KENYA NATIONAL

DISTRIBUTION CODE

Version 03

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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 safe, secure, reliable and efficient operation.

This preamble provides the background and rationale for the development of the *Kenya National Distribution Code* (*KNDC*) and summarises its provisions. The *KNDC* will go through a rigorous approval process involving the *Energy Regulatory Commission (ERC),* the Ministry of Energy and Petroleum, the Attorney General and the Parliament.

1.2 PURPOSE

The *Kenya National Distribution Code has* been developed to define the rules and regulations for various *Participants* for accessing and using the *Distribution System*. The objective of the *KNDC* is to improve the ability of Kenya's power 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* of the *Distribution System* for accessing and using the *Distribution System*. More specifically 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.*

1.3 BACKGROUND

Before 1997, Kenya Power and Lighting Company Limited (KPLC) was charged with the generation, transmission and distribution of electricity in Kenya. In other words, it was a classic state-owned vertically integrated utility that had not yet embarked on the steps typical of a reform process.

Potential reform steps designed to improve power sector performance included:

a. Reduction/elimination of direct government control over electric utility organisations
b. Functional unbundling of existing organisations
c. Corporatisation and commercialisation of the resulting organisations
d. Independent regulation of monopoly functions
e. Free markets for competitive functions
f. Establishing conditions to attract private investment
g. Rationalisation of tariffs
h. Privatisation
i. Open access transmission

In 1997, the functions of generation were split from transmission and distribution. The Kenya Power Company, which had been under the management of KPLC since 1954, became a separate entity responsible for public-funded power generation projects. In 1998, the Kenya Power Company was re-launched as the Kenya Electricity Generating Company (KenGen). This separation of generation from transmission and distribution functions was an initial step in the reform process.

The next major reform legislation was Kenya's *Energy Act No. 12 of 2006*, which repealed the Electric Power Act, No. 11 of 1997 and established the *Energy Regulatory Commission (ERC)* to replace the Electric Power Act's Electricity Regulatory Board (ERB), and also established the Rural Electrification Authority (REA) and the Energy Tribunal.

The *Energy Act* has many reform-oriented provisions. Among others, it makes *ERC* an independent regulatory body, because its Commissioners cannot be removed from office before the expiration of their (staggered) terms except for good cause. This minimises the potential for governmental interference with the *ERC*. It also mandates that contracts for bulk supply of electrical energy shall be just and reasonable, which specifically means a rate that enables the licensee to maintain its financial integrity, attract capital, operate efficiently, and fully compensate investors for the risks assumed.

Using the power conferred by the *Energy Act* in 2012, the Minister for Energy made the Energy (Electricity Licensing) Regulations, 2012. Though a step forward in licensing and permitting, the Regulations are not reform-oriented. Significant disaggregation of Kenya's power sector from the former Kenya Power and Lighting Company (KPLC) began in 1997 when the functions of generation were split from transmission and distribution and (in 1998) re-launched as the Kenya Electricity Generating Company (KenGen). Since then other power sector organisations have been spun off from KPLC or founded by the Government of

Kenya, including the Rural Electrification Authority (REA), the Kenya Electricity Transmission Company (KETRACO), and the Geothermal Development Company. KPLC was rebranded to Kenya Power Company in 2011. All of these organisations are wholly or partly owned by the Government of Kenya.

The Kenya Electricity Grid Code, developed in 2008, was a very comprehensive document that covered the regulations required for electric transmission and distribution network technical requirements as well as planning procedures, tariff methodologies and internal regulations of the *ERC*. This approach of including technical and commercial information for both the transmission and distribution networks would complicate the amendment and maintenance of such a document. Therefore, the decision was made to develop separate grid code documents for the electric transmission and distribution networks.

1.4 PREVIOUS KENYA ELECTRICITY GRID CODE

Kenya's *Energy Regulatory Commission (ERC)* developed an initial draft Grid Code for the transmission and distribution system regulations and constituted the Kenya Electricity Grid Code Steering Committee to review the draft. The result of that review is the Kenya Electricity Grid Code (KEGC), dated March 2008.

Although the KEGC has not yet been gazetted, its terms apply to all licensees in the Electricity Supply Industry in Kenya. Gazetting is the legal process by which the *ERC* puts in place rules and regulations under the *Energy Act*.

1.5 STRUCTURE OF THE KNDC

The *KNDC* is broken into nine parts as follows;

a. **Preamble:** This section outlines the *KNDC's* background, the purpose of the *Kenya National Distribution Code (KNDC)*, the structure of the Kenya power sector, and how the various parts of the *KNDC* are relevant to the different *Distribution Network User*s of the *Distribution System.*

b. **Glossary:** This section provides the definitions of terms pertinent to this *KNDC* document.

c. **Governance:** This section describes the provisions necessary for the administration and review of the various aspects of the *KNDC*.

d. **General Conditions:** This section presents the provisions which are of general application to all parts of the *KNDC*.

e. **Distribution System Planning**: This section specifies the technical and design criteria and procedures for the planning and development of the *Distribution System*.

f. **Distribution System Connection Requirements:** This section defines the minimum standards for the methods of connection to the *Distribution System.*

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

h. **Metering:** This section specifies the technical and operational criteria in carrying out the obligation of providing metering services to all *Distribution Network User*s.

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

1.6 STRUCTURE OF THE KENYA ELECTRICITY POWER SECTOR

The main power sector organisations include those listed below.

a. **Ministry of Energy and Petroleum:** The Ministry of Energy and Petroleum (MoEP) is responsible for formulation and articulation of energy policies through which it provides an enabling environment for all stakeholders. Its tasks include national energy planning, training of manpower and mobilisation of financial resources.

b. **Energy Regulatory Commission:** The *Energy Ac*t established the *Energy Regulatory Commission (ERC)* to replace the Electric Power Act's Electricity Regulatory Board (ERB). The functions of the *ERC* are to regulate importation, exportation, generation, transmission, distribution, supply and use of electrical energy, and production, distribution, supply and use of renewable and other forms of energy. Its functions also include tariff setting, review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts. The *ERC* has all powers necessary to expedient for the performance of its functions under the *Energy Act*.

c. **Energy Tribunal:** The Energy Tribunal is a quasi-judicial body which was established under section 108 of the *Energy Act*. It came into operation in July 2007 primarily to hear appeals against the decisions of the *ERC*. It also has jurisdiction to hear and determine all matters referred to it relating to the energy sector.

d. **Rural Electrification Authority:** The Rural Electrification Authority was established under Section 66 of the *Energy Act* as a body corporate. The REA was created in order to accelerate the pace of rural electrification in the country, a function which was previously undertaken by the Ministry of Energy. The REA became operational in July 2007. Its principle mandate is extending electricity supply to rural areas, managing the rural electrification fund, mobilising resources for rural electrification and promoting the development and use of renewable energy.

e. **Geothermal Development Company:** The Geothermal Development Company (GDC) is a 100% state-owned company, formed by the Government of Kenya as a Special Purpose Vehicle to fast track the development of geothermal resources in the

country. The creation of GDC was based on the government's policy on energy and the *Energy Act*, which un-bundled the key players in the electricity sector to ensure efficiency. The search for geothermal energy is not new in Kenya. It started in 1957, but this has so far yielded only 209 MW against a potential estimated at 7,000 MW to 10,000 MW. The speed of harnessing geothermal resources had been too low, necessitating the creation of GDC.

f. **Kenya Power:** The Kenya Power & Lighting Company Limited was re-branded to Kenya Power in 2011. It is a State Corporation with the Government of Kenya shareholding of 50.1% and private shareholding of 49.9% as of December 2011. It purchases electrical energy in bulk from KenGen, IPPs, and imports from Uganda, and carries out the transmission, distribution, supply and retail of electric power.

g. **Kenya Electricity Generating Company Limited:** The Kenya Electricity Generating Company Limited (KenGen) is a State Corporation with GoK shareholding of 70% and private shareholding of 30% as at December 2011. It is mandated to generate electric power, currently producing the bulk of electricity consumed in the country. The company utilises various sources to generate electricity ranging from hydro, geothermal, thermal and wind.

h. **Kenya Electricity Transmission Company Limited:** The Kenya Electricity Transmission Company Limited (KETRACO) is a Government of Kenya wholly owned company established to be responsible for the development, maintenance and operation of the Kenya National Transmission System. It is also responsible for facilitating regional power trade through its transmission network.

i. **Independent Power Producers:** Independent Power Producers (IPPs) are private companies which generate power and sell electricity in bulk to Kenya Power. In fiscal 2012-2013 they accounted for about 25% of the country's installed capacity and 23% of delivered electrical energy and play an important role in bridging the demand gap. The operating IPPs are primarily thermal power plants, but include a geothermal facility and a cogeneration facility.

j. **Kenya Nuclear Electricity Board (KNEB):** KNEB is charged with the mandate of spearheading and fast tracking development of nuclear electricity generation in order to enhance the production of affordable and reliable electricity.

1.7 SCOPE OF THE DISTRIBUTION CODE

The *KNDC* (this Code) establishes the technical aspects of the planning, connection, operation, and use of the *Kenya National Distribution System* and the relationships between the *Distribution Network Service Provider*(s) and *Distribution Network User*s of the *Distribution System*.

Upon the request from *Distribution Network User*s, the *DNSP* must provide a connection to

the *Distribution System* and deliver electric energy to the *Distribution Network User*s in accordance with the applicable laws, its licence and this *KNDC*, at a level of service quality consistent with the applicable Performance Standards described in the *KNDC*. Once connected to the distribution grid, the *Distribution Network User*s of the *Distribution System* must comply with the conditions and standards specified the *KNDC* to avoid adverse effect on the *Distribution System* or other *Distribution Network User*'s systems.

The *KNDC* shall be read in conjunction with the relevant legislation, including the *Energy Act* of 2006, the Energy (Electricity Licensing) Regulations of 2012 and any applicable amendments related to the administrative authority for the *KNDC*. These legislative policies shall be utilisation in conjunction with the licences issued to generators, transmission companies and *DNSP*s and the codes and regulations that relate to the Electricity Supply Industry (ESI) adopted by the *ERC* and the Ministry of Energy and Petroleum. All distribution agreements and granting of licences to operate a *Distribution System* that are concluded after implementation of the *KNDC* shall include the obligation of parties to comply with the *KNDC* requirements.

2 GLOSSARY AND DEFINITIONS

2.1 INTRODUCTION

All defined terms and acronyms are capitalised and italicised when used in the *KNDC*, and hold the meaning as defined in this section. However, if there are instances in which the terms are not capitalised or italicised, these meanings still hold.

The table below provides a summary of the terms and definitions used in the *KNDC*.

Table 2-1 Glossary and Definitions

Word or Phrase	Definition
Act, Energy	The Energy Act, No 12 of 2006.
Active Energy	The electrical energy produced, flowing or supplied by an electrical circuit during a time interval, and being the integral with respect to time of Active Power, measured in units of Watt- Hours or multiples thereof.
Active Energy Meter	An integrating instrument, which measures active energy in Watt-hours or in suitable multiples thereof.
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	Those services that are necessary to support the transmission of capacity and energy from resources to loads, while maintaining reliable operation of the Kenya National Transmission System in accordance with Prudent Utility Practice. Without limitation, these services may include: (a) the provision of sufficient regulating capability to meet fluctuations in load occurring within a scheduling interval; (b) the provision of sufficient contingency capacity reserve to maintain power system frequency in the event of network or generation outages; (c) the provision of reactive power support to guard against power system failure through voltage collapse; and (d) the provision of black start capability to allow restoration of power system operation after a complete failure of the power system or part of the power system.
Application for Connection	The application made by a connection Applicant for connection to a network and/or the provision of network services or modification of a connection to a network and/or the provision of network services.

Word or Phrase	Definition
Authorisation Personnel	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 Kenya National Transmission System from Total Shutdown or Partial Shutdown.
Black Start Capability	Ability in respect of a Generator, for at least one of its Generating Units to Start-Up from Shutdown without an external electrical power supply and to energise a part of the Kenya National Transmission System and be Synchronised to the System upon instruction from the Transmission Licensee or Distribution Licensee.
Capacitor Bank	An electrical equipment used to generate reactive power and support voltage levels on transmission/distribution lines in periods of high load.
Check (Back-up) Meter	A kWhr meter used for measuring electrical usage for the purpose of the meter data validation in the process of producing bills and credit notes
Clearance Space	A space surrounding a distribution power line, which should be clear of obstructions and vegetation at all times.
Commission	The Energy Regulatory Commission established under section 4 of the Energy Act of 2006.
Conductor	A material that allows the flow of electrical current in one or more directions. Conductors are typically classified in the following sizes: Small: up to and including 8mm diameter(e.g. 3/2.75 SC/GZ, 3/12 SC/GZ, 7/.064 Cu, 7/2.50 AAC) Medium: range from 8mm up to and including 14mm diameter (e.g. 7/3.00 AAAC, 6/1/3.00 ACSR, 7/3.75 AAC, 19/.064 Cu.) Large: all conductors over 14mm in diameter (e.g. 19/3.25, 6/4.75 – 7/1.60)
Confidential Information	Information which is or has been provided under or, in connection with the Kenya National Distribution Code and which is stated under the Code or by the Commission to be confidential information or otherwise confidential or commercially sensitive or information which is derived from any such 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 KNDC Participant or other person is connected to the distribution network and/or receives distribution services.
Connection Applicant	An individual or an entity who wants to establish or modify connection to the distribution network and/or who wishes to receive network services.

Word or Phrase	Definition
Connection Assets	Components of a transmission/distribution system, which are used to provide connection services.
Connection Point	Point of supply as agreed between the DNSP and a KNDC Participant or Customer.
Connection Service	An entry service at a transmission/distribution connection point for an individual or a group of electric power producers. It could also be an exit service at a transmission/ distribution connection point for an individual or a group of Transmission or Distribution Customers.
Conservation	Preservation, maintenance, sustainable use, and restoration of natural and cultural environment.
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.
Construction	Includes reconstruction, replacement, or making structural changes.
Consumer	A person or entity obtaining end-use electricity supply from a licensee
Control System	A set of devices used for monitoring and controlling the operation of a power system or equipment including generators 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 (CT)	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 or entity obtaining electricity services from a licensee
Data Collection System	All equipment and arrangements that lie between the metering database and the point where the metering data enters the public telecommunications network.
Data Logger	A device that collects energy data, packages it into 30 minute intervals (or submultiples), holds a minimum of 35 days of data, and is capable of being accessed electronically by the relevant KNDC Participant via the data collection system. This device may be a separate item of equipment, or combined with the energy measuring components within one physical device.
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.

Word or Phrase	Definition
Derogation	A waiver issued by Energy Regulatory Commission after consultation with Ministry of Energy and Petroleum, Distribution Licensees and the Kenya National Distribution Grid Code Review Committee, to suspend a Distribution Licensee's obligations to implement or comply with a provision or provisions of the KNDC.
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.
Distribution	The ownership, operation, management, or control of facilities for the movement or delivery of electrical energy to enable supply to customers.
Distribution Area	Area in which the distribution network service provider is licensed to distribute electricity.
Distribution Customer	A Customer, distribution network service provider and a Customer having a connection point with a distribution network.
Distribution Licence	A licence granted by the ERC to operate a distribution system in Kenya.
Distribution Licensee	An entity granted a licence by the ERC to operation a distribution system in Kenya
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 delivers electric power from electrical substation at sub-transmission level to the end users. Distribution networks consist of: (i) Distribution substation; (ii) Primary distribution feeder; (iii) Distribution Transformer; (iv) Distributors; and (v) Service mains
Distribution Network Service Provider (DNSP)	An entity that owns, controls, and/or operates a distribution system and engages in activities in relation to: (a) a Customer or a Customer's electrical installation; (b) an embedded generator or an electric power producer with an embedded generator; or (c) the distribution network service provider in whose distribution area that Customer's electrical installation or that embedded generator or electric power producer's embedded generator is located.
Distribution Network User	A distribution Customer or an electric power producer, 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 individual customers.

Word or Phrase	Definition
Distribution System	A distribution network, together with the connection assets associated with the distribution network, which is connected to another transmission or distribution system. Connection assets on their own do not constitute a distribution system.
Electric Power Industry Safety Code	Kenya Standard National Electric Safety Code KS 1586: 2007
Electric Power Producer	An entity licenced to own, control, and/or operate a generating system supplying electricity to a transmission or distribution system.
Electric Supply Line	Conductors used to transmit electric energy and their necessary supporting or containing structures
Electrical Connection	A point to which a Customer may connect the Customer's electrical installation for the purpose of receiving electricity supply from a distribution network.
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: any electrical supply main or service line of a distribution network service provider; 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 that is not used for the consumption of electricity on those premises; or solely for purposes incidental to that consumption; any connections to a Customer's terminals for the purpose of providing electrical energy; or any metering equipment owned by a distribution network service provider.
Embedded Generator	A generator 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 generator resulting in a non- zero voltage beyond a connection point or part of the transmission or distribution network
Energy Data	Data that result s from measurement of power flow through a conductor, at a metering point.
Entry Service	Transmission/distribution service provided to serve an electric power producer/ group of electric power producers at a single connection point.
Estimated Equipment Data	The best estimate of the of the values and parameters and information pertaining to a Distribution Network User's equipment provided to the DNSP for the purpose of distribution system planning.

Word or Phrase	Definition
Excitation Control System	Automatic control system (including excitation limiting devices and any power system stabiliser) that provides field excitation for the generator.
Existing Metering Equipment	Metering equipment installed before the date of enactment of the KNDC.
Financial Year	The period commencing on 1 July in one calendar year and terminating on 30 June in the following calendar year.
Fire Control Authority	Fire Service under the control of any local or public authority or any other authorisation entity in Kenya.
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 caused by an increase or decrease in voltage.
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
Frequency (Hz)	Number of cycles for alternating current electricity occurring in each second. The term Hertz (Hz) corresponds to cycles per second.
Generator	A person who owns or operates Generating Units or facilities to generate electricity.
Generation Licence	A licence authorising a person to generate electrical energy
Good Electricity Industry Practice	Degree of skill, diligence, prudence and foresight that is expected from operators of facilities forming part of the power system for the generation, transmission or supply of electricity under conditions comparable to those applicable to the relevant facility consistent with applicable laws, regulations, licences, Codes, reliability, safety and environmental protection. The determination of comparable conditions is to take into account factors such as the relative size, duty, age and technological status of the relevant facility and the applicable laws, regulations, licences and Codes.
Governor System	Automatic control system which maintains the desired system frequency by adjusting the mechanical power output of the turbine.
Grid	The network of transmission systems, distribution systems and connection points for the movement and supply of electrical energy from generators to customers.

Word or Phrase	Definition
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 (HV)	A nominal voltage above 33 kilovolts.
Impulse Voltage	A unidirectional voltage that rapidly rises to a peak value and then drops to zero rapidly.
Industry	The industry in Kenya involved in the generation, transmission, distribution, supply and sale of electricity and related business.
Independent Power Producers (IPP)	An entity, which is not a public utility, but owns facilities to generate electric power for sale to utilities and/or Customer.
Individual Contract	A contract for the sale of electricity to a Customer negotiated under the Energy Act.
Interconnection	A transmission line/group of transmission lines that connects the transmission network in one region or jurisdiction to another region or jurisdiction.
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.
Kenya National Distribution Code Review Committee	The committee responsible for the review of the operations and revision of the *KNDC*.
Kenya National Distribution System	The electric distribution system in Kenya.
Kenya National Transmission Grid Code	The set of requirements placed upon the Users of the Kenya National Transmission System
Kenya National Transmission System	The electricity transmission system of Kenya including all Users connected to that system.
Kenya National Transmission System Operator (TSO)	The entity responsible for the overall coordination of the planning and operation of the Kenya National Transmission System, including the scheduling and dispatch of Generating Units connected to it.
Kenya Standard (KS)	The most recent edition of a standard publication by Kenya Bureau of Standards.
Licence	Any document or instrument in writing granted under the Energy Act, to any person authorising the importation, exportation, generation, transmission, distribution and supply of electrical energy, in the manner described in such document or instrument.

Word or Phrase	Definition
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 generator or load.
Loss Factor	Multiplier used to describe the additional electrical energy loss for each increment of electricity used or transmitted.
Low Voltage (LV)	A nominal voltage up to 400 volts as per the Energy Act.
Medium Voltage (MV)	A nominal voltage of more than 1 kilovolt but not more than 33 kilovolts.
Meter	A device complying with Kenya Standards which measures and records the production or consumption of electrical energy. Any and every kind of machine, device or instrument used for the measurement of the quantity of electrical energy, and includes such auxiliary appliances as resistors, shunts, reactances, current transformers, voltage transformers and time switches, external and necessary to the meter.
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 Code Participant.
Metering Equipment	Equipment installed or to be installed to safely measure, record and, in certain cases, collect and read records of the amount of electricity (in the nature of apparent energy and reactive energy) supplied from a distribution network service provider's distribution system to an electrical installation of a Customer including meters, current transformers and voltage transformers, wiring and any computing or communications equipment designed to facilitate electronic access and in the case of a Customer that has installed half hour metering equipment means half hour metering equipment.
Metering Installation	Assembly of components between metering point(s) and the point of connection 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.

Word or Phrase	Definition
Metering System	Collection of all components and arrangements installed/existing between each metering point and the metering database.
Minister	The Minister of Energy and Petroleum of the Government of Kenya
Monitoring Equipment	Testing instruments and devices used to record the performance of plant for comparison with expected performance.
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.
Network Service Provider	A legal entity that engages in the activity of owning, controlling, or operating a transmission system and who holds or is deemed to hold a licence or has been exempted from the requirement to obtain a licence under a regulation of the Energy Act.
Network User	A User of the Kenya National Distribution System.
Normal Operating Frequency Band	Range of frequency of the power system so specified in the KNDC.
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.
Occupier	A person or entity who is in actual occupation of the land or if no one is in actual occupation of the land, the owner of the land.
Outage	Disconnection or separation, planned or unplanned of one or more elements of the Kenya National Transmission System or the Kenya National Distribution System..
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 Kenya National Distribution Code and includes: the *Commission*; the *DNSPs*; *electric power producers; Customers*; a person who holds or is deemed to hold a *licence* under the *Act.*
Party	In a general sense refers to any person or entity with the specific meaning ascribed in the related provision of the Kenya National Distribution Code.

Word or Phrase	Definition
Peak Load	Maximum load.
Plant	In relation to a connection point, includes all equipment involved in generating, utilising or transmitting electrical energy.
Point of Connection	Point at which the embedded generator is connected to the distribution network service provider's distribution system.
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 point of connection 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 an electric power producer's generators are located.
Power Purchase Agreement (PPA)	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.
Profile	With respect to the output from a generator, 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.
Protection System	A system, which includes equipment, used to protect a Code Participant'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 operatives 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.

Word or Phrase	Definition
Public Electricity Supplier	An entity with an exclusive right under his licence to sell electricity to Customers within a particular supply area or a person who has been exempted from the requirement to obtain a licence.
Public Land	Land belonging to a public or local authority
Public Lighting	Street lighting provided by a governmental body or agency in Kenya.
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 Energy Meter	A meter used to measure reactive energy.
Reactive Plant	Plant which is capable of providing or absorbing reactive power.
Reactive power	Rate at which reactive energy is transferred. Reactive power is a necessary component of alternating current electricity which is separate from active power and is predominantly consumed in the creation of magnetic fields in motors and transformers and produced by plant such as: (1) alternating current generators; (2) capacitors, including the capacitive effect of parallel transmission wires; and (3) synchronous condensers.
Reactive Power Capability	Maximum rate at which reactive energy may be transferred from a generator to a point of connection 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 in a region of Kenya.
Registered Equipment Data	Validated actual values of parameters and information about the Distribution Network User's equipment, as filed with the DNSP 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.
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.

Word or Phrase	Definition
Reserve	A measure of available capacity over and above the capacity needed to meet normal peak demand levels. In case of a generator, 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.
Revenue Meter	High accuracy meter that is used by the utilities to measure and record energy transactions for settlement charges and payments.
Revenue Metering Data	The data obtained from a Revenue Meter reading.
Revenue Metering Installation	Installation of Revenue Meters that conform to the required standards.
Revenue Metering Point	The point at which the Revenue Metering Installation is connected.
Rural Customer	
Service Line	Any portion of any electric supply line through which electrical energy is 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 generator 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.
Supply Licence	A licence to sell or deliver electricity under the Energy Act
Switchyard	Connection point of a generator into the network, generally involving the ability to connect the generator to one or more outgoing network circuits.
Synchronisation	The act of electrically connecting a generator to the power system.
Synchronous Condensers	Plant, similar in construction to a generator 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.

Word or Phrase	Definition
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 Kenya National Transmission System, including the scheduling and dispatch of Generating Units connected to it.
Transformer	A plant or device that reduces or increases the voltage of alternating current.
Transmission	The operation, management or control of facilities, consisting of high voltage electric supply lines for movement of electrical energy in bulk between generating stations and transmission substations for the purposes of enabling supply to customers.
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 system with the ultimate objective of bringing to the end users or consumers. ,
Transmission and Distribution (T&D) 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.
Urban Customer	
User	Any person or entity connected to or making use of the Kenya National Distribution System as a Generator, Distribution 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 (except in the case of impulse voltage) the root mean square (RMS) of the phase to phase voltage.
Voltage Transformer (VT)	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.
Way leave	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.

2.2 LIST OF ACRONYMS

The table below provides a summary of the acronyms used the *KNDC.*

Table 2-2: Acronyms used in the KNDC

Acronym	Meaning
AC	Alternating Current
ACE	Area Control Error
AGC	Automatic Generation Control
AS	Ancillary Services
AVR	Automatic Voltage Regulator
COMESA	Common Market for Eastern and Southern Africa
CT	Current Transformer
DC	Direct Current
DER	Distributed Energy Resources
DMP	Defined Metering Point
DNSP	Distribution Network Service Provider
DR	Demand Response
EAC	East African Community
EHV	Extra High Voltage
ENA	Energy Network Association
ERC	Energy Regulatory Commission
GC	General Conditions
GD	Glossary and Definitions
GoK	Government of Kenya
GPS	Global Position System
HV	High Voltage
HVDC	High Voltage Direct Current
IC	Interconnected System
ICCP	Inter-Control Centre Communications Protocol
IEC	International Electro-technical Commission
ISO	International Standard Organisation
KEGC	Kenya Electricity Grid Code

Acronym	Meaning
Kenya National TSO	Kenya National Transmission System Operator
KNDC	Kenya National Distribution Code
KNDS	Kenya National Distribution System
KNTGC	Kenya National Transmission Grid Code
KNTS	Kenya National Transmission System
KS IEC	Kenya Standard IEC
kWh	Kilowatt-Hour
MW	Megawatt
MWh	Megawatt hour
Mvar	Megavar, megavolt ampere reactive
Mvarh	Megavolt ampere reactive hour
PSS	Power System Stabiliser
PV	Photo Voltaic
RCC	Regional Control Centre
RPP	Renewable Power Plant
SCADA	Supervisory Control and Data Acquisition
S, SH	Kenya Shillings
TCP/IP	Transmission Control Protocol/Internet Protocol
TSO	Transmission System Operator
UM	Voltage Maximum
UN	Voltage Nominal

2.3 LIST OF UNITS

Table 2-3: List of Units

Symbol	Unit
Amp	Ampere
GW	Gigawatt (1,000,000,000 W)
GWh	Gigawatt-hour
h, hrs	Hour

Symbol	Unit
Hz	Hertz
Kbps	Kilobits per second
kV	Kilovolt
kVA	Kilovolt-ampere
kvar	Kilovars
kW	Kilowatt
kWh	Kilowatt-hour
Mbps	Megabits per second
mHz	Milli-hertz (1/1000 Hz)
Min	Minute
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 *Kenya National Distribution System* 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 *KNDC*. The GC also deal with those aspects of the *KNDC* not covered in other Chapters, including the resolution of disputes, bilateral agreements, confidentiality, non-compliance and the revision of the *KNDC* through a *Kenya National Distribution Code Review Committee*.

3.2 SCOPE

These General Conditions apply to the *Energy Regulatory Commission*, *Kenya National Transmission System Operator*, *Regional Control Centres, Transmission Licensees, Distribution Licensees, and Users* of the *Kenya National Distribution System.*

3.3 OBJECTIVE

The objective of the General Conditions are to establish the conditions applicable to all of the *KNDC* and, to the extent possible, ensure that the various parts and sections of the *KNDC* work together for the benefit of the *Distribution Network Service Provider*s and all *Distribution Network User*s, and apply consistently to all *Distribution Network User*s.

3.4 APPLICABILITY

This Kenya National Distribution Code must be applied and used together with the *Kenya National Transmission Grid Code* and all other applicable policies and procedures that govern the use of the Kenya power system. These conditions apply to:

a. All *DNSPs*
b. All *Distribution Network Users* of the *Distribution System* (load serving *Customers* and *Embedded Generators*).

3.5 HIERARCHY

In the event of any inconsistency between this *KNDC* and the *Energy Act* or the licence of a *DNSP* or a *Licensee* that is a *Distribution Network User*, the *Energy Act* or the licence respectively shall prevail to the extent of such inconsistency.

In the event of any inconsistency between this *KNDC* and the *Kenya National Transmission Grid Code*, the latter shall prevail to the extent of such inconsistency unless the contrary intention is explicit in the *KNDC*.

Nothing in this *KNDC* is intended to or shall *Derogate* from a *DNSP* or a Licensee any licence obligation. If any provision of this *KNDC* should be found to be unlawful or wholly or partially invalid for any reason, the validity of all remaining provisions of this *KNDC* shall not be affected. If part of a provision of this *KNDC* is found to be unlawful or invalid but the rest of such provision would remain valid if part of the wording were deleted, the provision shall apply with such minimum modification as may be:

a. Necessary to make it valid and effective; and
b. Most closely achieves the result of the original wording but without affecting the meaning or validity of any other provision of this *KNDC*.

In the event of any conflict between the provisions of this *KNDC* and any contract, agreement or arrangement between the *DNSP* and a *Distribution Network User*, the provisions of this *KNDC* shall prevail unless this *KNDC* expressly provides otherwise, provided that in the case of *Connection Agreements* with *Customer*s or *Distribution Network User*s signed prior to the approval of this *KNDC*, the conditions in such agreement shall prevail unless:

a. The parties agree an amendments; or
b. The *Distribution Network User* registers a non-compliance situation that negatively affects the security of the *Distribution System*, in which case the *Distribution Network User* must accept the necessary amendments to ensure full compliance with this *KNDC*, except for any *Derogation*.

3.6 IMPLEMENTATION AND ENFORCEMENT

The *Energy Regulatory Commission* is responsible for the implementation and enforcement of the *KNDC*. They may, in certain cases, need access to services and facilities of *Distribution Network User*s or *DNSP*s, or to issue instructions to *Distribution Network User*s or *DNSP*s to implement and enforce the *KNDC*. Accordingly, all *Distribution Network User*s and *DNSP*s are required not only to abide by the letter and spirit of the *KNDC*, but also to provide the *Energy Regulatory Commission* with such rights of access, services and facilities and to comply with any instructions of the *Energy Regulatory Commission*.

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

When the issuance of this *KNDC*, or an amendment to this *KNDC,* causes a *DNSP* to be in non-compliance with the *KNDC* relating to facilities already connected or approved to be connected to the *Distribution System*, 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 *ERC* for review and resolution (as described in Section 3.12, Derogation.) The burden of proof shall rest with the *DNSP* to show good reason why it cannot comply.

Likewise, when the issuance of this *KNDC*, or an amendment to this *KNDC*, causes a *Distribution Network User* to be in non-compliance with the *KNDC* relating to facilities already connected or approved to be connected to the *Distribution System*, 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.

3.7 SAFETY AND ENVIRONMENT

For the avoidance of doubt, nothing in or pursuant to this *KNDC* shall be taken to require a *Party* to do anything which could or would be unsafe or contrary to the *Party's* environmental obligations nor shall prevent a *Party* from doing anything which could or would be unsafe or contrary to that *Party's* environmental obligations to omit to do.

3.8 UNFORESEEN CIRCUMSTANCES

The *KNDC* cannot predict and address all possible operational situations. In case of circumstances unforeseen in the *KNDC,* or in the case of difference in interpretation, the *DNSP* has the right (and all *Distribution Network User*s 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 *Energy Act*, conditions of its *Distribution Licence* and the *KNDC.*

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 *KNDC*.

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 User*s 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 *KNDC* should arise, the *DNSP*s shall, to the extent reasonably practicable in the circumstances, consult promptly and in good faith with the *Kenya National Distribution Code Review Committee* or all affected *Distribution Network User*s in an effort to reach agreement as to what should be done. If agreement between the *DNSP* and the *Kenya National Distribution Code Review Committee* or affected *Distribution Network User*s cannot be reached in the time available, the issue shall be reviewed by the *ERC* to determine what shall be done in accordance to this *KNDC*.

The *DNSP* shall promptly refer any unforeseen circumstance identified, together with the determinations and interpretations made, to the *Kenya National Distribution Code Review Committee* 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 *KNDC*, and do not endanger the safety of its equipment or staff.

3.9 FORCE MAJEURE

In situations of *Force Majeure*, the provisions of the *KNDC* may be suspended in whole, or in part, pursuant to any directions given by the *Energy Regulatory Commission* being the custodian of the *KNDC*.

Neither Party shall be held to have defaulted in respect of any obligation under the *KNDC* 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 *KNDC*, that *Party* shall:

a. Promptly notify any other *Party* involved, the Ministry of Energy and Petroleum and the *Energy Regulatory Commission* 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 *ERC* website.

b. Not be entitled to suspend performance of any of its obligations under the *KNDC* 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* continually informed of its efforts, and

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

3.10 COMPLIANCE

a. All *DNSP*s and *Distribution Network User*s shall comply with the *KNDC* as updated via the *ERC* decisions from time to time.

b. *DNSP*s shall inform the *ERC* of any non-compliance report of a material nature that has been submitted to another *Participant* without delay, but no later than 30 days after becoming aware of the item unless there is a significant risk to the safety of the public, electrical workers, and/or *Kenya National Distribution System or the Kenya National Transmission System*, which then must be reported immediately.

c. The *ERC* may require a *Participant* to provide the *ERC* with information that it deems necessary for the proper administration of the *KNDC*. This information shall, upon request, be treated as confidential.

d. Upon a report or suspicion of non-compliance, the *ERC* 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 *KNDC* is treated under Section 3.11 “Non-Compliance”.

3.11 NON-COMPLIANCE

If a *DNSP* or *Distribution Network User* finds that it is, or will be unable to comply with any provision of this *KNDC*, then that party shall without delay, but not later than 30 days after discovery, report such non-compliance to the *ERC*.

3.11.1 Non-Compliance Situations

If the *DNSP* fails to fulfil all the provisions established in this Performance Standard, it shall be considered a Non-Compliance situation.

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

a. Failure to provide the *ERC*, on time, all of the information established in this Distribution Performance Standards
b. Providing the *ERC* incomplete or inaccurate data or reports, in particular inaccuracies or other problems verified by the audits of the *ERC*
c. Failure to implement in time the procedures and information systems established in this Performance Standard
d. Failure or unsuitable delays in the execution of the approved remedial actions and plans to improve supply quality
e. Failure or unsuitable delays in correcting situations that imply inadequate Power Quality (*Voltage, Flicker or Harmonics*)

3.11.2 Penalties

If the *DNSP* is determined to be in a non-compliance situation, the *ERC* may apply a monetary penalty to correct the non-compliance situation. The *ERC* could also consider that the Distribution Service Provider is in non-compliance with its licence conditions.

In the case that a *DNSP* exceeds the approved tolerances for a Performance Standard as established in this *KNDC*, the *DNSP* will be considered as not achieving the expected efficiency. This lack of efficiency could translate into a penalty and the development of a mitigation plan to correct the deficiency.

3.12 DEROGATION

If a *DNSP* or *Distribution Network User* finds that it is, or will be, unable to comply with any provision of the *KNDC*, then they shall, without delay, report such non-compliance. The applicant may request

an exemption from the *KNDC* requirement, or request additional time to correct the non-compliance item.

3.12.1 Request for Derogation

A Request for *Derogation* form (see Appendix B for a sample 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.

3.12.1.1 *DNSP*s and *Embedded Generator*s

A *DNSP* or *Embedded Generator* seeking *Derogation* shall submit the form (see Appendix B: "Derogation Request and Mitigation Plan Forms") along with any supporting evidence to the *ERC* for their review and determination. The request shall contain:

a. Party applying for *Derogation*;
b. Contact information, name and signature of CEO or other corporate officer with requisite authority to sign the *Derogation* request;
c. Whether the *Derogation* request is for an exemption from a *KNDC* requirement or a request for a time extension to achieve compliance.
d. The specific provision of this *KNDC* with which the *DNSP* is, or will be, unable to comply with;
e. 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;
f. The reason for the non-compliance;
g. A description of any health and safety implications and the associated risk management measures
h. A description of the proposal for restoring compliance (where applicable) with the *KNDC* requirement(s), including details of actions to:
    1. Mitigate risks to *Customers* or other authorisation electricity operators
    2. Restore compliance (including timetable of works)
i. A description of the reasonable alternative actions that have been considered
j. A statement of the expected duration of the non-compliance

(The *DNSP* or *Generator* 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 *Derogation* will not be granted unless the *ERC* is satisfied that the request is justified.)

3.12.1.2 Customers

A *Customer* seeking *Derogation* shall submit the form along with any supporting evidence to their *DNSP* for their review and determination. The request shall contain:

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 *KNDC* requirement will not pose a risk to the distribution network, other *Distribution Network Users,* utility workers or the public.

3.12.2 Derogation Review

Upon receipt of any request for *Derogation*, the *ERC* or *DNSP*, as applicable, shall promptly consider such a request provided that the *ERC* or *DNSP* or the *ERC* considers that the grounds for the *Derogation* are reasonable. In its consideration of a *Derogation* request, the *DNSP* or the *ERC*, as applicable, 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 as soon as reasonably practicable.

The *ERC* 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.

3.12.3 Derogation Reporting

Every three months, the *DNSP* shall report to the *ERC*:

a. The list of *Derogations* requested during the last quarter, including requests by the *DNSP*, 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.

3.12.4 Derogation Register

The *DNSP* shall:

a. Keep a register of all *Derogations* which have been granted to *Distribution Network Users*, identifying *User* name,, the relevant provision of this *KNDC*, a record of the completed mitigation and the period of the *Derogation;* and
b. On request from the *ERC* or any *Distribution Network User*, provide a copy of such register of *Derogation*s.

The *ERC* shall:

a. Keep a register of all *Derogation*s that have been granted to *DNSP*s, identifying the name of the *DNSP*
b. Publish a current register of all *Derogation*s that have been granted to *DNSP*s and *Distribution Network User*s on the *ERC* website, the relevant provision of this *KNDC*, the period of the *Derogation* and a record of the completed mitigation, if applicable.

3.12.5 Transitional Provisions

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

Transitional Provisions are provisions of the *KNDC* approved by the *Energy Regulatory Commission* that shall not apply either in whole or in part to some or all Users. They differ from a *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 *Energy Regulatory Commission* 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 *KNDC* 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
c. Weather

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

3.13 DISPUTE RESOLUTION

If any dispute arises between *Distribution Network User*s or between a *DNSP* and any *Distribution Network User* in relation to this *KNDC*, the parties in dispute shall use their best endeavours to resolve the dispute amicably between them.

If one or more of the parties is not a licence holder, the party or parties may refer the dispute to the *ERC* for determination, unless a contract between the parties in dispute provides otherwise.

If the dispute is between Licensees only, the dispute may be referred to the *ERC* for determination if a contract so requires, or if all parties in dispute agree to such action.

4 GOVERNANCE

4.1 INTRODUCTION

The objective of this Governance section is to describe the provisions necessary for the overall administration and review of the various aspects of the *KNDC*. This section also summarises the main documents and organisations that provide the authority governing the planning, construction, and operation of the *Kenya National Distribution System.*

This *KNDC* shall be read in conjunction with the relevant legislation including the *Energy Act* of 2006, the Energy (Electricity Licensing) Regulations of 2012 and any applicable amendments related to the administrative authority for the *KNDC*. The KNDC requirements shall also be applied in conjunction with the licences issued to *Generators*, Transmission companies and *Distribution Network Service Provider*s and regulations that relate to the Electricity Supply Industry (ESI) adopted by the *ERC* and the Ministry of Energy and Petroleum. All *Distribution Licences* and agreements concluded after implementation of the *KNDC* shall include the obligation of parties to comply with *KNDC* requirements.

4.2 GOVERNANCE DOCUMENTS

The primary laws defining governance are Kenya's *Energy Act* No. 12 of 2006 (The Act) and the energy (Electricity Licensing) Regulations, 2012. The *Energy Act* repealed the Electric Power Act, No. 11 of 1997 and established the *Energy Regulatory Commission* (*ERC*), the Rural Electrification Authority (REA), and the Energy Tribunal. The *Energy Act* authorises the Minister of Energy to issue the regulations, which they did 2012. The organisations with governance functions include the *ERC*, the Energy Tribunal, and the Ministry of Energy and Petroleum (MoEP), the *Kenya National Transmission Grid Code Review Committee* and the *Kenya National Distribution Code Review Committee*.

4.3 DISTRIBUTION CODE MANAGEMENT

4.3.1 Purpose

This section describes the methodology that will be used to:

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

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

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

4.4 KENYA NATIONAL DISTRIBUTION CODE REVIEW COMMITTEE

The *Energy Regulatory Commission* shall establish, maintain and administer a *Kenya National Distribution Code Review Committee* (the "Distribution Code Review Committee") and is responsible for the review of the operations and revision of the *KNDC*.

The *Kenya National Distribution Code Review Committee* shall consist of the following Members:

a. A Chairperson appointed by the *Energy Regulatory Commission*;
b. One person representing the *Energy Regulatory Commission*;
c. One person representing the *Regional Control Centres;*
d. One person representing each *Transmission Licensee*;
e. One person representing each *Distribution Licensee*;
f. One person representing the Distribution Network *Embedded Generator*s

4.4.1 Conduct of Business

The *Distribution Code Review Committee* shall establish and comply at all times with its own rules and procedures governing the conduct of its business as approved by the *Energy Regulatory Commission*.

If the *Distribution Code Review Committee* is unable to reach an agreement on any matter presented before it as discussed in Section 4.7.8, that matter shall be referred to the *Energy Regulatory Commission* for determination. Any such referral shall set out the cause of disagreement and the views held by the respective members of the *Kenya National Distribution Code Review Committee* and resolve the issues.

4.4.2 Constitution and Rules of the Distribution Code Review Committee

4.4.2.1 Committee Name

The Committee charged with the review of the operation and revision of the Kenya National Distribution Code shall be called the *Kenya National Distribution Code Review Committee* and shall be governed by the Constitution and Rules set out in this section of the *KNDC*.

4.4.2.2 Definitions

The following words and expressions shall have the following meanings in this Constitution:

a. "**Chairperson**" means the person duly appointed by the *ERC* to be Chairperson, the

person appointed by the Chairperson to be his alternate, or the person appointed to act as Chairperson of the meeting in the absence of the Chairperson or his alternate.

b. "**Constitution**" means the constitution and rules of the *Kenya National Distribution Code Review Committee* as set out herein and as may be amended from time to time with the approval of the *Energy Regulatory Commission*.

c. "**Member**" means a person duly appointed to be a member of or the Chairperson of the *Kenya National Distribution Code Review Committee*.

d. "**Secretary**" means the person appointed by the *ERC*, and named as such.

4.4.2.3 Interpretations

Except as otherwise provided herein and unless the context otherwise admits, words and expressions used herein shall have the same meaning as defined in the *KNDC*.

Words denoting the singular shall also include the plural and vice versa as the context requires and references to the masculine shall also include the feminine.

Headings and titles to clauses shall not be taken into consideration in the interpretation or construction of the words and expressions used herein.

Unless otherwise required, any reference to a clause herein is a specific reference to a clause of this Constitution.

4.4.3 Distribution Code Review Committee Member Qualifications

Due to the technical nature of many of the duties and responsibilities of the *Distribution Code Review Committee* members, any person that is being considered as a Committee member must meet the following minimum experience and qualifications;

4.4.3.1 Chairperson

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

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

4.4.3.2 *Distribution Code Review Committee* Member

a. Minimum of 7 years of electric industry experience in a technical capacity.

b. Minimum of 3 years of experience in regulatory requirement compliance responsibilities for an electric utility, regulatory commission or independent power producer.

4.4.4 Distribution Code Review Committee Member Duties and Responsibilities

The *Kenya National Distribution Code Review Committee* is a standing body established,

maintained and administered by the *Energy Regulatory Commission*. The *Kenya National Distribution Code Review Committee* shall:

a. Keep the *KNDC* and its working under review;

b. Ensure that the *KNDC* 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 *KNDC* which the *Energy Regulatory Commission*, *Kenya National Transmission System Operator, Transmission Licensees, Distribution Licensees* or *Distribution Network User*s submit to the *Distribution Code Review Committee* for consideration from time to time;

d. Present recommendations to the *Energy Regulatory Commission* as to amendments to the *KNDC* that the Kenya National *Distribution Code Review Committee* considers warranted and the reason for such changes;

e. Review existing standards relevant to the operation of the *Kenya National Distribution System* and to make modifications or proposals for new standards in relation to the operation of the *Kenya National Distribution System*; and

f. Issue guidance in relation to the *KNDC* and its implementation, performance, and interpretation.

4.4.5 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 clauses of this Constitution and Rules.

The *ERC* has the right to modify the term of office during the initial formation of the *Kenya National Distribution Code Review Committee* to assure that incumbent member's terms do not expire at the same time. This will assure that the Committee has a consistent mix of incumbents and new members.

4.4.6 Appointment by Energy Regulatory Commission

If at any time any person or group of persons entitled to appoint a Member or Members shall not have made an appointment(s) and/or shall be in disagreement as to whom to appoint and as a result no Member represents that person or group of persons, the Chairperson shall notify the *Energy Regulatory Commission*. The *Energy Regulatory Commission* shall have the right, until the relevant person or group of persons has decided upon an appointment and the Chairperson has notified the *Energy Regulatory Commission* accordingly, to appoint a Member or Members on behalf of that person or group of persons, and to remove any person so appointed by him, provided that the *Energy*

Regulatory Commission shall have no obligation to exercise that right. In the event that the *Energy Regulatory Commission* does not exercise his right the *Kenya National Distribution Code Review Committee* shall be regarded as complete in the absence of that Member or those Members. For the avoidance of doubt, this paragraph does not apply to the reappointment of a Member or Members appointed by any person or group of persons entitled to so appoint.

4.4.7 Nature of Member

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

4.4.8 Retirement and Reappointment of Members

Each Member shall retire automatically at the beginning of the meeting of the *Kenya National Distribution Code Review Committee* held on the first business day in the month of March each year (or if no meeting is held on such day, at the meeting, which is held on the date falling closest after that day) but shall be eligible for re-appointment.

Each person or group of persons entitled to appoint a Member may, by notice in writing to the Chairperson, indicate its wish to re- appoint the retiring Member or to appoint a new Member in his place.

Such notifications for re-appointment or appointment must be delivered to the Chairperson at least twenty one (21) days in advance of the meeting of the *Kenya National Distribution Code Review Committee* from the person or group of persons represented by each Member. A notification for re-appointment in respect of an existing Member shall be deemed to be given if no notification is delivered to the Chairperson at least twenty-one (21) days in advance of the meeting of the *Kenya National Distribution Code Review Committee*. Should the position of a Member become vacant, the party appointing him must appoint a replacement within twenty-five (25) Calendar days.

4.4.9 Alternates

The Chairperson and each Member shall have the power to appoint any individual to be his alternate and may at his discretion remove an alternate Member so appointed. 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 *Kenya National Distribution Code Review Committee*. If his appointer so requests, an alternate Member shall be entitled to receive notice of all meetings of the *Kenya National Distribution Code Review Committee* 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 this Constitution shall apply as if the alternate appointed were a Member.

4.4.9.1 Ceasing to Act

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

4.4.10 References Include Alternates

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

4.4.11 Representation and Voting

4.4.11.1 Representation

The Chairperson and each other Member shall be entitled to attend and be heard at every meeting of the *Kenya National Distribution Code Review Committee*. One adviser (or such greater number as the Chairperson shall permit) shall be entitled to attend any meeting of the *Kenya National Distribution Code Review Committee* with each Member and shall be entitled to speak at any meeting but shall not be entitled to vote on any issue.

4.4.11.2 Voting

The *Kenya National Distribution Code Review Committee* will seek to achieve a consensus agreement between all voting members. If the Committee is unable to reach 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. Otherwise, the Chairperson shall not cast a vote.

Every person acting as an alternate Member shall have one vote for each Member for whom he acts as alternate, in addition to his own vote if he is also a Member. Execution by an alternate Member of any resolution in writing of the *Kenya National Distribution Code Review Committee* shall, unless the notice of his appointment provides to the contrary, be as effective as execution by his appointer.

4.4.12 Removal

Any person or persons entitled to appoint a Member, including the Chairperson, may at any time remove that Member or the Chairperson, as the case may be, from office and appoint

another person in his place. A person or persons will only have the right to remove from office 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 4.4.6 "Appointment by ERC" shall apply with any necessary changes. Whenever any individual Member or the Chairperson changes, the person or group of persons entitled to appoint that Member or the Chairperson shall notify the Secretary in writing within seven (7) days of the change taking effect.

4.5 THE CHAIRPERSON POSITION

The Chairperson is a Member of the *Kenya National Distribution Code Review Committee* and references to a "Member" in this Constitution shall, unless the context otherwise requires, include the Chairperson. Consequently, the Chairperson shall be entitled to cast one vote if consensus or a simple majority vote is unable to make a decision on an item that the Distribution Code Review Committee is acting upon.

4.5.1 Appointment/Removal

The *Energy Regulatory Commission* may at any time remove the Chairperson from office. Upon retirement or removal by the *ERC* of the first and each successive Chairperson, the *ERC* shall appoint a person to act as Chairperson.

4.5.2 Alternate Chairperson

The Chairperson shall preside at every meeting of the *Kenya National Distribution Code Review Committee* 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 *ERC* 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.

4.6 THE SECRETARY POSITION

4.6.1 Appointment

The *Energy Regulatory Commission* shall have power to appoint and dismiss a Secretary and such other staff for the *Kenya National Distribution Code Review Committee* as it may deem necessary. The *ERC* 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.

4.6.2 Duties

The Secretary's duties shall be to attend to the day to day operation of the *Kenya National Distribution Code Review Committee* 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 the Chairperson and alternates as appointed from time to time; and

c. Keep minutes of all meetings.

4.6.3 Registers

The Secretary shall make available the registers of names and addresses and minutes for inspection by the *Energy Regulatory Commission*, Members, and Member Transmission and *Distribution Licensee*s.

4.6.4 Group Representative's Addresses

Each Member shall from time to time communicate all contact information (address, email, office and mobile number) Secretary and all notices sent to such address shall be considered as having been duly given.

4.7 MEETINGS

4.7.1 Date and Venue

The *Kenya National Distribution Code Review Committee* shall hold meetings quarterly at regular scheduled times as the Committee may decide.

4.7.2 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 business that it is proposed will be conducted. The Secretary shall proceed to convene a meeting of the *Kenya National Distribution Code Review Committee* within seven (7) days of the date of expiry of such notice.

4.7.3 Notice of Meetings

4.7.3.1 Notice by Secretary

All meetings shall be called by the Secretary 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. If at any time a person has not been appointed as Secretary, or the Secretary is for any reason unable to act, the Chairperson shall attend to the requisition of meetings.

4.7.3.2 Details in Notice

The notice of each meeting shall contain the time, date and venue of the meeting, an agenda and a summary of the business to be conducted and shall be given to all Members.

4.7.3.3 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.

4.7.3.4 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.

4.7.4 Proceedings at Meetings

4.7.4.1 *Distribution Code Review Committee* Business

The *Kenya National Distribution Code Review Committee* may meet for the transaction of business, and adjourn and otherwise regulate its meetings, as it sees fit.

4.7.4.2 Quorum

50% plus one (1) Member present in person, or by their alternates, shall constitute a quorum.

4.7.4.3 Inquorate Meetings

If, within half an hour from the time appointed for holding any meeting of the *Kenya National Distribution Code Review Committee*, a quorum is not present, the meeting shall either:

- 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. If at such adjourned meeting a quorum is not present within half an hour from the time appointed for holding the meeting, the meeting shall not take place; or
- Be held subject to the holding of the meeting being ratified at the next meeting at which a quorum is present.

4.7.5 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.

4.7.6 Validity of Acts

All acts done by any meeting of the *Kenya National Distribution Code Review Committee* 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.

4.7.7 Resolutions

A resolution put to the vote at a meeting shall be decided by a show of hands. For the avoidance of doubt, where a person attending a meeting is entitled to cast more than one vote because, for example, he is the alternate for another Member, that person may, subject to establishing to the Chairperson's reasonable satisfaction that he is so entitled, cast his full number of votes by raising his hand.

4.7.8 Voting

A resolution of the *Kenya National Distribution Code Review Committee* shall be passed by consensus agreement between all members. If the Committee is unable to reach consensus on a resolution, a simple majority of votes cast will pass the resolution. If there is a tie on the vote, the Chairperson will be allowed to make a tie-breaking vote. In no other case shall the Chairperson vote.

4.7.9 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 *Kenya National Distribution Code Review Committee* duly convened and held and may consist of several documents in like form each signed by or on

behalf of one or more Members.

4.7.10 Attendance by Conference

A meeting of the *Kenya National Distribution Code Review Committee* may consist of a conference between Members who are not all in one place but who are able directly or by telephonic communication to speak to each of the others and to be heard by each of the others simultaneously. The word “meeting” shall be construed accordingly.

4.7.11 Minutes

4.7.11.1 Circulation

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

4.7.11.2 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 *Kenya National Distribution Code Review Committee* at the meeting to which the minutes relate.

4.7.11.3 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 *Kenya National Distribution Code Review Committee* as the first item for resolution.

4.7.12 Guidance from the Kenya National Distribution Code Review Committee

The *Kenya National Distribution Code Review Committee* may at any time, and from time to time, issue guidance in relation to the *KNDC* and its implementation, performance and interpretation, and it may establish sub-committees and working groups to carry out such work.

4.7.13 Sub-Committees and Working Groups

4.7.13.1 Sub-Committees

The *Kenya National Distribution Code Review Committee* may establish 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 *Kenya National Distribution Code Review Committee* 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 *Kenya National Distribution Code Review Committee*.

4.7.13.2 Working Groups

The *Kenya National Distribution Code Review Committee* 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 *Kenya National Distribution Code Review Committee* may determine for the purpose.

4.7.13.3 Resolutions

Resolutions of sub-committees and working groups shall not have binding effect unless approved by resolution of the *Kenya National Distribution Code Review Committee*.

4.8 VACATION OF OFFICE

The office of a Member shall be vacated if:

a. They resign office by notice delivered to the Secretary; or

b. They become bankrupt or compounds with their creditors generally; or

c. They become of unsound mind or a patient for any purpose of any statute relating to mental health; or

d. They or their alternate fails to attend more than three consecutive meetings of the *Kenya National Distribution Code Review Committee* without submitting an explanation to the Chairperson which is reasonably acceptable to the Chairperson.

4.9 MEMBER'S RESPONSIBILITIES AND PROTECTIONS

4.9.1 Responsibilities

In the exercise of its powers and the performance of its duties and responsibilities, the *Kenya National Distribution Code Review Committee* shall have due regard for the need to promote the attainment of the principal duties of the *Kenya National Distribution Code Review Committee*.

4.9.2 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 that person or persons by whom he is for the time being appointed, provided that such obligation of representation shall at all times be subordinate to the obligations of the Member as a Member of the *Kenya National Distribution Code Review Committee*.

4.9.3 Reliance on Documentation

The *Kenya National Distribution Code Review Committee*, 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.

4.10 AMENDMENTS TO THE KNDC

Any *Distribution Network User*, *Kenya National Distribution Code Review Committee* Member, *DNSP*, *Transmission Licensee*, the *Kenya National Transmission System Operator*, the Ministry of Energy and Petroleum or the *Energy Regulatory Commission* may propose amendments to the *KNDC*. The *Energy Regulatory Commission*, as the custodian of the *KNDC*, shall be the Approving Authority for any revisions to the *KNDC*.

4.10.1 Review of Proposed *KNDC* Amendments

All proposed revisions shall be sent to the Chairperson of the *Kenya National Distribution Code Review Committee* for consideration by the *Kenya National Distribution Code Review Committee*. The Chairperson will advise the *Kenya National Distribution Code Review Committee* of all proposed revisions to the *KNDC* with notice of no less than [20 Business Days] in advance of the next scheduled meeting of the *Distribution Code Review Committee*.

Following the review of a proposed revision by the *Distribution Code Review Committee*, the *ERC* shall review the Committee's recommendation. The *ERC* shall consider the proposed revision, other views, and any further representations and shall determine whether the proposed revision should be made and, if so, whether in the form proposed or in an amended form. In considering the proposed revisions, the *Energy Regulatory Commission* may also seek the opinion of an *Independent Expert.*

4.10.2 Notification of Amended KNDC

If the *ERC* decides that the revision shall be made, the Chairperson shall notify each *DNSP* of

the revision at least [30 Business Days] prior to the revision taking effect. The revision shall take effect with this *KNDC* deemed to be amended accordingly from [and including] the date specified in such notification or other such date as directed by the *ERC*. The representatives of *DNSP*s in the *Distribution Code Review Committee* shall have the responsibility of drafting the amended Conditions, unless the *ERC* specifies that such amendment shall be drafted by the *ERC*.

4.10.3 Publishing Amended KNDC

The *Energy Regulatory Commission* shall, as required, prepare and issue amended versions of the *KNDC* containing such revisions as have been approved by the *Energy Regulatory Commission*. All revisions to the *KNDC* shall be recorded in the *Kenya National Distribution Code Revision Register* which shall indicate the date, Chapter amended and the reason for the change. An up-to-date *KNDC* including all approved revisions shall be published on the *Energy Regulatory Commission* website along with the *Kenya National Distribution Code Revision Registe*r. The revised version of the *KNDC* shall take effect from the date on which it is published on the *ERC* website, or such other later date as specified by the *Energy Regulatory Commission*.

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 Generator Connection

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

5.1.2 Distribution System Requirements

The *DNSP* shall furnish relevant *Distribution 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

*Distribution Network User*s 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.

*Distribution Network User*s 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 or the *KNDC*.

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 *KNDC*.

5.1.4 Small Connections (10kVA and below)

For new or modified Small Connections, it is possible in most cases to assess whether a proposed connection is acceptable, and to 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 (Up to 2 MVA)

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

a. Expected point of connection 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)
    3. Maximum Reactive Power requirements (kvar)
f. For Fluctuating Loads:
    1. The rate of change of the 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 System*
h. The maximum flicker and harmonic content which will be imposed on the *Distribution 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 voltages (kV);
    3. Winding arrangement;
    4. Positive and zero sequence resistance and reactance
    5. Tap changer range, step size and type (on-Load or off-Load); and
    6. Basic Lightning Impulse Insulation Level (kV).

5.1.6 Large Connections (Greater than 2 MVA)

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 profiles (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):
    i. Rated voltage (kV);
    ii. Rated current (A);
    iii. Rated symmetrical RMS short-circuit current (kA); and
    iv. Basic Lightning Impulse Insulation Level (kV).

5.1.7 Generation Connections

Distribution Network Users seeking connection of a *Generator* to the *Distribution System* shall use the following procedures.

5.1.7.1 Small Generator (less than 50KW)

a. *Distribution Network User*s seeking to connect a Small *Generator* 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 one-line diagram of the Generating Plant.

b. *DNSP*s will use the following criteria to assess a Small *Generator* connection application:

1. For connection of a Generating Plant 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 sectionalising 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 20 kilovolt-amps (kVA).
3. If the Generating Plant is single-phase and is to be connected on a transformer centre tap neutral of a 230-volt service, its addition will not create an imbalance between the two sides of the 230-volt service of more than 20 percent of nameplate rating of the service transformer.

5.1.7.2 Medium Generating Plant (50 kW – 10 MW)

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

a. Generating Plant Specifications
   1. Prime Mover: PV/Reciprocating Engine/Fuel Cell/Gas Turbine/Steam Turbine/Microturbine
   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
   8. List Energy Network Association (ENA) certified components of the Connection Equipment Package
   9. Is prime mover compatible with the Connection Equipment Package?

b. Individual *Generator* Data
   1. Manufacturer, Model Name and Number
   2. Version Number
   3. Nameplate Output Rating in kW: Summer / Winter
   4. Nameplate Output Power Rating in kVA: Summer / Winter
   5. Rated Power Factor: Leading / Lagging
   6. Total Number of *Generator*s to be Connected
   7. Elevation
   8. Single- or Three-Phase?
   9. 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 (if applicable)

d. Synchronous *Generator*s
   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 *Generator*s
   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 vars (No Load)
   14. Reactive Power Required in vars (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 generator and the Connection Point?
   2. Will the transformer be provided by the Connection *Customer*?
   3. Transformer Data: (If applicable, for Connection *Customer*-Owned Transformer)
   4. Is the transformer single- or three-phase?
   5. Size: kVA

6. If three phase:
    i. Transformer Primary: _____Volts _____Delta _____Wye _____Wye Grounded
    ii. Transformer Secondary: ____Volts _____Delta _____Wye _____Wye Grounded
    iii. Transformer Tertiary: _____Volts _____Delta _____Wye _____Wye Grounded

g. Transformer Fuse Data (If 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 (if applicable)
    1. Manufacturer
    2. Type
    3. Load Rating (Amps)
    4. Interrupting Rating (Amps)
    5. Trip Speed (Cycles)

i. Connection Protective Relays (if applicable)
    1. If microprocessor, provide a list of functions and adjustable set points (min/ max)
    2. Discrete Components (if 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 (if 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 (if applicable)

k. Attach copy of site electrical one-line diagram showing the configuration of all Generating Plant equipment, current and potential circuits, and protection and control schemes. This one-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 Unit at rated MW output; and
2. Each Generation Unit auxiliary Load other than (a) above and where the station auxiliary Load is supplied from the *Distribution System*.

m. 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 MW)

As appropriate for the size and type of Generating Plant, *Distribution Network User*s seeking to connect a Larger *Generator* 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
8. List Energy Network Association (ENA) certified components of the Connection Equipment Package
9. Is prime mover compatible with the Connection Equipment Package?

b. Individual *Generator* Data

1. Manufacturer, Model Name and Number
2. Version Number
3. Nameplate Output Rating in kW: Summer / Winter
4. Nameplate Output Power Rating in kVA: Summer / Winter
5. Rated Power Factor: Leading / Lagging
6. Total Number of *Generator*s to be Connected
7. Elevation
8. Single- or Three-Phase?
9. 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 (if applicable)

d. Synchronous *Generator*s

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 *Generator*s

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 vars (No Load)
14. Reactive Power Required in vars (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 generator and the Connection Point?
2. Will the transformer be provided by the Connection *Customer*?

3. Transformer Data: (If applicable, for Connection *Customer*-Owned Transformer)
4. Is the transformer single- or three-phase?
5. Size: kVA
6. If three phase:
    i. Transformer Primary: _____Volts _____Delta _____Wye _____Wye Grounded
    ii. Transformer Secondary: ____Volts _____Delta _____Wye _____Wye Grounded
    iii. Transformer Tertiary: _____Volts _____Delta _____Wye _____Wye Grounded

g. Transformer Fuse Data (If 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 (if applicable)
    1. Manufacturer
    2. Type
    3. Load Rating (Amps)
    4. Interrupting Rating (Amps)
    5. Trip Speed (Cycles)

i. Connection Protective Relays (if applicable)
    1. If microprocessor, provide a list of functions and adjustable set points (min/ max)
    2. Discrete Components (if 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 (if 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 (if applicable)

k. Attach copy of site electrical one-line diagram showing the configuration of all Generating Plant equipment, current and potential circuits, and protection and control schemes. This one-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 Unit at rated MW output; and
    2. Each Generation Unit auxiliary Load other than (a) above and where the station auxiliary Load is supplied from the *Distribution System*.

m. 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

The *DNSP* shall establish the procedure for the processing of applications for connection or modification of an existing connection to the *Distribution System*. The *DNSP* shall process the application for connection or modification to an existing connection within 30 days.

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 fulfils all the technical requirements of the *KNDC*, 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*.

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 User*s of the *DNSP* or for other technical reasons or may agree alternative methods for minimising the effects of disturbing loads.

5.1.10 Application Approval

After evaluating the application submitted by the *Distribution Network User*, the *DNSP* shall inform the *Distribution Network User* whether the proposed *Distribution Network User* Development is acceptable or not. The *DNSP* may disapprove an application for connection or a Modification of an existing connection to the *Distribution System* if it is determined through the Distribution Impact Studies that the proposed connection or Modification will not meet the technical requirements or result in the degradation of the *Distribution System*.

If the application of the *Distribution Network User* is not acceptable, the *DNSP* shall notify the *Distribution Network User* as to why its application is not acceptable. The *DNSP* shall include in its notification details of the amendments required to make the *Distribution Network User*'s application acceptable to the *DNSP*. The *DNSP* shall report this situation to the *ERC*.

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 reach agreement on the proposed connection or modification to an existing connection, the *Distribution Network User* shall have the right to bring the matter before the *ERC* for resolution. The *ERC* shall have the reasonable right of access to any information that it deems fit in order to resolve such disagreement.

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 reasonably satisfied that the *Distribution Network User*'s System at the boundary with the *Distribution System* will comply with all appropriate requirements of the *KNDC*.

The *Connection Agreement* might include, but not be limited to, provisions for the submission of information and reports, Safety Rules, Test and Commissioning programmes,

Electrical Diagrams, statement of readiness to connect, certificate of approval to connect, and other requirements agreed between the parties. 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 Submittals Prior to the Commissioning Date

The following shall be submitted by the *Distribution Network User* prior to the Commissioning date, pursuant to the terms and conditions and schedules specified in the *Connection Agreement*:

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 authorisation 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.

5.1.13 Commissioning of Equipment and Connecting to Distribution System

Upon completion of the *Connection Agreement* and installation of the equipment at the *Connection Point*, the *Distribution Network User* shall be subjected to the test and

commissioning procedures developed by the *Distribution Network User* and approved by the *DNSP*.

The *Distribution Network User* shall then submit to the *DNSP* a statement of readiness to connect, which shall include a certified Test and Commissioning report. The *DNSP* shall be entitled to witness the tests. The *DNSP* may withhold agreement to energise the *Distribution Network User*'s Equipment where test results do not demonstrate compliance with the *KNDC*.

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

The point or points at which supply is given or taken between the *Distribution System* and *Distribution Network User*s will be agreed between the *DNSP* and the *Distribution Network User* as required. For MV connections, including connections between the *DNSP* and *Distribution Network User*, and where necessary bus bar connected supplies at LV, the *Connection Point*s will be subject to specific agreement between the parties in each case.

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 follow ownership.

For supplies to *Generator*s connected to *Distribution* that operate in parallel with the *Distribution System* and all supplies at MV, the *DNSP* will with the *Distribution Network User*'s agreement, prepare a description of the site responsibilities, included in the *Connection Agreement*, with an electrical equipment diagram showing the agreed *Ownership Boundary* at any point.

The description of the site responsibilities within the *Connection Agreement* 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.

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 electrical equipment 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

If 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 minimised. 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

If 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 a revised Electrical Diagram and *Connection Point* Drawing, at least one (1) month prior to the proposed addition or change.

If the modification involves the replacement of existing Equipment, the revised Electrical Diagram and/or *Connection Point* Drawing, as suitable, 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 System to ensure that at any *Distribution Network User*'s *Connection Point*, the Supply Quality Standards specified in the Performance Standards Section are complied with. *Distribution Network User*s 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 Kenya National Transmission System Operator* 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 short-term operation in the range of 48.0 Hz to 52 Hz. The *Kenya National Transmission System Operator* 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)	11000 volts (11kV)
	33000 volts (33kV)
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 Section 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 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	± 10%

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 over-voltages 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 2% in any hour.

Table 5-3: Negative Sequence Voltage Levels

Nominal Voltage (kV)	Averaging Time	Maximum Negative Sequence *Voltage* (%)	
		Normal	Single
> 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 energisation, series or shunt capacitor bank energisation or shunt reactor energisation within the power system.

5.2.7 Harmonics

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

Table 5-4: Harmonics

Harmonic Order (n)	LV < 1000 V	MV
(odd non-multiples of 3)		
5	6.0	5.0
7	5.0	4.0
11	3.5	3.0
13	3.0	2.5
(odd multiples of 3)		
3	5.0	4.0

9	1.5	1.2
15	0.4	0.3
21	0.3	02
>21	0.2	-
(even)		
2	2.0	1.8
4	1.0	1.0
6 to 24	0.5	0.5
Total Harmonic Distortion:	8%	5%

IEEE Standard 519 establishes harmonic limits on THD to be 8% and 5% of the fundamental voltage respectively for the LV and MV systems. For special load (e.g., hospital, airport), IEEE Standard 519 requires theses limits to be 5% and 3% of the fundamental voltage respectively for the LV and MV systems. IEEE Standard 519 also stipulates that the harmonic limits can be relaxed to 10% for dedicated loads such as converter loads for equipment manufacturers where operation at higher distortion is allowable.

Distortion of the System voltage waveform, caused by certain types of equipment, may result in annoyance to *Distribution Network User*s or damage to connected apparatus. In order to limit these effects, *Distribution Network User*s' 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 %
(odd non-multiples of 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

Harmonic Order (n)	Low Voltage Contracted Power less than 10 kW A	Low Voltage Contracted Power greater than 10 kW %	Medium Voltage %
25	0.18	1.6	1.6
> 25	4.5/n	0.8 +0.8*25/n	0.8 +0.8*25/n
(odd non-multiples of 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 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

For the purpose of this Section, *Flicker* shall be defined as the impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.

The *Flicker* Severity at the *Connection Point* of any *Distribution Network User* shall not be above the maximum values stated in KS 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* 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. If required, the *DNSP* shall provide, install, and maintain a telemetry outstation and

all associated Equipment needed to monitor the *Distribution Network User* System. If the *Distribution Network User* agrees that the *DNSP* shall control the switchgear in the *Distribution Network User* 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 Kenyan national standards. All equipment at the *Connection Point* shall be designed, manufactured, and tested in accordance with the quality assurance requirements of the ISO9002.

All Equipment at the *Connection Point* shall be operated and maintained in accordance with *Prudent Utility 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 *ERC*.

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 User*s (or other *Distribution Network User*s as may be determined by the *ERC* from time to time) of the *Distribution System* shall maintain a Power Factor not less than 0.85 lagging at the *Connection Point*, unless a different value have been agreed to in the *Connection Agreement*.

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 0.85 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 AT GENERATOR CONNECTION POINT

The *Generators* connected to the *Distribution System*:

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

b. Shall meet the requirements for Voltage Unbalance as specified in this *KNDC*.

c. With a size of 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.

5.3.1 Embedded Generator

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

5.3.2 System Frequency

The *Generator* connected to the *Distribution System* shall be capable of continuously supplying its Active Power output, as specified in the *Generator*'s declared data, within the System Frequency range specified in the *KNDC*. 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.

If the System frequency momentarily rises up to the value of 51.5 Hz or falls up to the value to 48.5 Hz, *Generator*s 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 be responsible for protecting its *Generator* connected to the *Distribution System* against damage for frequency excursions outside the range of

51.5 Hz and 48.5 Hz. The *Distribution Network User* shall decide whether or not to disconnect its Generation Unit from the *Distribution System*.

5.3.3 Protection System Coordination

The Protection of *Generator*s 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 minimise the impact of faults on the *Distribution System*. The *DNSP* and the *Generator* Connected to Distribution shall be solely responsible for the Protection System of the electrical Equipment and facilities at their respective sides of the *Connection Point*. Tables 5-6 and 5-7 summarise typical protection requirements of *Generator*s of different types and sizes. As protection requirements could widely vary depending on the *Generator* 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 Generators

Interconnection Control, Protection and Safety Equipment[1] YES denotes a requirement for this *Guideline*	
Generation Size	
15 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
Synchronising 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 Distribution Network Service Provider.
[2]. For synchronous and other types of Generators with standalone capability.
[3]. For single-phase Generators larger than 50 kW, consult with Distribution Network

Service Provider 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 Distribution Network Service Provider.

Table 5-7 Protection for Three-Phase Generators

Interconnection Control, Protection and Safety Equipment[8] **YES denotes a requirement for this *Guideline* - All devices are three-phase unless otherwise specified.**					
Generator 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
Synchronising 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]				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		YES[6]	YES[6]	YES[6]	YES[6]
Telemetry Data Communication			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 Distribution Network Service Provider will inform the Generator 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 Distribution Network Service Provider 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 Distribution Network Service Provider.

A fault or maintenance outage could result in the disconnection of the Generation connected to the *Distribution System* together with an associated section of the *Distribution System*, from the remainder of the total system. Unless explicitly arranged with the *DNSP*, and clearly stated on the *Connection Agreement* or amended *Connection Agreement*, the *Generator* 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 *Generator* is capable of maintaining this voltage because it is equipped with synchronous or self-excited asynchronous *Generators*, the *Distribution Network User* should install adequate protection devices (that could include inter-tripping schemes) to assure the disconnection either of the *Generator* or the whole *Distribution Network User*'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 *Generator* (or the *Generator* and other *Distribution Network User*'s facilities below the *Connection Point*) following the first *DNSP*'s Main Breaker, Recloser or Sectionaliser opening, and to remain disconnected until the System has completely restored.

5.3.4 Reactive Power

The *Generators* 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 the *KNDC*, during normal conditions.

The *Generators* 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 *Generators* connected to Distribution 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 *Generators* Connected to Distribution. The performance requirements for excitation control facilities, including *Power System Stabilisers,* where necessary for System operations shall be specified in the Distribution *Connection Agreement* or Amended *Connection Agreement*.

5.3.5 Black Start

The *Generator* 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 *Generator* wishes to provide Ancillary Services for Black Start to the *Kenya National Transmission System*

Operator, it shall develop and sign the necessary agreements with it, and comply with the *KNDC.*

5.3.6 Renewable Generation

5.3.6.1 Fault Ride-through Requirements for RPPs

Fault ride-through refers to the ability of a *Generator* to remain connected during a system voltage disturbance.

Four main characteristics typically provide the requirements for RPPs in the event of a voltage disturbance:

a. Conditions for which the RPP must remain connected
b. Active Power provision during fault
c. Voltage support requirements during the disturbance
d. Restoration of Active Power after the fault has been cleared

Each is discussed in more detail below.

5.3.6.2 Remain Connected Voltage Condition

A wind or solar photovoltaic RPP shall remain connected to the *Kenya National Distribution System* for voltage disturbances on any or all phases, where the system phase voltage measured at the HV terminals of the connection transformer remains above a specified level for a specified length of time.

The “remain connected” requirements take the form of a voltage vs. time profile which dictates the level of voltage drop or increase that an RPP must be capable of withstanding along with the time for which the voltage drop or increase should be endured.

Figure 5-1 shows the combinations of voltages and time that the RPP shall be able to endure.

Area A shows that the RPP shall be able to operate continuously between 0.9 p.u. and 1.1 p.u. In Area A the RPP shall stay connected to the network and uphold normal production.

Area B is the area between the Lower Bound and the bottom of the continuous operating range, at 0.9 p.u. In Area B the RPP shall stay connected to the network. Figure 5-1 shows that the RPP shall be able to withstand voltage drops to zero, measured at the *Connection Point*, for a minimum period of 0.15 seconds without disconnecting. Less severe voltage

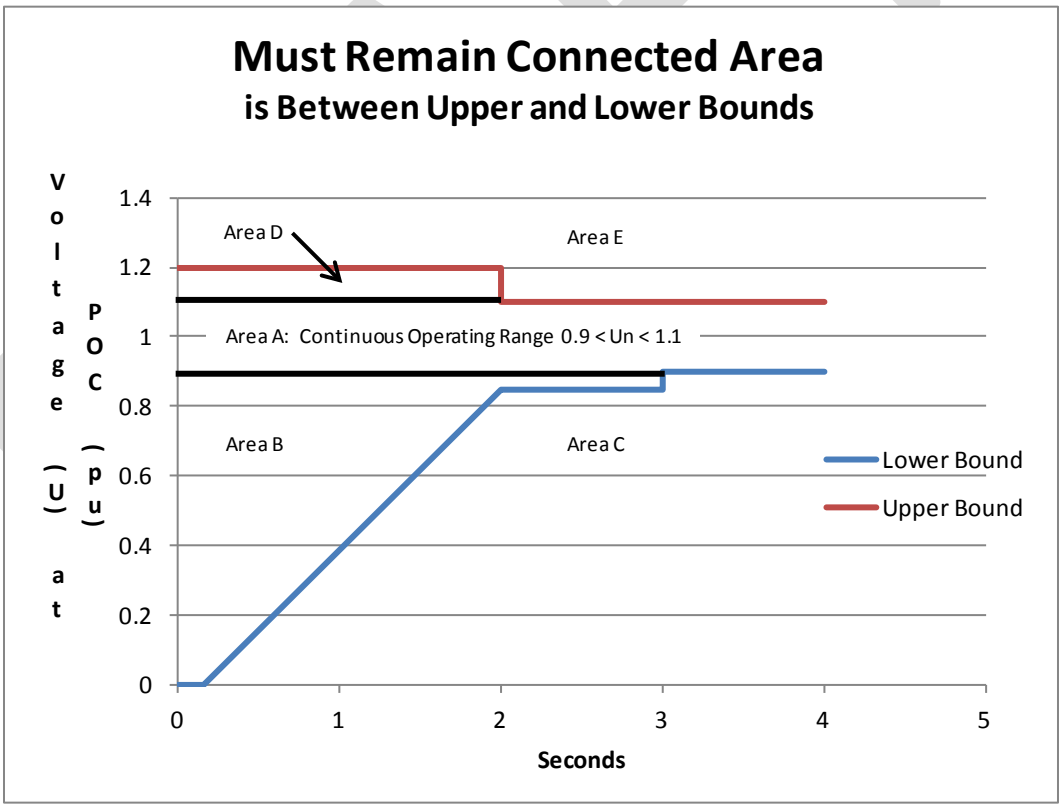
drops increase the length of time they must be endured. Just below 0.85 p.u. the voltage drop shall be endured for nearly two seconds. At 0.85 p.u. the voltage drop shall be endured a minimum of three seconds.

Area D is the area between the Upper Bound and the top of the continuous operating range, at 1.1 p.u. In Area D the RPP shall stay connected to the network. Figure 5-1 shows that the RPP shall be able to withstand voltage increases to 1.2 p.u. for at least two seconds.

Area C is the area outside the Lower Bound and below the continuous operating range, at 0.9 p.u. In Area C disconnecting the RPP is allowed.

Area E is the area above the Upper Bound and above the continuous operating range, at 1.1 p.u. In Area E disconnecting the RPP is allowed.

Figure 5-1: Voltage Must Remain Connected Area



5.3.6.3 Active Power Provision During Fault

During a voltage dip, the controllable RPP shall provide Active Power in proportion to retained voltage and maximise reactive current to the *Kenya National Distribution System* without exceeding its declared limits.

5.3.6.4 Reactive Current Flows During Fault

The maximisation of reactive current during a fault shall continue for at least 600 ms or until the voltage recovers to within the normal operational range of the *Kenya National Distribution System,* whichever is the sooner.

5.3.6.5 Active Power Recovery After Fault

The controllable RPP shall provide at least 90% of its maximum available Active Power as quickly as possible and in any event within one second of the voltage recovering to the normal operating range.

5.3.6.6 Power System Remain Connected Frequency Ranges

Frequency is the one parameter common to all members of a synchronous electric power system, and an accepted indicator of that system's ability to balance resources and demand as well as to manage disturbances. This requires that *Generators* remain connected beyond the frequency range associated with normal operation.

Under normal operation, the frequency of the *Distribution System* shall be nominally 50 Hz, shall be controlled between 49.50 Hz and 50.50 Hz (± .5%), and shall be capable of continuous operation.

Increasingly severe system disturbances require progressively wider frequency bands and reduce the time required to operate within the specified frequency range. These figures are summarisation in Table 5-8.

Table 5-8: Frequency Limits

Frequency Limits	Duration
49.50 Hz to 50.50 Hz	Continuous operation (normal)
49.00 Hz to 51.00 Hz	For duration of at least 60 minutes
48.50 Hz to 51.50 Hz	For duration of at least 30 minutes

Frequency Limits	Duration
47.50 Hz to 51.50 Hz	For duration of at least 3 minutes
<47.50 Hz or >51.50 Hz	For duration of at least 20 seconds
<47.00 Hz for more than 0.2 sec	May disconnect
>52.00 for more than 4 sec	Must disconnect

5.3.6.7 Active Power Control

The RPP control system shall be capable of operating the RPP at a reduced level if the Active Power output has been restricted by the *Regional Control Centre*. The RPP control system shall be capable of receiving an on-line Active Power Control Set-point sent by the *Regional Control Centre* and shall commence implementation of the set-point within 10 seconds of receipt of the signal from the *Regional Control Centre*. The rate of change of output to achieve the Active Power Control Set-point should be no less than the maximum ramp rate settings of the RPP control system, as advised by the *Regional Control Centre*.

5.3.6.8 Frequency Response

Frequency response can be achieved through decreasing G*enerator* power output when frequency exceeds the upper bound of a specified acceptable frequency range, and by increasing G*enerator* power output when frequency falls below the lower bound of the specified range. Thus an 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 *Regional Control Centre*.

It is usually economically beneficial for RPPs to operate at their instantaneous available capacity. If they operate below their instantaneous available capacity, wind, photovoltaic, and run-of-river hydro *Plants* lose some of the energy they could have captured. The same is true for other types of RPP which may lack energy storage facilities. This may be a factor in reaching agreement with *the Regional Control Centre* on the power frequency curve.

5.3.6.9 Ramp Rates

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*. There shall be two 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. These ramp rate settings shall be applicable for all ranges of operation including start up, normal operation and shut down. It is recognised that falling wind speed or frequency response may cause either of the maximum ramp rate settings to be exceeded.

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.

The RPP operator and the *Regional Control Centre* shall agree on a procedure for setting and changing the ramp rate control.

5.3.6.10 Reactive Power Capability

The Reactive Power capability of an RPP shall be available within the parameters presented in Table 5-9.

Table 5-9: *Reactive Power* Capability

Voltage, p.u.	Reactive Power Range (p.u. of full output)	Equivalent Full Load Power Factor
0.20 to 0.80	-0.33 to 0.33	- 0.95 to 0.95
0.80 to 1.10	-0.228 to 0.228	- 0.975 to 0.975

5.3.6.11 Rate of Change of Frequency Range

The requirements for remaining connected during a frequency disturbance apply when the rate of change of frequency is within certain limits. Outside these limits, the unit is not obliged to remain connected. RRPs shall remain connected to the *Distribution System* during rate of change of frequency of values up to and including 1.0 Hz per second.

5.3.6.12 Voltage and Frequency for Synchronisation

RPPs shall only be allowed to connect to the *Distribution System*, at the earliest, 3 seconds after the voltage at the *Connection Point* is within ±5% around the nominal voltage, and the

frequency in the *Distribution System* is within the range of 49.0 Hz and 50.2 Hz, or otherwise as agreed with the *Regional Control Centre.*

5.3.6.13 High Wind Curtailments

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

The wind power *Plant* shall stay connected to the *Kenya National Distribution System* at average wind speeds below a predefined cut-out wind speed. The cut-out wind speed shall as a minimum be 25 m/s, based on the wind speed measured as an average value over a 10-minute period. To prevent instability in the *Distribution System*, the wind power 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.

Downward regulation shall be performed as continuous or discrete regulation. Discrete regulation shall have a step size of maximum 25%. When downward regulation is being performed, the shutting down of individual *Wind Turbine Generator* systems is allowed. The downward regulation band shall be agreed with the *DNSP* upon commissioning of the wind power *Plant*.

6 PLANNING

6.1 DISTRIBUTION PLANNING RESPONSIBILITY

The *Distribution Network Service Provider*(s) shall be responsible for Distribution Planning, including:

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

b. Analysing the impact of the connection of new facilities such as Generation 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*

6.1.1 Planning Data

The *Distribution Network User*s 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*s in maintaining the Distribution Planning data.

6.1.2 5-Year Distribution Plan

The *DNSP* shall develop and submit annually to the *Energy Regulatory Commission*, a 5-Year Distribution Plan.

a. Energy and Demand Forecasts;

b. Distribution feeder routing and sizing
    1. Detailed at above 11kV;
    2. Outline for 11kV

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 5-Year Distribution Plan.

6.1.3 Submission, Consolidation and Maintenance of Planning Data

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.

When requested, *Distribution Network User*s shall submit to the *DNSP* the relevant historical planning data for the previous year and/or the forecast planning data for the three (3) succeeding years. These shall include the updated Standard Planning Data and the Detailed Planning Data.

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*.

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 Point*s.

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

a. Forecast Data
b. Estimated Equipment Data
c. Registered Equipment Data

The Forecast Data shall contain the *Distribution Network User*'s best estimate of the data, including Energy and Power, being projected for the five (5) succeeding years.

The 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 User*s with Large Connections (greater than 2MVA) and connected at Medium or High Voltage shall provide annually the *DNSP* with its Energy and Demand Forecasts at each *Connection Point* for the 5 succeeding years. The Forecast Data for the first year shall include monthly Energy and Power Forecasts, while the remaining four years shall include only the annual Energy and Power Forecasts.

In the case of *Distribution Network User*s 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 Generating 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
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 [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:

a. Evaluate the requirement of *Distribution System* reinforcement projects;
b. Assure the requirement stated under the Technical Requirements section and in the Performance Standards Code are met for all the *Distribution Network User*s in the *Distribution System*; and
c. 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 the conduct of 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 *Kenya National TSO* 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 programmes; 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 *ERC's* 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 should be studied and adequate measures should 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

Location of 33/11kV substations and 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 Standardisation

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 standardisation by the *DNSP*.

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 are expected to be carried out by the *DNSP* in order to develop the 5 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 Point*s comply with the requirements stated on the Technical Requirements section and in the Performance Standards Code. It shall take into account the connection of new Generation 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 Generation 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. The studies shall also identify 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 Code. 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 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 financial year ending December 31st as the Base Year and projecting the Demand over the succeeding five years.

The *DNSP* shall forecast Demand using *Prudent Utility 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 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 licence area;

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

e. Significant public Events;

f. Expected schedules for *Generator*s Connected to Distribution;

g. *Interconnection* with adjacent *DNSP*s, 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 programme with the objective of obtaining *Distribution Network User* load profile data that describes the usage characteristics of specific appliances, *Distribution Network User*s, and group of *Distribution Network User*s. 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 Point*s with the Transmission System after accounting for System losses. Based on the metering data at each *Connection Point* with the Transmission System, the *DNSP* 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 *DNSP* 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 *ERC* as stated in the Performance Standards Code.

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 Losses

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 Operations Chapter of the *KNDC* is:

a. To define the operational responsibilities of the *Distribution Network Service Provider* and all *Distribution Network User*s;

b. To specify the requirements and procedures for Load Forecast;

c. To specify the maintenance programmes for the Equipment and facilities in the *Distribution System*;

d. To describe the Demand control strategies used for the control of the Total 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 User*s and the notices to be issued by *Distribution Network User*s to the *DNSP* and other *Distribution Network User*s.

f. To specify the procedures to be followed by the *DNSP* and *Distribution Network User*s during emergency conditions;

g. To specify the Safety Management System criteria to be applied by the *DNSP*s and *Distribution Network User*s 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 *Generator* Connected to Distribution 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 *DNSPs*

b. *Generator*s Connected to the *Distribution System* greater than or equal to 1 MVA output or with a single Generating Unit over 500kVA;

c. Others *Generator*s Connected to the *Distribution System* if so instructed in the *Connection Agreement*;

d. All *Distribution Network User*s with a contracted demand equal to or greater than 4 MVA, unless differently stated in the *Connection Agreement*.

e. Other *Distribution Network User*s, if so instructed in the *Connection Agreement*.

7.2.1 DNSP

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 Code, and in proposing solutions to Supply or Power Quality problems.

The *DNSP* is responsible for providing and maintaining all distribution Equipment and facilities within its licensed area.

The *DNSP* is responsible for preparing the Annual Maintenance Plans for the adequate maintenance of its Equipment and facilities, as is described in the *KNDC*.

The *DNSP* is responsible for designing, installing, and maintaining distribution protection that will ensure selective and timely disconnection of faulted facilities and Equipment.

The *DNSP* has a responsibility for maintaining an Automatic Load Shedding scheme to meet the targets agreed to with the *Kenya National TSO* and per the *KNTGC*.

7.2.2 Embedded Generators

The *Generator* Connected to Distribution is responsible for ensuring that its Generating Units can deliver the capabilities declared in its *Connection Agreement*.

The *Generator* Connected to Distribution is responsible for providing accurate and timely planning and operations data to the *DNSP*.

The *Generator* Connected to Distribution is responsible for executing the instructions of the *DNSP* during emergency conditions.

7.2.3 Distribution Network Users

The *Distribution Network User* is responsible for 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.

The *Distribution Network User* shall be responsible for ensuring that its System will not cause any Degradation of the *Distribution System*. It shall also be responsible in undertaking all necessary measures to remedy any degradation that the *Distribution Network User* System has caused to the *Distribution System*.

The *Distribution Network User* is responsible for 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 User*s to provide loading and generation output information to the *DNSP*. The information, required to be provided by *Distribution Network User*s, will enable the *DNSP* to comply with these requirements of the *KNDC.*

The *KNDC* specifies the *DNSP's* requirements for Demand forecasting for Centrally Dispatched Generation Units. This section of the *KNDC* specifies the information to be provided by other Generation Units and the *Distribution Network User*s.

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 *KNDC* to provide Demand forecast information to the *Kenya National Transmission System Operator* 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.

In this sub-section of the *KNDC*, Year 0 means the current calendar year at any time, Year 1 means the next calendar year at any time, Year 2 means the calendar year after Year 1.

7.3.2 Demand Forecast Information

Information shall be supplied by *Distribution Network User*s to the *DNSP* for the following rolling timescales is required by the *DNSP*:

a. Operational Planning Phase – next year ahead

b. Programming Phase – 24 hours to 8 weeks ahead

c. Control Phase – 0 to 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 required to be provided to the *DNSP* during the Operational Planning Phase shall be provided by Calendar week 35 each year.

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 Unit with output greater than 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 [3 MW] or more (averaged over any hour) on an hourly basis for each of the *DNSP*'s *Connection Point*s;

c. From *Distribution Network User*s and Other *DNSP*s connected to the *Distribution System* whose operations are likely to result in an aggregated change in Demand at the *Connection Point* of greater than [3 MW] of Demand at that time on an hourly basis;

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 the *KNDC*; and

b. Minimise the risks associated with the failure or reduced performance of assets; and

c. Adopt *Prudent Utility Practice.*

7.4.2 Maintenance Plans and Time Scales

In this Section, Year 0 means the current calendar year at any time, Year 1 means the next calendar year, Year 2 means the calendar year after Year 1, etc.

The *DNSP* shall prepare the following Distribution Maintenance Programmes:

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* will prepare an Annual Maintenance Plan. All interested *Distribution Network Users*, *Embedded Generators*, and other *Users* as required by the *DNSP* will provide the *DNSP* with their maintenance and outage plans to include into the Annual Plan.

The Annual Maintenance Plan and its proposed outage programme shall be submitted to the *ERC* and to the *Kenya National TSO* on a year-ahead basis by November 1st each 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 User*s for changes in their maintenance schedules;

d. The requirements for the maintenance of the *Distribution System;*

e. The need to minimise the total cost of the required maintenance; and

f. Any other relevant factor.

*Distribution Network User*s and *Generator*s 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 Programme for its System or Equipment:

a. Identification of the Equipment and the MW capacity involved;

b. Reasons for the maintenance;

c. Expected duration of the maintenance work;

d. Preferred start date for the maintenance work and the date by which the work shall have been completed; and

e. If there is flexibility in dates, the earliest start date and the latest completion date.

The *DNSP* shall advise *Distribution Network User*s or *Generator*s 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 User*s, the *DNSP* and the *Distribution Network User* shall attempt to resolve the problem. The *DNSP* shall make all reasonable attempts to revise the Annual Maintenance Plan to address the *Distribution Network User*'s concerns. If no reasonable alternative exists, the then the *DNSP* may take the outage despite the concerns of the Large *Distribution Network User*s or *Generator*s.

7.5 VEGETATION MANAGEMENT

The objective of this section 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. Minimise the impact of vegetation management on the natural environment.

7.5.1 Applicability

This section applies to *DNSP*s 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 programme 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

Factors that the *DNSP*s 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 Programme

The *DNSP* shall have a written Vegetation Management Program that apply 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 programme are:

a. Inventory of distribution facilities requiring tree trimming, including the frequency based on species and proximity to the line;
b. Multi-year maintenance cycles;
c. Annual maintenance plans; including scope, schedule and budget;
d. Approved work practices;
e. Training Programme;
f. 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.

7.5.5 Definitions

To provide a consistent and measurable approach to pruning or clearing vegetation near *Distribution Powerlines* and to assist people to understand these concepts, the following practices and classifications apply:

a. Clearance space

The *Clearance Space* varies with the type of distribution power line 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 vigour 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 *KNDC* 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 line. 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 *Clearance Space* are best removed at an early stage of their growth to minimise 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 recognised 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* should identify where the maintenance may be detrimental to important vegetation. The *DNSP* should seek advice from the relevant authorities, for example the Ministry of Environment and Natural Resources, as well as land care and community groups as advised by the relevant authorities, to identify "important vegetation".

Alternative distribution power line 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* should 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 artefacts;
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 line is situated and factors associated with the type of distribution power line installed.

7.5.9 Fire Hazard Categories

The risk of fire starting and spreading varies throughout Kenya. To establish the *Clearance Space* required, Kenya has been 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* should 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 line installed and include:

a. Line Voltage

The *voltage* level of the distribution power line influences the potential for electric discharge. The higher the *voltage,* the greater the potential, 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 causes 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 Powerline* conductor affects its weight and therefore the amount that the conductor will sag. *Distribution Powerline* 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 Powerline* conductors from the pole -

Along the *Distribution Powerline 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 *C*onductors

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 *Clearance Space* for the temperature of distribution power line conductors.

7.5.11 Consumer 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 *Distribution Network Service Provider* should:

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;
    3. Avoiding transfer of noxious weeds and diseases; or
    4. 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 the *Act*.

Under emergency circumstances, pruning may be undertaken without consultation, but the *DNSP* should notify the owner or occupiers as soon as practicable after the removal of the vegetation.

7.5.14 Disputes

Disputes with owners or occupiers may arise from decisions made by a *DNSP* in carrying out vegetation management activities. The *DNSP* should endeavour to resolve any dispute in accordance with the *DNSP*'s documented dispute resolution process.

A *DNSP* should make his dispute resolution processes available to interested parties as a public document. If this process fails to resolve the dispute, the matter may be referred to the *ERC*.

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 *Clearance Space* at all times cannot be compromised.

7.5.15 Training

A *DNSP* should ensure that any of his employees undertaking vegetation management in the vicinity of his *Powerlines*, and any contractors he engages 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* should seek advice from the relevant authorities as to appropriate training for vegetation management.

7.6 DISTRIBUTION ASSET REGISTER

A *DNSP* shall keep a register of all electrical infrastructure and other assets forming part of his *Distribution System*, which shall include:

a. A physical description of each item of electrical infrastructure or other asset, including its location; and
b. The value of each item of electrical infrastructure and other asset, calculated in accordance with accounting standards generally accepted in Kenya 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 for which it has maintenance responsibility within 7 business days of being notified by any person that such repair or replacement is necessary.

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*. This shall however, not apply under the following circumstances:

a. If the import or export at each *Interconnection* 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 *Kenya National TSO* must be kept fully informed.

Maintenance of the *Distribution System* may require outages that interrupt the supply to a *Distribution Network User* or group of *Distribution Network User*s. In such cases, the *DNSP* shall:

a. Notify the affected *Distribution Network User*s at least [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 User*s 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 *TNSP* at the *Interconnection 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 User*s.

These Contingencies are classified as:

a. System Blackout (Total or Partial).
b. Failure of equipment at the transmission *Interconnection* points.
c. *Distribution System* failure.

7.9.2 System Blackout

Total System Blackout is a situation when all generation has ceased with no electricity supply from External *Interconnection*s.

Partial Blackout is a situation where all generation has ceased in a separate part of the *Kenya National Transmission or Kenya National Distribution Systems* and there are no available *Interconnection*s to the other parts of the Total System.

In case of Total System Blackout or Partial Blackout at any point of *Interconnection*, the *DNSP* shall abide by the black start procedures framed by the *Transmission Licensee* and incorporated in the *KNDC.*

The *DNSP* shall be responsible for sectionalising the *Distribution System* into discrete, unconnected blocks of Demand. It shall advise the *Kenya National Transmission System Operator* regarding the amount of MW likely to be picked up when switching on each block of Demand.

The *DNSP* shall prepare a schedule of Essential and non-Essential loads in order of priority at each *Connection Point* to the *KNTS* to be picked up during the restoration process. The schedule is to be approved by the *Kenya National TSO* and forwarded to the *ERC*. Such schedule shall be updated continually. The schedule shall conform to provisions of the *KNDC*.

The DNSP shall maintain direct communications links with the *Regional Control Centre* throughout the restoration process until the system is restored to normal.

To coordinate activities, *Distribution Network User*s 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* the name and designation of person/persons, along with their telephone number/s and location, authorisation to deal with any contingency operations. This list shall always be kept up to date.

7.9.3 System Recovery

The *DNSP*s will segregate its total Demand into suitably sized components to allow progressive re-energisation of the *Distribution System* from black start *Generator*s. The size of the areas of Demand of these will be determined by the *Kenya National Transmission System Operator* and will be commensurate with the size of the *Generator*s being re-started.

The overall strategy of recovery will be to re-establish stable Islands of Supply and Demand and to re-synchronise these islands progressively. *Generator*s Connected to Distribution other than *Embedded Generator*s will be required to operate under the *DNSP* directives, to enable the *DNSP* to comply with its *KNDC* and/or licence obligations.

Where there are no *Generator*s with a Black Start capability within the *Distribution System*, then restoration of supply may be substantially delayed while the *Kenya National Transmission System Operator* re-establishes the *Transmission System* from a restored island or part of the Total System. The *DNSP* will re-appraise its priorities in these situations and restore supplies in accordance with its *KNDC* and/or licence obligations.

7.9.4 Failure of Transmission System or Equipment

In all cases that failures exists on lines or equipment of the *Transmission Licensee* that origin, or may origin, an Incident in the *Distribution System*, the *DNSP* shall immediately contact the *Kenya National Transmission System Operator* and/or the person authorisation 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

If a part of the *Distribution System* to which a *Generator* Connected to Distribution is connected becomes isolated from the *Distribution System*, the *DNSP* shall decide if it is desirable for the *Generator* Connected to Distribution to continue operating.

If no facilities exist for the subsequent resynchronisation with the rest of the *Distribution System*, the *DNSP* shall issue an instruction to the *Generator* Connected to Distribution to disconnect its Generating Unit 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 the *Kenya National Transmission System Operator*, 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 User*s.

This section applies to the *DNSP*s and to *Distribution Network User*s, which in this section means *Generator*s Connected at Distribution, and *Distribution Network User*s connected to the *Distribution System*.

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 *Distribution Network User* Demand reduction.

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 *Kenya National Transmission System Operator*, 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 *KNDC*, 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 User*s as required and submit the information to the *Kenya National Transmission System Operator*. The *Distribution Network User*s shall cooperate with the *DNSP*s 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 as to avoid widespread 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*, then planned rotational load shedding may be used to share the available power among affected *Distribution Network User*s.

In addition, *Generator*s Connected to Distribution may wish to disconnect, automatically or manually, their Plant from the System to which it is connected at certain frequency levels. Any such disconnection will be agreed with the *DNSP* or the *Kenya National Transmission System Operator*, as required, in accordance with the Distribution Planning and Connection Code.

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 *KNDC.* Emergency manual load shedding may be also carried out on the *Distribution System* if so instructed by the *Kenya National Transmission System Operator*.

Where Demand Control is exercised by the *DNSP* on instruction or request from the *Kenya National Transmission System Operator* 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 User*s so far as is reasonable practicable.

Where Demand Control is exercised by the *DNSP*, either instructed by the *Kenya National Transmission System Operator* or in order to safeguard the *Distribution System*, the *DNSP* shall liaise with and inform *Distribution Network User*s accordingly as far as is reasonably practicable.

Detailed load shedding procedures shall be established by the *DNSP* and a detailed procedure shall be furnished to the *Kenya National Transmission System Operator* 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 *Kenya National Transmission System Operator* 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 User*s 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 *KNDC*. Each *DNSP* shall abide by the instructions of the *Kenya National Transmission System Operator* 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 should be contained and documented in a Distribution Load Shedding Plan. *DNSP*s shall permanently maintain and update this document, which should be submitted to the *ERC* for revision and approval, if instructed to do so.

7.11 SAFETY COORDINATION

7.11.1 Introduction

This section specifies the Safety Management System criteria to be applied by the *DNSP* and *Distribution Network User*s 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 User*s.

This Safety Coordination section does not seek to impose a particular set of safety rules on the *DNSP* and *Distribution Network User*s. The safety rules to be adopted and used by the *DNSP* and each *Distribution Network User* shall be those chosen by each.

7.11.2 Objectives

To lay down requirements with a view to ensuring safety of facilities and persons working at or across Operational and Ownership Boundaries between the *Distribution System* and *Distribution Network User*s' Systems.

7.11.3 Scope

This section specifies the Safety Management System criteria to be applied by the *DNSP* and all *Distribution Network User*s of the *Distribution System* at or across a *Connection Point*, *Distribution Network User*s for the purposes of this *KNDC* being:

a. Medium Voltage *Distribution Network User*s.
b. *Generator*s Connected to Distribution.
c. Other *DNSP*s connected to the *Distribution System.*
d. Any other party reasonably specified by the *DNSP* including *Distribution Network User*s with un-metered supply and those connected at LV.

7.11.4 Electric Power Industry Safety Code

A *DNSP* and all *Distribution Network User*s shall, in respect of electrical infrastructure installed into his *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 this *KNDC* 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.

7.11.5 Operational Safety

7.11.5.1 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, a Safety Management System will be established by the *DNSP* and *Distribution Network User*s. 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.

The Safety Management System must include the provision for written authorisation 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 authorisation shall indicate the class of Operation and/or work permitted and the section of the System to which the authorisation 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 *KNDC*, those persons being referred to in this *KNDC* 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* or be a person authorised who is at the site or location of the *Connection Point.*)

7.11.5.2 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).

7.11.5.3 System of Documentation

A system of documentation shall be maintained by the *DNSP* and the appropriate *Distribution Network User*s which will record the inter-system Safety Precautions taken when:

a. Work and/or testing is to be carried out on MV Plant and/or Apparatus across the *Connection Point*.
b. Isolation and/or earthing of the other's System is required.

Where relevant, copies of the Safety Management Systems and related documentation shall be exchanged between the *DNSP* and *Distribution Network User*s prior to performing work at a *Connection Point.*

The *DNSP* and *Distribution Network User*s 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.

7.11.5.4 Safety Precautions

The establishment of Safety Precautions involves:

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 immobilised 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, immobilised and locked, the extent of the Safety Precautions required being determined pursuant to this *KNDC*.

7.11.6 Environmental Safety

Site Safety and Security Arrangements shall be made by the *DNSP* and *Distribution Network User*s to ensure site safety and security.

Suitable arrangements shall be agreed between the *DNSP* and the relevant *Distribution Network User*s 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 User*s 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 Energy Act

The Statute Law Miscellaneous Amendment Act No. 12 of 2012 to the *Energy Act* was adopted to impose stiffer penalties to those persons found:

a. Vandalising, or found to be in possession of vandalised power equipment.
b. Illegal tapping of distribution power lines

The law was signed by the President on July 6 2012, and has enhanced penalties to a minimum fine of Ksh5 million or a jail term of not less than ten years or both for anyone convicted of theft of electric energy and/or vandalism of electric facilities.

7.12.2 Electric Facility Theft and Vandalism Deterrent Programme

In order to reduce the risk of serious injury, system interruptions and commercial losses that occur on the *Kenya National Distribution Systems*, the *DNSP* shall develop and implement an Electric Facility Theft and Vandalism Deterrent Programme 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 Programme will be measured through the *Distribution System* Losses Performance Indicator described in Appendix A of this Distribution Code.

7.12.2.2 Reporting Requirements

The *DNSP*s will submit a report to the *ERC* 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 User*s, which in this Section means:

a. Any other *DNSP* connected to the *Distribution System*
b. Medium and High Voltage *Distribution Network User*s
c. *Generator*s 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 *Customer*s will identify individuals and agree communication channels to make effective the exchange of information required by this section. Communication should, as far as practicable, be direct between the *Distribution Network User* and the operator of the *Distribution System* to which that *Distribution Network User* is connected.

Any communication from the *DNSP* and the *Distribution Network User* utilising 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 *Authorised Personnel* and their telephone numbers 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 *Authorised 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 affected *Distribution Network User*s.

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 of:

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 Sectionaliser or any sequence or combination of the two including any temporary overstressing, system parallels, or Generating Unit synchronising; 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 User*s 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 sections, descriptions of site responsibilities 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 electrical equipment 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 descriptions of site responsibilities and electrical equipment diagrams shall be retained as part of the *Connection Agreement* by the *DNSP* and the appropriate *Distribution Network User*(s), and 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 User*s 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 User*s. Schedules of telephone numbers/call signs shall be exchanged by the *DNSP* and appropriate *Distribution Network User* to enable control activities to be efficiently co-ordinated.

The *DNSP* and appropriate *Distribution Network User*s will establish 24-hour availability of personnel with suitable authorisation where the joint operational requirements demand it.

7.14.3 Outage Coordination

7.14.3.1 Distribution Network Users Connected at Medium and High Voltage

For those *Distribution Network User*s 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

*DNSP*s shall establish a comprehensive programme 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 owner of the System affected. This incident will be termed a "Significant Incident". Information regarding the occurrence of Significant Incidents shall be reported to the *ERC* in writing, in the form and manner prescribed by the *Energy Regulatory Commission*, 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 *ERC*. It also provides for the joint investigation of Significant Incidents by the *Distribution Network User*s 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 User*s 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, as a minimum, contain following matters, 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 and in the absence of agreement the joint investigation will take place.

Any joint investigation occurs only when both parties agree. It shall form part of any dispute resolution procedure.

7.14.4.4 Report to the ERC

The *DNSP* shall submit a written report to the *ERC* 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 (in MW) and generation (in MW) interrupted and the duration of the Interruption.

The *ERC* 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 UNITS CAPABILITY TESTS

7.15.1 Test Requirements

Tests shall be conducted on *Generator*s Connected to Distribution, in accordance with procedures and standards specified by the *DNSP* (or the *Regional Control Centre,* if applicable), to confirm compliance with the *KNDC* and/or the *KNTGC* for the following:

a. Capability of Generating Units to operate within their registered Generation parameters;
b. Capability of the Generating Units to meet the applicable requirements of the *KNTGC* and the *KNDC;*
c. Capability to deliver any Ancillary Services that the *Generator* has agreed to provide; and
d. Availability of Generating Units in accordance with their capability declaration.

All tests shall be recorded and witnessed by representatives of the *DNSP* and the *Generator.*

The *Generator* shall demonstrate to the *DNSP* (or the *Kenya National Transmission System Operator* if applicable), the fitness for purpose and accuracy of the test instruments to be used in the test.

The *DNSP* (or the *Kenya National Transmission System Operator*, if applicable) may at any time issue instructions requiring tests to be carried out on any Generating Unit 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 Unit connected to the *Distribution System* fails the test, the *Generator* shall correct the deficiency within a period agreed with the *DNSP* (or the *Kenya National Transmission System Operator* if applicable) to attain the relevant registered parameters for that Generating Unit.

Once the *Generator* achieves the registered parameters of its Generating Unit that previously failed the test, it shall immediately notify the *DNSP* (or the *Kenya National Transmission System Operator* if applicable). The *DNSP* (or the *Kenya National Transmission System Operator* if applicable) shall then require the *Generator* Connected to Distribution 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 Unit to pass a given test, the *DNSP* (or the *Kenya National Transmission System Operator* if applicable), the *Generator* Connected to Distribution, and/or *Distribution Network User* shall seek to resolve the dispute among them.

If the dispute cannot be resolved, one or more of the parties may submit the issue to the *ERC*, unless specified otherwise in the *Connection Agreement* or where a contract, licence excludes such action.

7.15.2 Tests to be Performed

A *Generator*'s production of Reactive Power shall be subject to the agreement with the *DNSP* and *KNDC compliance* (if applicable).

The Reactive Power test shall demonstrate that the Generating Unit meets the registered Reactive Power Capability requirements specified in the *KNDC*'s Performance Standards. The Generating Unit shall pass the test if the measured values are within ±5 percent of the capability as registered with the *Kenya National Transmission System Operator* (if applicable) and the *DNSP*.

The Black Start test shall demonstrate that the Generating Unit with Black Start capability can implement a Black Start procedure, as specified in the *Connection Agreement*. To pass the test, the Generating Unit shall start on its own, synchronise and carry load without the need for external power supply.

The Declared Data capability test shall demonstrate that the Generating Unit can be scheduled and dispatched in accordance with the Declared Data. To pass the test, the Generating Unit shall satisfy the ability to achieve the Declared Data.

The Dispatch accuracy test shall demonstrate that the Generating Unit meets the relevant Generation Scheduling and Dispatch Parameters. The Generating Unit shall pass the test if:

a. In the case of synchronisation, the process is achieved within ±5 minutes of the registered synchronisation time;
b. In the case of synchronising generation (if registered as a Generation Scheduling and Dispatch Parameters), the synchronising generation achieved is within an error level equivalent to 2.5% of Declared Net Capacity;
c. In the case of meeting ramp rates, the actual ramp rate is within ±10% 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% of the declared values.

The Ancillary Services test, as specified by the *DNSP* or the *Kenya National Transmission System Operator* if applicable, shall demonstrate the services in terms of quantity, quality and operational requirements. *Generator*s providing Ancillary Services shall conduct the tests and the *DNSP* (or the *Kenya National Transmission System Operator,* if 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, 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 labelling nomenclature, which specifies the dimension, sizes of characters, and colures of labels, to identify the Sites and Equipment.

7.16.3 Signage and Labelling

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 section is:

a. To specify the technical and operational criteria, including the procedures to be complied with by the *Distribution Network Service Provider* in carrying out its obligation to provide metering services to *Distribution Network Users* at each Metering Point.

b. To specify the ownership of the metering equipment for *Generators* connected to the Distribution Network.

8.1.2 Applicability

The Distribution Metering section applies to the following:

a. *DNSP*s

b. *Distribution Network User*s connected to or seeking connection to, the *Distribution System*.

c. *Embedded Generator*s connected to the *Distribution System*.

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 *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 *ERC*, 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 *ERC* of all Metering Systems where the *DNSP* cannot comply with the Distribution Metering requirements.

g. Fully implement Net Metering systems, as appropriate.

The *Embedded Generator Distribution Network* User shall:

a. In accordance with *Prudent Utility Practice*, supply and install, test and commission the Main Metering Equipment and the Back-up Metering.

b. Thereafter, the *Embedded Generator* shall transfer to the *DNSP* as beneficial owner (and without any encumbrances) all rights, title and interest in the Back-up Metering Equipment (together with all warranties and guarantees applicable thereto) and;

c. Upon such transfer the *DNSP* shall own and maintain the Back-up Metering Equipment while the *Embedded Generator* shall own and maintain the Main Metering Equipment.

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 *KNDC*. The *DNSP* shall notify the *Distribution Network User* in advance of any replacement, unless that replacement is 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; and
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.

The *DNSP* shall maintain the following information for each Metering System:

a. Location of the Metering System;
b. A record of any malfunction of the Metering System including any test results and of repairs made to the Metering System; and
c. Documentation of Meter testing prior to installation.

The *DNSP* shall, on request, make the information available for each Metering System to:

a. The Distribution Network User;
b. The *ERC*.

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, such Metering Equipment shall be:

a. Submitted by the *DNSP* to a laboratory for testing and certification; or
b. Received by the *DNSP* directly from a manufacturer with a test certificate endorsed by an independent laboratory.

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 *ERC*.

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 standards in this Distribution Metering section;
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 and voltage transformers that are tested and certified.

The rated short-duration current rating shall not be less than:

a. 25kA for 3 seconds for MV Metering Points above 6.6kV; or
b. 20kA for 3 seconds for MV Metering Points at 6.6kV and below.

For each circuit, metering voltage transformers of accuracy class 1.0 with 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 standards in this Distribution Metering Code, 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 transformer(s) provided by the *DNSP* that are tested and certified; and

f. Shall contain a suitable facility (including all necessary pre-wiring), as specified by the *DNSP* (installed by the *Customer*, or provided and installed by the *DNSP* and costs borne by the *Customer*) in which to house the Metering System.

8.4 ALTERNATIVES TO STANDARD METERING SYSTEMS

Upon the 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 section, 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 this *KNDC*.

8.5 FAULTY METERING EQUIPMENT

A Metering System shall be considered faulty and not in compliance with this *KNDC* if it is determined that any part of that Metering System does not comply with this Distribution Metering section.

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 working days of the *DNSP* discovering that the fault exists.

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.

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.

The *DNSP* shall record all relevant Meter parameters for a replacement Meter in that Metering System.

8.6 TECHNICAL REQUIREMENTS AND ACCURACY OF METERS

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.

The limits of accuracy for the following classes of Meters shall be:

a. ± 0.2% for class 0.2 S static watt-hour meters.
b. ± 0.5% for class 0.5 S static watt-hour meters.
c. ± 0.5% for class 0.5 watt-hour meters.
d. ± 1.0% for class 1.0 watt-hour meters.
e. ± 2.0% for class 2.0 watt-hour meters.

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.

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.

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 *ERC*.

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 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 *KNDC*. 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 *ERC* may carry out its own unannounced inspection and or test, in which case the *Distribution Network User* shall grant access to the *ERC*.

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 fulfil 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 urgent metering repairs.

8.9 SECURITY OF METERING SYSTEMS

8.9.1 Statute Law Miscellaneous Amendment Bill

In 2012, the Statute Law Miscellaneous Amendment Bill to the *Energy Act* was adopted to impose stiffer penalties to those persons found;

a. Vandalising, or in possession of vandalised power equipment.

b. Tampering with electric metering systems to illegally divert electric energy.

c. Illegal tapping of distribution power lines

The law was signed by the President on July 6 2012, and has enhanced penalties to a minimum fine of Ksh5 million or a jail term of not less than ten years or both for anyone convicted of theft of electric energy and/or vandalism of electric.

8.9.2 Energy Diversion Programme

In order to reduce the risk of serious injury, system interruptions and commercial losses on the *Distribution System*, the *DNSP* shall develop and implement an Energy Diversion Programme that establishes plans for the ongoing monitoring and enforcement procedures.

8.9.2.1 Performance Measures

The effectiveness of the Deterrent Programme will be measured through the *Distribution System* Losses Performance Indicator described in Appendix A of this *KNDC*.

8.9.2.2 Reporting Requirements

The *DNSP*s will submit a report to the *ERC* 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 Energy Diversion Cases Identified and Addressed
b. Percentage of Commercial System Losses

8.9.3 Meter Sealing

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.

The *DNSP* shall, so far as is reasonably practicable, ensure that physical access to each Meter contained in each Metering System is protected by:

a. Sealing all associated links, circuits, data storage and data processing systems;
b. Ensuring that the Metering System meets the requirements for the security of Metering Systems;
c. The *DNSP* shall use reasonable endeavours to ensure that all metering data within each Metering System is secure.

8.9.4 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 endeavours 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 the *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. The owner of the *Meter* is responsible for replacement costs. 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 this *KNDC*.

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 *Kenya National Distribution System* and for the commercial performance of the retail business.

9.2 APPLICABILITY

The Distribution Performance Standards apply to:

a. *Distribution Network Service Provider*s;

b. *Distribution Network User*s connected to the *Distribution System*; and

c. *Customers*

These Distribution Performance Standards must be applied and used together with the *KNDC*

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 *ERC* 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

*Customer*s of the *DNSP* shall be classified either as Urban *Customer*s or Rural *Customer*s, according with the definition stated in the *Glossary and Definitions*.

9.5.1.1 Request for Rural Area Designation

When a *DNSP* considers that due to topological reasons and/or scattering of population on a specific town or village although with more than 3,500 distribution *Customer*s, it should be considered as a rural area. If so proposed, the issue shall be brought to the *ERC*, together with adequate supporting documentation, including maps or drawings as considered suitable, requesting authorisation to consider these *Customer*s as *Rural Customer*s.

The *ERC* will evaluate the submitted documentation, conduct independent analysis or studies that can include meetings or hearings with the involved *Customer*s and/or representative institutions. Based on this analysis or studies, the *ERC* may grant an authorisation for this specific town or village, or part of town or village to be considered as rural, and the *Customer*s located in that zone to be considered as Rural *Customer*s.

9.5.2 Types of Interruptions

Supply quality will be expressed as a function of the Interruptions to *Customer*s and will be evaluated using indicators that measure the number of Interruptions and their duration.

9.5.2.1 Interruption Classification

Interruptions will be classified according to type and origin as:

a. Scheduled Interruptions
b. Unscheduled Interruptions
c. External Supply Interruptions, both scheduled and unscheduled; and
d. Third Party Interruptions

9.5.2.2 Customers Affected

Interruptions will also be classified according to the affected *Customer* as:

a. Interruptions to *Rural Customers*; and
b. Interruptions to *Urban Customers*

9.5.3 Interruption Register Requirements

Each *DNSP* is obliged to have a detailed chronological register of all Interruptions caused to their *Customer*s, with clear identification of starting and ending 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 Starting Time

An Interruption starting time shall be calculated as:

a. For a Scheduled Interruption: the time that the first impacted *Customer's* power is interrupted;

b. For an Unscheduled Interruption,

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, whichever occurs first.

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 *Customer*s´ incoming calls.

9.5.3.5 Special Cases

The following Interruptions will not be considered for the calculation of *Distribution System* Service Quality indicators:

a. Momentary Interruptions (less than 3 minutes in duration)

b. *Force Majeure* Interruptions

c. Interruptions due to authorised disconnection of a *Customer* due to non-payment

d. 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 *TNSP* or of another *DNSP*, all Interruptions to *Customer*s 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 causes also an Interruption to another *Customer*, the Interruption to the other *Customer*s 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 *DNSP*s.

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 number of Scheduled Interruptions per calendar year
b. Total number of Unscheduled Interruptions per calendar year
c. Total number of External Interruptions per calendar year
d. Total duration of Scheduled Interruptions per calendar year
e. Total duration of Unscheduled Interruptions per calendar year
f. 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* will be the following:

a. System Average Interruption Duration Indicator (SAIDI): the total time an average *Customer* has been interrupted during a pre-specified period.
b. System Average Interruption Frequency Indicator (SAIFI): the number of times an average *Customer* has been out of service during a pre-specified period.
c. System Average Momentary Interruptions Frequency Indicator (MAIFI): the total number of times an average *Customer* has experienced an Interruption during a pre-specified period.

All Performance Indicators, except for MAIFI, will be calculated and differentiated by:

a. Scheduled, Unscheduled, External and Third Party interruptions; and
b. *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 *ERC* 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 *ERC* 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

Phase 1 will be a nine (9) month duration:

a. From the date that the *ERC* gazettes the *KNDC*; or

b. 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 SAIDI and SAIFI Performance Indicators;

b. Each quarter, calculate and submit to the *ERC* the previous quarter's monthly SAIDI and SAIFI 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 System*s; *Generators* connected to the *Distribution System* to the low voltage side of distribution transformers and to the *Connection Point* of MV *Customer*s.

2. Indicators will be calculated for the whole system without discrimination between Rural and Urban *Customer*s.

9.5.7.2 Final Phase

At the end of the Phase 1 period, the implementation of the Supply Quality Performance Indicator process will be in full affect.

9.5.8 Procedures and Information System

Before the end of Phase 1, the *DNSP* shall prepare and submit a report to the *ERC* 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

To comply with the previous paragraph, the *DNSP* shall implement the necessary procedures and systems, including among others the following:

a. Procedures and systems to identify and register all of the Interruptions that occur in its Control Area of the *Distribution System*

b. Procedures and systems to classify the Interruptions according to this Distribution Performance Standard

c. Procedures and systems to determine the duration of the Interruptions

The *DNSP* shall implement the necessary databases and information systems in order to provide the following information:

a. A *Customer* database with the information to identify all the components of the associated supply network chain;
    1. Consumer identification number
    2. MV/LV transformer number to which the *Customer* is connected
    3. Classification of Rural or Urban
    4. MV circuit which feeds the above mentioned transformer
    5. HV/MV substation that feeds the MV circuit mentioned above

b. Interruption databases with all the information regarding each Interruption that occurs in the area of supply of the *DNSP*, including among others for each Interruption the following information:
    1. Date and hour when the Interruption started
    2. Circuit or sections affected by the Interruption
    3. Type of Interruption (scheduled, unscheduled or external)
    4. Cause of Interruption (equipment failure, weather, third party, operating error)
    5. Quantity of *Customer*s affected by the Interruption

6. Date and time that the Interruption ended

c. If the restoration is done in phases, the duration shall be different for each group of *Customer*s restored

9.5.9 Monitoring and Control

9.5.9.1 Audit

At the completion of the phased implementation of the Performance Indicators, the *ERC* will have the right and the *DNSP* shall allow the *ERC* or its authorised representatives to inspect the database and information system in order for the *ERC* to audit the process, data and the accuracy of the information. The *ERC* 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 *ERC* in a suitable organised manner, monthly Supply Quality Performance Indicator information and a list of actions to be undertaken by the *DNSP* to improve supply quality to those *Customer*s 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. Not later than eight (8) hours after the beginning of the emergency, submit to the *ERC* 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 *Customer*s are restored, at least every eight (8) hours, submit to the *ERC* by fax or electronic mail an update regarding the number of MV circuits and *Customer*s restored and remaining interrupted by the emergency;

c. Once the emergency has ended, but not more than five (5) business days after, submit a detailed report of the event to the *ERC*, its consequences and any remedial action to avoid or mitigate a similar incident in the future.

The *ERC* 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 *ERC*. 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 Authorised Tolerances

9.5.10.1 Phase 1

During Phase 1, the *ERC* will not enforce the Performance Indicator tolerance requirements. The *DNSP* shall calculate the System Performance Indicators and submit to the *ERC* the information established in this Distribution Performance Standards in order for the *ERC* to evaluate the performance of the *DNSP*.

9.5.10.2 Final Implementation Phase

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 authorised tolerance, the *DNSP* shall submit to the *ERC* 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 *ERC* 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 *ERC* 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 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 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 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 *Kenya National Transmission System Operator* in maintaining the fundamental frequency within the limits established in the *KNDC* 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	Steady State Change
< 1.0 kV	± 6% to Urban Customers
	± 10% in Rural Customers
1.0 to 33 kV	± 10%

The tolerances for the voltage quality standard may be reviewed by the *ERC* based on technical and economic studies.

9.6.3.1 Voltage Level Deviation

The *DNSP* shall maintain voltage level deviations within the allowed tolerances at least during 97% of the time. During the remaining 3% of the time, voltage deviations shall not exceed 50% of the allowed tolerance values.

9.6.3.2 Audit of Voltage Level Adequacy

Control of the adequacy of voltage level to *Customers* will be assessed through a random/directed measurement campaign at the *Customer's Connection Points*. The *ERC* 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.

Each year the *DNSP* will be required by the *ERC* to perform:

a. One measurement for every 100 MV *Customer*s

b. One measurement for every 1,000 LV *Customer*s

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 *ERC*, will select the *Customer*s to be measured taking into account:

a. *Customer*s located in areas where voltage problems have been detected

b. *Customer*s that have presented voltage complaints to *DNSP*s

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 *KNDC* and due to existing reported problems and based on technical and economic studies, the *ERC* 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 shall be computed over a 10-minute period, as defined in the *KNDC*.

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, as defined in the *KNDC*.

9.6.4.2 Harmonics Distortion Measurements

The Performance Indicators to measure *Harmonic Distortion* will be:

a. Total *Harmonic Distortion* (THD), as defined in the *KNDC*;

b. Values of each individual harmonic, as defined in the *KNDC*.

The allowed ranges for *Flicker* and harmonic indicators are established in the *KNDC*, and shall not be exceeded, at the *Connection Point*, during a time greater than 3% of a measurement period.

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 *Kenya National TSO* and from Generation Connected to Distribution, and the total energy invoiced to *Customer*s 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 corresponds to the energy used by *DNSP*s for its own consumption in order to carry out distribution retail activities; and

c. Non-Technical Losses: This is the difference between the Distribution energy Losses and the sum of (a) and (b).

9.7.3 Distribution Energy Losses

The *ERC* 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 *ERC*.

The targets to the *Distribution System* Loss reductions approved by the *ERC* will be used for tariff determination and as Performance Indicators, and each *DNSP* shall procure 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 to the *ERC*, in a suitable organised manner or such format as may be established by the *ERC*, the following information:

9.7.4.1 Monthly Basis

a. Total Energy purchased from the *Kenya National TSO* and from each *Generator* Connected to Distribution selling to the *DNSP*, identifying the *Connection Points* where the energy enters the *Distribution System*.

b. Total Energy billed to *Customer*s, 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 approval of this Performance Standards or the granting of a distribution and retail supply licence that includes Performance Indicators in accordance with this Distribution Performance Standards, the *DNSP* shall submit to the *ERC* for approval 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 *Generator*s Connected to Distribution within the supply area of the *DNSP*

b. Energy metered at each transmission *Connection Point*, connection of *Generator*s Connected to Distribution 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 / 33 kV substation

e. Energy metered in each distribution feeder, connected at a HV / 11 kV substation

f. Energy metered in the distribution feeders, connected at 33 / 11 kV substations.

9.7.5.1 Transitional Submittal

If at the time of report submission there is a lack of adequate metering capabilities to fulfil the above mentioned requirements, the *DNSP* shall inform the *ERC* the transitory 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 *ERC* 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.

Appendix A SUPPLY QUALITY AND SYSTEM LOSSES PERFORMANCE INDICATORS

The following tolerances will apply, unless the *ERC*, when issuing a new licence to a *DNSP*, specifies different values for one or more of these tolerances:

A.1.1 Unscheduled Interruptions

Table A-1: System Performance Indicators for Urban Customers

Urban System Interruption Performance Indicators		
Name	**Acronym**	**Value**
System Average Interruption Frequency: Urban	SAIFI	3.0 Interruptions/year
System Average Interruption Duration: Urban	SAIDI	2.5 hours/year

Table A-2: System Performance Indicators for Rural Customers

Rural System Interruption Performance Indicators		
Name	**Acronym**	**Value**
System Average Interruption Frequency: Rural	SAIFI	6.0 disconnection/year
System Average Interruption Duration: Rural	SAIDI	7.0 hours/year

A.1.2 System Losses

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 *ERC* specifies different values for the tolerance.

Table A-3: System Loss Reduction Targets

	First Year	**Second Year**	**Third Year**
% Losses	2.0%	2.0%	2.0%

Appendix B DEROGATION REQUEST AND MITIGATION PLAN FORMS

KENYA NATIONAL DISTRIBUTION CODE
DEROGATION REQUEST FORM

Name of Entity:		**Date:**
Contact Name:	**Contact Phone:**	**Email:**
Type of Code Request: **Transmission Grid Code** ☐		**Distribution Code** ☐
Type of Derogation Being Requested: **Exemption** ☐		**Mitigation** ☐
Date of Non-Compliance Discovery:		
Date Non-Compliance Reported:		
Code Section Title:	**Code Section Number:**	
How was the Non-Compliance Found? (e.g. Routine inspection, incident investigation, Internal/regulatory audit):		
Describe the cause of Non-Compliance:		
Describe the Impact to Grid Reliability due to Non-Compliance:		
Expected date that a Mitigation Plan will be submitted:		
Supporting evidence attached to this request: **1.** **2.** **3.**		

KENYA NATIONAL DISTRIBUTIONCODE
MITIGATION PLAN

Name of Entity:		**Date:**
Contact Name:	**Contact Phone:**	**Email:**
Type of Code Request: **Transmission Grid Code** ☐		**Distribution Code** ☐
Date of Non-Compliance Discovery:		
Date Non-Compliance Reported:		
Code Section Title:	**Code Section Number:**	
How was the Non-Compliance Found? (e.g. Routine inspection, incident investigation, Internal/regulatory audit):		
Describe the Cause of Non-Compliance:		
Describe your Detailed Plan to Become Compliant:		
Describe your Detailed Milestone Schedule to Become Compliant:		
Supporting evidence attached: **1.** **2.** **3.**		