documentation shall be maintained by the *DNSP* and the appropriate *Distribution Network Users* which will record the inter-system Safety Precautions taken when:

(a) Work and/or testing are to be carried out on *MV* Plant and/or Apparatus across the *Connection Point*.

(b) Isolation and/or earthing of the other's System are required.

Where relevant, copies of the Safety Management Systems and related documentation shall be exchanged between the *DNSP* and *Distribution Network Users* prior to performing work at a *Connection Point*.

The *DNSP* and *Distribution Network Users* shall maintain a suitable system of documentation which records all relevant operational events that have taken place on the *Distribution System* or any other System connected to it and the co-ordination of relevant Safety Precautions for work.

All documentation relevant to the Operation of the *Distribution System*, and Safety Precautions taken for work or tests, shall be held by the *DNSP* and the appropriate *Distribution Network User* for a period of not less than one year.

7.11.10.4 Safety Precautions

The establishment of Safety Precautions shall include:

(a) The isolation from the remainder of the System of Plant and/or Apparatus, including from Low Voltage back feeds, either by an Isolating Device in the isolating position and immobilized and locked or by other means of rendering the Plant or Apparatus Isolated, and/or

(b) The earthing by way of providing a connection between a conductor and earth by using an earthing device which is applied and where reasonably practicable, immobilized and locked, the extent of the Safety Precautions required being determined pursuant to the *ENDGC*.

(c) Safety equipment for wind and solar turbines shall include: (i) Manual disconnect switches; (ii) Grounding systems; (iii) Shutoff devices. IEC 61400-24:2010 shall be followed for grounding of wind turbine generators. IEC 61730 shall be followed for PV modules.

7.11.11 Environmental Safety

Site Safety and Security Arrangements shall be made by the *DNSP* and *Distribution Network Users* to ensure site safety and security.

Suitable arrangements shall be agreed between the *DNSP* and the relevant *Distribution Network Users* to provide free and unrestricted access to the *DNSP*'s Plant and Apparatus at substations or similar by the *DNSP*'s personnel or their designated representatives at all times.

Site Specific Hazards; Suitable arrangements shall be made by the *DNSP* and/or the relevant *Distribution Network Users* to ensure that personnel are warned by an appropriate means of hazards specific to any site, before entering any area of the site. This shall include hazards that may be temporary or permanent. Where these risks include contamination or similar, suitable decontamination facilities and procedures shall be provided.

7.12 Security of Distribution Systems

7.12.1 Proclamation on Energy

The Energy Proclamation Part Seven (7) imposes penalty for an act of:

(a) Working without having license – up to 10 years of imprisonment/up to Birr 50,000 fine, or, both, with working equipment/appliance forfeited.

(b) Failing to comply with the requirements/conditions/obligations of Certificate of Competency – up to 3 years of imprisonment/ up to Birr 15,000 fine, or, both.

(c) Damaging Generation/Transmission/Distribution facility –5 to 15 years of rigorous imprisonment/ up to Birr 50,000 fine, or, both.

(d) Obstructing an inspector of the Authority – up to 5 years' imprisonment/up to Birr 25,000 fine, or, both.

(e) Abstracting electrical energy through unlawful connection – up to 5 years of imprisonment/Birr 20,000 fine, or, both.

7.12.2 Electric Facility Theft and Vandalism Deterrent Program

In order to reduce the risk of serious injury, system interruptions and commercial losses that occur on the *ENDS*, the *DNSP* shall develop and implement an Electric Facility Theft and Vandalism Deterrent Program that establishes plans and procedures for the ongoing monitoring and enforcement with a goal of reducing the losses suffered by these illegal practices.

7.12.2.1 Performance Measures

The effectiveness of the Deterrent Program will be measured through the *Distribution System* Losses Performance Indicator described in Annex A Supply Losses and System Performance Indicators of this *ENDGC*.

7.12.2.2 Reporting Requirements

The *DNSPs* will submit a report to the *Regulatory Authority* annually describing the plans and procedures implemented in the previous year and the results of those efforts. This will include the following metrics:

(a) Number of Interruptions Caused by Theft or Vandalism of Electric Distribution Facilities;

(b) Percentage of Commercial Losses

7.13 OPERATIONAL LIAISON

7.13.1 Introduction

This section sets out the requirements for the exchange of information in relation to Operations and/or Incidents on the *Distribution System* or the system of any *Distribution Network User* connected to the *Distribution System* which have had or may have an operational effect on the Distribution System or the system of any other *Distribution Network User*.

This Section applies to the *DNSP* and to *Distribution Network Users*, which in this Section means:

(a) Any other *DNSP* connected to the *Distribution System*

(b) Medium and High Voltage *Distribution Network Users*

(c) *Generators* connected to Distribution at LV and rated above 50kW.

7.13.2 Procedures

The *DNSP* and each Large *Distribution Network User* (greater than 2 MVA) and Essential Customers will identify contact individuals in the appropriate organizations and agree on communication channels to make effective the exchange of information required by this section. In order to ensure reliability and safety, the *DNSP* may request additional *Distribution Network Users*, meeting the criteria listed above (7.13.1), to do the same. Communication should, as far as practicable, be direct between the *Distribution Network User* and the *DNSP*.

Any communication from the *DNSP* and the *Distribution Network User* utilizing the agreed communication channels, including telephone communications, should be considered to be acknowledged by the *Distribution Network User*.

7.13.2.1 Contact List

A list of duly authorized personnel and their telephone numbers and full contact information shall be exchanged between the *DNSP* and the *Distribution Network User* so that control activities can be efficiently coordinated. The *DNSP* and the *Distribution Network User* shall maintain 24-hour availability for these duly authorized personnel when necessary.

In the case of an operation on the System of a *Distribution Network User* connected to the *Distribution System*, which will have or may have an operational effect on the *Distribution System*, the *Distribution Network User* will notify the *DNSP* in accordance with the procedures established in this section.

7.13.2.2 Notification

In the case of an operation on the *Distribution System* or on receipt of notification of an operation on the Transmission System which will have, or had, an operational effect on the *Distribution Network Users* connected to the *Distribution System*, the *DNSP* will notify the *Distribution Network Users*.

The following are examples of situations where, in as much as they may have or have had an effect on the Operation of the *Distribution System* or another System, notification will be required :

(a) The implementation of a scheduled outage of lines and/or equipment which has been arranged;

(b) The operation of any Circuit Breaker, Recloser or Sectionalizer or any sequence or combination of the two including any temporary overstressing, system parallels, or *Generating Plant* synchronizing; and

(c) Voltage and Demand control

7.13.3 Form of Notification

The notification will be of sufficient detail to enable the recipient of the notification reasonably to consider and assess the implications and consequences arising from the operation on the *Distribution System* and will include the name of the individual reporting the operation on behalf of the *DNSP*.

7.14 INFORMATION FLOW AND COORDINATION

7.14.1 Responsibility

The *DNSP* and *Distribution Network Users* shall jointly agree in writing, specifying the responsibilities for System Control of Equipment. These shall ensure that only one party is responsible for any item of Plant or Apparatus at any one time.

Pursuant to the Distribution Planning and Connection Chapters, site responsibility schedules specifying the responsibilities for ownership, operation and maintenance shall be jointly agreed by the *DNSP* and the appropriate *Distribution Network User(s)* for each site or location where a *Connection Point* or joint responsibility exists. This will include Operation Diagrams illustrating sufficient information for Control Persons to carry out their duties which shall be exchanged by the *DNSP* and the appropriate *Distribution Network User*.

A copy of the Site Responsibility Schedules and Operation Diagrams shall be retained by the *DNSP* and the appropriate *Distribution Network User(s)*. Site Responsibility Schedules and Operation Diagrams shall be maintained by the *DNSP* and the appropriate *Distribution Network User(s)* and exchanged as necessary to ensure that they reflect the current agreements.

7.14.2 Communications

Where the *DNSP* reasonably specifies the need, suitable communication systems shall be established between the *DNSP* and other *Distribution Network Users* to ensure the control function is carried out in a safe and secure manner. Where the *DNSP* reasonably decides a backup or alternative routing of communication is necessary to provide for the safe and secure operation of the *Distribution System* the means shall be agreed with the appropriate *Distribution Network Users*. Schedules of telephone numbers shall be exchanged by the *DNSP* and appropriate *Distribution Network User* to enable control activities to be efficiently coordinated.

The *DNSP* and appropriate *Distribution Network Users* will establish 24-hour availability of Authorised Personnel via established communications channels.

7.14.3 Outage Coordination

7.14.3.1 Distribution Network Users Connected at Medium and High Voltage

For those *Distribution Network Users* connected at Medium or High Voltage and where the *Distribution Network User* so requests to the *DNSP*, these schedules shall identify those circuits on which Planned Outages by the *DNSP* shall be notified to the Distribution Network User. These specified circuits will be those where the *DNSP* and the *Distribution Network User* have agreed that during outages of the specified circuits the *Distribution Network User* can introduce measures to manage critical processes or safety aspects. These specified circuits will usually have a significant effect on the security level of the *Distribution Network User's* supply.

7.14.3.2 All other Distribution Network Users

The *DNSP*s shall establish a comprehensive program for the notification and updating of the status of outages affecting *Customers*.

7.14.4 Significant Incident and Accident Reporting

7.14.4.1 Introduction

Where an Incident on the *Distribution System* has had a significant effect on the System, the Incident shall be reported in writing to the *DNSP* of the affected system. This incident will be termed a "Significant Incident". Information regarding the occurrence of Significant Incidents shall be reported to the *Regulatory Authority* in writing, in the form and manner prescribed, of any accident or incident causing loss of life, personal injury, major outages and loss of load, or any other accident or incident causing significant harm or damage to the environment or property.

This section sets out the requirements for reporting in writing those Incidents termed "Significant Incidents" which were initially reported verbally and those specified Incidents to be reported under the request of the *Regulatory Authority*. It also provides for the joint investigation of Significant Incidents by the *Distribution Network Users* involved.

7.14.4.2 Incident Reporting

When it has been determined that a Significant Incident has occurred, a written report will be given to the *DNSP* by the *Distribution Network User* in accordance with this section. The *DNSP* will not pass this report on to other affected *Distribution Network Users* but may use the information contained therein in preparing a report to a *Distribution Network User* in relation to a Significant Incident on the *Distribution System* which has been caused by (or exacerbated by) the Significant Incident on the *Distribution Network User* System.

A report will be in writing and shall contain written confirmation of the verbal notification given together with more details relating to the Significant Incident. The report should, at a minimum, contain the following information, which is not intended to be exhaustive:

(a) Date and time of Significant Incident;
(b) Location;
(c) Apparatus involved;
(d) Brief description of Significant Incident;
(e) Duration of incident;
(f) Estimated date and time of return to normal service, and
(g) Details of any Demand Control undertaken.

7.14.4.3 Joint Investigation of Significant Incidents

Where a Significant Incident has been declared and a report submitted, either party or parties may request in writing that a joint investigation be carried out.

The composition of such an investigation panel will be appropriate to the Incident to be investigated and agreed by all parties involved.

Where there has been a series of Significant Incidents (that is to say, where a Significant Incident has caused or exacerbated another Significant Incident) the parties involved may agree that the joint investigation should include some or all of those Significant Incidents.

A joint investigation will only take place where all parties affected by a Significant Incident agree to it. The form and rules of the procedure for, and all matters relating to the joint investigation will be agreed at the time of a joint investigation.

Any joint investigation occurs only when both parties agree. The joint investigation shall form part of any *Dispute* resolution procedure.

7.14.4.4 Report to the Regulatory Authority

The *DNSP* shall submit a written report to the *Regulatory Authority* detailing all the information, findings, and recommendations regarding the *Distribution System* Incident. The following minimum information shall be included in the written report following the joint investigation of the Significant Incident:

(a) Time and date of the Significant Incident;
(b) Location of the Significant Incident;
(c) Equipment directly involved and not merely affected by the Event;
(d) Description of the Significant Incident; and
(e) Demand (MW) and generation (MW) interrupted and the duration of the Interruption.

The *Regulatory Authority* shall have the right to request any information and explanations that it reasonably sees fit about any incident, significant incident or event.

7.15 GENERATING PLANTS CAPABILITY TESTS

7.15.1 Test Requirements

Tests shall be conducted on *Generating Plants* connected to the *Distribution System*, in accordance with procedures and standards specified by the *DNSP* (or the *Regional Control Centre* and/or the *ENTSO* where applicable), to confirm compliance with the *ENDGC* and *ENTGC* for the following:

(a) Capability of *Generating Plant* to operate within their registered Generation parameters;

(b) Capability of the *Generating Plant* to meet the applicable requirements of the *ENTGC* and *ENDGC*;

(c) Capability to deliver any *Ancillary Services* that the *Generation Licensee* has agreed to provide; and

(d) Availability of *Generating Plant* in accordance with their capability declaration.

All tests shall be recorded and witnessed by representatives of the *DNSP*, and the *Generation Licensee.*

The *Generation Licensee* shall demonstrate to the *DNSP* (or the *ENTSO* where applicable), the fitness for purpose and accuracy of the test instruments to be used in the test.

The *DNSP* (or the *ENTSO*, where applicable) may at any time issue instructions requiring tests to be carried out on any *Generating Plant* connected to the *Distribution System*. All tests shall be of sufficient duration and shall be conducted no more than twice a year except when there are reasonable grounds to justify further tests.

If a *Generating Plant* connected to the *Distribution System* fails the test, the *Generation Licensee* shall correct the deficiency within a period agreed with the *DNSP* (or the *ENTSO* where applicable) to attain the relevant registered parameters for that *Generating Plant*.

Once the *Generation Licensee* achieves the registered parameters that previously failed the test, it shall immediately notify the *DNSP* (or the *ENTSO* where applicable). The *DNSP* (or the *ENTSO* where applicable) shall then require the *Generation Licensee* to conduct a retest in order to demonstrate that the appropriate parameter has already been restored to its registered value.

If a *Dispute* arises relating to the failure of a *Generating Plant* to pass a given test, the *DNSP* (or the *ENTSO* where applicable), the *Generation Licensee*, and/or *Distribution Network User* shall seek to resolve the *Dispute* among them according to the provisions in Section 3.11 of the *ENDGC*.

7.15.2 Tests to be Performed

A *Generating Plant's* production of Reactive Power shall be subject to the agreement with the *DNSP* and *ENDGC* compliance (where applicable).

7.15.2.1 Reactive Power Test

The Reactive Power test shall demonstrate that the *Generating Plant* meets the registered Reactive Power Capability requirements specified in the *ENDGC*'s Performance Standards. The *Generating Plant* shall pass the test if the measured values are within ± five (5) percent of the capability as registered with the *ENTSO* (where applicable) and the *DNSP*.

7.15.2.2 Black Start Test

The Black Start test shall demonstrate that the *Generating Plant* with Black Start capability can implement a Black Start procedure, as specified in the *Connection Agreement*. To pass the test, the *Generating Plant* shall start on its own, synchronize and carry load without the need for external power supply.

7.15.2.3 Declared Data Capability Test

The Declared Data capability test shall demonstrate that the *Generating Plant* can be scheduled and dispatched in accordance with the Declared Data. To pass the test, the *Generating Plant* shall satisfy the ability to achieve the Declared Data.

7.15.2.4 Dispatch Accuracy Test

The Dispatch accuracy test shall demonstrate that the *Generating Plant* meets the relevant Generation Scheduling and Dispatch Parameters. The *Generating Plant* shall pass the test if:

(a) In the case of synchronization, the process is achieved within ± five (5) minutes of the registered synchronization time;

(b) In the case of synchronizing generation (if registered as a Generation Scheduling and Dispatch Parameters), the synchronizing generation achieved is within an error level equivalent to 2.5 percent (%) of Declared Net Capacity;

(c) In the case of meeting ramp rates, the actual ramp rate is within ± ten (10) percent (%) of the registered ramp rate;

(d) In the case of meeting Load reduction rates, the actual Load reduction rate is within ±10% of the registered Load reduction rate; and

(e) In the case of all other Generation Scheduling and Dispatch Parameters, values are within ±1.5 percent (%) of the declared values.

7.15.2.5 Ancillary Services Test

The *Ancillary Services* test, as specified by the *DNSP* or the *ENTSO* where applicable, shall demonstrate the services in terms of quantity, quality and operational requirements. *Generating Plants* providing *Ancillary Services* shall conduct the tests and the *DNSP* (or the *ENTSO where* applicable) shall have the right to witness the tests.

7.16 FACILITY AND EQUIPMENT IDENTIFICATION

7.16.1 Site and Equipment Identification Requirements

The *DNSP* shall develop and establish a standard System for Site and Equipment Identification to be used in identifying any Site or Equipment in all Electrical Diagrams, distribution operation instructions, notices, and other documents.

The identification for the Site shall include and be unique for each substation and switchyard where a *Connection Point* is located.

The identification for Equipment shall be unique for each transformer, distribution line, bus, circuit breaker, disconnect switch, grounding switch, *Capacitor Bank*, *Shunt Reactor*, lightning arrester, and other MV equipment at the *Connection Point*.

7.16.2 Site and Equipment Identification Label

The *DNSP* shall develop and establish a standard labeling nomenclature, which specifies the dimension, sizes of characters, and colures of labels, to identify the Sites and Equipment.

7.16.3 Signage and Labeling

The *DNSP* and the *Distribution Network User* shall be responsible for the provision and installation of a clear and unambiguous label showing the Site and Equipment Identification for their respective System.

8 METERING

8.1 PURPOSE AND SCOPE

8.1.1 Purpose

The purpose of this Distribution Metering Chapter is:

(a) To specify the technical and operational criteria, including the procedures to be complied with by the *DNSP* in carrying out its obligation to provide metering services to *Distribution Network User Customers* at each *Metering Point*.

(b) To specify the ownership of the *Metering Equipment* for the *Generation Licensee*.

8.1.2 Applicability

The Distribution Metering Chapter applies to the following:

(a) DNSP

(b) *Distribution Network Users* connected to or seeking connection to, the *Distribution System*.

(c) *Embedded Generating Plants* connected to the Distribution Network.

The *DNSP* shall:

(a) Own, install, verify, operate, maintain, inspect and replace all Metering Systems at Metering Points on the *Distribution System*, except Metering Systems situated at *Connection Points* to the Transmission System and at *Embedded Generators*.

(b) Ensure that each *Metering System* installed on its *Distribution System* meets the performance, functional and technical requirements set out in this Distribution Metering Code;

(c) Ensure that each *Metering System* installed on its *Distribution System* is certified where so required by the *Regulatory Authority*, is in working condition and has been tested for accuracy;

(d) Retrieve data from each *Metering System* installed on its *Distribution System* for the purposes of billing and settlement;

(e) Process data retrieved from each *Metering System* installed on its *Distribution System* for the purposes of billing and settlement; and

(f) Shall notify *the Regulatory Authority* of all *Metering Systems* where the *DNSP* cannot comply with the Distribution Metering requirements.

(g) Fully implement Net *Metering systems*, as appropriate.

The *Generation Licensee* shall:

(a) In accordance with Prudent Operating Practice, supply and install the *Main Metering equipment* and the *Check Metering*. The *Generating Plant* in conjunction with the *DNSP* also shall test and commission the *Main Metering equipment* and the *Check Metering*.

(b) Thereafter, the *Generating Plant* shall transfer to the *DNSP* as beneficial owner (and without any encumbrances) all rights, title and interest in the *Check Metering* equipment (together with all warranties and guarantees applicable thereto) and;

(c) Upon such transfer the *DNSP* shall own and maintain the Check Metering equipment while the *Generation Licensee* shall own and maintain the *Main Metering equipment*.

For the metering between transmission and distribution lines, the *TNSP* shall own and place the Main Meters on the outgoing lines on all HV substations. The *DNSP* shall own and place Check Meters on the distribution lines as close as possible to where the *DNSP* ownership begins. Each entity/owner of the respective meters shall be responsible for their meters and perform the role of the Transmission Metering Administrator (*TMA*). Each entity/owner shall be responsible for providing the other party with all information required to enable performance of its metering duties.

8.2 OBLIGATIONS

8.2.1 Installation and Replacement of Metering Equipment

The installation of *Metering Equipment* shall be in accordance with the technical requirements of the *DNSP*.

The *DNSP* may replace *Metering Equipment* for which it is responsible at any time after it has been installed, subject to the provisions of this *ENDGC*. The *DNSP* shall notify the *Distribution Network User* in advance of any replacement, unless that replacement is required due to a an urgent condition.

The *DNSP* shall:

(a) Assign a unique identifier to the *Metering System*, cross-referenced to the location of the Metering System

(b) Record the date of installation of the *Metering System*

(c) Record the functionality of the Meter and the unit of measurement used to measure energy flowing through the *Metering System* or Maximum Load, as it corresponds

(d) Record the identification of the ancillary equipment

(e) Record any site-specific loss adjustment factors to be applied

(f) Record redundancy details and sources of check metering data and identification of the meters designated as the main Meter and as the check Meter

(g) Record the initial Meter register reading

(h) Ensure that the metering data stored in the *Metering System* is retrieved and, where a meter is removed, shall ensure that a final Meter reading is obtained

(i) Maintain information on location of the Metering System

(j) Maintain a record of any malfunction of the Metering System including any test results and of repairs made to the Metering System

(k) Maintain documentation of Meter testing prior to installation

(l) Request, and make the information available for each Metering System to the Distribution Network User

(m) Request and make the information available for each Metering System to the Regulatory Authority

8.3 STANDARD METERING SYSTEMS

Each Metering Point shall be situated as close as is reasonably practicable to the relevant *Connection Point*.

Prior to the installation of any Meter or *Current Transformers* and *Voltage Transformers* that form part of a *Metering System*:

(a) Metering Equipment shall be Submitted by the *DNSP* to a laboratory for testing and certification, or received by the *DNSP* directly from a manufacturer with a test certificate endorsed by an independent laboratory

(b) Copies of all test certificates shall be retained by the DNSP for the Metering Equipment that is in service and for Metering Equipment that is no longer in use for a minimum period of six years. The DNSP shall produce these certificates upon notice from the Regulatory Authority

(c) No Metering Equipment shall be certified unless the DNSP has received the relevant test certificates from the relevant accredited laboratory or manufacturer

8.3.1 Standard Medium Voltage Metering Systems

(a) Shall contain a Meter or more than one Meter, each of which complies with the *ENDGC* Metering standards

(b) Shall record Active Energy (kWh)

(c) Shall record Reactive Energy (kvarh)

(d) Shall record Maximum Load in the cases the applicable tariffs specifies that, and

(e) Shall have metering Current Transformers and Voltage Transformers that are tested and certified

(f) The rated short-duration current rating shall not be less than 25kA for 3 seconds for MV Metering Points above 6.6kV, or 20kA for 3 seconds for MV Metering Points at 6.6kV and below

(g) For each circuit, metering Voltage Transformers of accuracy class 1.0 with 100/110 volts secondary voltage and 100VA burden per phase for star-star connection or 180VA burden per phase for 'V' connection shall be provided

8.3.2 Standard Low Voltage Metering Systems

(a) Shall contain a Meter or more than one Meter, each of which complies with the *ENDGC* Metering standards, being either 1-phase, 2-wire or 3-phase, 4-wire type of accuracy class 2.0 and metering *Current Transformers*, where applicable, of accuracy class 0.5 with 5 amperes secondary current and 5VA burden.;

(b) Shall record Active Energy (kWh);

(c) May record Reactive Energy (kvarh);

(d) Shall record Maximum Load in the cases the applicable tariffs specifies that;

(e) Shall contain, where necessary, metering *Current Transformers* provided by the *DNSP* that are tested and certified; and

(f) Shall contain a suitable facility (including all necessary pre-wiring), provided by the *DNSP*, in which to house the *Metering System*.

8.4 ALTERNATIVES TO STANDARD METERING SYSTEMS

Upon request of a *Distribution Network User*, the *DNSP* may arrange for a *Metering System* to install a *Check Meter*, or to contain features or equipment in addition to those specified in this Distribution Metering Chapter, provided that:

(a) The *Distribution Network User* agrees to pay the full costs of the additional features or equipment, including the costs of installation, operation, maintenance, repairs and replacement; and

(b) The additional features or equipment are compatible with the rest of the *Metering System* and do not lead to any degradation of the capability of the *Metering System* that would cause the *Metering System* to fail to meet any standards contained in the *ENDGC*.

8.5 FAULTY METERING EQUIPMENT

(a) A *Metering System* shall be considered faulty if it is determined that any part of that *Metering System* does not comply with *ENDGC* Metering standards.

(b) If a *Metering System* fault occurs, the *DNSP* shall repair or replace the *Metering System* as soon as is reasonably practicable and in any event within two (2) working days of the *DNSP* discovering that the fault exists.

(c) The *Distribution Network User* shall use Metering Equipment in a safe and prudent manner and shall take due care to avoid damage. The *Distribution Network User* shall notify the *DNSP* of any damage to the Metering Equipment, however caused.

(d) The *DNSP* shall ensure that suitable data is obtained or estimated for the period of time commencing when a Meter or Metering Equipment becomes faulty until the completion of the repair or replacement.

(e) The *DNSP* shall record all relevant Meter parameters for a replacement Meter in that Metering System.

8.6 TECHNICAL REQUIREMENTS AND ACCURACY OF METERS

(a) The DNSP shall ensure that the accuracy of each Meter in each Metering System is certified by an accredited Meter test laboratory and meets the applicable accuracy limits

(b) The limits of accuracy for the following classes of Meters shall be:

1. ± 0.2 percent (%) for class 0.2 S static watt-hour meters.
2. ± 0.5 percent (%) for class 0.5 S static watt-hour meters.
3. ± 0.5 percent (%) for class 0.5 watt-hour meters.
4. ± 1.0 percent (%) for class 1.0 watt-hour meters.
5. ± 2.0 percent (%) for class 2.0 watt-hour meters.

(c) In the event of non-compliance with the required standards, the DNSP shall ensure that the accuracy of any Meter in that Metering System is restored to comply with the accuracy standards as soon as is reasonably practicable

(d) The DNSP shall maintain certification records and test results relating to the accuracy class and compliance with the relevant standards for the particular type and model of Meter in that Metering System

(e) The DNSP shall maintain records of the information referred to in this section for each Metering System, either in use or no longer in use, for at least six years and shall produce these records when required by the *Regulatory Authority*

8.7 AUDIT AND INSTALLATION TESTS

The *DNSP* shall ensure that each *Metering System* is inspected according to the minimum frequencies specified:

(a) Medium Voltage : Once every year

(b) Low Voltage, including prepayment: Once every three (3) years

The *DNSP* may carry out periodic, random and unannounced inspection and or testing of any *Metering System* and associated data for the purpose of ascertaining whether the *Metering System* complies with the requirements of this *ENDGC*. The *Distribution Network User* may request the *DNSP* to carry out such inspection and or testing, provided that the *Distribution Network User* pays the cost, unless an error or malfunction not caused by the *Distribution Network User* is discovered. In addition, the *Regulatory Authority* may carry out its own unannounced inspection and or test, in which case the *Distribution Network User* shall grant access to the *Regulatory Authority*

The *DNSP* shall, as soon as practicable, make the results of any inspection and or tests conducted pursuant to this section available to the requesting party and to the *Distribution Network User* associated with the *Metering System*.

8.8 ACCESS TO METERING SYSTEMS

The *Distribution Network User* shall grant access to the *DNSP* to enable the *DNSP* to fulfill its obligations. This right of access is conditional upon:

(a) Where practicable, prior notice by the *DNSP*; and

(b) The production of identification by the *DNSP*'s staff or contractor.

Prior arrangement by the *DNSP* shall not be required in respect of routine Meter reading or periodic random and unannounced audits or when the *DNSP* is performing emergency metering repairs.

8.9 SECURITY OF METERING SYSTEMS

8.9.1 Statute Law Miscellaneous Amendment Bill

The Energy Proclamation Part twenty nine (29) imposes penalty that includes an act of:

(a) Tampering, permitting to be tampered, or disabling electrical meters installed by a licensee from recording electrical consumption or giving assistance thereof

(b) Using electrical energy where the quantity of the supply of electrical energy is not ascertained by meter , or using any electrical equipment or device other than what the individual has contracted to pay for, or using such electrical equipment or device at any other time than the time specified (and for which he has contracted to pay)

The Energy Proclamation stipulates that such offences shall be punished with up to five (5) years of rigorous imprisonment, or with a fine not exceeding Birr 25,000, or with both.

8.9.2 Meter Sealing

(a) Appropriate seals shall be applied to each Metering System. Seals shall be replaced following work requiring the removal of any seals. The DNSP shall have procedures for the control of seals and sealing pliers

(b) The DNSP shall, so far as is reasonably practicable, ensure that physical access to each Meter contained in each Metering System is protected by:

1. Sealing all associated links, circuits, data storage and data processing systems
2. Ensuring that the *Metering System* meets the requirements for the security of *Metering Systems*

8.9.3 Meter Data

The *DNSP* shall, so far as is reasonably practicable, maintain the security of the metering data stored in or obtained from each Metering System.

8.10 METER READING

The *DNSP* shall schedule a monthly reading for all manually read meters.

For kilowatt-hour meters, the *DNSP* shall verify at each Meter reading that the Meter identification number on the Meter matches the Meter identification number on the Meter reading schedule.

The *DNSP* shall record:

(a) The Meter identification number

(b) The Meter reading and read date at the beginning of the Meter reading period

(c) The Meter reading and read date at the end of the Meter reading period

(d) The cumulative Active Energy (kWh) recorded during the Meter reading period

(e) Where the *Distribution Network User* is billed for Reactive Energy, the cumulative Reactive Energy (kvarh) recorded during the Meter reading period

(f) Where the *Distribution Network User* is billed for maximum Active Power, the maximum Active Power recorded during the Meter reading period

(g) Where the *Distribution Network* User is billed for maximum Reactive Power, the maximum Reactive Power recorded during the Meter reading period, and

(h) Details of any Meter alarms that were recorded during the period (e.g., system outages, VT failure)

8.11 REMOTE METERING EQUIPMENT

The *DNSP* shall specify the type of equipment to be used for communication with remote meters.

The *DNSP* shall conduct such tests as it deems necessary to verify production or consumption recorded at each *Metering Point*.

8.12 DATA MANAGEMENT

The *DNSP* shall:

(a) Maintain a metering data registry that contains usage data for each *Distribution Network User* and data required for settlement purposes in respect of each *Metering System*;

(b) Validate metering data for each *Metering System*;

(c) Estimate usage when Meter readings are not available, inaccurate, or otherwise not suitable for settlement purposes;

(d) Apply adjustments to metering data to account for system losses and unaccounted for energy;

(e) Aggregate metering data for settlement and loss calculation purposes; and

(f) Use reasonable endeavors to maintain the security and confidentiality of the metering data.

8.13 DATA REGISTRATION

The *DNSP* shall establish and maintain a register that contains the following information for each Metering System:

(a) A unique identifier assigned by the *DNSP* to the *Metering System* cross-referenced to the location of the *Metering System* and cross referenced to the *Distribution Network User's* account

(b) The date of installation of the *Metering System*

(c) The functionality of the Meter and the unit of measurement used to measure Energy flowing through the Metering System (e.g., kWh meter, kvarh meter)

(d) Identification of the ancillary equipment

(e) Any site-specific adjustment factors to be applied, including a cross reference to the unique identifier specified in (a) above

(f) The existence of redundancy and sources of *Check Metering* data, where required by this Distribution Metering Code, and identification of the meters designated as the main Meter and as the check Meter

(g) Data for each Meter following completion of the validation and estimation procedures

(h) Billing data for each Meter following completion of adjustments for losses and unaccounted for energy, and

(i) The data covering a period of not less than twelve months which shall be immediately accessible in electronic form

8.14 DATA VALIDATION AND LOSS ADJUSTMENT FACTORS

The *DNSP* shall:

(a) Have in place data validation procedures and loss adjustment calculation methodologies

(b) Where necessary, determine site-specific loss adjustment factors for each *Metering System*

(c) Multiply each valid reading by the appropriate loss adjustment factor to produce loss adjusted production or consumption, and

(d) Shall maintain both unadjusted and loss-adjusted values in the metering data registry in respect of each *Metering System*

8.15 METERING DISPUTES

If the *DNSP* receives a complaint about the accuracy of metering data or the calculation of any substitute or estimated metering data from a *Distribution Network User*, the *DNSP* shall investigate the complaint. The investigation shall include a review of all available information, including any information supplied by the *Distribution Network User*. If the *DNSP* determines that there is an inaccuracy due to Meter error, malfunction or error in the metering data, the *DNSP* shall take appropriate steps to remedy the defect, including repair or replacement of equipment and adjustment of metering data. Appropriate adjustments shall also be made to the *Distribution Network User's* bill. In the event of a *Dispute*, the *Dispute* shall be settled using the procedure specified in Section 3.11 of the *ENDGC*.

9 PERFORMANCE STANDARDS

9.1 PURPOSE

These Distribution Performance Standards establish the rules, procedures, requirements and indicators for the technical and operational performance of the *ENDS* and for the commercial performance of the retail business.

9.2 APPLICABILITY

The Distribution Performance Standards apply to:

(a) *DNSP*;

(b) *Distribution Network Users* including *Customers.*

9.3 OBJECTIVES

The objectives of these Distribution Performance Standards are:

(a) To ensure the quality of electric power in the *Distribution System*;

(b) To ensure that the *Distribution System* will be operated in a safe and efficient manner and with a high degree of reliability

(c) To specify *Customer* Services for the protection of the *Customer*; and

(d) To ensure that the voltage at the Connection Point of a Customer or Distribution Network User is adequate for the normal operation of equipment and appliances.

9.4 CONFIDENTIALITY

Unless otherwise specifically stated in these Performance Standards, the *Regulatory Authority* shall be at liberty to publish the Performance Indicators and performance results of each *DNSP* or Licensee to whom this Performance Standards applies.

9.5 SUPPLY QUALITY STANDARDS

9.5.1 Rural and Urban Customers

Customers of the *DNSP* shall be classified either as Urban *Customers* or Rural *Customers*, according with the definition stated in the Glossary and Definitions.

The *DNSP* shall be responsible for maintaining a *Customer* Service Plan to achieve the service standard stated in the *Customer* Charter and Regulation and other service standards accepted by the *Regulatory Authority*. The *Customer* Service Plan shall include standards, indicators, and targets for measuring the distributor performance against those standards. The *Customer* Service Plan shall address: objectives, input, processes, and output of the service, service principle, and strategy.

The first *Customer* Service Plan shall be submitted after six month of completion of construction work in case of newly constructed distribution network, or, after six months of issuance of distribution license in case of already established distribution network. Re-submission of *Customer* Service Plan shall be done every year. The deadline for resubmission of the plan for the Ethiopian fiscal year following it shall be Ginbot thirty (30) of each year.

Specific items in the *Customer* Service Plan include:

1. Prompt addressing of commercial and non-commercial service problems
2. Capacity building for front line and support staff to improve information availability
3. Customer handling and service reaction
4. Encouraging customer feedback
5. Benchmarking to meet customer expectation most cost effective way
6. Innovative use of technology
7. Timely service delivery

9.5.1.1 Request for Rural Area Designation

The primary parameters for assessing Distribution Service requirement in rural areas will be characterized as: (i) estimated demand in kW; (ii) reliability of power supply; and (iii) quality of power supply. The defining rural *Customer* in a Distribution Network needs careful assessment because approach to demand estimation and quality standards for Rural *Customers* could have significant impact on cost of service.

When a *DNSP* considers that due to topological reasons and/or scattering of population on a specific town or village although with more than three thousand five hundred (3,500) *Customers*, the town or village may be considered to be a rural area. If so proposed, the issue shall be brought to the *Regulatory Authority*, together with adequate supporting documentation, including maps or drawings as considered suitable, requesting authorization to consider these *Customers* as Rural *Customers*.

The *Regulatory Authority* will evaluate the submitted documentation, conduct independent analysis or studies that can include meetings or hearings with the involved *Customers* and/or representative institutions. Based on these analyses or studies, the *Regulatory Authority* may grant an authorization for this specific town or village, or part of town or village to be considered as rural, and the *Customers* located in that zone to be considered as Rural *Customers*.

9.5.2 Types of Interruptions

Supply quality will be expressed as a function of the Interruptions to *Customers* and will be evaluated using indicators that measure the number of Interruptions and their duration.

Interruptions will be classified according to the affected *Customer* as Interruptions to *Rural Customers*; and Interruptions to *Urban Customers.*

For *Rural* and *Urban Customers*, Interruptions will be further classified by: Scheduled Interruptions; Unscheduled Interruptions; External Supply Interruptions, both scheduled and unscheduled and Third Party Interruptions.

9.5.3 Interruption Register Requirements

The *DNSP* is obliged to have a detailed chronological register of all Interruptions that impact their *Customers*, with clear identification of start and end date and time. The information in this register shall be maintained by the *DNSP* for at least a five year calendar cycle.

9.5.3.1 Interruption Start Time

An Interruption or Outage start time shall be calculated as:

(a) For a Scheduled Interruption or Planned Outage: the time that the first impacted *Customer's* power is interrupted;

(b) For an Unscheduled Interruption , whichever of the following occurs first:
   1. The time the *SCADA* system detects and reports an operation that drops load; or
   2. The time when the first Customer call was received to report the outage to the *DNSP*; or
   3. The time the *DNSP* has knowledge of the situation by any other means. An interruption begins when supply is lost, not when it is reported. When there is no automatic recording of the duration of an interruption, the best estimate is to be used.

9.5.3.2 Interruption Ending Time

In the register, the ending date and time of an Interruption shall be the time when service was restored to the *Customer(s).*

9.5.3.3 Interruption Time Uniformity

The *DNSP* shall implement a system and procedures to ensure time uniformity among all the offices and locations that are involved in assigning times to the Interruptions.

9.5.3.4 Customer Outage Notification

To ensure adequate timing of Customer complaints upon an Interruption, the *DNSP* shall assure the availability of sufficient telephone lines and operators to attend *Customers'* incoming calls.

9.5.3.5 Special Cases

The *DNSP* shall not consider the following Interruptions for the calculation of *Distribution System* Service Quality indicators:

(a) Force Majeure Interruptions

(b) Interruptions due to authorized disconnection of a *Customer* due to non-payment

(c) Interruptions due to disconnection for illegal diversion of electricity or meter tampering

9.5.3.6 Performance Indicator Calculation

For the calculation of the supply quality Performance Indicators:

(a) Emergency maintenance Interruptions shall be considered Unscheduled Interruptions

(b) When, due to protection malfunctioning, a fault in a facility owned by a *DNSP* is not correctly cleared by equipment under the responsibility of the *Transmission Licensee* or of another *DNSP*, all Interruptions to Customers of the *DNSP* in excess of those strictly necessary will be classified as External Interruptions

(c) The Interruptions affecting a *Customer* whose facilities are the source of the event will not be considered for the calculation of supply quality of such *Customer*. When such Interruption also causes an Interruption to another *Customer*, the Interruption to the other *Customers* will be classified as Unscheduled Interruption for the calculation of Performance Indicators

9.5.4 Performance Indicators

The same type of Performance Indicators will be applicable to all *DNSPs*.

9.5.5 Supply Quality Performance Indicator Types

Supply quality of each *DNSP* will be assessed through two types of Performance Indicators:

(a) *Customer* Performance Indicators

(b) System Performance Indicators

9.5.5.1 Customer Performance Indicators

The *Customer* Performance Indicators to measure supply quality of individual *Customers* will be:

(a) Total and average number of Planned Interruptions per month

(b) Total and average number of Unplanned Interruptions per month

(c) Total and average number of Momentary Interruptions per month

(d) Total and average duration of Planned Interruptions per month

(e) Total and average duration of Unplanned Interruptions per month

(f) Customer Average Interruption Duration Index (*CAIDI*): Average *Customer* minutes of interruption per *Customer* interrupted per month.

(g) Customer Average Interruption Frequency Index (*CAIFI*): Average number of interruptions per *Customer* interrupted per month.

(h) Total duration of External Interruptions per calendar year

9.5.5.2 System Performance Indicators

The Overall Performance Indicators to measure average supply quality of a *DNSP* are generally the following, per IEEE Standard 1366:

(a) System Average Interruption Duration Indicator (*SAIDI*): Average Customer minutes of interruption per *Customer*. As opposed to *CAIDI, SAIDI* is calculated dividing total *Customer* minutes of interruption by the total number of *Customers in a given period of time*

(b) System Average Interruption Frequency Indicator (*SAIFI*): Average number of times a *Customer* experiences an outage. As opposed to *CAIFI, SAIFI* is expressed as total number of *Customers* interrupted over total number of *Customers* served in a given period of time

(c) Momentary Interruptions Frequency Indicator (*MAIFI)*: Average number of momentary interruptions that a *Customer* experiences in a given period of time

(d) Customer Average Interruption Duration Index (CAIDI): Average outage duration that any given Customer would experience, measured in units of time

(e) Customer Average Interruption Frequency Index (CAIFI): Average frequency of sustained interruptions for those customers experiencing sustained interruption in a given period. The customer is counted once regardless of the number of interruptions

(f) All Performance Indicators, except for MAIFI, are calculated and differentiated by:

1. Scheduled, Unscheduled, External and Third Party interruptions, and
2. Rural *Customers* and Urban *Customers*

9.5.5.3 Calculation Intervals

The calculation of the Overall Performance Indicators will be done by all *DNSP* s on a monthly and annual basis. When calculated on an annual basis, the pre-specified period mentioned above shall be considered as a calendar year. When calculated on a monthly basis the pre-specified period shall be considered from the beginning of the calendar year up to the month the Overall Performance Indicator is calculated.

9.5.6 Tolerance of Performance indicators

The *Regulatory Authority* will assign the numerical values for the tolerances of each Performance Indicator for each *DNSP* taking into consideration the characteristics of its *Distribution System* and load dispersion in the area of supply.

The tolerances for the Performance Indicators of a *DNSP* shall be approved by the *Regulatory Authority* in each tariff review period and may be different for each calendar year during such period.

9.5.7 Implementation of Supply Quality Performance Indicators

The implementation of the Supply Quality Performance Indicators and this Distribution Performance Standard shall be done in two consecutive phases:

9.5.7.1 Phase 1 – Implementation of Supple Quality Performance Indicator

Phase 1 will be nine (9) month duration from the date that the *Regulatory Authority* gazettes the *ENDGC*, or from the date of the granting of a *Distribution Licence* to a new *DNSP.* During Phase 1, each DNSP will have the following obligations:

(a) Develop internal procedures and information systems to properly calculate the *CAIDI, CAIFI, SAIDI* and *SAIFI*, and *MAIFI* Performance Indicators

(b) Each quarter, calculate and submit to the *Regulatory Authority* the previous quarter's monthly *CAIDI, CAIFI, SAIDI, SAIFI, MAIFI Performance* Indicator measurements. In calculating these indicators:

1. The Control Area for the statistical measurement will extend from the interconnection with the Transmission system and other *Distribution systems*; *Generating Plants* connected to the *Distribution system* to the low voltage side of distribution transformers and to the *Connection Point* of MV *Customers*
2. Indicators will be calculated for the whole system without discrimination between Rural and Urban *Customers*

9.5.7.2 Phase 2 (Final Phase) - Implementation of Supply Quality Performance Indicator

At the end of the Phase 1 period, the implementation of the Supply Quality Performance Indicator process will be in full effect.

9.5.8 Procedures and Information System

Before the end of Phase 1, the *DNSP* shall prepare and submit a report to the *Regulatory Authority* for approval, containing adequate documentation regarding internal procedures, databases and information systems to be implemented in order to control supply quality and calculate Performance Indicators in accordance with this Distribution Performance Standard.

9.5.8.1 Development of Procedures and Information Systems

(a) To comply with this section, the *DNSP* shall implement the necessary procedures and systems, including among others the following:

1. Procedures and systems to identify and register all of the Interruptions that occur in its Control Area of the Distribution System

2. Procedures and systems to classify the Interruptions according to this Distribution Performance Standard

3. Procedures and systems to determine the duration of the Interruptions

(b) The *DNSP* shall implement the necessary databases and information systems in order to provide the following information:

1. A Customer database with the information to identify all the components of the associated supply network chain;
   a. Consumer identification number
   b. MV/LV transformer number to which the customer is connected
   c. Classification of Rural or Urban
   d. MV circuit which feeds the above mentioned transformer
   e. HV/MV substation that feeds the MV circuit mentioned above
2. Interruption databases comprising information on each Interruption that occurs in the area of supply of the DNSP, including the following:
   a. Date and hour when the Interruption started
   b. Circuit or sections affected by the Interruption
   c. Type of Interruption (scheduled, unscheduled or external)
   d. Cause of Interruption (equipment failure, weather, third party, operating error)
   e. Quantity of Customers affected by the Interruption
   f. Date and time that the Interruption ended

If the restoration is done in phases, the duration shall be different for each group of Customers restored.

9.5.9 Monitoring and Control

9.5.9.1 Audit

At the completion of the phased implementation of the Performance Indicators, the *Regulatory Authority* will have the right and the *DNSP* shall allow the *Regulatory Authority* or its authorized representatives to inspect the database and information system in order for the *Regulatory Authority* to audit the process, data and the accuracy of the information. The *Regulatory Authority* will have the right to hire qualified companies or persons to perform this activity on its behalf.

9.5.9.2 Routine Reporting

On a semi-annual basis (January and July), the *DNSP* shall submit to the *Regulatory Authority* in a suitable organized manner, monthly Supply Quality Performance Indicator information and a list of

actions to be undertaken by the *DNSP* to improve supply quality to those *Customers* with quality below the Performance Indicators tolerance.

9.5.9.3 Emergency Reporting

In case of an Emergency Condition in a *Distribution System*, the affected *DNSP* shall:

(a) Within eight (8) hours from the beginning of the emergency, submit to the *Regulatory Authority* by fax or electronic mail, information with preliminary analysis of the incident
(b) Following the initial information submitted in (a) and up to the moment all Customers are restored, at least every eight (8) hours, submit to the *Regulatory Authority* by fax or electronic mail an update regarding the number of MV circuits and Customers restored and remaining interrupted by the emergency
(c) Within five (5) business days after the end of an emergency, submit a detailed report of the event to the *Regulatory Authority*, its consequences and any remedial action to avoid or mitigate a similar incident in the future

The *Regulatory Authority* shall have the right to request additional information as necessary to perform its monitoring and control role and the *DNSP* shall allow the access to the primary documentation and/or send the necessary data regarding supply quality as requested by the *Regulatory Authority*. The deadline to submit this additional information shall be not less than seven (7) Business Days from the date of receipt of the request.

9.5.10 Non Compliance with Authorized Tolerances

9.5.10.1 Phase 1 – Non Compliance with Authorized Tolerance

During Phase 1, the *Regulatory Authority* will not enforce the Performance Indicator tolerance requirements. The *DNSP* shall calculate the System Performance Indicators and submit to the *Regulatory Authority* the information established in this Distribution Performance Standards in order for the *Regulatory Authority* to evaluate the performance of the *DNSP*.

9.5.10.2 Phase 2 – Non Compliance with Authorized Tolerance

During the Final Phase, if the *DNSP* fails to perform in one or more of the System Performance Indicators established in this Performance Standard, not later than ninety (90) calendar days after a System Performance Indicator fails to comply with the authorized tolerance, the *DNSP* shall submit to the *Regulatory Authority* for approval a detailed report with an action plan to solve or mitigate the deficiency. The report shall include, among others, the following:

(a) Analysis of the causes of the deficiencies in quality
(b) Description of the current situation and the detected deficiency
(c) Description of equipment which contributes in a large extent to the non-compliance
(d) Remedial actions to correct the situation, including immediate and medium term actions

and maintenance) and expected improvements

(e) Detailed Mitigation Plan with the proposed actions and required investments

When the *DNSP* submits the report, the *Regulatory Authority* will review the proposed plan and may request clarifications or modifications prior to approval. Once approved, the plan will be binding to the *DNSP* and the *Regulatory Authority* shall have the right to monitor and audit its effective execution.

9.6 POWER QUALITY STANDARDS

9.6.1 Definition

A Power Quality problem exists when at least one of the following conditions is present:

(a) The System Frequency has deviated from the nominal value of fifty (50) Hz;

(b) Voltage magnitudes are outside their allowed range of variation;

(c) There are imbalances in the magnitude of the phase voltages;

(d) The phase displacement between the voltages is not equal to one hundred twenty (120) degrees;

(e) Voltage fluctuations caused by:

1. Flicker that is outside the allowed flicker severity limits; or
2. Harmonics that are outside the allowed values; or
3. High frequency over voltages

9.6.2 Frequency Standards

The nominal fundamental frequency shall be fifty (50) Hz. Although frequency deviations will not be a controlled indicator under this Performance Standard, the *DNSP* shall design and operate its *Distribution System* in order to assist the *ENTSO* in maintaining the fundamental frequency within the limits established in the *ENDGC* during normal conditions.

9.6.3 Voltage Standards

The Performance Indicator to control voltage quality will be the voltage level. Deviation of actual voltage level from its Nominal Voltage shall not exceed the tolerance values established in Table 9-1:

Table 9-1: Voltage Standards

Voltage Level	Voltage Range	Steady State Change
Low	Up to 400 V	± 10 %
Medium	Above 400 V up to 33 kV	± 6%
High	Above 33 kV	± 10 %

Permitted variation in voltage for low voltage supplies shall be as set out in directive issued by the *Regulatory Authority* in the following documents: "Supplies to rural communities mini-grid code", and "The interim permitted voltage variation directive" (Source: "Final English Draft Energy Operation Regulation", Part V)

9.6.3.1 Voltage Level Deviation

The *DNSP* shall maintain voltage level deviations within the allowed tolerances at least during ninety seven (97) percent (%) of the time. During the remaining three (3) percent (%) of the time, voltage deviations shall not exceed 50 % of the allowed tolerance values.

9.6.3.2 Audit of Voltage Level Adequacy

(a) Control of the adequacy of voltage level to Customers shall be assessed through a random/directed measurement campaign at the Customer's Connection Points

(b) The Regulatory Authority will define the specification to be used to perform this campaign and the duration of each measurement shall be not less than seven (7) consecutive days

(c) During each year the *DNSP* shall be required by the *Regulatory Authority* to perform:

1. One measurement for every one hundred (100) MV Customers
2. One measurement for every one thousand (1,000) LV Customers

(d) In the measurement campaigns, voltage level will be determined as the average RMS voltage during a 15 minutes period. The DNSP, with the approval of the Regulatory Authority, will select the Customers to be measured taking into account:

(e) Customers located in areas where voltage problems have been detected

(f) Customers that have presented voltage complaints to DNSP

(g) Qualified staff of the *DNSP* shall perform the connection and disconnection of the equipment

9.6.3.3 Remedial Actions

In addition to the remedial actions obligations, when the voltage levels fall out of range, it will be considered as a lack of efficiency of the *DNSP* that will be translated in an economic impact in its allowed revenues.

9.6.4 Perturbations Standards

During Phase 1 and Phase 2, the following perturbation Indicators will be controlled:

(a) Flicker: defined as the impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.

(b) Harmonic distortion: defined as the sinusoidal voltages and currents having frequencies that are integral multiples of the fundamental frequency.

During the Final Phase, in view of the obligations of the *DNSP* stated in the *ENDGC* and due to existing reported problems and based on technical and economic studies, the *Regulatory Authority* may establish additional perturbation Indicators in order to control other disturbances as necessary.

9.6.4.1 Flicker Disturbance Assessment

The assessment of the disturbance caused by a *Flicker* shall be measured according to the following:

(a) For disturbances caused by a *Flicker* source with a short duty cycle, the Short Term *Flicker* Severity (PST) shall be computed over a ten (10) minute period.

(b) For disturbances caused by *Flicker* sources with a long and variable duty cycle, the Long Term *Flicker* Severity shall be derived from the Short Term *Flicker* Severity levels.

9.6.4.2 Harmonics Distortion Measurements

The Performance Indicators to measure harmonic distortion will be:

(a) Total *Harmonic* Distortion (THD in);

(b) Values of each individual *harmonic*.

The allowed ranges for flicker and *harmonic* indicators are established in the *ENDGC*, and shall not be exceeded, at the *Connection Point*, during a time greater than three percent (3 %) of a measurement period.

The acceptable or compatibility level for voltage unbalance at all voltage levels shall be set at 3% in accordance with IEC 61000-4-30 as described in the "Quality of Service Code for Ethiopia".

9.7 DISTRIBUTION LOSSES

9.7.1 Definitions

For a specified period, Distribution Energy Losses are defined as the difference between the total energy purchased by the *DNSP* during such period from the *ENTSO* and from *Generating Plants* connected to the *Distribution System*, and the total energy invoiced to *Customers* during such period, independently on whether the energy (purchased or sold) has been paid or not.

9.7.2 Losses Categories

Distribution Energy Losses shall be classified in three categories:

(a) Technical Losses: There are distribution losses that occur due to current flowing into the *Distribution System*, including conductor losses and core losses on transformers;

(b) Administrative Losses: This category includes the losses due to errors associated with energy data processing, miscalculations, record keeping etc. ultimately contributing to the increase in non-technical losses; and

(c) Non-Technical Losses: This is the difference between the Distribution energy Losses and the sum of Technical Losses and Administrative Losses.

9.7.3 Distribution Energy Losses

The *Regulatory Authority* will determine and approve in each tariff review period, after due notice and consultation with the *DNSP*, a target for the reduction of Technical Losses, a target for the reduction of the Non-Technical Losses and a target for the reduction of the Administrative Losses. The percentage of reduction approved may be different for each calendar year during such Review Period. The *DNSP* shall be allowed to pass through to tariffs and recover from its Customers the reductions to the *Distribution System* Losses approved by the *Regulatory Authority*.

The targets for *Distribution System* Loss reductions approved by the *Regulatory Authority* will be used for tariff determination and as Performance Indicators, and each *DNSP* shall endeavour to maintain Distribution Energy Losses below these targets.

9.7.4 Monitoring and Reporting

For the purpose of carrying out suitable monitoring and control of the performance of each *DNSP* regarding Distribution Energy Losses, the *DNSP* shall submit appropriate information to the *Regulatory Authority*, in a format as may be established by the *Regulatory Authority*, the following intervals:

9.7.4.1 Monthly Basis

(a) Total Energy purchased from the *ENTSO* and from each *Generating Plant* connected to the *Distribution System* selling to the *DNSP*, identifying the *Connection Point* where the energy enters the Distribution.

(b) Total Energy billed to *Customers*, differentiated by voltage level.

9.7.4.2 Every Six Months

Semi-annual report on Distribution Energy Losses with aggregated information on losses, differentiated by:

(a) Categories of losses (technical, non-technical and administrative)

(b) Voltage level (losses at the medium and low voltage level)

(c) Geographic zones

9.7.5 Implementation of Losses Performance Indicators

Within six (6) months following the adoption of the *ENDGC* or the granting of a distribution and retail supply licence that includes Performance Indicators in accordance with the Distribution Performance Standards of the *ENDGC*, the *DNSP* shall submit to the *Regulatory Authority* for approval of the methodology and assumptions to be used to calculate Distribution Energy Losses,

the separation into the different categories of losses, the separation into the different voltage levels and different geographical zones. The proposed methodology shall take full advantage of all the technical data and metering capability the *DNSP* has available at the time the report is submitted, and shall use at least the following information:

(a) Technical data of feeders, transformers and *Generating Plant* connected to the *Distribution System* within the supply area of the *DNSP*

(b) Energy metered at each transmission *Connection Point*, connection of *Generating Plant* connected to the *Distribution System* and connection with other *DNSP* s

(c) Energy metered in each HV/MV transformer

(d) Energy metered in each distribution feeder, connected at a HV / 66 kV substation

(e) Energy metered in each distribution feeder, connected at a HV / 45 kV substation

(f) Energy metered in each distribution feeder, connected at a HV / 33 kV substation

(g) Energy metered in each distribution feeder, connected at a HV/ 19.1kV SWER

(h) Energy metered in each distribution feeder, connected at a HV / 15 kV substation

9.7.5.1 Transitional Submittal

If at the time of report submission there is a lack of adequate metering capabilities to fulfill the above mentioned requirements, the DNSP shall inform the *Regulatory Authority* the transitional methodology to be used to overcome that situation, and/or the remedial plans to install all the required meters or to obtain the required technical data.

In addition to the information to be provided by the *DNSP* on a monthly and six monthly basis, within the first three months of each year, the *DNSP* shall also submit to the *Regulatory Authority* an Annual Report on Losses, covering the full previous year performance, including among others the following:

(a) Statistical losses data of the previous year and comparing it with the two (2) previous years.

(b) Main actions undertaken by the *DNSP* in order to reduce technical and non-technical losses, with an identification of the cost of such actions and the achieved or expected results.

(c) Feeders, zones or areas were the annual Energy losses considerably exceed the Performance Indicators, and actions to be undertaken to reduce losses in such feeders, zones or areas.

(d) Any study or analysis carried out by the *DNSP* to reduce losses

(e) Plans for the following 24 months associated to loss reduction, together with the corresponding cost – benefit analysis.

10. Effective Date

This code shall enter into force as of the 2nd day of March 2021.

FREHIWOT WOLDEHANNA (PhD)

BOARD CHAIRMAN, ETHIOPIAN ENERGY AUTHORITY

Annex A SUPPLY QUALITY AND SYSTEM LOSSES PERFORMANCE INDICATORS

The following tolerances will apply, unless the *Regulatory Authority*, when issuing a new license to a *DNSP* , specifies different values for one or more of these tolerances:

A.1.1 Planned and Forced Interruptions

The Table A-1 shows the target parameters for planned and forced interruptions that should not be exceeded. These target values are as per the, Quality of service standards for grid supply-2019 or latest editions, issued by the Authority.

Table A-1: System Performance Indicators for Urban Customers

Parameter Description	Unit of Measure	Average Target
Frequency of outages caused by planned interruptions	Interruption frequency per customer per year (numbers)	5
Duration of outages caused by planned interruptions	Interruption duration per customer per year (hours)	5
Frequency of non-momentary outages caused by forced interruptions	Interruption frequency per customer per year (numbers)	15
Duration of non-momentary outages caused by forced interruptions	Interruption duration per customer per year (hours)	20

Note: Average target is based on the fiscal year 2001 target values. Actual performance shall be as per the given target in the Quality of service standards for grid supply-2019 or better latest editions.

A.1.2 System Losses

Quality of service standards for grid supply-2019 or latest editions dictates that the overall transmission and distribution technical and non-technical losses of the network shall be below twelve percent (12%).

In addition, the following values for distribution loss reduction, as described in Section 9.7.3, will apply for the first 3 years following the approval of this Performance Standard unless the *Regulatory Authority* specifies different values for the tolerance.

Table A-2: System Loss Reduction Targets

	First Year	Second Year	Third Year
% Losses	2.0 %	2.0 %	2.0 %

Annex B DEROGATION REQUEST AND MITIGATION PLAN FORMS

B1. Ethiopia National Distribution Grid Code (ENDGC) Derogation Request Form

Name of Entity:		**Date:**
Contact Name (CEO or delegated Officer):	**Contact Phone:**	**Email:**
Signature (CEO or delegated officer):		
Type of Derogation Being Requested (Indicate One): Exemption _____ Mitigation _____ **If Mitigation: Proposed date by which mitigation plan will be filed:** **Date by which the non-compliance will be remedied:**		
Date of Non-Compliance Discovery: **Date Non-Compliance Reported:**		
Code Section Title:	**Code Section Number:**	
Described the nature and extent of the Non-Compliance (Attach)		
Describe the cause of Non-Compliance (Attach)		
Identification and Description of the system, facility, equipment, process, procedures or specific *Connection Point* in respect of which the Derogation is sought (Attach)		

B2. Ethiopia National Distribution Grid Code (ENDGC) Mitigation Plan

Name of Entity:	Date:
Code Section Title:	**Code Section Number:**
Describe Detailed Plan to Become Compliant, including expected duration of non-compliance (Attach)	
Describe Customer/User Health and Safety Risk Mitigation Plan (Attach)	
Description of reasonable alternative actions that have been considered (Attach)	
Describe Detailed Milestone Schedule to Become Compliant (Attach)	

Annex C METERING STANDARD

C1. Metering Standard to be complied with

Standard	Type
ISO/IEC 17025	General requirements for the competence to carry out tests and/or calibrations, including sampling (covers testing and calibration performed using standard/non-standard/laboratory-developed methods)
IEC 60044 - 2 (replaced by IEC 61869 - 3)	Requirements for voltage transformers to be used with electrical measuring instruments and protective devices at frequencies from 15 Hz to 100 Hz.
IEC 60044 - 3 (replaced by IEC 61869 - 4)	Requirements for combined transformers
IEC 60044 -5 (replaced by IEC 61869-5)	Requirements for single-phase capacitive voltage transformers connected between line and ground for system voltages Um ≥ 72.5 kV at power frequencies from 15 Hz to 100 Hz. They are intended to supply a low voltage for measurement, control and protective functions
IEC 60044 -1 (replaced by IEC 61869-2)	Requirements for current transformers to be used with electrical measuring instruments and protective devices at frequencies from 15 Hz to 100 Hz.
IEC 61000 - 3-2: 2014	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
IEC 62052-11:2003	Electricity Metering Equipment (a.c.) - General Requirements, Tests and Test Conditions - Part 11: Metering Equipment; Plastic Determination of Temperature Deflection of Load
IEC 62053-20:2003	Automatic Meter Reading
IEC 62053-21:2003	Electricity Metering Equipment (a.c.) - Particular Requirements - Part 21: Static Meters for Active Energy (class 1.0)
IEC 62053-23:2003	Electricity Metering Equipment (a.c.) - Particular Requirements - Part 23: Static Meters for Reactive Energy (classes 2 and 3)
IEC 62054 - 21	Accuracy of the Real Time Clock
IEC 62056-21:2003	Electricity Metering, Data Exchange for Meter Reading , Tariff, and Load Control - Part 21: Direct Local Data Exchange
IEC 62059	Electricity Metering Equipment Dependability

Annex D DATA AND SERVICE PERFORMANCE INDICATOR

D1. Distribution Data and Service Performance Indicators

Ser. No.	Data filled	Indicator definition	To be reported as	Data to be presented	
				Monthly	Annual
A	Technical Indicators				
1	Supply area	Area name	Name	☐	✓
2	Feeder	Number of feeder lines and substation names	Number of feeder and substation name	☐	✓
3	Distribution customer-residential	A supply point through which electricity is distributed to an end user with a separate account. Unmetered supplies are included	Number of customers at the end of the reporting period		✓
4	Distribution customer non-residential	See above	See above	☐	✓
5	Length of distribution lines - high voltage – overhead or underground	The total length of feeders including all spurs (a double circuit line counts as two lines)	Route length in kilometers	☐	✓
6	Total energy sold	Total energy sold to all customers over the reporting period	MWh	☐	✓
7	Maximum demand (MVA)	Maximum demand over the reporting period for the feeder(s) calculated from the nominal feeder voltage and maximum feeder current	MVA	☐	✓

Ser. No.	Data filled	Indicator definition	To be reported as	Data to be presented	
				Monthly	Annual
8	Unplanned outages	Unplanned event causing interruptions to customers (an interruption being when supply is lost, not when it is reported). Where there is no automatic recording of the duration of an interruption, the best estimate is to be reported	Cause (% of total); Total and average interruption frequency per customer (CAIFI); Total and average duration of interruption per customer (CAIDI)	✓	☐
9	Planned outage	Planned events causing interruptions to customers	Total and average interruption frequency per customer (CAIFI); Total and average duration of interruption per customer (CAIDI)	✓	☐
10	External Outage	When, due to protection malfunctioning, a fault in a facility owned by a DNSP is not correctly cleared by equipment under the responsibility of the Transmission Licensee or of another DNSP, all Interruptions to Customers of the DNSP in excess of those strictly necessary will be classified as External Interruptions/outage	Total and average frequency and duration per customer		✓
11	Momentary feeder outage	An outage less than one minute in duration. It includes any outage of an entire feeder (sub transmission faults included). Each successful reclose is counted as one momentary outage. Reclose followed by a lockout are to be included in the unplanned outage indicator, not the momentary outage indicator	Total and average interruption frequency per customer (MAIFI)	✓	☐

Ser. No.	Data filled	Indicator definition	To be reported as	Data to be presented	
				Monthly	Annual
12	Energy not supplied – Planned or Unplanned	Estimated as average customer demand (multiplied by number of customers interrupted and the duration of interruption). Interrupted KVA can be used as a proxy for this measure. Average customer demand is to be determined from (in order of preference): (i) Feeder demand at the time of interruption divided by the number of customers on the feeder, or (ii) Average consumption of customers on the feeder based on their billing history, or (iii) Average feeder demand derived from maximum demand and estimated load factor divided by the number of customers on the feeder, or (iv) On customer category basis	MWh	☐	✓
13	Over voltage /under voltage events due to high voltage injection events (e.g., from the transmission system), lighting, due to voltage regulation or other causes	Number of over voltage/under voltage events in the distribution or transmission system leading to at least one customer complaint. The estimated number of customers affected by over-voltage/under voltage events is to be determined based on customer complaints and the Licensee's investigation	Frequency customers receiving over voltage/under voltage as % of total number of customers	☐	✓

Ser. No.	Data filled	Indicator definition	To be reported as	Data to be presented	
				Monthly	Annual
14	Mandatory under-frequency load shedding	Number and average duration of mandatory under frequency load shedding events in the distribution or transmission system	Frequency and duration customers being affected by mandatory under frequency load shedding as % of total number of customers	✓	
15	User voluntary load shedding	Number and average duration of user voluntary load shedding events in the distribution or transmission system	Frequency and average duration of such events	✓	
16	Distribution loss	Annual distribution network losses		☐	✓
B	**Personnel Indicator**				
17	Distribution staff	Number of distribution staff per total distribution circuit kilometer			✓

D2. Customer Service Data and Performance Indicator

Ser. No.	Data filled	Indicator definition	Data to be presented	
			Monthly	Annual
A	Technical Indicator			
1	Number of existing customers within the service area	(a) By customer category; (b) By tariff category	✓	☐
2	Electrification of service territory	Percentage	✓	☐
3	Customer complaint	a) By total number; (b) By complaint issue	✓	
4	Disconnection/Reconnection	(a) By number; (b) By reason	✓	☐

Ser. No.	Data filled	Indicator definition	Data to be presented	
			Monthly	Annual
5	Billing log		✓	☐
7	Average length of wait per service hookup		☐	✓
8	Time required to make service call	The amount of time required to respond to service/maintenance demands		
B	Personnel Indicator			
	Number of employees	(a) Per customer; (b) Per kilowatt-hour		✓

Annex E REVISION LOG

Chapter	Comments	Page	Action Taken	Date of Action

Chapter	Comments	Page	Action Taken	Date of Action