



NATIONAL ELECTRICITY DISTRIBUTION CODE

REPUBLIC OF GHANA

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PART A: GENERAL PROVISIONS

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SECTION 1: THE PURPOSE

PURPOSE AND SCOPE OF THE NATIONAL ELECTRICITY DISTRIBUTION CODE

Art 1.00 The National Electricity Distribution Code of Ghana referred to in this document as the Distribution Code, sets out the conditions that a Distribution Utility must meet in carrying out its obligations to distribute electricity under its licence in accordance with **L.I 1816: Electricity Supply and Distribution (Technical & Operational) Rules, 2005; and L.I.1935: Electricity Supply and Distribution (Standards of Performance) Regulations, 2008** which establish the requirements, procedures, practices and standards that govern the development, operation, maintenance and use of the distribution network in Ghana. The purpose of the Distribution Code is to ensure that the distribution network provides fair, transparent, non-discriminatory, safe, reliable, secure and cost efficient delivery of electrical energy.

Art 1.01 This Distribution Code issued by the Energy Commission is based on the provisions of sections 26, 27, 28 and 56(1)(a)(v) of the Energy Commission Act, 1997(Act 541).

Art 1.02 Unless otherwise stated in a licence or a Code issued under Energy Commission Act,1997 (Act 541), these conditions apply to all transactions and interactions between a Distribution Utility and all Retailers, Generators, other Distribution Utilities, Transmission Utility and Consumers of electricity who use the Distribution Utility's distribution network. The Distribution Code prescribes the responsibilities and obligations associated with all the functions involved in the supply and delivery of electric power and energy over a distribution network including the functions of the Distribution Utility, a Distribution Network Asset Owner, a Wholesale Supplier, a Retailer and a Bulk Customer.

SCOPE OF A DISTRIBUTION NETWORK

Art 1.03 In accordance with the Act, the Energy Commission has determined that a distribution network shall comprise **“all electricity plant and equipment within the borders of Ghana that function or are operated at 36kV and below, as well as any associated feeder or supply equipment that are for shared or common use in the area or zone designated by the Energy Commission Board”**

STRUCTURE OF THE DISTRIBUTION CODE

Art 1.04 The Parts of the Distribution Code are generally organized according to the legal instruments by which they are to be implemented.

Art 1.05 Part A of the Distribution Code covers those provisions that are common to both legal instruments, L.I 1816 and L.I.1935. This Part, the General Provisions, contains the purpose and scope of the Distribution Code, a definition of roles, responsibilities, terminology, transitional measures and exemptions, as well as arrangements for the management and governance of the Distribution Code.

Art 1.06 Part B of the Distribution Code defines the Conditions of the Distribution and Sale Licence. This Part contains the sub-Codes that deal with connection arrangements, rights and the requirements for transparency and non-discrimination.

Art 1.07 Part C, the Rules of Practice, details the planning requirements, arrangements for system operations, scheduling and safety.

Art 1.08 Part D, the Standards of Performance, states the indicators and benchmarks for quality and reliability of supply. It also contains the sub-Code for metering which describes the applicable standards and installation arrangements for metering.

Art 1.09 Part E, the Definitions, provides meanings and definitions for special words and technical terms used in the text to bring out the meanings in the context that they have been used in the Distribution Code

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Art 1.10 Despite the separation, the different Parts of the Distribution Code are intended to be consistent and complementary for the satisfactory delivery of distribution services.

Art 1.11 Nothing in this Distribution Code precludes the application of evolving technologies and processes as they become available.

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SECTION 2: ABBREVIATIONS & DEFINITIONS

ABBREVIATIONS

AFLC.....	Automatic Frequency Load Control
AFLS	Automatic Frequency Load Shedding
AGC.....	Automatic Generation Control
AVR.....	Automatic Voltage Regulation
BC.....	Bulk Customer
BST.....	Bulk Supply Tariff
COC.....	Compliance and Oversight Committee
CT.....	Current Transformer
ECOWAS.....	Economic Community of West African States
ECG.....	Electricity Company of Ghana
EMS.....	Energy Management System
EPA	Environmental Protection Agency
ETC.....	Electricity Technical Committee
GoG	Government of Ghana
GPS.....	Global Positioning System
GWh.....	Gigawatt-hour or one billion (10 ⁹) watt-hours of energy
IEC.....	International Electro-technical Committee
ISO.....	Independent System Operator
ITU	International Telecommunication Union
kVA.....	one thousand volt-amperes
kVar.....	Kilovar, or one thousand volt-amperes of reactive power
kW	Kilowatt or one thousand watts of active electric power

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kWh	Kilowatt-hour or one thousand watt-hours of electrical energy
MOU	Memorandum of Understanding
MVA	one million volt-amperes
MVar	Megavar, one million volt-amperes of reactive electric power
MW	Megawatt, one million watts of active electric power
NEDCo	Northern Electricity Distribution Company
NEP	National Electrification Programme
DN	Distribution network
PURC.....	Public Utilities Regulatory Commission
SCADA.....	Supervisory Control And Data Acquisition
VAR.....	Volt Amperes Reactive

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DEFINITIONS

In this Code:

+50% means 1.5 times the relevant **voltage**,

-100% means 0 **Volts**,

+20% means 1.2 times the relevant **voltage**,

+80% means 1.8 times the relevant **voltage**,

acceptable identification –in relation to:

(a) a **domestic customer** includes one of the following: a driver's licence, a current passport issued by the Government of Ghana or other form of photographic identification, or a birth certificate;

(b) a **business customer** which is a sole trader or a partnership includes one of the forms of identification for a **domestic customer** for each of the individuals that conduct the business; or

(c) a **business customer** which is a company,

Accidents means any unplanned event that results in damage to property, the natural environment or affect the distribution network operation's relationship with the community,

Act means the Energy Commission 1997 (Act 541),

active energy means the time integral for the product of **voltage** and the in-phase component of current flow,

active power means the rate at which **active energy** is **supplied**,

apparent power means the square root of the sum of the squares of the **active power** and the **reactive power**,

approved statement of charges has the same meaning as an approved statement within the meaning given to that term in the **Distribution Utility's distribution licence**.

augmentation in relation to the **transmission connection** assets or the **Distribution Utility's distribution system**, means the process of upgrading the **transmission**

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connection assets or the **distribution system** by replacing or enhancing existing plant and equipment or by adding new plant or equipment and includes modifying any of the **Distribution Utility's distribution fixed assets**,

avoided costs means the payment described in Art 13.05 of the **price determination**,

business day means a day, other than a Saturday or Sunday, or a **Public Holiday**,

business customer means a **customer** who is not a **domestic customer**,

CAIDI means the 'Customer Average Interruption Duration Index' which is the

average time taken for **supply** to be restored to a **customer** when an unplanned **interruption** has occurred, calculated as the sum of the duration of each **customer interruption** (in minutes), divided by the total number of **customer interruptions** (**SAIDI** divided by **SAIFI**). Unless otherwise stated **CAIDI** excludes **momentary interruptions**.

Commission means the Energy Commission,

complaint means a written or verbal expression of dissatisfaction about an action, a

proposed action, or a failure to act by a **Distribution Utility**, its employees or contractors. This includes failure by a **Distribution Utility** to observe its published practices or procedures,

confidential information means any information about a **customer** or information

provided to the **Distribution Utility** under an obligation of confidence,

connect means the making and maintaining of contact between the electrical

systems of two persons allowing the **supply** of electricity between those systems and includes **energisation** unless expressly excluded and **reconnect** has a corresponding meaning,

customer, unless the context otherwise permits or requires, means a person whose

electrical installation is **connected** to the **Distribution Utility's distribution system** or who may want to have its **electrical installation connected** to the **Distribution Utility's distribution system** and includes an **embedded generator**,

Customer Charter means a code of practice instituted to improve access to an organisation's services and to promote quality by telling the customer the standards of service to expect and what to do if something goes wrong,

date of receipt in relation to a notice given by a **Distribution Utility**, means:

- (a) if the **Distribution Utility** hands the notice, or sends a facsimile of the notice, to the **customer**, the date the **Distribution Utility** does so;
- (b) if the **Distribution Utility** leaves the notice at the **customer's supply address**, the date the **Distribution Utility** does so;
- (c) if the **Distribution Utility** gives the notice by post, a date 2 business days after the date the **Distribution Utility** posts the notice,

deemed distribution contract means the contract deemed to have been entered between the **Distribution Utility** and each “retail **customer**”,

demand means the **active power** or **apparent power** consumed by a **customer** in respect of an **electrical installation** integrated over a fifteen or thirty minute period,

Distribution Company means a person licensed under the Act to distribute and sell electricity without discrimination to consumers in an area or zone designated by the Energy Commission Board,

Distribution Utility means Electricity Distribution Company licensed by the Energy Commission,

distribute in relation to electricity, means to distribute electricity using a **distribution system**,

distribution area means the area in which a **Distribution Utility** is licensed, or exempt from the requirement to hold a licence, to **distribute** and **supply** electricity,

distribution fixed assets means any fixed assets used by a **Distribution Utility** to **supply** electricity including those which have been allocated to the **Distribution Utility** even though they may be located in another **Distribution Utility's distribution area**,

distribution licence means a licence to **distribute** and **supply** electricity granted under the Energy Commission Act,

distribution losses means electrical energy losses incurred in **distributing** electricity over a **distribution system**,

distribution system in relation to a **Distribution Utility**, means a system of electric lines and associated equipment (generally at nominal **voltage** levels of 36 kV

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or below) which that **Distribution Utility** is licensed to use to distribute electricity for supply under its **distribution licence** excluding **public lighting assets**,

domestic customer means a **customer** who purchases electricity principally for personal, household or domestic use at the relevant **supply address**,

drills means a situation in which an emergency is simulated to test the preparedness to respond,

electrical installation means any electrical equipment at a **customer's** site that is **connected** to, but not part of, a **distribution system**,

eligible means eligible under any relevant applicable law,

embedded generating unit means a **generating unit** which is **connected** to a **distribution system**,

embedded generator means a generator whose **embedded generating units** are **connected** to a **distribution system**,

emergency means an emergency due to the actual or imminent occurrence of an event which in any way endangers or threatens to endanger the safety or health of any person or which destroys or damages, or threatens to destroy or damage any property,

Emergency Response Team (ERT) means full time employees dedicated to responding to and coordinating emergency situations 24/7 which involves electric distribution network employees, contractors, properties, equipment and plant,

Emergency Response Plan (ERP) means a comprehensive document that plans for probable emergencies which involves electric distribution network employees, contractors, properties, equipment, and plants and prescribes appropriate response or actions,

energisation means the act of the insertion of a fuse or the operation of switching equipment which results in there being a non-zero **voltage** beyond a **point of supply**,

energy means active and reactive electrical energy,

excitation control system in relation to an **embedded generating unit**, means the automatic control system that provides the field excitation for the **embedded**

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generating unit (including excitation limiting devices and any power system stabiliser),

feeder means an electric line and associated equipment at a normal **voltage** level between 11kV and 36kV which a **Distribution Utility** uses to **distribute** electricity,

force majeure breach means a breach by a **Distribution Utility** or a **customer** of their **deemed distribution contract** which, the **Distribution Utility** or the **customer** would commit arising only through a **force majeure event**,

force majeure event means an event outside the reasonable control of a **Distribution Utility** or a **customer** (as the case may be),

generating unit means an electricity generator and related equipment essential to its operation, which together function as a single unit,

generation licence means a licence to generate electricity for **supply** and sale granted under the Energy Commission **Act**,

generator means a person who holds, or is exempt from holding, a **generation licence** under the Energy Commission **Act**,

governor system means the automatic control system which regulates energy input (for example, steam, gas or water) into the turbine of an **embedded generating unit**,

guideline means a guideline published by the **Commission**,

impulse voltage means a wave of **voltage** which, without appreciable oscillations, rises rapidly to a maximum value and falls, usually less rapidly, to zero with small, if any, loops of opposite polarity,

incident Any unplanned event that has the potential to damage property, the natural environment or affect the electric distribution network operations,

interruption means the temporary unavailability of **supply** from the **distribution network** to a **customer**, but does not include **disconnection**,

interval meter means a meter that is capable of recording **energy** consumption in intervals of 30 minutes or less,

load means a **customer's demand** for electricity at a **supply point**,

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MAIFI means the ‘Momentary Average Interruption Frequency Index’ which is the total number of **momentary interruptions** that a **customer** could, on average, expect to experience in a year, calculated as the total number of **momentary interruptions**, divided by the total number of **connected customers** averaged over the year,

Metering Code means the laws, Codes or other regulatory instruments about metrology applicable to a particular **customer** which may include one or more of the:

- (a) **National Electricity Wiring Regulations**; and
- (c) **Electricity Customer Metering Code**.

momentary interruption means an **interruption** continuing for a period of less than one minute,

point of common coupling means the nearest point in a **Distribution Utility’s distribution**,

system that **connection** is made between:

- (a) the **Distribution Utility’s distribution system** and another **Distribution Utility’s distribution system**; or
- (b) two or more **customers’ electrical installations**,

point of connection in relation to an **embedded generating unit**, means the point at which the **embedded generating unit** is **connected** to the **Distribution Utility’s distribution system**,

point of supply

(a) in relation to a low **voltage** electric line, means:

(i) in the case of an underground line (unless sub-paragraph (iii) applies),

the point at which that line crosses the boundary of the land; and

(ii) in the case of an overhead line (unless sub-paragraph (iii) applies), the first point of **connection** of that line on the land, being either:

A) if the line is carried onto the land by one or more poles, the first pole on the land carrying that line;

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B) if the line is **connected** directly to premises on that land, that **connection** to the premises; or

C) if it is not possible to determine a point of **supply** in accordance with sub-sub-paragraph (A) or (B), the point at which the line crosses the boundary of the land; and

(iii) in the case of a line **connected** to a **Distribution Utility's** assets, the point at which the line is **connected** to a **Distribution Utility's** assets; and

(b) in relation to a high **voltage** electric line, means the point agreed between the relevant **Distribution Utility** and the **customer supplied** by that electric line,

power factor means the ratio of **active power** to **apparent power**,

price determination means the **PURC's** Electricity Distribution Price

Determination (as re-determined from time to time) or any other price determination in force.

public holiday means a public holiday appointed,

public lighting assets means all assets of a **Distribution Utility** which are dedicated to the provision of public lighting including lamps, luminaries, mounting brackets and poles on which the fixtures are mounted, supply cables and control equipment (for example, photoelectric cells and control circuitry) but not including the **Distribution Utility's** protection equipment (for example, fuses and circuit breakers),

quality of supply means the measure of the ability of the **distribution system** to provide **supply** that meets the **voltage** quality requirements of this Code,

reactive energy means the time integral of the product of **voltage** and the out of phase component of current flow,

reactive power means the rate at which **reactive energy** is **supplied**,

reliability of supply means the measure of the ability of the **distribution system** to provide **supply** to **customers**,

redundant load means a **load connected** to the **distribution system** that is planned to be permanently **disconnected**,

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retailer means a person who holds, or is exempt from holding, a **retail licence** under the Energy Commission Act,

retail licence means a licence granted under the Energy Commission Act to sell electricity otherwise than through the wholesale electricity market,

rural area means an area **supplied** electricity by an electric line which:

(a) forms part of a **distribution system**; and

(b) is a single feeder the length of which measured from the relevant zone substation is at least 15 km

SAIDI means the ‘System Average Interruption Duration Index’, which is the total minutes, on average, that a **customer** could expect to be without electricity over a specific period of time, calculated as the sum of the duration of each **customer interruption** (in minutes), divided by the total number of **connected customers** averaged over the year,

SAIFI means the ‘System Average Interruption Frequency Index’ which is the number of occasions per year when each **customer** could, on average, expect to experience an unplanned **interruption**, calculated as the total number of **customer interruptions**, divided by the total number of **connected customers** averaged over the year. Unless otherwise stated, SAIFI excludes **momentary interruptions**,

small embedded generator means an **embedded generator** meeting either or both of the following conditions:

(a) the **embedded generator** has or proposes to have **embedded generating units** at a **point of connection** with power transfer capability of not more than 2kW;

(b) the **embedded generator** has or proposes to have **embedded generating units** that meet the standards for the grid connection of energy systems via inverters.

supply in relation to electricity, means the delivery of electricity,

supply address means the address where the **customer** is being **supplied** with electricity.

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sustained interruption means an **interruption** of duration longer than one minute.

system means the network for the generation, transmission and **distribution** of electricity in Ghana.

time of use network tariff means a distribution tariff as determined in accordance with the **PURC's** prevailing distribution determination or transmission tariff as determined in accordance with the **PURC** prevailing transmission determination that has varying components for the time that electricity consumption occur,

total harmonic distortion means the ratio of the root-mean-square of the harmonic content to the root-mean-square of the fundamental quantity, expressed as a percent of the fundamental,

transmission connection means those parts of an electricity transmission network which are dedicated to the **connection** of **customers** at a single point, including transformers, associated switchgear and plant and equipment,

urban feeder means a **feeder** with load density greater than 0.3 MVA/km,

voltage means (except in the case of impulse voltage) the root mean square (RMS) of the phase to phase voltage, and

wholesale market means the market for wholesale trading in electricity .

SECTION 3: APPLICATION OF THE CODE

MAIN ACTORS

Art 3. 00 This Code applies to

- (a) Distribution Utilities,
- (b) retailers of electricity,
- (c) embedded generators, and
- (d) customers of a distribution utility or retailer.

These entities shall comply with the Code.

Art 3. 01 A customer shall comply with this Code where an obligation to do so is included as a term or condition in a contract for the supply of electricity by a Distribution Utility or the sale of electricity by a retailer, to the customer or in a deemed/ presumed distribution contract

Art 3. 02 A Distribution Utility is a person licensed by the Energy Commission to distribute and sell electricity without discrimination to consumers in an area or zone designated by the Board.

Art 3. 03 A retailer is a person licensed by the Energy Commission to

- a) sell or offer electricity to a consumer;
- b) to act as an agent or broker for a retailer with respect to the sale or offering for sale of electricity; or
- c) to act or offer to act as an agent or broker for a consumer with respect to the sale or offering for sale of electricity.

Art 3. 04 An embedded generator whose facility is licensed by the Energy Commission and is directly connected to a distribution network

Art 3. 05 A customer is a person that has contracted for the supply of electricity by a Distribution Utility or the purchase of electricity from a retailer.

GENERAL REQUIREMENTS

Art 3.06 A Distribution Utility shall operate its distribution network to provide services in accordance with the Performance and Reliability Standards of the Distribution Code. The Distribution Utility's responsibilities in this regard shall include:

- (a) the operation of all distribution network equipment, installations and facilities in accordance with the operation instructions and guidelines for the respective equipment or in accordance with Prudent Utility Practices;
- (b) the provision of open, fair and non-discriminatory access and connection to the distribution network for all licensed or permitted main actors, in accordance with the regulations and provisions of the Distribution Code;
- (c) the performance of all the planning functions related to the distribution network;
- (d) making the necessary recommendations for transmission or distribution network expansion projects to adequately meet the forecast requirements for demand growth and customer reliability standards;
- (e) the control and operation of the distribution network to ensure security of the network within its technical limits and in accordance with the provisions of the Distribution Code;
- (f) undertaking outage planning and coordinating maintenance activities of all equipment and facilities that will or are likely to impact on the reliability of the distribution network;
- (g) the planning, development, supply, installation, commissioning and maintenance of adequate central SCADA/EMS system together with any necessary associated backup systems, telecommunication systems and the coordination of their expansion and upgrade;
- (h) the planning, development, installation and maintenance of remote terminal distribution network at substations and the coordination of their upgrade;

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- (i) investigation and review of each major power system operational incident and the issuance of the relevant reports;
- (j) provision, installation, operation and maintenance of the revenue meters of the distribution network ;
- (k) administering power supply and power purchase agreements;
- (l) the real-time monitoring and recording of electric power and energy balance and the performance of the accounting and billing function for the distribution network supply and services;
- (m) the development of the System Operational Manual and Safety Rules for coordinated and safe operation of the distribution network; and
- (n) supervising and ensuring adherence to Safety Rules by the main actors.

Art 3. 07 The Distribution Utility shall collect information and statistics, publish reports and disseminate information relating to the performance of its distribution network.

Art 3. 08 The Distribution Utility shall operate its distribution network efficiently in accordance with the Distribution Code.

Art 3. 09 The Distribution Utility shall liaise with other bodies within Ghana that have regulatory functions with respect to the power industry in order to ensure consistent and effective development and application of the Distribution Code.

Art 3. 10 A main actor who intends to establish and connect to the distribution network any new or modified equipment or network that it owns operates or controls shall liaise with the Distribution Utility and obtain the required approval from the Energy Commission.

Art 3. 11 A Distribution Utility shall develop and publish a Customer Charter in accordance with its licensing requirements

COMPLIANCE WITH LAWS AND INDUSTRY STANDARDS

Art 3. 12 A main actor shall comply with all relevant laws, the requirements of the Distribution Code, permits and Prudent Utility Practice.

SECTION 4: TRANSITIONAL PROVISIONS AND EXEMPTIONS

PURPOSE AND SCOPE

Art 4.00 This section of the Distribution Code makes recommendations for a transition period. These recommendations include temporary reliefs, relaxation of standards and capacity building in response to changes in roles, obligations and responsibilities. It provides the rationale and suggests the duration of any reliefs, relaxations or exemptions.

CONFIGURATION OF EQUIPMENT AND INSTALLATIONS

Art 4.01 “Non-compliance Listing” of all assets and connected facilities indicating the specific technical characteristics which do not comply with the Distribution Code shall be prepared by the Distribution Utility within three months of the coming into force of the Distribution Code.

Art 4.02A transitional period for compliance shall commence after the compilation of the Non-compliance Listings by the Distribution Utility and approval by the Energy Commission.

Art 4.03 Distribution Network Facilities: All equipment and facilities that are in operation within the distribution network at the time of coming into effect of this Distribution Code shall be accepted and operated as part of the distribution network during a transitional period which shall not exceed thirty months, provided that, the deficiency has been identified and included in the “Non-compliance Listing”. Each equipment and facility not included in the Non-compliance Listing shall be deemed to be fully compliant.

Art 4.04 Generation Facilities: All generation equipment and facilities that are in operation within the distribution network at the time of coming into force of this Distribution Code shall, despite any deficiency or non-compliance with the Distribution Code, continue to operate during a transitional period which shall not exceed thirty-six months, provided that the deficiency has been identified and included in the “Non-compliance Listing”. Each equipment

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and facility not included in the Non-compliance Listing shall be deemed to be fully compliant.

Art 4.05 Off-taker Facilities: All user facilities that are connected to receive power from the distribution network at the time of coming into force of this Distribution Code shall, despite any deficiency or non-compliance with the Distribution Code, continue to operate during a transitional period which shall not exceed thirty months, provided that the deficiency has been identified and included in the “Non-compliance Listing”. Each equipment and facility not included in the Non-compliance Listing shall be deemed to be fully compliant.

Art 4.06 Every main actor, in consultation with the Distribution Utility, shall prepare “Compliance Plans” for the upgrade of their respective affected off-taker facilities, and the Distribution Utility shall prepare “Compliance Plans” for the upgrade of each affected distribution network node or distribution network facility to make them fully compliant within a reasonable period and, in any case, not exceeding the transition period allowed for that category.

Art 4.07 The Distribution Utility shall present all such Compliance Plans to the Energy Commission for acceptance and approval within a period of nine months after the coming into force of the Distribution Code and thereupon confirm to the respective main actor their obligations and accepted time-frame to remedy the identified non-compliance and/or deficiencies.

Art 4.08 The non-compliance and/or deficiencies identified for each listed asset or node shall for all other purposes of the Distribution Code be deemed to be fully compliant during the transition period.

Art 4.09 During such part of the transitional period as has been accepted by the Energy Commission for implementation of remedial action on that non-compliant asset or node, no main actor may be disconnected or denied service on the basis of that deficiency or non-compliance which has been identified and included in the “Non-compliance Listing”.

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SERVICE PERFORMANCE STANDARD DURING TRANSITION PERIOD

Art 4.10 Prior to the completion of the upgrade of any distribution network node or facility that was declared to be non-compliant; the performance benchmarks for only those services affected by the recorded deficiency shall not be applicable.

MANAGEMENT SYSTEMS

Art 4.11 The application of the procedures prescribed in this Distribution Code for supply may be deferred with the consent of the Energy Commission until the associated commercial arrangements and corresponding energy accounting, billing and settlement instruments are finalised.

Art 4.12 Enforcement of the procedures for maintenance and outage planning may be deferred by up to nine months with the consent of the Energy Commission to enable the main actors and the Distribution Utility complete administrative arrangements for introduction of the procedures.

CAPACITY BUILDING (HUMAN RESOURCE DEVELOPMENT)

Art 4.13 The Distribution Utility shall employ, train, suitably equip and maintain an adequate workforce that is qualified and competent in distribution planning, maintenance scheduling and performance monitoring as well as commissioning and testing of distribution network components to enable it perform its functions.

EXISTING CONTRACTS

Art 4.14 Each contract in respect of distribution services entered into by the Distribution Utility and existing at the commencement of this Distribution Code shall continue in force unless the contract is revoked or amended by agreement.

Art 4.15 The Distribution Utility shall have responsibility for distribution services required under an existing contract when the Distribution Code comes into effect.

Art 4.16 The PURC shall determine the charges payable to the Distribution Utility for the distribution services rendered by the Distribution Utility.

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Art 4.17 The Distribution Code shall apply to all such existing contracts in so far as the Distribution Code does not impair the obligations arising from the existing contract.

Art 4.18 The Distribution Utility shall endeavour to negotiate for new or amended contracts which shall conform to all the provisions of the Distribution Code .

Art 4.19 The Distribution Utility shall not enter into a new contract or extend any existing contract that is not in accordance with the Distribution Code.

DRAFT, MAY 2012

SECTION 5: MANAGEMENT AND GOVERNANCE OF DISTRIBUTION CODE

PURPOSE AND SCOPE

Art 5. 00 This section defines the arrangements for the management and governance of the provision of distribution network services and for the implementation of the Distribution Code.

CONDUCT OF DISTRIBUTION UTILITY

Art 5. 01 The Distribution Utility which has been given the exclusive mandate to operate its distribution network shall be responsible for the good governance and management of its distribution network in accordance with the Distribution Code and guided at all times by generally accepted best practices.

Art 5. 02 The Distribution Utility shall not accept any advice, directions or instructions that may have the effect of subverting the fundamental principles of fairness, transparency, non-discrimination and open access in the governance and management of its distribution network.

Art 5. 03 A report of the activities of the Distribution Utility shall be made available for review by an interested main actor.

Art 5. 04 The Distribution Utility shall be accountable to the Energy Commission for the performance of its distribution network and compliance with the letter, spirit and intent of the Distribution Code.

Art 5. 05 A main actor shall where applicable have a valid Connection Agreement with the Distribution Utility.

ROLE OF THE ENERGY COMMISSION

Art 5. 06 The primary purpose of the Energy Commission with regard to the operation of the distribution network shall be to ensure compliance with the Distribution Code.

Art 5. 07 The Energy Commission shall oversee all technical operations, activities and transactions of the main actors on the distribution network and also

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supervise the performance of all the functions of the Distribution Utility towards ensuring the fulfilment of its role as required under the Distribution Code.

- Art 5. 08 The Energy Commission shall have the mandate to
- (a) review and assess on a regular basis the following:
 - i) performance of the Distribution Utilities and their distribution networks,
 - ii) compliance with rules and regulations by Distribution Utility and main actors,
 - iii) fairness and non-discrimination in all operational activities;
 - (b) consider, investigate, assess and advise the Distribution Utilities and the PURC as appropriate on the following issues:
 - i) possible unacceptable behaviour of main actors,
 - ii) proposals for the revision of the Distribution Code, procedures, practices, rules or regulations covering the distribution network,
 - iii) distribution network development strategies and plans,
 - iv) distribution network Standards of Performance and penalties, and
 - v) any distribution network related complaints;
 - (c) audit, approve or affirm as relevant the following:
 - i) Non-compliance Listing, Compliance Plans and remedial programs, and
 - ii) data archiving systems of main actors and the Distribution Utilities; and
 - (d) establish procedures for the resolution of disputes among main actors.

REVISION OF DISTRIBUTION CODE

Art 5. 09 Proposals for the revision of any provision of the Distribution Code may be made by any main actor, the “Proposer”.

Art 5.10 All proposals for Distribution Code revisions shall be in writing and shall be sent to the Energy Commission with a copy to the Distribution Utility.

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Art 5.11 The Energy Commission shall receive, register and acknowledge all submissions.

Art 5.12 The Energy Commission shall notify main actors and the Distribution Utility of all such proposals and make copies accessible to them either over the internet or through other appropriate means.

Art 5.13 All relevant main actors shall within three months of their receipt of a revision proposal, provide the Energy Commission and the “Proposer” with their views.

Art 5.14 The Energy Commission shall consider the submissions of the “Proposer” and the comments of the relevant main actors and inform all the parties of its decision with written justifications.

COMPLAINTS AND DISPUTES

Art 5.15 Any main actor may lodge a complaint in writing with the Energy Commission where it believes that the rules, regulations or procedures of the Distribution Code are not operating fairly.

Art 5.16 A main actor may also lodge a complaint where it believes that the Distribution Utility or a main actor is not acting in accordance with the Distribution Code.

Art 5.17 The Energy Commission shall receive, register and acknowledge all complaints.

Art 5.18 The Energy Commission shall promptly notify the relevant parties to the complaint and the Distribution Utility of the receipt of such a complaint and make copies of the complaint accessible to them either over the internet or through other appropriate means.

Art 5.19 All affected parties shall, within one month of their receipt of a complaint, provide the complainant, the Distribution Utility and the Energy Commission with their views, comments and responses to the complaint.

Art 5.20 The Energy Commission shall consider each complaint and make recommendations to the parties for the resolution of the complaint or dispute.

PART B: CONDITIONS OF DISTRIBUTION & SALE LICENCE

SECTION 6: TRANSPARENCY & NON-DISCRIMINATION REQUIREMENTS

PUBLICATION OF PROCEDURES

Art 6. 00 The Distribution Utility shall develop and publish in detail all the requirements, qualifications and administrative procedures to be fulfilled or followed by those seeking to be provided services by the Distribution Utility.

Art 6. 01 The requirements shall include all technical standards for connection equipment, communication, operating parameters and performance benchmarks for service provision.

Art 6. 02 The qualifications shall include all legal, financial and technical qualifications to be fulfilled.

Art 6. 03 The administrative procedures shall include all administrative, financial, technical and any other procedures to be followed prior to the commissioning of the connection as well as the obligations of the main actors for the continued provision of the service.

Art 6. 04 The Energy Commission shall publish the Distribution Code on its website and make readily available to the public copies of the Distribution Code and all related publications upon the payment of a published fee.

EQUAL APPLICATION OF THE DISTRIBUTION CODE

Art 6. 05 The Distribution Code shall be fairly and uniformly applied to all classes within a category of main actors. All conditions and situations that are similar shall also receive consistent and equitable treatment.

EXERCISE OF DISCRETION BY THE DISTRIBUTION UTILITY AND OTHER OFFICIALS

Art 6. 06 The Distribution Utility or any other person shall not make a decision that is inconsistent with the Distribution Code in respect of the usage or provision of services from the distribution network.

Art 6. 07 The Distribution Utility may use its discretion and good judgment in making decisions on any matter on which this Distribution Code does not contain complete

or adequate stipulations.

Art 6. 08 The exercise of a discretionary power shall however be justified in writing to the Energy Commission and the affected party at the same time that such decision is taken.

Art 6. 09 The principles and rationale for any discretion exercised or decision taken by the Distribution Utility shall be published and made available to any person upon request.

Art 6. 10 A person aggrieved by a discretionary decision taken by the Distribution Utility may request for a review by the Public Utilities Regulatory Commission or Energy Commission as necessary.

Art 6. 11 The Public Utilities Regulatory Commission or Energy Commission shall consider the complaint and uphold or recommend a reconsideration of the decision.

CHARGES FOR DISTRIBUTION NETWORK SERVICES

Art 6. 12 Charges for the use of the distribution network or the services of the Distribution Utility shall not exceed those approved by the Public Utilities Regulatory Commission and published in the Gazette or national dailies.

SECTION 7: CONNECTION AGREEMENT REQUIREMENT

EQUIPMENT

Art 7. 00 In respect of each location address which is in a Distribution Utility's designated area, the Distribution Utility must provide, install and maintain standard metering and necessary associated equipment, at a suitable location to be provided by the customer in respect of that location address, unless the customer's retailer is eligible to choose and chooses a different service provider to install a meter and associated equipment in accordance with the applicable metering code.

NEW CONNECTION

Art 7. 01 Where a connection request has been made by a person or a retailer on behalf of a customer,

- (a) On receipt of the applicant's application form and
- (b) payment of the required charges

a Distribution Utility must use best endeavours to connect the customer at the new location address on the date agreed with the customer or with the retailer on behalf of the customer.

Art 7.02 Where no date is agreed

- (a) five working days if the connection is to be made from an existing supply line; or
- (b) one month if the connection requires a line extension.

NO ENERGISATION

Art 7. 03 A Distribution Utility must not energise a customer's location address unless:

- (a) a request to do so is made by:
 - (i) a customer; or
 - (ii) a customer's retailer.

- (b) there is a relevant emergency; or
- (c) energisation is otherwise expressly authorised or required by this Code or by law.

Art 7.04 If a person contacts a Distribution Utility to request energisation and the person is not a customer of the Distribution Utility but a customer of the retailer, the Distribution Utility must advise the person that the request must be made by the person's retailer.

CONNECTION WITHOUT ENERGISATION

Art 7.05 Subject to Art 7.07, where a connection request has been made by a customer and the customer's supply address cannot be energised due to the operation of Art 7.03 a Distribution Utility must use best endeavours to connect but not energise a new supply address on the date agreed with the customer. Where no date is agreed, the Distribution Utility must perform its obligations within one month after the request.

PREVIOUS CONNECTION

Art 7.06 Where a customer only requires energisation and the customer provides acceptable identification and settles all financial obligations to the Distribution Utility or the customer's retailer, a Distribution Utility must use best endeavours to energise the customer's location address of a request being made by a customer's retailer if such request has been made to the Distribution Utility orally or in writing within;

- (a) six hours, in the case of a metropolitan or municipal area or industrial estate,
- (b) twelve hours, in the case of a district capital, and
- (c) eighteen hours, in the case of a rural area.

CONDITIONS FOR CONNECTION

Art 7.07 The Distribution Utility's obligation to connect is subject to :

- (a) an adequate supply of electricity being available at the required voltage at

the boundary of the new supply address;

- (b) an Installation Completion Certificate (ICC) being provided to the Distribution Utility in respect of the customer's electrical installation at the customer's supply address;
- (c) the customer complying with Art 7.10 and Art 7.11;
- (d) the customer complying with reasonable technical requirements required by the Distribution Utility; and
- (e) the customer providing acceptable identification.

Art 7.08 Where a Distribution Utility is not obliged to comply with its obligation to connect under Art 7.07, the Distribution Utility must comply with such obligation as soon as practicable after the removal or elimination of the reason for which connection or connection without energisation was not made.

DISTRIBUTION UTILITY'S EQUIPMENT ON CUSTOMER PREMISES

Art 7.09 A customer must:

- (a) not interfere, and must use best endeavours not to allow interference with the Distribution Utility's distribution network including any of the Distribution Utility's equipment installed in or on the customer's premises; and
- (b) provide and maintain on the customer's premises any reasonable or agreed facility required by its Distribution Utility to protect any equipment of the Distribution Utility.

Art 7.10 Provided official identification is produced by the Distribution Utility's representatives on request, a customer must provide to the Distribution Utility's representatives at all times convenient and unhindered access:

- (a) to the Distribution Utility's equipment for any purposes associated with the supply, metering or billing of electricity; and
- (b) to the customer's electrical installation for the purposes of:
 - (i) the inspection or testing of the customer's electrical installation for the

purpose of assessing whether the customer is complying with this Code; or

- (ii) connecting, disconnecting or reconnecting supply, and safe access to and within the customer's premises for the purposes described in this Art.

Art 7.11 If necessary, the customer must provide safety equipment and appropriate safety instructions to representatives of the Distribution Utility to ensure safe access to the customer's premises.

Art 7.12 In cases other than emergencies, a Distribution Utility must use best endeavours to access a customer's premises at a time, which is reasonably convenient to both the customer and the Distribution Utility.

SECTION 8: LIABILITY

- Art 8. 00 A Distribution Utility shall only be liable to a customer and a customer shall only be liable to a Distribution Utility for any damages which arise directly out of the wilful misconduct or negligence:
- (a) of the Distribution Utility in providing distribution services to the customer;
 - (b) of the customer in being connected to the Distribution Utility's network; or
 - (c) of the Distribution Utility or Customer in meeting their respective obligations under this Code, their licences and any other applicable law.
- Art 8. 01 Despite Art 8.00, neither the Distribution Utility nor the customer shall be liable under any circumstances whatsoever for any loss of profits or revenues, business interruption losses, loss of contact or loss of goodwill, or for any indirect, consequential, incidental or special damages, including but not limited to punitive or exemplary damages, whether any of the said liability, loss or damages arise in contract, tort or otherwise.
- Art 8. 02 The Distribution Utility shall educate its customers on the use of appropriate equipment to control loss or damage, which may result from poor quality or reliability of electricity supply within its distribution network.
- Art 8. 03 A customer shall be liable to the Distribution Utility for any loss or damage resulting from the use of electricity in a manner that will make the Distribution Utility's system unsafe.

SECTION 9: FORCE MAJEURE

Art 9. 00 Neither party shall be held to have committed an event of default in respect of any obligation under this Code if prevented from performing that obligation, in whole or in part, because of a force majeure event.

Art 9. 01 If a force majeure event prevents a party from performing any of its obligations under this Code and the applicable Connection agreement , that party shall:

- (a) Promptly notify the other party of the force majeure event and its assessment in good faith of the effect that the event will have on its ability to perform any of its obligations. If the immediate notice is not in writing, it shall be confirmed in writing as soon as reasonably practicable.
- (b) Not be entitled to suspend performance of any of its obligations under this Code 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 the efforts to mitigate the effects of the force majeure event; and
- (e) Provide written notice to the party when it resumes performance of any of its obligations affected by the force majeure event.

Art 9. 02 Notwithstanding any of the foregoing, settlement of any strike, lockout, or labour dispute constituting a force majeure event shall be within the sole discretion of the party to the agreement involved in the strike, lockout, or labour dispute. The requirement that a party must use its best efforts to remedy the cause of the force majeure event, mitigate its effects, and resume full performance under this Code shall not apply to strikes, lockouts, or labour disputes.

SECTION 10: CONDITIONS OF SERVICE

ESTABLISHMENT

Art 10. 00 All Distribution Utilities shall have a Conditions of Service which must be consistent with the provisions of this Code and all other applicable Codes and legislations.

Art 10. 01 The Conditions of Service shall describe the operating practices and the connection policies of the Distribution Utility..Subject to this Code and other applicable laws, a Distribution Utility shall comply with its Conditions of Service but may waive a provision of its Conditions of Service in favour of a customer or a potential customer with the approval of the Public Utilities Regulatory Commission or the Energy Commission as necessary.

Art 10. 02 A Distribution Utility shall

(a) file a copy of its Conditions of Service with the Public Utilities Regulatory Commission and the Energy Commission;

(b) publish its Conditions of Service on its application form and website ;and

(c) make copies of its Condition of Service available to customers upon request .

Art 10. 03 A Distribution Utility's existing Conditions of Service shall meet the standards set out in this Code for a period of one year following the coming into force of this Code after which date the Distribution Utility must fully comply.

Art 10. 04 A Distribution Utility's Conditions of Service may be subject to review as part of the Distribution Utility's performance based rates plan.

Art 10. 05 A distribution Utility's Conditions of Service shall include, at minimum, a description of the following:

(a) the types of connection service performed by the Distribution Utility for each customer class, and the conditions under which

these connections will be performed;

- (b) the Distribution Utility's basic connection service that is recovered through its revenue requirements and does not require a variable connection charge;
- (c) the Distribution Utility's capital contribution policy by customer class for an offer to connect, including procedures for collection of capital contributions;
- (d) the demarcation point at which the Distribution Utility's ownership of distribution equipment ends at the customer;
- (e) the billing cycle period and payment requirements by customer class;
- (f) design requirements for connection to the distribution network;
- (g) voltages at which the Distribution Utility provides electricity and corresponding load thresholds;
- (h) type of meters provided by the Distribution Utility;
- (i) meters required by customer class;
- (j) Quality of Service standards to which the distribution network is designed and operated;
- (k) conditions under which supply may be unreliable or intermittent;
- (l) conditions under which service may be interrupted;
- (m) conditions under which the Distribution Utility may disconnect a consumer;
- (n) policies for planned interruptions;
- (o) the business process the Distribution Utility uses to disconnect and reconnect consumers, including means of notification and timing;
- (p) the Distribution Utility's rights and obligations with respect to a

customer;

- (q) rights and obligations a consumer or embedded generator has with respect to the Distribution Utility;
- (r) the Distribution Utility's limitations in accordance with this Code;
- (s) the Distribution Utility's dispute resolution procedure; and
- (t) terms and conditions under which the Distribution Utility provides other services in its capacity as a Distribution Utility.

SECURITY DEPOSIT

Art 10. 06 A Distribution Utility's Conditions of Service shall include the distribution Utility's security deposit policy which shall be consistent with the provisions of this Code. A Distribution Utility's security policy shall, include at a minimum, the following

- (a) a list of all potential types or forms of security accepted;
- (b) a detailed description of how the amount of security is calculated;
- (c) limits on amount of security required;
- (d) the planned frequency, process and timing for updating security;
- (e) criteria customers must meet to have security deposit waived and/or returned; and
- (f) methods of enforcement where a security deposit is not paid.

Art 10. 07 In managing customer non-payment risk, a Distribution Utility shall not discriminate among customers with similar risk profiles or risk related factors except where expressly permitted under this Code.

Art 10. 08 If a Distribution Utility's Conditions of Service are documented in a form or in an order different from that specified in the generic Conditions of Service attached to this Code as Appendix A, the Distribution Utility shall provide a mapping of terms in its Conditions of Service to the sections and subsections in Appendix A.

Art 10. 09 A Distribution Utility shall provide advance public notice of any changes to its Conditions of Service. Notice shall be, at a minimum, provided to each customer by means of a note on and/or included with the customer's bill. The public notice shall include a proposed timeline for implementation of the new Conditions of Service and means by which public comment may be provided. A Distribution Utility shall provide the Public utilities and regulatory Commission and the Energy Commission with a copy of the new Conditions of Service once they are implemented. The copy of the revised document shall include a cover letter that outlines the changes from the prior document, as well as a summary of any public comments on the changes.

Art 10. 10 A Distribution Utility may require a security deposit from a customer who is not billed by a competitive retailer under retailer-consolidated billing unless the customer has a good payment history of 1 year in the case of a residential customer, of 2 years in the case of a non-residential customer, of 3 years in the case of any other rate class. The time period that makes up the good payment history must be the most recent period of time and some of the time period must have occurred in the previous 24 months. A Distribution Utility shall provide a customer with the specific reasons for requiring a security deposit from the customer.

Art 10. 11 For the purposes of Art 10.10, a customer is deemed to have a good payment history unless, during the relevant time period set out in Art 10.10,

- (a) the customer has received more than one disconnection notice from the Distribution Utility;
- (b) the customer has more than one cheque given to the Distribution Utility by the customer has been returned for insufficient funds; or
- (c) the customer has more than one pre-authorized payment to the Distribution Utility which has been returned for insufficient funds or
- (d) a disconnect- collect trip has occurred in respect of the customers service connection.

If any of the preceding events occur due to an error by the Distribution Utility, the

customer's good payment history shall not be affected.

Art 10. 12 Despite Art 10.10, a Distribution Utility shall not require a security deposit where:

(a) a customer provides a letter from another Distribution Utility or gas or water Distribution Utility in Ghana confirming a good payment history with that Distribution Utility for the most recent relevant time period set out in Art 10.10 where some of the time period which makes up the good payment history occurred in the previous 24 months; or

(b) a customer, other than a bulk customer provides a satisfactory credit check made at the customer's expense.

Art 10. 13 The maximum amount of a security deposit which a Distribution Utility may require a customer to pay shall be calculated in the following manner:

Billing cycle factor x estimated bill based on the customer's average monthly load with the Distribution Utility during the most recent 12 consecutive months within the past two years.

Where relevant usage information is not available for the customer for 12 consecutive months within the past two years or where the Distribution Utility does not have systems capable of making the above calculation, the customer's average monthly load shall be based on a reasonable estimate made by the Distribution Utility.

Art 10. 14 Subject to Art 10.07, a Distribution Utility may in its discretion reduce the amount of a security deposit, which it requires a customer to pay for any reason including where the customer pays under an interim payment arrangement and where the customer makes pre-authorized payments.

Art 10. 15 For purposes of Art 10.13, the billing cycle factor is 2.5 if the customer is billed monthly, 1.75 if the customer is billed bi-monthly and 1.5 if the customer is billed quarterly.

Art 10. 16 Where a customer has a payment history which discloses more than one disconnection notice in a relevant 12 month period, the Distribution Utility may use that customer's highest actual or estimate monthly load for the most recent 12

consecutive months within the past 2 years for the purposes of making the calculation of the maximum amount of security deposit under Art 10.13.

Art 10. 17 The form of payment security deposit for a residential customer shall be cash or cheque at the discretion of the customer or such other form as is acceptable to the Distribution Utility.

Art 10. 18 The form of payment of a security deposit for a non-residential customer shall be cash, cheque or an automatically renewing, irrevocable letter of credit from a bank acceptable to the Utility.

The Distribution Utility may also accept other forms of security such as surety bonds and third party guarantees.

Art 10. 19 Interest shall accrue monthly on security deposits made by way of cash or cheque commencing on receipt of the total deposit required by the Distribution Utility. The interest shall be 50% of the policy rate as published by the Bank of Ghana.. The interest accrued shall be paid out at least once every 12 months or on the return or application of the security deposit or closure of the account, whichever comes first, and may be paid by crediting the account of the customer or otherwise.

Art 10. 20 A Distribution Utility shall review every customer's security deposit at least once every calendar year to determine whether the entire amount of the security deposit is to be returned to the customer as the customer is now in a position that it would be exempt from paying a security deposit under Art 10.10 or 10.12 had it not already paid a security deposit or whether the amount of the security deposit is to be adjusted based on a re-calculation of the maximum amount of the security deposit under Art 10.13.

Art 10. 21 A customer may, no earlier than 12 months after the payment of a security deposit or the making of a prior demand for review, demand in writing that a Distribution Utility undertake a review to determine whether the entire amount of the security deposit is to be returned to the customer as the customer is now in a position that it would be exempt from paying a security deposit under section Art 10.10 or 10.12 had it not already paid a security deposit or whether the amount of the security deposit is to be adjusted based on a re-calculation of

the maximum amount of the security deposit under Art 10.13 or 10.14.

Art 10. 22 Where the Distribution Utility determines in conducting a review under Art 10.20 or Art 10.21 that some or all of the security deposit is to be returned to the customer, the Distribution Utility shall promptly return this amount to this amount to the customer by crediting the customer's account or otherwise.

Art 10. 23 A Distribution Utility shall promptly return any security deposit received from the customer upon closure of the customer's account, subject to the Distribution Utility's right to use the security deposit to set off other amounts owing by the customer to the Distribution Utility. The security deposit shall be returned within six weeks of the closure of an account.

Art 10. 24 A Distribution Utility shall apply a security deposit to the final bill prior to the change in service where a customer changes from post paid to prepaid billing or from a Utility to a Retailer. A Distribution Utility shall promptly return any remaining amount of the security deposit to the customer. A Distribution Utility shall not pay any portion of a customer's security deposit to a competitive retailer. .

Art 10. 25 Despite Art 10.20, 10.21, 10.22, 10.23 and 10.24, where all or part of a security deposit has been paid by a third party on behalf of a customer, the Distribution Utility shall return the amount of the security deposit paid by the third party, including interest, where applicable, to the third party. This obligation shall apply where and to the extent that:

- (a) the third party paid all or part (as applicable) of the security deposit directly to the distribution utility;
- (b) the third party has requested, at the time the security deposit was paid or within a reasonable time thereafter, that the distribution utility return all or part (as applicable) of the security deposit to it rather than to the customer; and
- (c) there is not then any amount overdue for payment by the customer that the distribution utility is permitted by this Code to offset using the security deposit.

PART C : RULES OF PRACTICE

SECTION 11: PLANNING REQUIREMENTS

REQUEST FOR INFORMATION

Art 11.00 A customer, embedded generator or retailer must, on request from a Distribution Utility, provide details of loads connected or planned to be connected to the distribution system which are required for the purpose of the Distribution Utility planning its distribution system. The details shall include:

- (a) the location of load in the distribution system;
- (b) existing loads;
- (c) existing load profile;
- (d) changes in load scheduling;
- (e) planned outages;
- (f) forecasts of load growth;
- (g) anticipated new loads; and
- (h) anticipated redundant loads.

Art 11.01 A Distribution Utility must on request from another Distribution Utility provide such information concerning a point of common coupling as the other Distribution Utility may reasonably require for the purpose of the integrated planning of the system.

DISTRIBUTION NETWORK PLANNING REPORT

Art 11.02 A Distribution Utility must submit to the Commission an annual report called the 'Distribution Network Planning Report' detailing how it plans over the following five calendar years:

- (a) to meet predicted demand for electricity supplied through its sub transmission lines, zone substations and high voltage lines;
- (b) to improve reliability to its customers; and
- (c) to implement any security of supply upgrade plan.

Art 11.03 In fulfilling the requirements of Art 11.02(a), the report must include the following information:

- (a) the historical and forecast demand from, and capacity of, each zone substation;
- (b) an assessment of the magnitude, probability and impact of loss of load for each sub transmission line and zone substation;
- (c) the Distribution Utility's planning standards;
- (d) a description of feasible options for meeting forecast demand including opportunities for embedded generation and demand management;
- (e) where a preferred option for meeting forecast demand has been identified, a reasonably detailed description of that option, including estimated costs; and
- (f) the availability of contributions from the Distribution Utility to embedded generators or customers to reduce forecast demand and defer or avoid augmentation of the Distribution Utility's distribution network.

Art 11.04 In fulfilling the requirements of Art 11.02(b), the report must include the following information:

- (a) a description of the nature, timing, cost and expected impact on performance of the Distribution Utility's reliability improvement programs; and
- (b) an evaluation of the reliability improvement programs undertaken in the preceding year.

Art 11.05 A In fulfilling the requirements of Art 11.02(c) (if applicable), the report must include the following information:

- (a) an outline of the capital and other works carried out in the preceding year in implementing the security of supply upgrade plan;
- (b) an evaluation of whether the relevant security of supply objectives specified in the security of supply upgrade plan have been achieved in the preceding year; and
- (c) an outline of the capital and other works connected with the security of supply objectives proposed to be carried out in the following 5 years.

Art 11.06 Each Distribution Utility must publish the Distribution Network Planning Report

on its website and, on request by a customer, provide the customer with a copy. The Distribution Utility may impose a charge (determined by reference to its approved statement of charges) for providing a customer with a copy of the report.

CONSOLIDATED DISTRIBUTION PLANNING REPORT

Art 11.07 The Energy Commission, following the submission of the Distribution Network Planning Reports from all Distribution Utilities, shall prepare a joint report called a Consolidated Distribution Planning Report detailing how together all Distribution Utilities plan to meet predicted demand for electricity supplied into their distribution networks from the Bulk Supply Points (BSP) over the following five calendar years.

Art 11.08 The report must include the following information:

- (a) the historical and forecast demand from, and capacity of, each Bulk Supply Point;
- (b) an assessment of the magnitude, probability and impact of loss of load for each BSP;
- (c) each Distribution Utility's planning standards;
- (d) a description of feasible options for meeting forecast demand at each BSP including opportunities for embedded generation and demand management and information on land acquisition where the possible options are constrained by land access or use issues;
- (e) the availability of any contribution from each Distribution Utility including where feasible, an estimate of its size, which is available to embedded generators or customers to reduce forecast demand and defer or avoid augmentation of a BSP; and
- (f) where a preferred option for meeting forecast demand has been identified, a description of that option, including its estimated cost, to a reasonable level detail.

Art 11.09 The Energy Commission shall publish the Consolidated Distribution Network Planning Report on its website and, on request by a customer, provide the customer with a copy. The Energy Commission may impose a charge for providing a customer with a copy of the report.

SECTION 12: CONNECTIONS

Art 12. 00 A Distribution Utility shall establish a connection policy as specified in its Conditions of Service and in compliance with its obligations under the L.I.1816 - Electricity Supply and Distribution (Technical and Operational) Rules, 2005.

Art 12. 01 A Distribution Utility may consider the following reasons to refuse to connect, or disconnect a customer:

- (i) Contravention of the laws of Ghana including the Electrical Wiring Regulations
- (ii) Violation of conditions of a Distribution Utility's license
- (iii) Materially adverse effect on the reliability or safety of the distribution network
- (iv) Imposition of unsafe worker situation beyond normal risks inherent in the operation of the distribution network
- (v) A material adverse effects on the quality of the distribution network
- (vi) A materially adverse effect on the quality of distribution services received by an existing connection
- (vii) If the person requesting the connection owes the Distribution Utility money for distribution services, or for non-payment of a security deposit. The Distribution Utility shall give the person a reasonable opportunity to provide the security deposit.

Art 12. 02 A Distribution Utility shall ensure that all electrical connections to its system meet the Distribution Utility's design requirements, unless the electrical connections are separated by a protection device that has been approved by the Distribution Utility. If an electrical connection does not meet the Distribution Utility's design requirement and the provisions of the Electrical Wiring Regulations, a Distribution Utility may refuse connection.

Art 12. 03 If a Distribution Utility refuses to connect a customer, the Distribution Utility shall inform the person requesting the connection of the reason(s) for not connecting and, where the Distribution Utility is able to provide a remedy, make an

offer to connect. If the Distribution Utility is unable to provide a remedy to resolve the issue, it is the responsibility of the customer to do so before a connection may be made.

HEALTH, SAFETY OR EMERGENCY

Art 12. 04 A Distribution Utility may disconnect supply to a customer's location address if supply otherwise would potentially endanger or threaten to endanger the health or safety of any person or the environment or an element of the environment or if there is otherwise an emergency.

Art 12. 05 Except in the case of an emergency, or where there is a need to reduce the risk of fire or where relevant regulations require otherwise, a Distribution Utility must not disconnect a customer's supply address under Art 25.01 unless the Distribution Utility has:

- (a) given the customer written notice of the reason;
- (b) allowed the customer 5 business days from the date of receipt of the notice to eliminate the cause of the potential danger; and
- (c) at the expiration of those 5 business days given the customer by way of a written disconnection warning another 5 business days notice of its intention to disconnect the customer (the 5 business days is to be counted from the date of receipt of the notice).

RETAILER'S REQUEST

Art 12. 06

- (a) The retailer shall have the responsibility to apply to the Distribution Utility for a new service connection to be made to a customer for which the retailer is an agent. In this instance, the retailer shall work with the customer to ensure that all electrical connections to be made to the Distribution Utility's system meet the Distribution Utility's requirements. The payment of all connection fees directly to the Distribution Utility shall be the responsibility of the retailer.
- (b) In the instance where the customer previously received service directly from the Distribution Utility and is now is to obtain service through the retailer, the retailer shall liaise with the Distribution Utility to arrange for the necessary disconnection and reconnection of service (equipment e.g. meters, etc.) to effect the provision of services to the customer through the retailer. The payment of all connection fees directly to the Distribution Utility shall be the responsibility of the retailer.

- (c) If the Distribution Utility informs the retailer that the Distribution Utility is unable or unwilling to connect the retailer's customer, and the Distribution Utility provides the reason(s) for not connecting the customer, the retailer shall take all steps to provide a remedy to resolve the issue as agent for the customer, or to assist the Distribution Utility to provide a remedy to resolve the issue, or shall accept the Distribution Utility's offer to connect as mentioned in Art 12.01

CUSTOMER'S REQUEST

Art 12. 07 A Distribution Utility must disconnect supply to a customer's location address if the customer has requested disconnection and must use best endeavours to disconnect supply in accordance with the customer's request.

SECTION 13: EXPANSIONS

Art 13. 00 If a Distribution Utility must construct new facilities to its main distribution network or increase the capacity of existing distribution network facilities in order to be able to connect a specific customer or group of customers, the Distribution Utility shall perform an economic evaluation of the expansion project to determine if the future revenue from the customer(s) will pay for the capital cost and on-going maintenance cost of the expansion project.

Art 13. 01 If an expansion of the Distribution Utility's main distribution network is needed in order for the Distribution Utility to connect a customer, the Distribution Utility is required to make an offer to connect a customer. A Distribution Utility's offer shall include the following:

- (a) A description of the material and labour required by the Distribution Utility to build the expansion required to connect the customer.
- (b) An estimate of the amount that will be charged to the customer in order to construct the distribution network expansion necessary to make the connection.
- (c) A description of the estimate of the connection charges that would apply to the offer in accordance with Art 12.00.
- (d) Whether the offer is a firm offer or is an estimate of the cost that would be revised in the final payment to reflect the actual costs incurred.
- (e) Whether the offer includes work for which the customer can obtain alternative bid and, if so, the process by which the customer may obtain an alternative bid.
- (f) Reference to the Conditions of Service and information on how the person requesting the connection may obtain a copy.

Art 13. 02 A Distribution Utility will be responsible for the preliminary planning, design and engineering specifications of the work required for the distribution network expansion and connection. Specifications shall be made according to the Distribution Utility's standards for design, material and construction.

Art 13. 03 In providing the estimates for the amount to be charged to the customers in order to construct the distribution network referenced in Art 13.00, a Distribution Utility shall delineate estimated costs specifying those costs attributed to engineering design, materials, labour, equipment, and administrative activities.

Art 13. 04 The amount a Distribution Utility may offer to charge a customer other than a Generator or another Distribution Utility to construct the expansion to the Distribution Utility's distribution network shall not exceed that customer's share

of the difference between the present value of the projected capital costs and on-going maintenance costs for the equipment and the present value of the projected revenue for distribution services provided by those facilities. The methodology and inputs that a Distribution Utility shall use to calculate this amount is presented in Appendix B.

Art 13. 05 The amount a Distribution Utility may offer to charge a generator to construct the expansion to connect a generation facility to the Distribution Utility's distribution network shall not exceed the generator's share of the present value of the projected capital costs and on-going maintenance costs for the equipment. Projected revenue and avoided costs from the generation facility shall be assumed to be zero, unless otherwise determined by the rates approved by the PURC. The methodology and inputs that a Distribution Utility shall use to calculate this amount is presented in Appendix B.

Art 13. 06 If a shortfall between the present value of the projected costs and revenues is calculated, the Distribution Utility may propose to collect all or a portion of that amount from the customer, in accordance with the Distribution Utility's documented policy on capital contributions by customer class.

Art 13. 07 Unforecasted customers who connect to the distribution network during the customer connection horizon will benefit from the earlier expansion and should contribute their share. In such an event, the initial contributor shall then be entitled to a rebate from the Distribution Utility as follows:

- (i) For a period of up to the customer connection horizon as defined in Appendix B, the initial contributor shall be entitled to a rebate without interest, based on apportioned benefit for the remaining period.
- (ii) The apportioned benefit shall be determined by considering such factors as the relative load level and the relative line length (in proportion to the line length being shared by both parties)

Art 13. 08 If a Distribution Utility's offer to connect is a firm offer, the Distribution Utility shall provide one offer to the customer for any plans submitted to the Distribution Utility for an expansion project, at no expense to the customer. If the customer submits revised plans, the Distribution Utility may provide a new firm offer based on the revised plans at the customer's expense.

Art 13. 09 If a Distribution Utility's offer is an estimate of the costs to connect the expansion and not a firm offer, the final amount charge to the customer shall be based on actual costs incurred, the methodology described in Appendix B and the capital contribution policy of the Distribution Utility. The Distribution Utility shall calculate the estimate and the final amount of customer contribution at no expense to the customer.

Art 13. 10 Art 13.08 and the 2nd sentence of Art 13.09 do not apply to a customer who is a generator or is proposing to become a generator unless the customer's proposed or existing generation facility is an emergency backup generation facility.

ALTERNATIVE BIDS

Art 13. 11 A Distribution Utility shall inform the customer requesting a connection that the customer has the choice to obtain alternative bids for the connection and expansion facilities ("alternative bid") from qualified contractors if the offer meets the following conditions:

- (a) the project requires a capital contribution from the customer; and
- (b) construction works will not involve work with existing circuits.

Art 13. 12 If a customer is interested in obtaining an alternative bid, the Distribution Utility shall, in a non-discriminatory and fair and reasonable manner:

- (a) inform the customer of the work that the customer may obtain through an alternative bid or
- (b) inform the customer that the customer may choose among the contractors that have been pre-qualified by the Distribution Utility to perform the work eligible for an alternative bid.

Art 13. 13 The Distribution Utility shall develop and document fair and reasonable criteria and processes to pre-qualify contractors for construction work on electricity distribution projects. The Distribution Utility shall maintain a list of contractors prequalified to perform such construction work. The criteria and processes shall not be discriminatory.

Art 13. 14 If a customer chooses to pursue an alternative bid and elects to obtain the services of an alternative contractor for an aspect of the expansion project, the Distribution Utility shall:

- (a) require that customer to select, hire and pay the contractor's costs for the eligible work for the alternative bid and to assume full responsibility for the construction of that aspect of the expansion project;
- (b) require that customer to be responsible for administering the contract or to have the customer pay the Distribution Utility to do this activity on a fee for service basis. Administering the contract includes acquisition of all required permissions, permits, and easements;
- (c) reserve the right to inspect and approve all aspects of the constructed facility as part of a system commissioning activity, prior to connecting the

constructed facilities to the existing distribution network, and be reimbursed on a fee for service basis; and

- (d) agree with the customer the amount to be capitalized by the Distribution Utility

Art 13. 15 The Distribution Utility may charge a customer that chooses to pursue an alternative bid any costs incurred by the Distribution Utility associated with the expansion project including but not limited to the following:

- (a) costs for additional design, engineering, or installation of facilities required to complete the project over and above the original offer to connect; and
- (b) costs for inspection or approval of the work performed by the contractor hired by the customer.

Art 13. 16 The details of customer contributions shall be entered into a separate Customer Contribution Register which shall be submitted to the Energy commission and the PURC together with the annual report by June 30 each year.

SECTION 14: ASSETS MANAGEMENT

GOOD ASSET MANAGEMENT

Art 14. 00 A Distribution Utility must use best endeavours to:

- (a) assess and record the nature, location, condition and performance of its distribution network assets;
- (b) develop and implement plans for the acquisition, creation, maintenance, operation, refurbishment, repair and disposal of its distribution network assets:
 - (i) to comply with the laws and other performance obligations which apply to the provision of distribution services including those contained in this Code;
 - (ii) to minimise the risks associated with the failure or reduced performance of assets; and
 - (iii) in a way which minimises costs to customers taking into account distribution losses; and
- (c) develop, test or simulate and implement contingency plans (including where relevant plans to strengthen the security of supply) to deal with events which have a low probability of occurring, but are realistic and would have a substantial impact on customers.

CUSTOMER'S ELECTRICAL INSTALLATION AND EQUIPMENT

Art 14. 01 A customer must use best endeavours to ensure that:

- (a) the customer's electrical installation and any equipment within it:
 - (i) complies with this Code; and
 - (ii) is maintained in a safe condition; and
- (b) protection equipment in the customer's electrical installation is at all times effectively coordinated with the electrical characteristics of the distribution network.

Art 14. 02 A customer must use best endeavours to:

- (a) ensure that the distribution network and the reliability and quality of supply to other customers are not adversely affected by the customer's actions or equipment;
- (b) not allow a supply of electricity to its electrical installation to be used other than at the customer's premises nor supply electricity to any other person except in accordance with the L.I.1816, the Electrical Wiring Regulations and this Code;
- (c) not take electricity supplied to another supply address at the customer's supply address;
- (d) not allow electricity supplied to the supply address to bypass the meter;
- (e) not allow electricity supplied under a domestic tariff to be used for non domestic purposes; and
- (f) not allow electricity supplied under a specific purpose tariff to be used for another purpose.

DISTRIBUTION UTILITY'S EQUIPMENT ON CUSTOMER PREMISES

Art 14. 03 A customer must:

- (a) not interfere, and must use best endeavours not to allow interference with the Distribution Utility's distribution network including any of the Distribution Utility's equipment installed in or on the customer's premises; and
- (b) provide and maintain on the customer's premises any reasonable or agreed facility required by its Distribution Utility to protect any equipment of the Distribution Utility.

Art 14. 04 Provided official identification is produced by the Distribution Utility's representatives on request, a customer must provide to the Distribution Utility representatives at all times convenient and unhindered access:

- (a) to the Distribution Utility's equipment for any purposes associated with the supply, metering or billing of electricity; and
- (b) to the customer's electrical installation for the purposes of:
 - (i) the inspection or testing of the customer's electrical installation in order to assess whether the customer is complying with this Code;

or

- (ii) connecting, disconnecting or reconnecting supply, and safe access to and within the customer's premises for the purposes described in this Art 14.04.

Art 14. 05 If necessary, the customer must provide safety equipment and appropriate safety instructions to representatives of the Distribution Utility to ensure safe access to the customer's premises.

Art 14. 06 In cases other than emergencies, a Distribution Utility must use best endeavours to access a customer's premises at a time, which is reasonably convenient to both the customer and the Distribution Utility.

SECTION 15: ENHANCEMENT AND RELOCATION OF PLANTS

ENHANCEMENTS

Art 15. 00 A Distribution Utility shall continue to plan and build the distribution network to meet reasonable forecast load growth. A Distribution Utility may perform enhancements to its distribution network for purposes of improving system operating characteristics or for relieving system capacity constraints. In determining system enhancements to be performed on its distribution network, a Distribution Utility shall consider the following:

- (a) Good utility practice;
- (b) Improvement of the system to either meet or maintain required performance-based indices;
- (c) Current levels of customer service and reliability and potential improvement from the enhancement; and
- (d) Costs to customers associated with current levels of distribution reliability and potential improvement from the enhancement.

RELOCATION OF PLANT

Art 15. 01 When requested to relocate distribution plant, a Distribution Utility shall exercise its rights and discharge its obligations in accordance with existing legislation, regulations, formal agreements, easements and common law. In the absence of existing agreements, a Distribution Utility is not obligated to relocate the plant. However, the Distribution Utility shall resolve the issue in a fair and reasonable manner. Resolution in fair and reasonable manner shall include a response to the requesting party that explains the feasibility or infeasibility of the relocation and a fair and reasonable charge for relocation based on cost recovery principles.

SECTION 16: SAFETY

- Art 16. 00 A Distribution Utility shall follow good utility practice in operating and maintaining the distribution system and shall abide by safety rules and regulations that apply to routine utility work.
- Art 16. 01 A Distribution Utility shall implement an industry recognised health and safety program that includes training and regularly conducted audits. This program also will include Public Education and Public safety initiatives.
- Art 16. 02 Any problems that a Distribution Utility identifies as part of the audit shall be remedied as soon as possible or in accordance with the Distribution Utility's health and safety procedures.
- Art 16. 03 A Distribution Utility shall have a corporate policy that addresses environmental stewardship that applies to all of the Distribution Utility's operations. A documented program with supporting procedures and appropriate training should be in place to ensure compliance with environmental regulations and indicate a proactive approach to the avoidance of environmental damage.

PART D: STANDARDS OF PERFORMANCE

SECTION 17: OPERATIONS

QUALITY OF SUPPLY

- Art 17.00 A Distribution Utility shall follow good utility practice in managing the power quality of the Distribution Utility's distribution network and define in its Conditions of Service the quality of service standards to which the distribution network is designated and operated.
- Art 17.01 A Distribution Utility shall maintain a voltage variance standard in accordance with L.I. 1816- Electricity Supply and Distribution (Technical and Operational) Rules, 2005 and L.I 1935- Electricity Supply and Distribution (Standards of Performance) Regulations, 2008. A Distribution Utility shall practice reasonable diligence in maintaining voltage levels, but is not responsible for variations in voltage from external forces, such as operating contingencies, exceptionally high loads and low voltage supply from the Transmission Utility or host Distribution Utility.
- Art 17.02 A Distribution Utility shall respond to and take reasonable steps to investigate all consumer power quality complaints and report to the consumer on the results of the investigations.
- Art 17.03 If the source of a power quality problem is found to have been caused by the consumer making the complaint, the Distribution Utility may seek reimbursement for the time and cost spent to investigate the complaint.
- Art 17.04 A Distribution Utility shall take appropriate actions to control harmonic distortions found to be detrimental to consumers' connection to its distribution network. If the Distribution Utility is unable to correct the problem without adversely impacting other distribution network customers, a Distribution Utility may chose not to make the corrections. In deciding which actions to take, a Distribution Utility should use appropriate industry standards and good utility practice as guidelines.
- Art 17.05 A Distribution Utility shall require a customer that owns equipment connected to its distribution network to take reasonable steps to ensure that the operation or failure of that equipment does not cause a distribution network outage or disturbance.
- Art 17.06 A Distribution Utility may require that a customer or customer condition that adversely affects its distribution network be corrected immediately by the consumer at the consumer's or customer's cost.
- Art 17.07 (1) Distribution Utility may direct a customer connected to its distribution network to take corrective or preventive action on the consumer's or customer's electric system when there is a direct hazard to the public or the consumer or customer causing or could cause adverse effects to the reliability of the Distribution Utility's distribution network. If the situation is not corrected, the Distribution Utility

may disconnect the consumer or customer in accordance with its disconnection policy.

(2) A customer must ensure that its equipment's contribution to the harmonic distortion levels in the distribution network at the point of connection is within the limits specified in Table 3.

RELIABILITY OF SUPPLY TARGETS

Art 17.08 Before 31 December each year, a Distribution Utility must publish on its website, and in a newspaper circulating in the area in which its distribution system is located, its targets for reliability of supply for the following year.

Art 17.09 As a minimum, these targets must include for customers supplied from Metropolitan and Industrial feeders, urban feeders, rural feeders:

- (a) average minutes of interruptions per customer (SAIDI) due to planned interruptions;
- (b) average minutes of interruptions supply per customer (SAIDI) due to unplanned interruptions;
- (c) average number of unplanned interruptions per customer (SAIFI), excluding momentary interruptions;
- (d) average number of momentary interruptions per customer (MAIFI); and
- (e) average duration of unplanned interruptions (CAIDI).

Art 17.10 A Distribution Utility must use best endeavours to meet targets required by L.I. 1935-Electricity Supply and Distribution (Standards of Performance) Regulations, 2008 and this Code or otherwise meet reasonable customer expectations of reliability of supply.

A DISTRIBUTION UTILITY'S RIGHT TO INTERRUPT SUPPLY

Art 17.11 A Distribution Utility may interrupt supply at any time for the following reasons:

- (a) planned maintenance, repair, or augmentation of the distribution system;
- (b) unplanned maintenance or repair of the distribution system in circumstances where, in the opinion of the Distribution Utility, the customer's electrical installation or the distribution system poses an immediate threat of

- injury or material damage to any person, property or the distribution system;
- (c) to shed energy because the total demand for electricity at the relevant time exceeds the total supply available;
 - (d) as required by Transmission Utility's System Operator;
 - (e) the installation of a new supply to another customer;
 - (f) in the case of an emergency; or
 - (g) to restore supply to a customer.

UNPLANNED INTERRUPTIONS

Art 17.12 In the case of an unplanned interruption or an emergency, a Distribution Utility must:

- (a) within 30 minutes of being advised of the interruption or emergency, or otherwise as soon as practicable, make available, by way of a 24 hour telephone service, radio announcement and by way of frequently updated entries on a prominent part of its website, information on the nature of the interruption and an estimate of the time when supply will be restored or when reliable information on restoration of supply will be available;
- (b) provide options for customers who call the service to be directly connected to a telephone operator if required; and
- (c) use best endeavours to restore the customer's supply as soon as possible making allowance for reasonable priorities.

Art 17.13 Wherever reasonable and practicable, a Distribution Utility must provide prior information to customers who may be interrupted by load shedding.

PLANNED INTERRUPTIONS

Art 17.14 In the case of a planned interruption, the Distribution Utility must provide each affected customer with at least 3 business days written notice of the interruption. The notice must:

- (a) specify the expected date, time and duration of the interruption; and
- (b) include a 24 hour telephone number for enquiries.

Art 17.15 The Distribution Utility must use best endeavours to restore the customer's supply

as quickly as possible or in accordance with L.I. 1935-Electricity Supply and Distribution (Standards of Performance) Regulations, 2008.

SPECIAL NEEDS

Art 17.16 Where a customer or a retailer provides a Distribution Utility with confirmation from a registered medical practitioner or a hospital that a person residing at the customer's supply address requires a life support machine, the Distribution Utility must:

- (a) register the supply address as a life support machine supply address and regularly update the register;
- (b) not disconnect supply to the customer's supply address while the supply address remains registered as a life support machine supply address; and
- (c) give the customer:
 - (i) at least 3 business days written notice of any planned interruption to supply at the supply address (the 3 business days to be counted from the date of receipt of the notice), unless a longer period of notice is requested by the customer and provided that the longer period of notice:
 - (aa) is reasonably necessary; and
 - (ab) can be accommodated by the Distribution Utility;
 - (ii) advice to assist the customer to prepare a plan of action in case an unplanned interruption should occur; and
 - (iii) an emergency telephone contact number.

Art 17.17 A customer whose supply address has been registered by a Distribution Utility in accordance with Art 17.16, must inform the Distribution Utility or the customer's retailer if the person for whom the life support machine is required vacates the supply address or no longer requires the life support machine. The Distribution Utility may then cancel the registration of the supply address as a life support machine supply address.

Art 17.18 At least once in each year a Distribution Utility must take all reasonable steps to ensure the accuracy and completeness of its register kept under Art 17.16(a).

DISCONNECTION AND RECONNECTION

Art 17.19 A Distribution Utility shall establish a process for disconnection and reconnection that specifies timing and means of notification consistent with L.I.1651-Public Utilities (Termination of Service) Regulations, 1999 and L.I.1935-Electricity Supply and Distribution (Standards of Performance) Regulations,2008. In developing physical and business processes for reconnection, a Distribution Utility shall document its business process for disconnection in the Distribution Utility's Conditions of Service.

Art 17.20 Without limiting the generality of the forgoing, prior to disconnecting a property for non-payment, a Distribution Utility shall provide to any person that, according to the Distribution Utility's Conditions of Service, receives notice of disconnection:

- (a) the Fire Safety Notice of the Ghana National Fire Service(GNFS); and
- (b) any other public safety notices or bulletins issued by public safety authorities and provided to the Distribution Utility, which provide information to consumers respecting dangers associated with the disconnection of electricity service.

Art 17.21 A Distribution Utility shall include a copy of the notices or bulletins referred to in Art 17.09 along with any notice of disconnection that is left at the property at the time of actual disconnection for non-payment.

Art 17.22 A Distribution Utility shall inform a customer responsible for an overdue amount that it may be disconnected in accordance with L.I.1651-Public Utilities (Termination of Service) Regulations,1999 and L.I.1935-Electricity Supply and Distribution(Standards of Performance) Regulations,2008

Art 17.23 A Distribution Utility may disconnect without notice in accordance with a court order or for emergency, safety or system reliability reasons.

Art 17.24 The physical process by which a Distribution Utility disconnects or reconnects shall reflect good utility practice and considered safety as a primary requirement.

Art 17.25 A Distribution Utility may recover from the customer responsible for the disconnection reasonable costs associated with disconnection, including overdue amounts payable by the customer. A Distribution Utility may recover from the customer responsible for the disconnection reasonable costs for repairs of the Distribution Utility's physical assets attached to the property in reconnecting the property.

UNAUTHORISED ENERGY USE

Art 17.26 A Distribution Utility shall use its discretion in taking action to mitigate unauthorized energy use. Upon identification of possible unauthorized energy use, a Distribution Utility shall disconnect and investigate.

Art 17.27 A Distribution Utility shall monitor losses and unaccounted for energy use on an annual basis to detect any upward trends that may indicate the need for management policies to moderate unauthorized energy use.

Art 17.28 A Distribution Utility may recover from the customer responsible for the unauthorized energy use all reasonable costs incurred by the Distribution Utility arising from unauthorized energy use.

ILLEGAL SUPPLY

Art 17.29 A Distribution Utility may disconnect supply to a customer's supply address immediately if:

- (a) the supply of electricity to a customer's electrical installation is used other than at the customer's premises, except in accordance with the Act;
- (b) a customer takes at the customer's supply address electricity supplied to another supply address;
- (c) a customer tampers with, or permits tampering with, the meter or associated equipment; or
- (d) a customer allows electricity supplied to the customer's supply address to bypass the meter.

SYSTEM INSPECTION REQUIREMENTS AND MAINTENANCE

Art 17.30 A Distribution Utility shall maintain its distribution network in accordance with good utility practice and performance standards to ensure reliability and quality of electricity service, on both a short-term and long-term basis.

Art 17.31 A Distribution Utility shall perform inspection activities of its distribution network in accordance with the requirements in Appendix C attached to the Code.

Art 17.32 A Distribution Utility shall perform more frequent inspections if warranted due to local conditions such as geographic location, climate, environmental

conditions, technologies available to perform the inspection, type and vintage distribution technology in place, manufacturer specifications, system design or relative importance to overall system reliability of a particular piece of equipment or portion of the Distribution Utility's distribution network.

Art 17.33 A Distribution Utility shall perform inspection activities using persons qualified to identify the types of defects that could be discovered during such inspection activities. Persons performing inspection activities shall be trained to protect both themselves and the public, and to respond to emergencies that may arise as a result of inspection activities.

Art 17.34 A Distribution Utility shall address any defects discovered during the inspection activities within a reasonable period of time after the discovery of the defect. A Distribution Utility shall address a defect by scheduling a more detailed inspection, by planning repair activities or by performing any other action that is an affirmative response to the discovery of the defect. A Distribution Utility shall have an internal review procedure to ensure that the identified defects and follow-up activities have been addressed appropriately.

Art 17.35 A Distribution Utility shall determine the methodology by which inspection cycles are structured and the manner in which defects identified during inspection activities are to be repaired in accordance with good utility practice.

Art 17.36 A Distribution Utility shall notify consumers regarding the expected duration and frequency of planned outages and provide as much advance notice as possible. A Distribution Utility shall make all reasonable efforts to minimize the duration and frequency of planned outages. The Distribution Utility's policies and procedures with respect to planned outages shall be described in the Conditions of Service.

UNPLANNED OUTAGES AND EMERGENCY CONDITIONS

Art 17.37 A Distribution Utility may require a consumer or customer or a party to a joint use agreement to comply with reasonable and appropriate instructions from the Distribution Utility during an unplanned outage or emergency situation.

Art 17.38 To assist with distribution network outages or emergency response, a Distribution Utility may require a customer to provide the Distribution Utility emergency access to customer-owned distribution equipment that normally is operated by the Distribution Utility or Distribution Utility-owned equipment on customer property.

Art 17.39 During an emergency, a Distribution Utility may interrupt supply to a consumer in response to a shortage of supply or to effect repairs on the distribution network or while repairs are being made to consumer-owned equipment.

Art 17.40 A Distribution Utility may require consumers or customers with permanently

connected emergency backup generation facility to notify the Distribution Utility regarding the presence of such equipment.

Art 17.41 A Distribution Utility shall require that a consumer's or customer's portable or permanently connected emergency backup generation facility complies with all applicable criteria of the Electrical Wiring Regulations and does not adversely affect the Distribution Utility's distribution network.

Art 17.42 A Distribution Utility shall develop and maintain appropriate emergency plans in accordance with the requirements of L.I.1816 - Electricity Supply and Distribution (Technical and Operational) Rules, 2005. A Distribution Utility's emergency plan shall include, at a minimum, mutual assistance plans with neighbouring Distribution Utilities or other measures to respond to a wide-spread emergency.

Art 17.43 A Distribution Utility shall establish outage management policies that include the following:

- (a) Arrangements for on-call personnel in accordance with good utility practice
- (b) Establishment and operation of a Call Centre or equivalent telephone service to provide consumers with available information regarding an outage
- (c) Identification of the location of distribution circuits for emergency services and critical customers such as hospitals, water supply, health care facilities, and designated emergency shelters for coordination with other agencies.

HEALTH SAFETY AND ENVIRONMENT

Art 17.44 A Distribution Utility shall show good utility practice in operating and maintaining its distribution network and shall abide by the safety rules and regulations that apply to routine work.

Art 17.45 A Distribution Utility shall implement an industry recognized health and safety programme that includes training and regularly conducted audits. This programme also will include Public Education and Public Safety Initiatives.

Art 17.46 Any problems that a Distribution Utility identifies as part of the audit shall be remedied as soon as possible or in accordance with the Distribution Utility's health and safety programme.

Art 17.47 A Distribution Utility shall have a corporate policy that addresses environmental stewardship that applies to all the Distribution Utility's operations. A documented programme supporting procedures and appropriate training should be in place to ensure compliance with environmental regulations and indicate a proactive approach to environmental damage avoidance.

UNDERGROUND CABLE NETWORK

PRELIMINARY WORKS

Art 17.48 Before any civil works are undertaken, due notice in writing shall be given to all utilities whose services may be in conflict with the proposed cable route, e.g. telephone, water, sewage, road and railway, etc. It may be advisable to contact the Engineering Coordinating Committee located at the offices of the Urban Roads for assistance. Where cables are to be installed in roads, footpaths or streets, it is advisable to liaise closely with the roads authority and police to ensure that all necessary measures are taken to minimize the hazards and disruptive effects of installation works.

SAFETY

Art 17.49 Working signs, bollards, danger tapes, light and watchmen shall be provided where necessary to ensure ample advance warning of, and restrict public access to, the works area.

Warning lights and signs shall be displayed along pits and trenches, on both sides. Steel plate or wooden planks shall be provided across the trench at entrances to residences

USE OF LINE MARKERS FOR BURIED UNDERGROUND CABLES

Art 17.50 A Distribution Utility shall ensure that a line marker is placed and maintained as close as practical over each buried underground cable:

- (a) at each crossing of a public road and railway; and
- (b) whenever necessary to identify the location of the buried underground cable to reduce the possibility of damage or interference.

CAPTION FOR LINE MARKERS

Art 17.51 A Distribution Utility shall ensure that the following is written legibly on a background of a sharply contrasting colour on each line marker:

- (a) the word “Warning” , “ Caution”, or “Danger” followed by the words “MV Cable” or “LV Cable”; and
- (b) the name of the Distribution Utility and telephone number, on which the Distribution Utility can be reached at all times.

SECTION 18: METERING

PROVISION OF METERS AND METERING SERVICES

- Art 18.00 A Distribution Utility shall provide, install and maintain a meter installation for the retail settlement and billing purposes for each customer connected to the Distribution Utility's distribution network, subject to Art 18.08.
- Art 18.01 A Distribution Utility may install a demand meter or interval meter for purposes of measuring demand in order to assign the customer to a rate class or to set the appropriate distribution services rate for the customer.
- Art 18.02 As of the date this Code comes into force a Distribution Utility shall have six months to provide a demand meter installed for any existing customer that is billed on demand and energy unless otherwise agreed between the customer and the Distribution Utility.
- Art 18.03 A Distribution Utility may set the threshold level for installation of demand meters other than that required by Art 18.02 as long as the threshold is delineated by customer class in the Distribution Utility's Conditions of Service with the approval of PURC
- Art 18.04A Distribution Utility shall identify in its Conditions of Service the type of meters that are available to a customer, the process by which a customer may obtain such meters and types of charges that would be levied on a customer for each meter type.
- Art 18.05 A Distribution Utility shall provide a special purpose meter within a reasonable period of time to any customer who submits to it a written request for such a meter installation, subject to the following conditions:
- (a) the customer that requests a special metering shall compensate a Distribution Utility for all incremental costs associated with that meter, including the capital cost of the special meter, installation costs associated with the special meter, ongoing maintenance (including allowance for meter failure), verification and reverification of the meter, installation and ongoing provision of communication line or communication link with the customer's meter, and cost of metering made redundant by the customer requesting special metering,
 - (b) a communication system utilized for special meters shall be in accordance with the Distribution Utility's requirements, and
 - (c) a communication line shall be required in the case of inside or restricted access meters.

METERING REQUIREMENTS FOR GENERATING FACILITIES

- Art 18.06 A Distribution Utility shall require that the Energy Commission-licensed generator connected to its distribution network that sells energy and settles through the Distribution Utility's retail settlement process install an appropriate meter.
- Art 18.07A Distribution Utility shall meter customers with generation that does not require the Energy Commission licence, such as back-up capability or generation for load displacement, in the same manner as the Distribution Utility's other load customers.
- Art 18.08 A Distribution Utility shall require that a customer with an embedded generation facility connected to the Distribution Utility's distribution network install its own meter in accordance with the Distribution Utility's metering requirements and provide the Distribution Utility with the technical details of the metering installation.
- Art 18.09 Where practical, metering for an embedded generation facility shall be installed at the point of supply. If it is not practical to install the meter at the point of supply, a Distribution Utility shall apply loss factors to the generation output in accordance with the loss factors applied for retail settlements and billing.

VEE PROCESS

- Art 18.10 Metering data collected by a Distribution Utility shall be subjected to a validating, estimating and editing (VEE) process if it is to be used for settlement and billing purposes.
- Art 18.11 A Distribution Utility shall establish a VEE process according to local practice that is fair and reasonable and provides assurance that correct data is submitted to the settlement process.

The VEE process shall do the following:

- (i) Convert raw metering data into validated, corrected or estimated "settlement-ready" metering data suitable for use in determining settlement amounts in accordance with the settlement schedule in the Retail Settlement Code.
- (ii) Detect errors in metering data introduced as a result of improper operational conditions and/or hardware/software malfunctions, including failures of or errors in metering or communication hardware, and metering data exceeding pre-financed variances or tolerances.
- (iii) Use operational system data, including historical generation and load patterns

and data collected by the Distribution Utility, as appropriate, for validating raw metering data, and for editing, estimating and correcting metering data, found to be erroneous or missing.

Art 18. 12 A Distribution Utility's billing procedure shall be consistent with the provisions of L.I. 1816-Electricity Supply and Distribution (Technical and Operational) Rules, 2005 and this Code.

Art 18. 13 Where an embedded generation facility metering installation does not conform to Ghana Standards Authority (GSA) standards or the accuracy class of instrument transformer cannot be confirmed, a Distribution Utility shall require the embedded generation facility to have a metering installation, including instrument transformers, tested, and apply appropriate correction factors to meter readings until such time as standards conformance is achieved.

Art 18. 14 A Distribution Utility shall ensure that persons involved in metering services have competency in performing these services. Competency may be based on recognized qualification requirements that include a training course that meets the requirements of the tasks to be performed. Metering services provided by a person that does not have the recognized qualification requirements shall be reviewed, affirmed and documented by a person with exhibited competency.

Art 18. 15 A Distribution Utility that provides metering services directly through a contractor shall exercise appropriate diligence in detecting and acting upon instances of tampering with metering and service entrance equipment. Upon identification of possible meter tampering, the Distribution Utility should rectify and take appropriate action.

Art 18. 16 Nothing in this Code shall affect the obligation of a Distribution Utility to comply with all Ghana Standard Authority requirements provided that, where this Code or other conditions of licence prescribe a higher standard than that prescribed in those requirements, the Distribution Utility shall comply with the higher standard.

Art 18. 17 A Distribution Utility shall respond to customer and retailer metering disputes, and shall establish a fair and reasonable charge for costs associated with resolution of these disputes. If the complaint is substantiated, the charge shall not be applied. In resolving the dispute, a Distribution Utility may use a qualified, independent organisation at any time during the dispute resolution process.

SECTION 19: DISTRIBUTION UTILITIES RESPONSIBILITIES

RESPONSIBILITIES TO BULK CUSTOMERS

Art 19. 00 A Distribution Utility shall enter into a Connection Agreement with a bulk customer that is connected to the Distribution Utility's distribution network and is a Wholesale Electricity Market participant.

Art 19. 01 A Distribution Utility shall make every reasonable effort to respond promptly to a bulk customer's request for connection. In any event a Distribution Utility shall respond to a bulk customer's written request for a customer connection within 15 calendar days. A Distribution Utility shall make an offer to connect within 60 calendar days of receipt of the written request, unless other necessary information is required from the bulk customer before the offer can be made.

Art 19. 02 A Distribution Utility has an implied contract with any bulk customer that is connected to the Distribution Utility's distribution network and receives distribution services from the Distribution Utility. The terms of the implied contract are embedded in the Distribution Utility's Conditions of Service, the Distribution Utility's rate schedules, the Distribution Utility's licence and the Distribution Code.

Art 19. 03 A Distribution Utility may require a bulk customer to enter into a Connection Agreement with the Distribution Utility if the Distribution Utility believes that the bulk customer has characteristics that require an explicit document to describe the relationship between the Distribution Utility and the bulk customer. Suggested information to be included in the Connection Agreement with customers is listed in Appendix A.

Art 19. 04 Before entering a property to carry out inspection or rectification of a fault, the Distribution Utility shall :

- (i) provide reasonable notice of the entry to the occupier of the property;
- (ii) in so far as is practicable, restore the property to its original condition;
and
- (iii) provide compensation for any damages caused by the entry that cannot be repaired.

RESPONSIBILITIES TO GENERATORS

Art 19. 05 The responsibilities to Generators do not apply to the connection or operation of an emergency backup generation facility.

Art 19. 06 A Distribution Utility shall enter into a Connection Agreement with all existing generators who have a generation facility connected to the Distribution Utility's

distribution network and prior to connecting a new generation facility. Where a Distribution Utility does not have a Connection Agreement with an existing generator that has a generation facility connected to the Distribution Utility's distribution network, the Distribution Utility shall be deemed to have an implied contract with the generator.

The terms of the implied contract are embedded in the Distribution Utility's Conditions of Service, the Distribution Utility's rate schedules, the Distribution Utility's licence and the Distribution Code.

CONNECTION PROCESS

Art 19.07 A Distribution Utility shall promptly make available a generation connection information package (the "package") to any person who requests this package. The package shall contain the following information:

- (a) the process for having a generation facility connected to the Distribution Utility's distribution network, including any form necessary for applying to the Distribution Utility;
- (b) information regarding any approvals from the EC or EPA, that are required before the Distribution Utility will connect a generation facility to its distribution network;
- (c) the technical requirements for being connected to the Distribution Utility's distribution system including the metering requirements; and
- (d) the standard contractual terms and conditions for being connected to the Distribution Utility's distribution network.

Art 19.08 Subject to all applicable laws, a Distribution Utility shall make all reasonable efforts in accordance with the provisions of Art 19.05 and 19.06 to promptly connect to its distribution network a generation facility which is the subject of an application for connection.

CONNECTION OF MICRO-GENERATION FACILITIES

Art 19.09 A Distribution Utility shall require a person that applies for the connection of a micro-embedded load displacement generation facility to the Distribution Utility's distribution network to provide, upon making the application, the following information:

- (a) the name-plate rated capacity of each unit of the proposed generation facility and the total name-plate rated capacity of the proposed

- generation facility at the connection point;
- (b) the fuel type of the proposed generation facility;
- (c) the type of technology to be used; and
- (d) the location of the proposed generation facility including address and account number with the Distribution Utility where available.

Art 19. 10 Where the proposed micro-embedded load displacement generation facility is located at an existing customer connection, the Distribution Utility shall within 15 days of receiving the application, make an offer to connect or provide reasons for refusing to connect the proposed generation facility. The Distribution Utility shall give that applicant at least 30 days to accept the offer to connect and the Distribution Utility shall not revoke the offer to connect until this time period has expired. The Distribution Utility shall not charge for the preparation of the offer to connect

Art 19. 11 The Distribution Utility shall make any necessary metering changes and connect the applicant's micro-embedded load displacement generation facility to its distribution network within 30 days of entering into a Connection Agreement in the form set out in Appendix D and the applicant paying the Distribution Utility for the costs of any necessary metering changes.

CONNECTION OF OTHER GENERATION FACILITIES

Art 19. 12 Art 19.13 to Art 19.25 apply to the connection to a distribution network of an embedded generation facility, which is not micro-embedded load displacement generation facility.

Art 19. 13 Where a person who is considering applying for the connection of a generation facility to the Distribution Utility's distribution network requests a preliminary meeting with the Distribution Utility and provides the required information, the Distribution Utility shall provide a time when it is available to meet with the person which shall be within 15 days of the person requesting the meeting. For the purposes of this section, the following is the required information:

- a) the name-plate rated capacity of each unit of the proposed generation facility and the total name plate rated capacity of the generation facility at the connection point;
- b) the fuel type of the proposed generation facility
- c) the type of technology to be used ; and
- d) the location of the proposed generation facility including address and

account number with the Distribution Utility where available.

- Art 19. 14 At the preliminary meeting, the Distribution Utility shall discuss the basic feasibility of the proposed connection including discussing the location of existing distribution facilities in relation to the proposed generation facility and providing an estimate of the time and costs necessary to complete the connection. The Distribution Utility shall not charge for its preparation for and attendance at the meeting.
- Art 19. 15 A Distribution Utility shall require a person who applies for the connection of a generation facility to the Distribution Utility's distribution network to, upon making the application, pay their impact assessment costs and provide the following information.
- (a) the information set out in Art 19.13 if this has not already been provided to the Distribution Utility;
 - (b) a single line diagram of the proposed connection; and
 - (c) a preliminary design of the proposed interface protection.
- Art 19. 16 The Distribution Utility shall provide an applicant proposing to connect a small embedded generation facility with its assessment of the impact of the proposed generation facility, a detailed cost estimate of the proposed connection and an offer to connect within:
- (a) 60 days of the receipt of the application where no distribution network reinforcement or expansion is required; and
 - (b) 90 days of the receipt of the application where a distribution network reinforcement or expansion is required.
- Art 19. 17 The Distribution Utility shall provide its assessment of the impact of the proposed generation facility within:
- (a) 60 days of the receipt of the application in the case of a proposal to connect a mid-sized embedded generation facility; and
 - (b) 90 days of the receipt of the application in the case of a proposal to connect a large embedded generation facility.
- Art 19. 18 The Distribution Utility's impact assessment shall set out the impact of the proposed generation facility on the Distribution Utility's distribution network and any customers of the Distribution Utility including:
- (a) any voltage impacts, impacts on current loading settings and impacts on fault currents;

- (b) the connection feasibility
- (c) the need for any line or equipment upgrades;
- (d) the need for transmission system protection modifications; and
- (e) any metering requirements.

Art 19. 19 Any material revisions to the design, planned equipment or plans for the proposed generation facility and connection shall be filed with the Distribution Utility and the Distribution Utility shall prepare a new impact assessment within the relevant time period set out in Art 19.17 or 19.18.

Art 19. 20 In the case of an application for the connection of a mid-sized or large embedded generation facility, once the impact assessment is provided to the applicant, the Distribution Utility and the applicant have entered into an agreement on the scope of the project and the applicant has paid the Distribution Utility for the cost of preparing a detailed cost estimate of the proposed connection, the Distribution Utility shall provide the applicant with a detailed cost estimate and an offer to connect by the later of 90 days after the receipt of payment from the applicant and 30 days after the receipt of comments from a Transmission Utility or Distribution Utility that has been advised under Art 19.22.

Art 19. 21 Where a Distribution Utility is preparing a detailed cost estimate in accordance with Art 19.21 with respect to a proposed large or mid-sized embedded generation facility, the Distribution Utility shall advise any Transmission Utility or Distribution Utility whose transmission or distribution network is directly connected to the Distribution Utility's distribution network that it is preparing an estimate, within 10 days of receiving payment from the applicant.

Art 19. 22 Where a Distribution Utility is preparing a detailed cost estimate in accordance with Art 19.16 with respect to a proposed small embedded generation facility, the Distribution Utility shall, where the Distribution Utility believes a system directly connected to its system may be impacted by the proposed generation facility, advise any Transmission Utility or Distribution Utility whose transmission or distribution network is directly connected to the Distribution Utility's distribution network that it is preparing an estimate, within 10 days of receiving payment from the applicant.

Art 19. 23 Once the applicant has entered into a connection cost agreement with the Distribution Utility and has provided the Distribution Utility with detailed engineering drawings with respect to the proposal, the Distribution Utility shall conduct a design review to ensure that the detailed engineering plans are acceptable.

Art 19. 24 The Distribution Utility shall have the right to witness the commissioning and

testing of the connection of the generation facility to the Distribution Utility's distribution network.

- Art 19.25 Once the applicant informs the Distribution Utility that it has received all necessary approvals, provides the Distribution Utility with a copy of the authorization to connect from the Energy Commission and enters into the Connection Agreement, the Distribution Utility shall act promptly to connect the generation facility to its distribution network.
- Art 19.26 Subject to any delays in commissioning and testing of the generation facility which are beyond the control of the Distribution Utility, a Distribution Utility shall connect a proposed small embedded generation facility within:
- (a) 60 days of the applicant taking the steps set out in Art 19.25, where no distribution network reinforcement or expansion is required; and
 - (b) 180 days of the applicant taking the steps set out in Art 19.25, where a distribution network reinforcement or expansion is required.
- Art 19.27 A Connection Agreement for a small, mid-sized or large embedded generation facility shall be in the form set out in Appendix D where a standard form of contract is set out in Appendix D for that size of embedded generation facility.
- Art 19.28 Material on the process for connecting a generation facility to a distribution network is set out in Appendix E.1. This material is for information purposes only and the provisions of the Code govern in the case of any conflict.
- Art 19.29 A Distribution Utility may by written agreement with an applicant who is proposing to connect a small, mid-sized or large embedded generation facility provided that the process for connecting the generation facility to be followed is the process set out for a smaller category of embedded generation facility, including a micro-embedded load displacement generation facility.

TECHNICAL REQUIREMENTS

- Art 19.30 A Distribution Utility shall ensure that the safety, reliability and efficiency of the distribution network is not materially adversely affected by the connection of a generation facility to the distribution network. A Distribution Utility shall require that a new or significantly modified generation facilities meet the technical requirements specified in Appendix E.2.
- Art 19.31 A Distribution Utility shall ensure that the distribution network is adequately protected from potential damage or increased operating costs resulting from the connection of a generation facility. Despite Art 8.00, if damage to the

distribution network or increased operating costs result from the connection of a generation facility other than a micro-embedded load displacement generation facility, the Distribution Utility shall be reimbursed for these costs through appropriate tariff mechanisms by the generator.

Art 19. 32 A Distribution Utility shall require that a generator with a generation facility connected to the Distribution Utility's distribution network has a regular, scheduled maintenance plan to ensure that the generator's connection devices, protection systems and control systems are maintained in good working order. This requirement will be provided for in the connection agreement.

Art 19. 33 All equipment that is connected, operating or procured or ordered by the effective date of this Code is deemed to be in compliance with the technical requirements of this Code.

Art 19. 34 A Distribution Utility may require that equipment deemed compliant under Art 19.33 be brought into actual compliance with the technical requirements of this Code within a specific reasonable time period where there is:

(a) a material deterioration in reliability of the distribution network resulting from the performance of the generator's equipment;

(b) a material negative impact on the quality of power of an existing or a new customer resulting from the performance of the generator's equipment; or

(c) a material increase in generator capacity at the site where the equipment deemed compliant is located.

Art 19. 35 The Distribution Utility may act in accordance with Art 19.34, once the Distribution Utility has developed rules and procedures for requiring equipment to be brought into actual compliance and these rules and procedures have been provided to the generator.

RESPONSIBILITIES OF OTHER DISTRIBUTION UTILITIES

Art 19. 36 A Distribution Utility shall make every reasonable effort to respond promptly to another Distribution Utility's request for connection. A Distribution Utility shall provide initial consultation with another Distribution Utility regarding the connection process within 30 days of receiving written request for connection.

A final offer to connect the Distribution Utility to the host Distribution Utility's distribution network shall be made within 90 days of receiving written request for connection, unless other necessary information outside the Distribution Utility's control is required before the offer can be made.

- Art 19. 37 A Distribution Utility shall make a good faith effort to enter into a Connection Agreement with a Distribution Utility connected to the Distribution Utility's distribution network. The contents and format of the Connection Agreement are in the discretion of the Distribution Utilities that participate in the Connection Agreement but must conform to the requirements of this Code. Appendix F provides an example of the process that Distribution Utilities should follow in providing a connection to another Distribution Utility.
- Art 19. 38 The reliability of supply and the voltage level at the delivery point from a host Distribution Utility's distribution network to an embedded Distribution Utility's distribution network shall be as good as or better than what is provided to a host Distribution Utility's other distribution customers.
- Art 19. 39 A Distribution Utility shall not build any part of its distribution network in another Distribution Utility's licensed service area except under the following conditions:
- (a) The part of the distribution network that is to be located inside another licensed service area is dedicated to the delivery of electricity to the Distribution Utility who owns the distribution facilities; and
 - (b) There is no apparent opportunity for both Distribution Utilities to share the distribution facilities; and
 - (c) The Distribution Utility in whose service area the distribution facilities are to be located determines that the presence of the distribution facilities in that location does not impinge on its distribution operations.
- Art 19. 40 A Distribution Utility that owns equipment in another Distribution Utility's licensed area shall allow that Distribution Utility access to the equipment for the following reasons:
- (a) emergencies;
 - (b) when the equipment may cause a violation of a licence condition by the Distribution Utility who is licensed for the service area;
 - (c) upon a reasonable request by the Distribution Utility who is licensed for the service area; or
 - (d) in accordance with any arrangement between the two Distribution Utilities.

SHARING ARRANGEMENTS BETWEEN DISTRIBUTION UTILITIES

Art 19. 41 A Distribution Utility that owns distribution facilities in another Distribution Utility's licensed service area, and decides to share those distribution facilities with the Distribution Utility licensed to service the service area, shall have an arrangement that prescribes the terms of the sharing arrangement with the Distribution Utility.

Art 19. 42 An operating agreement for multiple ownership circuits shall include, among other conditions, clauses that require that:

- (a) each section owner provide downstream owners with fault current information and protection settings of upstream protective devices;
- (b) each section owner provide upstream owners with load forecasting information;
- (c) each section owner ensure generally acceptable industry standards pertaining to power quality and the voltage levels are adhered to on the section owner's portion of the feeder;
- (d) the owner of the feeder breaker be responsible for maintaining appropriate relay settings for overall feeder protection; and
- (e) each Distribution Utility be responsible to provide the required information to accomplish appropriate relay settings for overall feeder protection, including information on feeder characteristics and loading information.

Art 19. 43 In existing or new multiple ownership circuits, a Distribution Utility shall be responsible for maintenance, protection and power quality of the Distribution Utility's own portion of the shared feeder. The Distribution Utility shall ensure that its portion of the feeder has proper fault protection and voltage within proper limits. This generally would require the owner of each section of the feeder to provide for suitable over-current protection devices and voltage regulators, as appropriate, at the upstream boundary and suitable metering, if not already available for settlement purposes, at the downstream boundary.

LOAD TRANSFERS

Art 19. 44 A Distribution Utility (referred to in this section as the geographic Distribution Utility) that provides distribution services through a load transfer may continue to do so under the following conditions:

- (a) the load transfer customer enters into a Connection Agreement or is deemed to have an implied contract with the geographic Distribution Utility and interacts only with the geographic Distribution Utility;

- (b) the geographic Distribution Utility provides service to the load transfer customer in accordance with its Condition of Service and bills the load transfer customer in accordance with its regulated charges and rates;
- (c) the geographic Distribution Utility is responsible for system reliability or equipment failures associated with the distribution network equipment it owns or operates that is used to deliver electricity to the load transfer customer;
- (d) the geographic Distribution Utility allows the Distribution Utility that owns the connection assets (referred to as the physical Distribution Utility) access to the distribution equipment used to service the load transfer customer, as required for system reliability and safety;
- (e) the geographic Distribution Utility is responsible to the physical Distribution Utility for all charges and costs incurred by the load transfer customer for all costs defined in Retail Settlement Code, including distribution costs, competitive electricity costs and non-competitive electricity costs provided to the customer through the physical Distribution Utility's distribution network; and
- (f) the physical Distribution Utility is responsible for facilities the loading transfer customer's access to retail competition and shall interact with any competitive retailer chosen by the customer.

Art 19. 45 A physical Distribution Utility that provides distribution services through a load transfer may continue to do so under the following conditions:

- (a) the physical Distribution Utility refers the load transfer customer or a retailer that intends to service the load transfer customer to the geographic Distribution Utility for all issues. The geographic Distribution Utility is responsible to work with the physical Distribution Utility on any issues that are the direct responsibility of the physical Distribution Utility;
- (b) the physical Distribution Utility is responsible for system reliability or equipment failures associated with the distribution equipment it owns or operates that is used to deliver electricity to the load transfer customer; and
- (c) The physical Distribution Utility allows the geographic Distribution Utility access to its equipment, as required for system reliability and safety.

Art 19. 46 During the five-year period after this Code comes into effect, a physical Distribution Utility shall be obligated to continue to service an existing load transfer customer unless otherwise negotiated between the physical Distribution Utility and geographic Distribution Utility.

Art 19. 47 During the five year period after this Code comes into effect, a geographic

Distribution Utility that services a load transfer customer shall either:

- (a) negotiate with a physical Distribution Utility that provides load transfer services so that a physical Distribution Utility will be responsible for providing distribution services to the customer directly, including application for changes to the licensed service areas of each Distribution Utility; or
- (b) expand the geographic Distribution Utility's distribution network to connect the load transfer customer and service that customer directly;

once a load transfer customer enters into a Connection Agreement or implied contract with the physical Distribution Utility, the physical Distribution Utility shall have sole responsibility for that customer.

Art 19. 48 A Distribution Utility may enter into a new load transfer agreement with another Distribution Utility with leave of the Energy Commission.

PROVISION OF INFORMATION

Art 19. 49 A Distribution Utility shall communicate general market and educational information to consumers connected to its distribution network as required by the Energy Commission.

Art 19. 50 A Distribution Utility shall inform a person about the person's obligations to the Distribution Utility, shall monitor and require compliance to ensure that the person is meeting its obligations. A Distribution Utility shall inform the consumer or customer about the Distribution Utility's rights to disconnect service.

Art 19. 51 At the request of a customer, a Distribution Utility shall provide a list of retailers who have Service Agreements in effect with the Distribution Utility.

The list should inform the consumer that an alternative retailer does not have to be chosen in order to ensure that the consumer receives electricity and the terms of service that are available under the Standard Supply Service.

Art 19. 52 A Distribution Utility shall not provide information on products retailed by a retailer.

Art 19. 53 Upon receiving an inquiry from a customer connected to its distribution network, the Distribution Utility shall either respond to the inquiry if it deals with the Distribution Utility's distribution services or provide the customer with contact information for the entity responsible for the item of inquiry.

Art 19. 54 An embedded Distribution Utility that receives electricity from a host Distribution Utility shall provide load forecasts or any other information related to the embedded Distribution Utility.

NET METERED GENERATORS

Art 19. 55 For Net Metered Generators:

- (a) “eligible generator” in respect of a Distribution Utility means a customer of a Distribution Utility that meets the following criteria;
- (i) the generator generates the electricity primarily for the generator’s own use;
 - (ii) the generator generates the electricity solely from a renewable energy source;
 - (iii) the maximum cumulative output capacity of the equipment used to generate the electricity that the generator intends to return to the Distribution Utility for net metering purposes is no greater than 500 kilowatts based on the rated maximum output capacity of the equipment; and
 - (iv) the generator conveys the electricity that is generated directly from the point of generation to another point for the generator’s own consumption without reliance on the Distribution Utility’s distribution system before conveying any electricity that is in excess of the generator’s own needs at the time of generation into the Distribution Utility’s distribution system.
- (b) “net metered generator” means an eligible generator to whom net metering has been made available by a Distribution Utility.

Art 19. 56 A Distribution Utility shall, upon request, make net metering available to eligible generators in its licensed service area in accordance with the Net Metering Regulation, on first-come first-served basis, unless the cumulative generation capacity from net metered generators in its licensed service area equals one percent of the Distribution Utility’s annual maximum peak load for the Distribution Utility’s licensed service area, averaged over three years, as determined by the Board from time to time.

Art 19. 57 A Distribution Utility shall bill a net metered generator on a net metering basis in accordance with the Net Metering Regulation provided that the net metered generator returns eligible electricity to the Distribution Utility by conveying eligible electricity into the Distribution Utility’s distribution system.

Art 19. 58 A Distribution Utility may, upon request, make net metering available to additional eligible generators in its licensed service area and may bill on a net metering basis when the cumulative maximum generation capacity from the net metered generators in its licensed service area exceeds one percent of the Distribution Utility’s annual maximum peak load for the Distribution Utility’s licensed service area, averaged over three years, as referred to in Art 19.65.

Art 19. 59 A Distribution Utility shall, in the manner and time specified by the Energy Commission, file with the Energy Commission the total rated maximum output

capacity of generation facilities in its licensed service area to which the net metering has been made available as of: -.....*date*.....such later dates as are stated by the Energy Commission.

AGREEMENT TO CONNECT

- Art 19. 60 A Distribution Utility must ensure that its distribution network is able to receive a supply of electricity from an embedded generating unit connected to its distribution network, in accordance with an agreement with the embedded generator on the terms and conditions of dispatch, connection and disconnection.
- Art 19. 61 If such an agreement is sought by an embedded generator, the Distribution Utility and embedded generator must negotiate in good faith.
- Art 19. 62 Despite Art 19.60, if two or more embedded generating units are connected in parallel, their obligations under Art 19.68 to Art 19.72 of this Code apply to the point of common coupling and the maximum permissible contribution of each embedded generating unit is to be determined in proportion to their capacity, unless otherwise agreed.
- Art 19. 63 For the avoidance of doubt, a Distribution Utility is not liable for any loss of income by an embedded generator for being unable to receive a supply of electricity from an embedded generating unit connected to its distribution network because of any supply interruption arising under Art 17.11 of this Code.

SUPPLY FREQUENCY

- Art 19. 64 An embedded generator must ensure that the embedded generating unit is capable of continuous uninterrupted operation at the system frequency of 50 Hz and permitted variations in accordance with L.I. 1816-Electricity Supply and Distribution (Technical and Operational) Rules, 2005.

CO-ORDINATION AND COMPLIANCE OF EMBEDDED GENERATING UNITS

- Art 19. 65 An embedded generator must ensure that:
- (a) the embedded generating unit, and any equipment within it that is connected to a distribution network;
 - (i) complies with this Code;
 - (ii) complies with all relevant Ghanaian Standards; and

- (iii) is maintained in a safe condition;
- (b) protection equipment is at all times effectively coordinated with the electrical characteristics of the distribution network;
- (c) A Distribution Utility may disconnect, or request the owner of an embedded generator to disconnect, any embedded generating unit from the distribution network if the embedded generating unit breaches any safety regulations, or is not in compliance with the relevant Ghana Standards; and
- (d) If requested under (c), the owner of an embedded generator must disconnect the embedded generating unit from the distribution network.

MINIMUM REQUIREMENTS FOR EMBEDDED GENERATING UNITS
(SYNCHRONOUS TYPE)

Art 19. 66 An embedded generating unit over 1 MW must have:

- (a) an excitation control system including voltage regulator;
- (b) a governor system responsive to system frequency changes; and
- (c) real time systems events log

Art 19. 67 An embedded generator must ensure that each of its embedded generating units with a nameplate rating over 10 MW complies with the National Electricity Rules requirements for generating units with a nameplate rating over 30 MW with regards to:

- (a) response to disturbances;
- (b) safe shutdown without external electricity supply;
- (c) restart following loss of external electricity supply; and
- (d) frequency responsiveness and governor stability.

NEGATIVE SEQUENCE VOLTAGE

Art 19. 68 An embedded generator must ensure that an embedded generating unit's contribution to the negative sequence voltage at the point of connection between the embedded generating unit and the distribution network is less than 1%.

HARMONICS

Art 19. 69 An embedded generator must ensure that an embedded generating unit's contribution to the harmonic distortion levels in the supply voltage at the point

of connection between the embedded generating unit and the distribution network is within the limits specified in Table 3.

Table 3

VOLTAGE HARMONIC DISTORTION LIMITS			
Voltage at point of common coupling	Total harmonic distortion	Individual voltage harmonics	
		Odd	Even
< 1 kV	5%	4%	2%
> 1 kV and ≤ 36 kV	3%	2%	1%

Art 19. 70 An embedded generator must comply with IEEE Standard 519-1992 ‘Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems’ and the current harmonic limits in Table 4.

Table 4

CURRENT HARMONIC DISTORTION LIMITS						
I_{sc}/I_L	Maximum Harmonic Current Distortion in Percent of I_L					
	Individual Harmonic Order “h” (Odd Harmonics)					Total Harmonic Distortion
	<11	11 ≤ h <17	17 ≤ h < 23	23 ≤ h < 35	35 ≤ h	
<20*	4.0%	2.0%	1.5%	0.6%	0.3%	5.0%
20<50	7.0%	3.5%	2.5%	1.0%	0.5%	8.0%

50<100	10.0%	4.5%	4.0%	1.5%	0.7%	12.0%
100<1000	12.0%	5.5%	5.0%	2.0%	1.0%	15.0%
>1000	15.0%	7.0%	6.0%	2.5%	1.4%	20.0%

Notes:

1. Even harmonics are limited to 25% of the odd harmonics listed above.
2. Current distortions that result in a DC offset, e.g. half-wave converters, are not allowed.
3. *All power generation equipment is limited to these values of current distortion, regardless of actual ISC/IL..
4. Isc = maximum short-circuit current at *point of common coupling*.
5. IL = maximum *demand* load current (fundamental frequency component) at *point of common coupling*.

INDUCTIVE INTERFERENCE

Art 19. 71 An embedded generator's embedded generating unit must not cause inductive interference above the limits specified.

FAULT LEVELS

Art 19. 72 An embedded generator must design and operate its embedded generating unit so that it does not cause fault levels in the distribution network to exceed the levels specified in Table 5.

Table 5

DISTRIBUTION SYSTEM FAULT LEVELS		
Voltage Level kV (V_n) Level kA	System Fault Level MVA (F_1)	Short Circuit level Circuit(kA) (I_f)
36	2500	40.1
22	500	13.1
11	350	18.4
6.6	250	21.9
<1	36	21.0
$I_f = F_1 / \sqrt{3} * V_n$		

REGISTER FOR EMBEDDED GENERATORS

Art 19. 73 A Distribution Utility must maintain a record of all embedded generators connected to its networks. As a minimum, the register must contain the name of the original owner, or the person who has a relevant connection agreement with the Distribution Utility, the associated National Metering Identifier (NMI) of the embedded generator and the connection address.

SECTION 20: BENCHMARKS AND INDICES FOR STANDARDS OF SUPPLY: RELIABILITY AND QUALITY

Table 6

STANDARD NOMINAL VOLTAGE VARIATIONS

Voltage Level in kV	Voltage Range for Time Period		
	Steady State	Transient State	
		Less than 1 minute	Less than 10 seconds
<1.0	±10%	±15%	Phase to Earth +50% - 100% Phase to Phase +20% - 100%
11	±10%	±15%	Phase to Earth +80% - 100% Phase to Phase +20% - 100%
33	±10%	±15%	Phase to Earth +80% - 100% Phase to Phase +20% - 100%
34.5	±10%	±15%	Phase to Earth +80% - 100% Phase to Phase +20% - 100%

Table 7**POWER FACTOR LIMITS**

Supply Voltage in kV	Power Factor Range for Customer Maximum Demand and Voltage					
	Up to 100 kVA		Between 100kVA – 2MVA		Over 2 MVA	
	Minimum Lagging	Maximum Leading	Minimum Lagging	Maximum Leading	Minimum Lagging	Maximum Leading
<1.0	0.95	0.95	-	-	-	-
11	0.95	0.95	0.95	0.95	0.96	0.96
33	0.95	0.95	0.95	0.95	0.96	0.96
34.5	0.95	0.95	0.95	0.95	0.96	0.96

Table 8**VOLTAGE HARMONIC DISTORTION LIMITS**

Voltage at point of Common coupling	Total harmonic distortion	Individual voltage harmonics	
		Odd	Even
<1 kV	5%	4%	2%
>1 kV and <34.5 kV	3%	2%	1%

Table 9**VOLTAGE HARMONIC DISTORTION LIMITS**

Maximum harmonic Current Distortion In Percent of k						
Individual Harmonic Order "h" (Odd Harmonics)						
Isc/L	<11	11≤h<17	17≤h<23	23≤h<35	35≤h	Total Harmonics Distortion
<20*	4.0%	2.0%	1.5%	0.6%	0.3%	5.0%
20<50	7.0%	3.5%	2.5%	1.0%	0.5%	8.0%
50<100	10.0%	4.5%	4.0%	1.5%	0.7%	12.0%
100<1000	12.0%	5.5%	5.0%	2.0%	2.0%	15.0%
<100	15.0%	7.5%	6.0%	2.5%	1.4%	20.0%

Table 10

Description of Breach	Prescribed Standard	Recipients of Penalty				
		Residential Customer	Non- Residential Customer	Industrial Customer		Energy Commission
				SLT-LV	SLT-MV/HV	
Processing of Application: Untimely provision of estimates => Untimely connection of service=>	Line Exists / Extension required					
	5 working days / Two Weeks	2 PU/week	5 PU/week	10 PU/week	20 PU/week	
	5 working days / One Month	3 PU/week	8 PU/week	15 PU/week	25 PU/week	
Supply Interruptions: Frequency limit exceeded Duration limit exceeded	Urban /D.Cap/Rural Frequency 6 / 6 / 6 periods Duration 8/12/24 hrs per period Total Dur 48/72/144 hrs per year					200 PU
Supply Restoration after Fault Clearance Supply restoration time elapsed => Supply restoration delay beyond deadline ==>	Major Fault Rural 240 hrs Minor Fault D.Cap 120 hrs Non Payment Urban 8 hrs					
	Each succeeding 12-hr delay	2 PU/week	5 PU/week	10 PU/week	20 PU/week	
		1 PU	1 PU	2 PU	2 PU/	
Planned Maintenance: No notice given for supply interruption => Non-adherence to notice =>	3 working days prior notice required					40 PU 40 PU
Violation of Reports Submission Deadlines: Quarterly Report Delayed > Annual Report Delayed =>	Deadline: 1 or 2 months after quarter for technical & financial reports respectively					40 PU
	Deadline: 3 or 4 months after the end of the year for technical & financial reports respectively					80 PU
System voltage complaint response: Visit to customer premises delayed ==>>>> No formal written explanation of problem from supplier =>	Visit within 24 hours	2 PU/week	4 PU/week	10 PU/week	15 PU/week	
	Report within 7 days	1 PU/week	3 PU/week	5 PU/week	5 PU/week	
Meter provision delayed	Within 6 months upon request	2 PU/week	4 PU/week	10 PU/week	15 PU/week	

Description of Breach	Prescribed Standard	Recipients of Penalty				
		Residential Customer	Non- Residential Customer	Industrial Customer		Energy Commission
				SLT-LV	SLT-MV/HV	
Separate Meter: Untimely provision of estimates => Untimely installation of additional meter ==>>	5 working days on receipt of request	2 PU/week	4 PU/week	10 PU/week	15 PU/week	
	5 working days after payment	2 PU/week	4 PU/week	10 PU/week	15 PU/week	
Prepayment meter credit sales facilities: Proximity distance limit of sales facilities exceeded => Non-adherence to opening hours of credit sales facilities > Persistence of non-availability of sales facilities>	10 kilometer distance of pre-payment meter premises					40 PU
	Minimum of 8 hrs daily for 7 days each week.					20 PU
	Each succeeding 6 months.					40 PU
Meter repositioning: Untimely provision of estimates ==>> Untimely repositioning of meter>	5 working days on receipt of request.	1 PU/week	3 PU/week	5 PU/week	5 PU/week	
	Within 14 days after payment	1 PU/week	3 PU/week	5 PU/week	5 PU/week	
Meter complaint: Response time elapsed ==>>>	Visit: Within 24 hrs. – 12(1) Replacement: 48 hrs after establishing defect. – 12(2) Estimated Billing: 6 months maximum	3 PU/week	8 PU/week	15 PU/week	25 PU/week	

SECTION 21: EMERGENCY RESPONSE PLANS

PURPOSE

Art 21. 00 To ensure that the main actors in the electricity distribution network in Ghana adequately identify, plan for and are able to respond effectively to emergency situations that might present adverse effects to personnel, facilities, or the environment.

SCOPE

Art 21. 01 This Emergency Response Plan applies to electricity distribution network operations including embedded generator facilities, retailer and contractor controlled areas. It addresses all aspects of an emergency preparedness and response systems including identification of potential emergencies, response personnel, preparedness measures, training, equipment, inspections, as well as detailed testing of the Emergency Response Plan.

RESPONSIBILITIES/ACCOUNTABILITIES

Art 21. 02 It is the responsibility of all officials and personnel of the Main Actors to ensure that persons in their area of control comply with this procedure. For specific responsibilities and accountabilities pertaining to emergency preparedness and response, see Table 11.

Table 11

Role	Responsibilities/accountabilities
1) Chief Executive Officer /Managing Director/or the designation for the head of the Main Actor organization.	(a) Ensure the operation, maintenance, effective, and up-to-date emergency response plans, contact list and response teams for all major potential emergency considerations; (b) Ensure that the necessary resources are in place to effectively control foreseeable and probable emergency situations; (c) Responsible for the overall management of an emergency; and (d) Ensure mobilization of resources to achieve a satisfactory outcome to an emergency.

<p>2) Emergency Response Coordinator /Safety Coordinator/ or the designation for the personnel responsible of the supervision of plan in the Main Actor's organization.</p>	<ul style="list-style-type: none"> (a) Response for oversight of the Emergency Response Plan, including adequate resource availability to respond to emergencies; (b) Review and revise the Emergency Response Plan annually and after any major emergency, if needed; (c) Participate in the development, implementation and supervision of the site specific Emergency Response Plan; (d) Ensure adequate equipment is available for every site; (e) Develop and schedule emergency response training programs and drills at every site; (f) Maintain training and equipment records; (g) Review of inspection records and testing results annually to ensure emergency equipment is of sufficient quantity and of the correct type for any foreseeable emergencies; (h) Meet the intent of regulatory requirements related to the Emergency Response Plan; and (i) Ensure that appropriate levels of skill and competency within the emergency response team are maintained based on the risk profile and probable emergencies of the operation for 24/7 coverage
<p>3) Emergency Response Team</p>	<ul style="list-style-type: none"> (a) Maintain appropriate levels of skill, competency and fitness; (b) Carry out inspection and maintenance of emergency equipment; (c) Participate in training sessions and drills; (d) Direct action in the emergency, initiating appropriate activities to minimize the effects of injury at the scene of the incident; and (e) Coordinate efforts with the supervisor and/or management in charge.

4) Employees and contractors	<ul style="list-style-type: none"> (a) Understand the procedure for notification of emergency situations; (b) Respond to alarms and follow directions from emergency response coordinator; (c) Ensure that employees and any visitor are accounted for in the event of an emergency evacuation; and (d) Be aware of emergency meeting locations, their role in an emergency situation, and the use of appropriate emergency equipment (e.g. fire extinguishers).
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PROCEDURE

IDENTIFICATION OF POTENTIAL INCIDENTS AND EMERGENCIES

Art 21. 03 (a) All facilities and areas of operations shall be audited in accordance with relevant hazard identification procedures to systematically identify situations or events that would require an emergency response including but not limited to:

- (i) Electrical leaks or faults;
- (ii) Fires (structural, equipment, etc.);
- (iii) Medical emergencies, injuries;
- (iv) Major chemical or hydrocarbon spills or gas;
- (v) Explosions;
- (vi) Civil disturbances; and
- (vii) Natural disasters.

(b) consideration must be given to extreme risks, geographic location of potential events, proximity to populated areas, concerned stakeholders, available external emergency services as well as internal and external communication channels;

(c) clean up and remediation procedures shall be included in the Emergency Response Plan, in particular for materials that pose a significant risk to human health and safety, the environment or the community;

(d) as a minimum, each Main Actor organization will conduct an annual review; and

(e) testing of the Emergency Response Plan, such as drills, and desktop situations shall be conducted to maximize the operation or facility's preparedness for emergencies.

AVAILABILITY OF EMERGENCY RESPONSE PLANS (ERP)

Art 21. 04 (a) A controlled copy of the Emergency Response Plan shall be available to appropriate personnel and at key locations and must be linked to the safety systems of the Main Actors; and

(b) to ensure a systematic approach is applied to identify and manage these situations or events, an emergency response plan must be communicated to relevant organizations such as the Fire Service, Police, and Hospitals.

EMERGENCY NOTIFICATION AND COORDINATION

- Art 21. 05 (a) The Emergency Response Plan shall clearly define the actions required to manage and control significant risk situations, how to notify and activate internal and external emergency response service (fire response, police, ambulance, etc), and how to liaise with government agencies in the event of an emergency;
- (b) communications with media, government inquires and release of public statements will be as per the Main Actor’s Public Affairs policy and the policy must define who is responsible for dealing with media and government inquires and the release of public statements in case of an emergency; and
- (c) formal mutual agreements shall be established between appropriate operations, local emergency service groups, other utility companies, and other appropriate groups where they exist to provide beneficial or mutual assistance to the network’s operation and community.

EMERGENCY RESPONSE TEAM

- Art 21. 06 (a) Facilities and areas of operation shall have an adequate number of personnel with appropriate expertise who are trained and competent to respond to emergencies 24hours a day throughout the year; and
- (b) Emergency Response Teams shall be trained to a skill level commensurate with the identified operational risks and hazards as a minimum.

TRAINING AND DRILL

- Art 21. 07 Training and scenario exercise (physical/desktop) shall be conducted at least annually and actual response if formally critiqued, can be considered a sufficient training exercise.

EMERGENCY EQUIPMENT LOCATION

- Art 21. 08 (a) Areas of operation and facilities shall identify key locations and provide emergency equipment as required ;
- (b) emergency equipment shall be located in easily accessible locations and within a reasonable distance from that identified source of the potential hazard and such locations shall be sign-posted and clearly marked on layout drawings that shall be maintained up to date in accordance with regulatory requirements; and
- (c) alarms and warning devices such as lights, sirens, bells, etc and emergency evacuation lighting shall be installed in locations where personnel need to be warned of hazard or evacuate in the event of an emergency.

INSPECTIONS AND MAINTENANCE

- Art 21. 09 (a) Emergency equipment, alarms, lighting and warning systems shall be regularly inspected in accordance with a schedule and maintained in proper working conditions;

- (b) inspections shall be carried out by qualified personnel; and
- (c) formal records of inspection and testing shall be reviewed and maintained.

POST EMERGENCY ACTIVITIES

- Art 21. 10
- (a) The site shall conduct a debriefing following emergency events or emergency response exercise to identify deficiencies and communicate these to the appropriate personnel;
 - (b) records of emergency response drills and/or events shall be maintained and these include actions identified from the debriefing, which shall be documented for corrective action; and
 - (c) the Emergency Response Plan and any associated procedures shall be reviewed post emergency to identify any additional corrective actions and/or updates to the plan.

SECTION 22: INFORMATION AND DATA EXCHANGE DISCLOSURE

BACKGROUND, PURPOSE AND SCOPE

- Art 22. 00 The Distribution Utility has an obligation to ensure that the distribution network is operated in a reliable and secure manner. To achieve this, the Distribution Utility shall obtain from and provide the main actors with power system information needed for the maintenance of system security. The exchange of information will enable the main actors to carry out their obligations and meet statutory reporting requirements.
- Art 22. 01 The Distribution Utility shall obtain from the main actors, the technical and operational information needed for the discharge of the Distribution Utility's responsibilities in order to provide open, fair and non-discriminatory access to the distribution network for all the main actors.
- Art 22. 02 The Information and Data Exchange Sub-Code is based on the requirements of the Distribution Code and other statutory requirements. The Distribution Code defines the reciprocal obligations of the main actors with regard to the provision of information and exchange of data for the implementation of the Distribution Code.
- Art 22. 03 The requirements of this Sub-Code are complementary to any information and data exchange requirements defined in other sections of the Grid Code.

INFORMATION EXCHANGE INTERFACE

- Art 22. 04 The Distribution Utility shall designate an office as its contact office for the exchange of information pertaining to the real time operation of the distribution network.
- Art 22. 05A main actor shall designate an office as its point of information and data exchange and shall provide the Distribution Utility with all the relevant details of contact for its offices.
- Art 22. 06 A main actor shall identify the following for each type of information exchange:
- (a) the name(s), title(s)/position(s) and contact details of the person(s) designated by the main actor to be responsible for provision of information; and
 - (b) the purpose for which the information is required.
- Art 22. 07 Main actors shall agree on appropriate procedures for the transfer of

information.

GENERAL PRINCIPLES FOR IMPLEMENTATION OF INFORMATION AND DATA EXCHANGE

- Art 22. 08 A main actor shall keep readily available, complete and accurate records of all data required for the proper administration of the Distribution Code.
- Art 22. 09 The Distribution Utility will provide open and timely exchange of relevant information among the main actors, to facilitate the secure and reliable operation of its distribution network.
- Art 22. 10 The information exchanged between the Distribution Utility and a main actor may be either confidential (bilateral) information or public information intended for all parties. The provider of the information shall indicate whether the information being provided should be considered confidential or public.
- Art 22. 11 The Distribution Utility shall make available critical data to allow a main actor to make rational and informed decisions regarding the operations of its distribution network.
- Art 22. 12 The Distribution Utility shall publish all relevant non-confidential information in a timely manner, or make them accessible by all main actors, in an open and non-discriminatory manner.
- Art 22. 13 In the case of electronic data sharing, access to the distribution network information shall be provided on read-only basis.
- Art 22. 14 A Distribution Utility shall be responsible for the procurement and maintenance of the required communication systems as well as the data communication costs of its systems used for the purpose of Information and Data Exchange.

INFORMATION EXCHANGE BETWEEN MAIN ACTORS

PROVISION OF INFORMATION TO THE DISTRIBUTION UTILITY

- Art 22. 15 The Distribution Utility may require information of a technical nature, to the extent not supplied under any other provisions of the Distribution Code, to be supplied by the main actors to enable it (the Distribution Utility) to undertake the following:
- (a) analysis and evaluation of equipment and service performance of the distribution network as well as the preparation of the distribution network performance reports;
 - (b) survey of distribution network conditions;

- (c) assessment of risks to distribution network operations;
- (d) analysis of distribution network equipment performance; and
- (e) analysis and validation of policies of the Distribution Code.

Art 22. 16 The Distribution Utility shall, for the purposes of Article 13.15, send a written request to a main actor, setting out the information it reasonably requires, the preferred medium and format for the submission and the time by which it reasonably requires a response to the request.

Art 22. 17 A main actor shall use all reasonable endeavours to provide the required information in the required format and within the time stated.

Art 22. 18 Unless specifically provided in other sections of the Distribution Code, communications with the Distribution Utility on all other matters shall be with the Head Office of the Distribution Utility.

PLANNING INFORMATION

Art 22. 19 A main actor shall provide on a regular basis such information as the Distribution Utility may reasonably request for the purposes of planning and developing the distribution network and to enable the Distribution Utility fulfil its statutory or regulatory obligations. Main actors shall submit the information to the Distribution Utility without unreasonable delay.

Art 22. 20 The Planning Information to be provided shall be as specified in the Planning Code and any other information which may from time to time be required.

Art 22. 21 A distribution network Asset Owner shall provide a main actor with information about equipment and systems installed at LV transmission substations.

Art 22. 22 The Distribution Utility shall keep an updated technical database of its distribution network for purposes of modelling and studies on the distribution network.

Art 22. 23 The Distribution Utility shall provide Distribution Companies and Bulk Customers with any relevant information that may be reasonably required to properly plan and design their networks and to comply with their obligations under the Connection Sub-Code.

NETWORK INFORMATION EXCHANGE

Art 22. 24 A main actor shall promptly provide to the Distribution Utility, on request, network information that is considered reasonable for the security and integrity of the distribution network

Art 22. 25 The Distribution Utility shall communicate network information as required for

safe and reliable operation to the contact points designated by each main actor required.

Art 22. 26 The network information exchange shall be both electronic and paper based and within the time frame agreed upon between the main actors.

OPERATIONAL COMMUNICATION AND DATA RETENTION REQUIREMENTS

Art 22. 27 Adequate communication facilities and procedures shall be established between the Distribution Utility and each main actor to allow the timely transfer of information.

Art 22.28 The communication facilities for voice and data that are to be installed and maintained between the Distribution Utility and a main actor shall comply with the applicable IEC and ITU standards for SCADA and Communication equipment.

Art 22.29 The communication facilities shall support data acquisition from Remote Terminal Units. The Distribution Utility shall be capable of monitoring the state of the distribution network via telemetry from the Remote Terminal Unit connected to plant or facility of a main actor plant and/or substation.

Art 22.30 The Distribution Utility and main actor may in place of the above systems adopt the use of new technologies and methodologies for communication of information, where there is a recognizable benefit in quality, reliability and features and to do so would be reasonable in the circumstances.

SCADA INFRASTRUCTURE

Art 22.31 Each Distribution Network Node shall be accessible to the SCADA system which shall be used for storage, display and processing of operational data.

Art 22.32 All Main actors shall make available outputs of their respective operational equipment to the SCADA System.

Art 22.33 SCADA Remote Terminal Units shall be installed for the transmission of signals and indications to and from the Distribution Utility. The signals and indications which must be provided by Main actors for transmission by SCADA equipment are those specified in the Connection Code, together with such other data or information as the Distribution Utility may reasonably request, from time to time, by notice to Main actors.

Art 22.34 All SCADA, metering, computer and communications equipment and the data or information carried by the distribution network shall be secure from unauthorized access. Procedures governing security and access shall be agreed with Main actors, but shall allow for adequate access to the equipment and information by the relevant Main actor and Distribution Utility for the purposes of maintenance, repair, testing and recording of measurements.

TIME STANDARD

Art 22.35 The time standard used shall be the Coordinated Universal Time (UTC) Standard and all time information shall be referenced to it. To maintain synchronization, each distribution network node shall be provided with a connection to GPS satellite receivers that enable all relevant devices to maintain time synchronization.

DATA RETENTION AND ARCHIVING

Art 22.36 The Distribution Utility and every Main actor shall maintain sufficient records to support audit and verification requirements and to support monitoring of compliance with the provisions of the Grid Code. They shall also maintain adequate data and records, in sufficient detail, to support event diagnostics and trouble shooting.

Art 22.37 The Distribution Utility shall maintain a complete and accurate record of all Operational Data supplied or maintained under this Code .

Art 22.38 All Operational Data shall be so maintained for a period of not less than five years, commencing from the date the Operational Data was first supplied or first created, if earlier.

Art 22.39 The Distribution Utility shall allow Main actors access to its records of Operational Data.

Art 22.40 The obligations for data retention and archiving shall be the responsibility of the information owner.

Art 22.41 The systems for the storage of data and information to be used by the parties shall be of their own choice and installed at their own cost.

Art 22.42 The Energy Commission may at any time audit the data retention and archiving systems of Distribution Utility.

Art 22.43 A Distribution Utility shall store operational information that is kept electronically for a period of at least five years or for the life of the plant or equipment concerned, whichever is the longer.

Art 22.44 A Distribution Utility shall ensure reasonable security against unauthorized access, use and loss of information. To this end, a Distribution Utility shall, among other things, develop and implement a backup strategy for the information system equipment.

DISTRIBUTION NETWORK PERFORMANCE DATA

Art 22.45 The following distribution network performance indicators and operational information shall be made available by the Distribution Utility to the Energy Commission and upon request to main actors:

- (a) Daily-
 - i) Power and energy generation by each generating facility registered with the Distribution Utility;
 - ii) Hourly actual demand of the previous day in MW;
 - iii) Reserve amounts during the morning and evening peaks of the previous day in MW
- (b) Monthly -
 - i) Energy balance indicating internal generation, imports, exports, energy available for sale and transmission losses;
 - ii) Generating plant Availability;
 - iii) Number and total duration of frequency excursions outside statutory limits;
 - iv) Number and total duration of voltage excursions outside statutory limits;
 - v) Outage time at each distribution network node.
- (c) Annually -
 - i) Annual energy balance for the year;
 - ii) Annual peak demand in MW, date and time;
 - iii) Annual minimum demand in MW, date and time;
 - iv) Outage time at each distribution network node.

Art 22.46 A distribution network Asset Owner shall also make available all information collected via recorders installed at substations to the Distribution Utility for analysis. The Distribution Utility shall make this information available to affected Main actors on request.

Art 22.47 The Distribution Utility shall publish each week a report on the power system performance for the previous week, including a report on Significant Incidents and operating conditions relevant to the operation of the distribution network.

EVENTS REPORTING

Art 22. 48 In the case of a Significant Incident, which has been notified by a Main actor to the distribution utility, the Main actor shall provide a written report to the Distribution Utility.

Art 22.49 In the case of a significant incident which has been notified by the Distribution Utility to a Main actor, the distribution utility shall provide a written report to all affected Main actors.

Art 22.50 The reports referred to in Art 22.48 and 24.49 shall, where applicable, include at least the following:

- (a) time and date of Significant Incident;
- (b) location;
- (c) plant and/or equipment involved;
- (d) brief description of the Significant Incident;
- (e) estimated time and date of return to service;
- (f) supplies/generation interrupted and duration of interruption;
- (g) generating unit – frequency response achieved;
- (h) generating unit – MVar performance achieved;
- (i) any other information that the Distribution Utility or Main actor reasonably considers may be required in relation to the Significant Incident

CONFIDENTIALITY OBLIGATIONS

Art 22.51 A Distribution Utility shall use all reasonable endeavours to keep as confidential any information classified as such and which comes into the possession or control of that Distribution Utility or of which the Distribution Utility becomes aware.

Art 22.52 The information owner may request the recipient of the information to enter into a confidentiality agreement before information established to be confidential is provided.

Art 22.53 A Distribution Utility shall not:

- (a) disclose confidential information to any third party without the written consent of the owner or provider of the information.
- (b) use or reproduce confidential information for any purpose other than that for which it was disclosed or for purposes contemplated by this Code; and
- (c) permit unauthorized persons to have access to confidential information.

Art 22.54 A Distribution Utility shall use all reasonable endeavours to prevent unauthorized access to confidential information which is in the possession or control of that

Distribution Utility.

Art 22.55 A Distribution Utility shall ensure that any person to whom it discloses confidential information observes the provisions for confidentiality in relation to that information.

Art 22.56 A Distribution Utility shall report any unauthorised disclosure of information that is governed by a confidentiality agreement as soon as practicable after it has become aware of the unauthorised disclosure and shall provide all reasonable assistance to ensure recovery or destruction of that confidential information as may be deemed appropriate by the information owner or provider.

EXCEPTIONS

Art 22.57 The confidentiality provisions in these section of this Code do not prevent the disclosure, use or reproduction of information,

- (a) if the relevant information is at the time generally and publicly available other than as a result of breach of confidentiality by a Distribution Utility or any person to whom the Distribution Utility has disclosed the information;
- (b) by a Distribution Utility for the use of an employee or officer of the Main actor or a related body corporate of the Distribution Utility; or a legal or other professional adviser, auditor or other consultant which require the information for the purposes of this Code, or for the purpose of advising the Distribution Utility;
- (c) with the consent of the person or persons who provided the relevant information under this Code;
- (d) to the extent required by law or by a lawful requirement of any government or governmental body, authority or agency having jurisdiction over a Distribution Utility or its related bodies corporate;
- (e) if required in connection with legal proceedings, arbitration, expert determination or other dispute resolution mechanism relating to this Code;
- (f) if required to protect the safety of personnel or equipment; or
- (g) of an historical nature in connection with the preparation and submission of reports under this Code.

DISCLOSURE OF CONFIDENTIAL INFORMATION

Art 22.58 A Distribution Utility who needs to disclose confidential information shall consult with the provider of the information prior to its release and inform those affected by the information disclosure.

SECTION 23: COMPLAINTS AND DISPUTE RESOLUTION

Art 23. 00 The Distribution Utility's Customer Charter must include information on its complaint handling processes which must be in accordance with L.I.1816.

Art 23. 01 When a Distribution Utility responds to a customer's complaint, the Distribution Utility must inform the customer that the customer has a right to raise the complaint to the PURC.

Art 23. 02 A Distribution Utility must include information about the PURC disconnection procedures on any disconnection warning issued by the Distribution Utility.

Art 23. 03 A person who is exempt from holding a distribution licence need not comply with this Section where a process of dispute resolution is specified in the applicable exemption.

SECTION 24: BREACH OF THE CODE

DISTRIBUTION UTILITY'S OBLIGATION TO REMEDY

Art 24. 00 If a Distribution Utility breaches this Code, it must remedy that breach as soon as practicable.

NOTIFICATION TO OTHER MAIN CUSTOMERS

Art 24. 01 If a Distribution Utility becomes aware of its failure to comply with any obligation under the Code, which can reasonably be expected to have a material, adverse impact on the other main actor, it must:

- (a) notify each customer likely to be adversely affected by the non-compliance within 5 business days;
- (b) undertake an investigation of the non-compliance as soon as practicable but in any event within 20 business days; and
- (c) advise the other main actor of the steps it is taking to comply.

Art 24. 02 If a Distribution Utility becomes aware of a breach of this Code by other main actors, which is not of a trivial nature, the Distribution Utility must notify the other main actors, in writing and as far as possible using plain English, of:

- (a) details of the non-compliance and its implications, including any impact on the Distribution Utility and other other main actors;
- (b) actions that the other main actors could take to remedy the non-compliance;
- (c) a reasonable time period in which compliance must be demonstrated;
- (d) any consequences of non-compliance; and
- (e) the Distribution Utility's procedure for handling complaints.

OTHER MAIN ACTORS OBLIGATION TO REMEDY

Art 24. 03 A main actor must use best endeavours to remedy any non-compliance with this Code within the time period specified in any notice of non-compliance sent by a Distribution Utility in accordance with Art 24.02 or other main actors.

DISCONNECTION FOR NON-COMPLIANCE

Art 24. 04 A Distribution Utility may disconnect supply to a customer's location address if:

(a) the customer has not fulfilled an obligation to comply with this Code as notified under Art 24.02; and

(b) the Distribution Utility has given the customer 5 business days' written notice of disconnection (such notice to be in addition to the notice referred to in Art 24.02); and

(c) the customer fails to comply with the notice or enters into an arrangement to comply but fails to comply with that arrangement.

APPENDICES

APPENDIX A: INFORMATION IN A CONNECTION AGREEMENT WITH A CUSTOMER

A Connection Agreement must conform to this Code and Distribution Utility's Conditions of Service. A Connection Agreement between a Distribution Utility and a customer connected to the Distribution Utility's distribution system, excluding embedded generators and connection with other Distribution Utilities, should include the following information (examples provided in italics):

Contact Information

- Date
- Account Number
- Date Customer's Responsibility Commences
- Name
- Service Address
- Mailing Address
- Home Phone No.
- Business Phone No.
- Mobile Phone No.
- Type of Business
- SIC Code

The following clauses are suggested as examples:

The Customer agrees to abide by the Distribution Utility's Conditions of Service, in effect and as amended from time to time.

The Customer further agrees to:

- (1) pay the Distribution Utility for the distribution services used by the customer at the location covered by this connection agreement from the date herein until such time as the customer no longer requires the service; and
- (2) to commence payment in accordance with the approved rates prescribed attributed to the appropriate class rating to which the service applies, on or before the due date shown on the first account rendered and to pay all accounts either monthly or bi-monthly or as specified, thereafter.

Signature of Customer (after reading the above and the General Conditions)

Witness

Signature of Distribution Utility (upon accepting the contract)

Date

General Conditions:

Space and Access

The customer agrees to provide suitable space for the Distribution Utility's meters, wires and where necessary poles, transformers and all other appliances and equipment on the said premises and further agrees that no one who is not an agent of the Distribution Utility shall be permitted to remove, inspect or tamper with same, including seals and that the properly authorized agents of the Distribution Utility shall have reasonable access to the said premises for the purpose of reading, examining, preparing or removing their meters, wires, poles, cables, transformers and other appliances, equipment of the Distribution Utility and for the inspection of all the customer's appliances and wiring.

Responsibility for Equipment

Meters, wires, poles, cables, transformers and all other appliances, equipment of the Distribution Utility on the said premises shall be in the care and at the risk of the customer and if destroyed or damaged by fire or any other cause whatsoever other than ordinary wear and tear, the customer shall pay to the Distribution Utility the value of such meters, wires, poles, cables, transformers, appliances and equipment, or the cost of repairing or replacing same.

Disconnection

The customer hereby expressly authorizes and empowers the Distribution Utility at the Distribution Utility's option to remove the meter, wires, poles, cables, transformers and all other appliances and equipment installed at the Distribution Utility's expense and discontinue the supply of electricity and terminate this agreement whenever any bills for the said service are in arrears or upon violation by the customer of any of the terms and conditions of this agreement.

Reliability

The Distribution Utility agrees to use reasonable diligence in providing a regular and uninterrupted service but does not guarantee a constant service or the maintenance of unvaried frequency of voltage and will not be liable in damages to the customer by reason of any failure in respect thereof. It is the customer's responsibility to provide for the protection of his equipment. From voltage variations, transient operations and single phasing.

Conditions of Service

The building must be supplied with electrical energy according to the Distribution Utility's Conditions of Supply.

Binding

This agreement shall not be binding upon the Distribution Utility until accepted by it through a designated officer and shall not be modified or affected by any promise, agreement or representation by any agent or employee of the Distribution Utility unless incorporated in writing into this agreement before such acceptance.

Maintenance Requirements

The customer shall maintain the installation in efficient condition with proper devices, according to the requirements and rules in respect of Electrical Safety. If the electrical installation is found to be inadequate, the supply of electricity shall be suspended until such a time as the above requirements are complied with.

Security Deposit

The Distribution Utility reserves the right to require security for payment of future charges.

Termination

This agreement shall continue in force until terminated by notice in writing given by either party hereto thirty days in advance of termination.

Successors

It is agreed that the signatures of the parties hereto shall be binding upon their successors or assigns and that the vacating of the premises herein named shall not release the customer from this agreement except at the option and by written consent of the Distribution Utility.

Approval of Equipment

All electrical and mechanical equipment such as motors and welders used by the customer shall be subject to the reasonable approval of the Distribution Utility and the customer shall so take and use the electrical energy as not to endanger the apparatus of the Distribution Utility or cause any wide or abnormal fluctuations of its line voltage. Where practical, equipment with the highest power factor should be chosen and motors should be sized to match the load. Equipment performance characteristics shall be in accordance with the Distribution Utility's Conditions of Service.

Fire or Other Casualty

In case fire or other casualty occurs in said premises, rendering the premises wholly unfit for occupancy, the supply of electricity shall thereupon be suspended until such time, within said contract period, as the wiring shall have been repaired and approved by the EC.

APPENDIX B: METHODOLOGY AND ASSUMPTIONS FOR AN ECONOMIC EVALUATION

B.1 Common Elements of the Discounted cash flow Model

To achieve consistent business principles for the development of the elements of an economic evaluation model, the following parameters for the approach are to be followed by all Distribution Utilities.

The discounted cash flow (DCF) calculated for individual projects will be based on a set of common elements and related assumptions listed below.

Revenue Forecasting

The common elements for any project will be as follows:

- (a) Total forecasted customer additions over the Customer Connection Horizon, by class as specified below;
- (b) Customer Revenue Horizon as specified below;
- (c) Estimate of average energy and demand per added customer (by project) which reflects the mix of customers to be added – for various classes of customers, this should be carried out by class;
- (d) Customer additions, as reflected in the model for each year of the Customer Connection Horizon; and
- (e) Rates from the approved rate schedules for the particular Distribution Utility reflecting the distribution (wires only) rates.

Capital Costs

Common elements will be as follows:

- (a) An estimate of all capital costs directly associated with the expansion to allow forecast customer additions.
- (b) For expansions to the distributed system, costs of the following elements, where applicable, should be included:
 - Bulk Supply Points (BSPs)
 - Primary/Secondary sub-stations;
 - Distribution lines/network;
 - Transformers
 - Ring Main Units;
 - Services; and
 - Land and land rights.

Note that the “Owner Demarcation Point” as specified in the Distribution Utility’s Conditions of Service would define the point of separation between a customers’ facilities and Distribution Utility’s facilities.

- (c) Estimate of incremental overheads applicable to distribution system expansion.

Expense Forecasting

- (a) Attributable incremental operating and maintenance expenditures – any incremental attributable costs directly associated with the addition of new customers to the system would be included in the operating and maintenance expenditures;
- (b) Income and taxes based on tax rates underpinning the existing rates schedules.
- (c) Municipal property taxes based on projected levels.

Specific Parameters/Assumptions

Specific parameters of the common elements include the following:

- (a) A maximum customer connection horizon of five (5) years.
- (b) A maximum customer revenue horizon of twenty five (25) years, calculated from the in service date of the new customers.
- (c) A discount rate equal to the incremental after-tax cost of capital, based on the prospective capital mix, debt and preference share cost rates, and the latest approved rate of return on common equity.
- (d) Discounting to reflect the true timing of expenditures. Up-front capital expenditures will be discounted at the beginning of the project year and capital expended throughout the year will be mid-year discounted. The same approach to discounting will be used for revenues and operating and maintenance expenditures.

B.2 DISCOUNTED CASH FLOW (DCF) METHODOLOGY

Net Present Value (“NPV”) = Present Value (“PV”) of Operating Cash Flow + PV of CCA Tax Shield - PV of Capital

1. **PV of Net Operating Cash Flow** = PV of Net Operating Cash (before taxes) PV of Taxes
- a) PV of Net Operating Cash = PV of Net Operating Cash Discounted at the Company’s discount rate for the customer revenue horizon. Mid-year discounting is applied. Incremental after tax weighted average cost of capital will be used in discounting.
- Net (Wires) Revenue Cash = (Annual(Wires) Revenues – Annual (Wires) O & M)
- Annual (Wires) O&M = Customer Additions* (Appropriate (Wires) Rates* Rates Determinant)
- Annual (Wires) O&M = Customer Additions* Annual Marginal (Wires) O&M Cost/customer
- b) PV of Taxes = PV of Municipal Taxes + PV of Capital Taxes + PV of Income Taxes (before interest tax shield)
- Annual Municipal Tax = Municipal Tax Rate * (Total Capital Cost)
- Total Capital Cost = Distribution Capital Investment + Customer Related Investment + Overhead at the project level
- Annual Capital Taxes = (Capital Tax Rate) * (Closing Un-depreciated Capital Cost Balance)
- Annual Capital Taxes = (Capital Tax Rate) * (Net Operating Cash – Annual Municipal Tax – Annual Capital Tax)

The Capital Tax Rate is a combination of the Provincial Capital Tax Rate and the Large Corporation Tax (Grossed up for income tax effect where appropriate).

Note: Above is discounted, using mid-year discounting, over the customer revenue horizon.

2. **PV of Capital** = PV of Total Annual Capital Expenditures

a) PV of total Annual Capital Expenditures

Total Annual Capital Expenditures over the customer’s revenue horizon discounted time zero

Total Annual Capital Expenditure = (for New Facilities and/or Reinforcement Investments + customer Specific Capital + Overheads at the project level). This applies for implicated system elements at the utility side of the “Ownership Demarcation Line”

Note: Above is discounted to the beginning of year one over the Customer addition horizon

3. **PV of CCA Tax Shield**

PV of the CCA Tax Shield on (Total Annual Capital)

The PV of the perpetual tax shield may be calculated as:

PV at time zero of :
$$\frac{(\text{Income Tax Rate}) \cdot \text{Annual Total Capital}}{(\text{CCA Rate} + \text{Discount Rate})}$$

or,
Calculated annually and present valued in the PV of Taxes calculation.

Note: An adjustment is added to account for the ½ year CCA rule.

4. **Discount Rate**

PV is calculated with an incremental, after-tax discount rate

APPENDIX C: MINIMUM INSPECTION REQUIREMENTS

C.1 DISTRIBUTION INSPECTION STANDARDS

Inspection Cycles

A Distribution Utility should ensure that only persons qualified under the Occupation of Health and Safety Act are involved in inspection activities. Since some inspections can expose inspectors to energized lines or high voltage circuits and equipment, and may include inspection repair, a qualified person should be assigned to this work. This assumes that they are both properly trained to protect both themselves and the public, and to respond to those emergencies, which may arise during inspections.

In developing the standards for facilities inspections, the patrol inspection is defined as follows:

Patrol or simple visual inspections consists of walking, driving or flying by equipment to identify obvious structural problems and hazards such as leaning power poles, damaged equipment enclosures, and vandalism. In cases where a patrol notices that a problem exists or identifies a condition that warrants a more thorough or rigorous inspection, patrol may then include situations where structures are opened as necessary, and individual pieces of equipment carefully observed and their condition noted and recorded, and a summary document prepared in the Distribution Utility's annual reports as part of their rates or licensing submissions.

In all cases, a Distribution Utility is responsible to ensure that appropriate follow up and corrective action is taken regarding problems identified during a patrol.

The Board or a Board-designated party reserves the right to conduct random audits of inspection reports to ensure that appropriate follow up and corrective action is taken regarding problems identified during a patrol.

It is expected that Distribution Utilities will file both annual summary reports of detailed patrol inspection activities that have taken place during the previous year as well as an outline of inspection plans ("compliance plan") for the forthcoming year.

Inspection cycles are categorized by the following major distribution facilities:

- Bulk Supply Points
- Primary/Secondary Substations
- Transformers
- Secondary Substation transformers
- Customer Specific Substations
- Protection and Control equipment
- Regulators

Capacitor banks
Conductors, cables, cable joints and lugs
Data and system control equipment
Vegetation
Poles/Supports
Civil Infrastructure

For each of these facilities, the Distribution Utility shall further distinguish between overhead facilities and underground facilities. The Distribution Utility shall also separate according to the facilities' location and the relative population density in the locale.

- **Urban(metropolitan/municipal/industrial area)** means an operational area with a customer population of over five thousand or a demand above fifteen megawatts and by definition the overhead and underground facilities pose safety and reliability consequences to greater numbers of people.
- **District Capital** means the administrative capital of a district.
- **Rural** means an operational area with a customer population of under five thousand or a demand below fifteen megawatts and by definition the overhead and underground facilities pose safety and reliability consequences to fewer number of people.

The following description provides a list of the requirements to be expected from a typical distribution line patrol inspection in terms of the types of defects that may be detected visually. Clearly, the list will vary depending on the equipment specifics and locations, thus this should be viewed as a 'generic' patrol expectation.

Transformers and Switchgears
Distribution Pillars
Paint condition and corrosion
Transformer platform (pad or vault mounted)
Check for lock and holding/anchor bolt in place
Grading changes
Access changes (Shrubs, trees, etc.)
Phase indicators and unit numbers match operating map (where used)
Leaking oil
Flashed or cracked insulators
Pad mounted – lid damage, missing bolts, cabinet damage, public security lock damage

Substation- May consist of one or all types of equipment listed

Switching/Protective Devices

Overhead pole mounted

Bent, broken bushings and cut-outs,
Damaging lightening arresters, control boxes, current and potential transformers

Pad mounted substations
Security condition of enclosure

Voltage Regulators
Condition of bushings
Tank corrosion/leaks
Damaged disconnect switches or lightning arresters

Capacitors
Condition of bushings
Tank corrosion/leaks
Damaged switches, disconnects or control cabinet

Conductors and Cables
Low conductor clearance
Broken /frayed conductors or tie wires
Tree conditions, exposed broken ground conductors
Broken strands, bird caging, and excessive or inadequate sag.
Insulations fraying on secondary especially open wire

Poles/Supports:
Bent, cracked or broken poles
Excessive surface wear or scaling
Loose, cracked or broken cross arms and brackets
Woodpecker or insect damage, bird nests
Loose or unattached guy wires or stubs
Guy guards out of position or missing
Grading changes, or washouts
Indications or burning

Hardware and attachments
Loose or missing hardware
Insulators unattached from pins
Conductor unattached from insulators
Insulators flashed over or obviously contaminated/cracked (difficult to see)
Tie wire unravelled
Ground wire broken or removed
Ground wire guards removed or broken

Equipment Installations (includes transformers and Ring Main Units)
Contamination/discoloration of bushing
Oil leaks
Rust
Ground lead attachment
Ground wires on arrestors unattached
Bird or animal nests
Vines or brush growth interference
Evidence of bushing flashover
Accessibility compromised

Vegetation and Right of Way:

- Leaning or broken “danger” trees
- Growth into line of “climbing “ trees
- Unapproved/unsafe occupation or secondary use

Civil Infrastructure – For example, buildings that house the equipment may need attention (cracking, fire hazards, etc). In addition, cable chambers, underground vaults and tunnels crossing the rail track or water are also included in this category. These inspections would likely be conducted in the patrol of the equipment, which they are “associated”

Underground systems:

With respect to underground systems, riser poles should be checked as with an overhead patrol, with a visual check of cable, cable guards, terminators and arrestors. While it is not possible to inspect underground cable directly, the system may be checked for exposed cable and or grade changes that may indicate that the cable has been brought too close to the surface. Patrol inspection of cable chambers is not required since a visual inspection will not reveal faults because the failure mechanism for underground cable (e.g. voids, water trees) is not visually detectable.

Cable is hard to check, but the system can be checked for exposed cable and/or grading changes that may have brought cable or wire too close to the surface.

TABLE C - 1
Electric Utility system inspection cycles
(Minimum number of inspection/patrols in a year)

Major or Substantial Distribution Facility*	Patrol/Inspection	Patrol/Inspection	Patrol/Inspection
	Urban	District Capital	Rural
Bulk Supply Point			
Switchgear	4	5	6
Cables, terminations and lugs	4	5	6
Protection and Control Equipment	4	5	6
busbars	4	5	6

Circuit breakers	4	5	6
Metering	4	5	6
Station service transformer	4	5	6
Primary Distribution Substation			
Transformers	4	5	6
Switchgear	4	5	6
Voltage Regulators and Surge Arrestors	4	5	6
Cables, terminations and lugs	4	5	6
Protection and Control Equipment	4	5	6
busbars	4	5	6
Circuit breakers	4	5	6
Secondary Distribution Substation			
distribution transformers	4	5	6
Distribution Pillars	4	5	6
Pad mounted transformers	4	5	6
Pole mounted transformers	4	5	6
Package transformers substation	4	5	6
Standalone transformer substation	4	5	6
Customer specific substation	4	5	6

Overhead Lines and Associated Equipment			
Conductors, cables, terminations and lugs	4	5	6
Switchgear (Ring main units, circuit breakers, etc)	4	5	6
Capacitor banks	4	5	6
Voltage Regulators	4	5	6
Poles	2	3	4
Line vegetation/undergrowth	2	3	4
Civil works/infrastructure/Gantry	2	3	4

Notes to Table C-1

1. The above distribution system patrol cycles form part of the regulatory framework and are minimum inspection requirements for each major or substantial distribution component and related hardware.
2. A Distribution Utility may determine that more frequent inspections may be required due to local conditions such as geographic location, climate, environmental conditions such as air pollution or highway salt spray, technologies available to perform the inspection, type and vintage of distribution technology in place, manufacturer specifications, systems design, or relative importance to overall system reliability of a particular piece of equipment or portion of the Distribution Utility’s distribution system.

The burden of proof is on the Distribution Utility to demonstrate that it should not have to comply with these inspection schedules or requirement in Table C-1. To demonstrate that it should not have to comply these inspection schedules, the Distribution Utility would have to present a comprehensive and detailed case establishing:

Revised inspection cycles may be allowed when justified by:

- Documented historical good utility maintenance and inspection practices, including a program to manage reliability.

- Alternative or additional maintenance activities that are practiced by the utility and can be demonstrated as being practiced.
- Achieved reliability performance. The utility will be required to submit both the current and historic reliability statistics over five years. These statistics must be verifiable. This will be measured by the following:
 - Once the data is available over the courses of Generation 1 and 2 of the PBR regime. The reliability indices that are better than the average of Distribution Utilities which are comparable in size and type. The reliability indices to be used are those that are defined over time in the PBR regime, including initially SAIDI, CAIDI and SAIFI averaged over the previous three year period, and;
 - The reliability indices over time for the individual utility that are at least as good, if not better, than the average of the indices over the previous five year period. Again the reliability indices to be used are those that are defined over time in the PBR regime, including initially SAIDI, CAIDI and SAIFI averaged over the previous five-year period.

3. The method by which inspection cycles are structured and the work carried out is at the discretion of the Distribution Utility. The above table is organised according to major classification of equipment, however Distribution Utilities may choose to conduct and record the inspections on some other basis such as:

- Circuit feeder basis
- Overhead & underground

System voltage

- Dividing its service area into geographical areas
- Other

It is intended that if the inspections are organised by one of the above approaches, all major equipment categories identified in the table and related hardware along the line or within the area will be inspected. However, the utility shall provide an explanation of any deviation in their annual submission. For clarity, the equipment shall be inspected on a cyclical basis, and the cyclical interval shall be specific to a particular region or portion of plant, and not on the system as a whole.

4 **“Civil Infrastructure”**: Refers to facilities and structures such as tunnels, duct suspended from or attached to bridges. Underground chambers and hand holes, towers supporting distribution plant, communication towers, buildings that house substation equipment. It is intended that civil infrastructure will be inspected as part of patrol of the distribution system or in the course of doing normal, routine utility work. It is recognized that there may be instances where it will be extremely difficult to perform a visual inspection (e.g where access is restricted due to energized equipment in cable chambers), and therefore the civil infrastructure associated with this would be inspected in the course of doing normal utility work which would require entrance to the chamber, which would require the utility to de-energize the equipment. In other words, the equipment should not be de-energized simply to comply with this scheduled inspection routine.

- 5 **“Patrol/Inspection”**: Visual Inspection of major distribution system components to identify problems and hazard such as leaning poles, damaged equipment enclosures, and vandalism. This will include an inspection of all related peripheral equipment, hardware, connections, all supports and attachments (e. g cross arms, braces, guys and anchors). This would also include an assessment of vegetation encroachment on right-of-ways.

The patrol may highlight that a problem exists or may identify conditions that warrant a more thorough or rigorous inspection or the need for specific maintenance. The specific follow up or corrective action shall be according to the best judgement of the Distribution Utility considering best industry practices. To further clarify the nature of problems detected during the inspection, the Distribution Utility may choose to utilize diagnostic tools such infrared thermography, ultrasonic testing or other technologies that may emerge. Several technologies are also available for wood pole testing. Distribution Utilities may choose, (as post inspection follow up or ongoing maintenance), to conduct test of major distribution system components on a sample basis. Issues such as the age, equipment design, exposure to adverse conditions, manufacturer specifications, and relative impact on overall system reliability may influence a Distribution Utility’s decisions regarding corrective action and application of these diagnostic technologies following a patrol. In all cases, a Distribution Utility is responsible to ensure that appropriate follow up and corrective is taken regarding problems identified during a patrol. This may entail upgrade or replacement of specific components or equipment.

Maintenance activities and schedules are not specified in the above table and are left to the discretion of the Distribution Utility. It is not practical to attempt to establish a regulatory regime for literally hundreds of maintenance activities that range from insulator washing, cable replacement, CO₂ cleaning of switchgear ,to gas-in-oil testing of station transformers, etc. The absence of more detailed inspection or maintenance criteria in the above table in no way reduces the Distribution Utility’s obligation to maintain the distribution system in a safe and serviceable condition.

The Board or a Board-designated party reserves the right to conduct random audits of inspection reports to ensure that appropriate follow up and corrective action is taken regarding problems identified during a patrol.

- 6.1 **Urban(metropolitan/municipal/industrial area)** means an operational area with a customer population of over five thousand or a demand above fifteen megawatts and by definition the overhead and underground facilities pose safety and reliability consequences to greater numbers of people.
- 6.2 **District Capital** means the administrative capital of a district.
- 6.3 **Rural** means an operational area with a customer population of under five thousand or a demand below fifteen megawatts and by definition the overhead and underground facilities pose safety and reliability consequences to fewer number of people.

- 7.0 **“Substations”**: means a station within a distribution network where voltage is transformed from one level to another
- 7.1 **“Bulk Supply Points (BSP)”**: means the tie-in between the transmission network and the distribution network
- 7.2 **“Primary Distribution Sub-Station”**: A transformation facility with the primary operating at a sub transmission or distribution voltage (34.5KV) and the secondary operating at lower distribution voltage (11KV). The upstream transformation facility will typically be a Transformer Station. A distribution Station supplies main feeders for wide area distribution.
- 7.3 **Secondary Distribution Station**: A transformation facility with the primary operating at a distribution voltage(11KV) and the secondary operating a lower voltage(0.43KV)
- 7.4 **“Customer-Specific Substation”** A transformation facility supplying a specific industrial/commercial customer.
- 7.5 **“Outdoor Open”** Typically refers to a station surrounded by a locked security fence. Within the station fence bare energized components operating at distribution voltage levels or higher are readily accessible. More frequent inspections are required for public safety considerations and to ensure integrity of the station fence.
- 7.6 **“Outdoor Enclosed”** : Similar to 7.5 above however all bare live components are enclosed in locked metal enclosures. Due to reduced accessibility to energized components less frequent inspections are appropriate.
- 7.7 **“Indoor”**: Typically refers to a station located within a secure building. Access by the public to bare energized components within the station is prevented by the building enclosure. Due to reduced exposure to unauthorized public access less frequent inspections are appropriate.
- 8 **“Conductors and Cables: Underground”**: It is not possible to inspect underground cable directly, however, the system can be checked for exposed cable and or grade changes that may indicate that the cable has been brought too close to the surface. Patrol inspection of cable chambers is not required since a visual inspection will not reveal faults because the failure mechanism for underground cable (e.g. voids, water trees) is not visually detectable.
9. **“Vegetation”**: Refers to encroachment of vegetation upon distribution lines on any right-of-way; either public road allowance or private property. It is intended that vegetation will be inspected as part of the regular patrol of distribution equipment.

**TABLE C-2
Sample annual Inspection Summary Report**

Distributor					
Reviewed	Name:	Position/Title:			
Date:	Signature:				
<u>Description</u>		Percentage of Distribution System Scheduled for Patrol (%)	Percentage of Distribution System Actually Patrolled (%)	Reason Patrol Was not completed	Date Patrol Will be completed
Bulk Supply Point					
Switchgear Cables, termination and lugs Protection and Control Equipment Busbars Circuit Breakers Metering Station service transformer	Urban				

<p>Switchgear</p> <p>Cables, termination and lugs</p> <p>Protection and Control Equipment</p> <p>Busbars</p> <p>Circuit Breakers</p> <p>Metering</p> <p>Station service transformer</p>	<p>District Capital</p>				
<p>Switchgear</p> <p>Cables, termination and lugs</p> <p>Protection and Control Equipment</p> <p>Busbars</p> <p>Circuit Breakers</p> <p>Metering</p> <p>Station service transformer</p>	<p>Rural</p>				
<p>Primary Distribution Substation</p>					

<p>Transformers</p> <p>Switchgear</p> <p>Voltage Regulators and Surge Arrestors</p> <p>Cables, terminations and lugs</p> <p>Protection and Control Equipment</p> <p>Busbars</p> <p>Circuit Breakers</p>	<p>Urban</p>				
<p>Transformers</p> <p>Switchgear</p> <p>Voltage Regulators and Surge Arrestors</p> <p>Cables, terminations and lugs</p> <p>Protection and Control Equipment</p> <p>Busbars</p> <p>Circuit Breakers</p>	<p>District Capital</p>				
<p>Transformers</p> <p>Switchgear</p>	<p>Rural</p>				

Voltage Regulators and Surge Arrestors					
Cables, terminations and lugs					
Protection and Control Equipment					
Busbars					
Circuit Breakers					
Secondary Distribution Substation					
	Urban				
Distribution Transformers					
Distribution Pillars					
Pad Mounted Transformers					
Pole Mounted Transformers					
Packaged Transformer Substation					
Standalone Transformer Substation					
Customer Specific Substation					
	District Capital				
Distribution Transformers					
Distribution Pillars					
Pad Mounted Transformers					

Pole Mounted Transformers Packaged Transformer Substation Standalone Transformer Substation Customer Specific Substation					
Distribution Transformers Distribution Pillars Pad Mounted Transformers Pole Mounted Transformers Packaged Transformer Substation Standalone Transformer Substation Customer Specific Substation	Rural				
Overhead Lines and Associated Equipment					
Conductors, Cables, Termination and Lugs Switchgear (Ring Main Units, Circuit Breakers, etc) Capacitor Banks	Urban				

<p>Voltage Regulators</p> <p>Poles</p> <p>Line</p> <p>Vegetation/Undergrowth</p> <p>Civil</p> <p>Works/Infrastructure/Gantry</p>					
<p>Conductors, Cables, Termination and Lugs</p> <p>Switchgear (Ring Main Units, Circuit Breakers, etc)</p> <p>Capacitor Banks</p> <p>Voltage Regulators</p> <p>Poles</p> <p>Line</p> <p>Vegetation/Undergrowth</p> <p>Civil</p> <p>Works/Infrastructure/Gantry</p>	<p>District Capital</p>				
<p>Conductors, Cables, Termination and Lugs</p> <p>Switchgear (Ring Main Units, Circuit Breakers, etc)</p> <p>Capacitor Banks</p> <p>Voltage Regulators</p> <p>Poles</p> <p>Line</p>	<p>Rural</p>				

Vegetation/Undergrowth					
Civil Works/Infrastructure/Gantry					

Notes to Table C-2

APPENDIX C – MINIMUM INSPECTION REQUIREMENTS

1. This report provides a summary of the patrols scheduled and carried out during the year as well as the target dates for completion of patrols, which were not completed as planned.
2. This format is a sample of report for patrols carried out on a geographical, system characteristic (overhead or underground) basis.
3. Major equipment categories need not be reported separately however, all categories of equipment within the particular area or circuits shall be inspected.
4. Civil infrastructure is intended to be inspected as part of the patrol of the distribution system or in the course of doing normal routine utility work.
5. This report is to be submitted to the Energy Commission on an annual basis.

APPENDIX C – MINIMUM INSPECTION REQUIREMENTS

Notes to table C-3

1. The format of this record is to be determined by the Distribution Utility based on their own system data input forms. This format is a sample for inspections done on a geographical or circuit basis and indicates the information that is expected to be collected.
2. Deficiencies and corrective action for all major equipment classifications for the area or circuit would be recorded.
3. Distribution Utilities are required to retain this information and make it available to the Board upon request.
4. Corrective Action Grade 1 is defined as a condition requiring urgent and immediate response and continued action until the condition is repaired or no longer presents a potential hazard.
5. Corrective Action Grade 2 is defined as a condition requiring timely corrective action to mitigate an existing condition which, at the time of identification, does not present an immediate hazard to the public, Distribution Utility employee, or property.

APPENDIX D: CONTRACTS AND APPLICATIONS FOR CONNECTING A GENERATOR TO THE LOCAL DISTRIBUTION SYSTEM

INFORMATION IN A CONNECTION AGREEMENT WITH A GENERATOR

A Connection Agreement between a Distribution Utility and a generator shall contain terms and conditions relating to connection and access to the Distribution Utility's system. Such terms and conditions include, but are not limited to the following:

1. Requirements for the inspection and testing of equipment.
2. Requirements for maintenance of the equipment,
3. Worker protection and safety considerations and measure to protect the public and the environment.
4. Requirements for protection systems associated with the connection and the need for periodic maintenance and testing.
5. Requirements for reporting any change affecting connected equipment of the configuration of this equipment.
6. Protocols for the provision of load forecast or forecast of information.
7. Terms and conditions for disconnection and reconnection, including as to the responsibility for the payment of costs associated with reconnection.
8. Requirements for coordinating maintenance and operations.
9. Duration and termination conditions.
10. Details of the connection point, including the ownership of the facility.
11. Connection service charges and payment conditions.
12. Requirements for reporting changes affecting access to metering, monitoring and telemetry equipment.
13. Circumstances that would require re-negotiation of the Connection Agreement.
14. Exchange procedures for information requirements.
15. Communication and operating protocols between Distribution Utility and generator for routine day-to-day operating matters and under emergency conditions.
16. Access to connection facilities.
17. Assignment of Controlling Authority.
18. Work Protection.

Micro-Embedded Load Displacement Generator

The Connection Agreement for a micro-embedded load displacement generator would be in the form set out below.

Micro-Embedded Load Displacement Generation Facility Connection Agreement

In consideration of the Local Distribution Company (LDC) agreeing to allow you to connect your 10KW nameplate rated capacity or smaller generation facility to the LDC's distribution system, you hereby agree to the following terms and conditions.

1.0 Eligibility

- 1.1 You agree that your generation connection shall be subject to all applicable laws and bound by the terms and conditions of the LDC's Conditions of Service as amended from time-to-time, which have been filed with the Energy Commission and are available on request.
- 1.2 You agree that the power produced by this generation facility shall be only for your own use.

2.0 Technical Requirements

- 2.1 You represent and warrant that you have installed or will install prior to the connection facility to the LDC's distribution system, an isolation device and agree to allow the LDC's staff access to and operation of this as required for the maintenance and repair of the distribution system.
- 2.2 You agree to perform regular scheduled maintenance to your generation facility as outlined by the manufacturer in order to assure that connection devices, protection systems, and control systems are maintained in good working order and in compliance with all applicable laws.
- 2.3 You agree that during a power outage on the LDC system generation facility will shut down, unless you have installed special transfer and isolating capabilities on your generation facility. You agree to the automatic disconnection of your generation facility from the LDC's distribution system, as per the generator protective relay settings set out in this Agreement, in the event of a power outage on the LDC's distribution system or any abnormal operation of the LDC's distribution system.
- 2.4 You covenant and agreement that the design, installation, maintenance, and operation of your generation facility are conducted in a manner that ensures the safety and security of both the generation facility and the LDC's distribution system.
- 2.5 Due to the LDC's obligation to maintain the safety and reliability of its distribution system, you acknowledge and agree that in the event the LDC determines that your generation facility (i) causes damage to: and/or (ii) is producing adverse effects affecting other distribution system customers or the LDC's assets, you will discount your generation facility immediately from the distribution system upon direction from the LDC and correct the problem at your own expense prior to reconnection.

3.0 **Liabilities**

- 3.1 You and the LDC will indemnify and save each other harmless for all damages and/or adverse effects resulting from either party's negligence or wilful misconduct in the connection and operation of your generation facility or the LDC's distribution system.
- 3.2 The LDC and you shall not be liable to each other under any circumstances whatsoever for any loss of profits or revenues, business interruptions losses, loss of contract or loss of goodwill, or for any indirect, consequential, incidental or special damages, including but not limited to punitive or exemplary damages, whether any of the said liability, loss or arise in contract, tort or otherwise.

4.0 **Compensation and Billing**

- 4.1 Subject to any applicable law, you agree that the LDC will not pay you for any excess generation that results in a net delivery of energy to the LDC between meter reads.
- 4.2 Subject to any applicable law, you acknowledge and agree that there will be no carryover of excess generation from one billing period to the next unless you are, at the relevant time, a net-metered generator.

5.0 **Termination**

- 5.1 You understand that you have the right to terminate this Agreement at any time, and that by doing so you are required to disconnect your generation facility and notify the LDC of such action.

6.0 **Assignment**

- 6.1 You may assign your rights and obligations under this Agreement with the consent of the LDC, which shall not withhold its consent unreasonably. The LDC shall have the right and obligations under this Agreement without your consent.

I understand, accept and agree to comply with and be bound by the above terms and conditions governing the connection of my generation facility to the LDC's distribution system.

Signature: _____ Date: _____

Print name and LDC account number: _____

I confirm that the following information is true and accurate:

Nameplate rating of Generator: _____ KW Total installed generation _____ KW

Type: *Wind Turbine* *Photovoltaic (Solar)* *Hydraulic Turbine* *Fuel Cell*
Other _____

Inverter Utilized: *Yes* *No*
Inverter Certification: *C22.2#107.1* *UL 1741 Site Certified by the ESA*

For office use: Station _____ *Feeder* _____ *Date Connected* _____

Generator Protective Relay Settings

Table 1- Inverter Based Generator
 The following relay setting shall be used for inverters built to the CSA standard:
Source: CSA C22.2 No. 107.1-01 Table 16

System Voltage $V_n = V_{normal}$ V(Volts)	Frequency F(Hertz)	Maximum number of cycles to disconnect	
		Seconds	Cycle
$V < 0.5 V_n$	50	0.1	5
$0.5 V_{n_s} \leq V < 0.88 V_n$	50	2	100
$1.11 V_{n_s} \leq V < 1.37 V_n$	50	2	100
$V > 1.37 V_n$	50	0.033	2
V_n	$F < 49.8$	0.1	5
V_n	$F < 50.2$	0.1	5

- The UL1741 & IEEE P1547 Standards use $F < \text{rated} \cdot 0.7$ i.e 59.3 Hz. To update if CSA C22.2 No. 107.1-01 is changed

Table 2 – Non – Inverter Generation

LDC's minimum requirements, for other generation are as follows:

System Voltage $V_n = V_{\text{normal}}$ V(Volts)	Frequency F(Hertz)	Minimum Clearing time*	
		Seconds	Cycle
$V < 0.5 V_n$	50	0.16	8
$0.5 V_n \leq V < 0.88 V_n$	50	2	100
$1.10 V_n \leq V < 1.20 V_n$	50	1	50
$V > 1.20 V_n$	50	0.16	8
V_n	$F < 59.3$	0.16	8
V_n	$F < 60.5$	0.16	8

*Clearing time is the time between the start of the abnormal condition and the generation ceasing to energize the LDC's distribution system.

- If you are uncertain about your generation equipment's protective relay settings, please check with your generating equipment supplier.
- Automatic reconnect setting time for your generator is after 5 minutes of normal voltage and frequency on the LDC's distribution system.

OTHER POTENTIAL CONTRACTS

Contact Name	Parties	Purpose
Construction Agreement	Distributor, Generator	Describe obligations of the distributor and generator to complete connection, including terms of cost recovery.
Construction Agreement	Distributor Transmitter	In the event a transmission system requires modifications to connect the generator, this document describes the obligations of distributor and transmitter to complete the connection, including terms of cost recovery.
Conditions of Service	Distributor Transmitter	In the event the generator is a load customer of distributor, this document describes terms and applicable rates.
Connection Agreement	Distributor Generator	Identifies language and procedures to be used for normal and emergency situations, installed protection equipment, ownership and operating control of equipment, expected levels of maintenance and testing by both parties, contact names and telephone numbers, definitions, and containing all necessary schematic diagrams for proper communication between the distributor and the generator.
Additional Operations ¹ Agreement (if required)	Distributor, Transmitter	

¹ Additional Operations Agreement(s) or Construction Agreement(s) may be required where other parties are affected by generation connection, e.g: embedded Distribution Utilities.

APPENDIX E: PROCESS AND TECHNICAL REQUIREMENTS FOR CONNECTING EMBEDDED GENERATION FACILITIES

E.1 CONNECTION PROCESS

INTRODUCTION

This Code provides for the standardization of connection processes, size categories and time frames for connecting embedded load displacement generation facilities to the distribution network. These categories are described below.

Generator Classification	Rating
Micro	≤ 10 kW, for customer's own use
Small	(a) ≤ 500 kW connected on distribution network voltage < 15 kV, (b) ≤ 1 MW connected on distribution network voltage ≥ 15 kV.
Mid-sized	(a) >500 kW connected on distribution network voltage < 15 kV, (b) > 1 MW < 10 MW connected on distributions system voltage > 15 kV.
Large	> 10 MW

E. 1.1 CONNECTION PROCESS FOR MICRO-EMBEDDED LOAD DISPLACEMENT GENERATION FACILITY

Micro-Embedded Load Displacement Generation Facility Connection Process

10 kW or less - Load Displacement or Emergency Back-up Generation

Step 1. – Request for Information

Customer proposing the installation of a micro-embedded load displacement generation facility contacts the Distribution Utility or Local Distribution Company.

Step 2. – Provision of Information

The Distribution Utility makes the information available to the proponent in a timely manner. Information package includes:

- Description of the connection process (basis is in The National Electricity Distribution Code – this incorporates the Distribution Utility’s specifics; contact numbers etc. and reiterates/stresses the need for Distribution Utility authorisation to connect);
- Approvals needed by the Distribution Utility for connection;
- Technical requirements including metering;
- Contractual requirements (Micro- Embedded Load Displacement Connection Agreement); and
- Application forms

Distribution Utility provided information on Electricity Safety Requirements

Step 3. – Generator Develops Plan

Generator reviews relevant information from Distribution Utility, on project, and puts together installation plan:

- Size/type of generation facility;
- Load displacement/net metering/isolated from distribution network; and
- Project plan – who needs to be included/when.

Step 4. – Application Process

Generator submits application to the Distribution Utility. Information required includes:

- The name-plate rated capacity of each unit of the proposed generation facility and the total name-plate rated capacity of the proposed generation facility at the connection point;
- The fuel type of the proposed generation facility;
- The type of technology to be used; and
- The location of the proposed generation facility including address and account number with the Distribution Utility where available.

Step 5. - Distribution Utility Electrical Inspection Application

Note: runs in parallel with Step 6.

- Generator to submit plans and specific information to Distribution Utility for inspection.

Step 6. – Distribution Utility Review Application

For generator at existing customer connection:

- Distribution Utility must respond to the generator's application and make an offer to connect approved generation or refusal to connect with reasons within 15 calendar days;
- Typical requirement is new meter only;
- Check for service upgrade requirement;
- Check for significant amount of other generation on feeder;
- Inform generator of requirements specified to the connection (typically requirements for metering) and costs, timing to implement, etc; and
- Offer to connect good for 30 days – generator to indicate intent within this timeframe

Steps 7 &8 Decision to Proceed and Install

If generator decides to proceed the generator will:

- Commit to paying the Distribution Utility for upgrades (metering);
- Begin to install;
- The generator must work closely with the Distribution Utility, and any other organization from which work, inspections, approvals or licenses are required to prevent delays;

- Activities will planned in coordination with project milestones and it is up to the generator to initiate actions at the required times; and
- Generator applies for Electrical Inspection.

Steps 9 & 10

The generator will contact the Distribution Utility after completing the inspection process to receive an Authorisation to Connect.

- The Distribution Utility will respond within 5 days to change the meter (if necessary).
- The Distribution Utility will check to ensure generator commitments have been satisfied

These include

- Distribution Utility Authorisation to Connect; and
- Signed Agreement

E.1.2 CONNECTION OF SMALL EMBEDDED GENERATION FACILITIES

Small Embedded Generation Facility Connection Process

Up to 500 kW Connected to < 15 kV

Up to 1 MW Connected to \geq 15 kV

Small embedded Generation Facilities have been split into two categories (a) and (b).

The process followed for connection of both (a) and (b) is identical, only the timelines will differ.

- Small (a) – No distribution network reinforcement or expansion required to facilitate generator connection.
- Small (b) – Distribution network reinforcement or expansion is required to facilitate connection

Step 1. – Initial Contact

Customer proposing the installation of a generation facility contacts the Distribution Utility .

Step 2. – Provision of Information

The Distribution Utility makes the information available to the proponent in a timely manner. Information includes:

- Description of the connection process (basis in the National Electricity Distribution Code – this incorporates the Distribution Utility’s specifics; timing, contact numbers etc. and reinstates/stresses the need for the Distribution Utility authorization to connect);
- Approvals needed by the Distribution Utility for connection;
- Technical requirements including metering
- Contractual requirements (Connection Agreement);
- Application forms
- Generator is informed of potential need to contact the Commission; and
- Notification of the potential involvement of the Transmission Utility

The Distribution Utility provides information on Electrical Safety Requirements and their Plan Approval process.

Step 3. – Generator Develops Plan

Generator reviews relevant information from Distribution Utility on technologies, and puts together an installation plan;

- Size/type of generation facility;
- Load displacement/net metering /isolated from the distribution network; and
- Project plan – who needs to be included/when

Step 4. – Initial Consultation (No Charge)

Generator requests preliminary meeting and submits basic information. Information required includes:

- The name-plate rated capacity of each unit of the proposed generation facility and the total name-plate rated capacity of the proposed generation facility at the connection point;
- The fuel type of the proposed facility;
- The type of technology to be used; and
- The location of the proposed generation facility including the address and account number with the Distribution Utility where available.

Within 15 days of receipt of basic information and request for meeting, the Distribution Utility meets with the generator to review plans at basic level:

- Location of existing distribution facilities in reference to proposed generation facility;
- Rough estimate on time and costs which could be associated with project; and
- Basic feasibility of project.

Step 5 – Application for Impact Assessment

The generator applies for an impact assessment by the Distribution Utility and makes payment with application. Information required includes:

- Size of generation facility (each unit and total at connection point);
- Type of generation facility;
- Type and details of technology;
- Type of fuel

- Single line diagram
- Location (address, account number); and
- Preliminary generator/consultant design of proposed interface protection.

Generator wants to know:

- Connection feasibility and cost;
- Metering requirements; and
- Distribution Utility requirements

Step 6. Offer to Connect (Impact Assessment and Distribution Utility Approval Process)

The Distribution Utility performs impact assessment of proposed generation facility on the distribution network and customers, including:

- Voltage impacts;
- Current loading;
- Fault currents; and
- Connection feasibility identification of line/equipment upgrades required, distribution or transmission system protection modifications/requirements, metering requirements, detailed cost estimate and offer to connect.

Timing

Time to review and inform receipt of payment and application:

- Small (a) – up to 60 days; and
- Small (b) – up to 90.

Steps 7 & 8 Decision to Proceed and Install

If the generator decides to revise the original plans based on result of impact assessment, the plans must be re-submitted for another review by going back to step 5. Any change in design, equipment or plans requires notification to the Distribution Utility.

If the generator feels that the offer to connect is not fair and reasonable, the generator should request Distribution Utility review using the dispute resolution process as defined in the Distribution Utility's Conditions of Service.

If the generator decides to proceed:

- Both parties sign Connection Agreement;

- Generator commits to payments;
- Both parties commit to schedules, information exchange, scope of work of the generator and Distribution Utility;
- Distribution Utility initiates the work to be done to facilitate the connection;
- Generator initiates the required activities; and
- Generator must work closely with the Distribution Utility and any other organizations from which work, inspections, approvals or licences are required to prevent delays.

Steps 9 & 10 Implementation

Both parties commit to obtain required approvals:

- Generator prepares detailed engineering drawings;
- Generator submits all detailed plans to the Distribution Utility for Plan Approval process (includes detailed single line programme, interfaces protection); and
- Submits information to Distribution Utility for design review (includes detailed single line diagram, interface protection and metering details). It is recommended that generators provide this information to the Distribution Utility within 30 days of signing to allow for timely design review.

The Distribution Utility performs design review to ensure detailed engineering is acceptable and informs generator:

- Interface protection design review
- Distribution Utility reviews detailed single line diagram and interface protection to ensure acceptability; and
- Recommendation that this review be completed before equipment purchase by generator.

Generator receives interface protection design review from the Distribution Utility:

- Generator tenders and awards contracts for equipment
- Build – including Distribution Utility and other approvals;
- Connect work; and
- Line/equipment upgrades are completed.

Generator constructs facility and applies for Distribution Utility Electrical Inspection to receive Authorisation to Connect.

Step 11 Authorisation to Connect

The generator arranges for and receives Authorisation to Connect from the Distribution Utility.

Step 12 Connection Agreement

The generator and the Distribution Utility agree to, and sign Connection Agreement.

Note: A temporary connection agreement for the purpose of connection for Commissioning and Verification may be signed at this point while negotiating final Connection Agreement.

Step 13 & 14 Commissioning & Verification

Generation facility commissioning and testing

- Generator arranges for commissioning and testing of the generation facility; and
- Distribution Utility witnesses and verifies the commissioning process.

Timing

Time for completion of step 9 to final connection:

- Small (a) – up to 60 days; and
- Small (b) – up to 180 days.

Step 15 Completion

Process Complete –generation facility fully connected and operational.

E.1.3 CONNECTION OF MID-SIZED EMBEDDED GENERATION FACILITY

Mid-sized Embedded Generation Facility Connection Process

Greater than 500 kW Connected to < 15 kV

Greater than 1 MW and Less than 10 MW Connected to \geq 15 k V

Step 1. – Initial Contact

Customer proposing the installation of a generation facility contacts the Distribution Utility for information. The Distribution Utility may also guide the generator to contact the Transmission Utility or additional connection information. Since it is likely that the generator may be planning on selling power to the grid, the generator may also need to contact the OEG regarding licence applications.

Step 2. – Provision of Information

The Distribution Utility to make the information available to the proponent in a timely manner. Information Package includes:

- Description of connection process (basis is in the National Electricity Distribution Code – this incorporates the Distribution Utility’s specifics – contract numbers etc. and reiterates/stresses the need for the Distribution Utility Plan Approval and authorization to connect);
- Approvals needed by the Distribution Utility for connection;
- Technical requirements including metering;
- Contractual requirements (Connection Agreement);
- Application forms;
- Generator is informed of the potential need to contact the Transmission Utility and the Energy Commission.

The Distribution Utility provides information on Electrical Safety Requirements and their Plan Approval process.

Step 3. – Generator Develops Plan

Generator reviews relevant information from Distribution Utility, Transmission Utility, and Energy Commission, and puts together a development plan:

- Size/type of generation facility;
- Load displacement/net metering/isolated from the distribution network; and
- Project plan – who needs to be included/when.

Step 4. – Initial Consultation (No Charge)

Generator requests preliminary meeting and submits basic information. Information required includes:

- The name plate rated capacity of each unit of the proposed generation facility and the total name-plate rated capacity of the proposed generation facility at the connection point;
- Fuel type of the proposed generation facility;
- The type of technology to be used; and
- The location of the proposed generation facility including address and account number with the Distribution Utility where available.

Within 15 days of receipt of basic information and request for meeting, the Distribution Utility meets with the generator to review plans at basic level:

- Location of existing distribution facilities in reference to proposed generation facility;
- Rough estimate on time and costs which could be associated with project; and
- Basic feasibility of project.

Step 5. – Application for Impact Assessment

Generator applies for an impact assessment by the Distribution Utility and makes payment with application. Impact assessment may also be required from Transmission Utility or host distribution network. The Distribution Utility will forward applicable information on behalf of generator.

In addition to the information provided in step 4, the following information is also required:

- A single line of the proposed connection; and
- A preliminary design of proposed interface protection.

Step 6. Impact Assessment

The Distribution Utility performs an impact assessment of proposed generation facility on the distribution network and customers:

- Voltage impacts;
- Current loading;
- Fault currents; and
- Connection feasibility and identification of line/equipment upgrades required, requirements, and an overview of cost implications.

Timing

Time to review and inform form receipt of anticipation:

- Up to 60 days

The Distribution Utility requests and receives an impact assessment of proposed generation facility on Transmission Utility/host distribution network and customers. Transmission Utility/host Distribution Utility will prepare impact assessment as required. The geographic Distribution Utility; and is only responsible for timely delivery of information specific to their distribution network.

Generator wants to know:

- Connection feasibility and cost; and
- Metering requirements

Assumes generator/consultant will design generation facility, including interface protection to achieve the required functionality. The Distribution Utility will review this design within 1 month of signing the Connection Cost Agreement (CCA).

Generator also provides information to the Distribution Utility for inspection to begin Plan Approval process.

Steps 7 & 8 Decision to Proceed and Establish Scope of Project

If the generator decides to revise the original plans based on results of the impact assessment, the generator must re-submit the revised plans for another review by going back to step 5. Any change in design, equipment, or plans requires notification to the Distribution Utility.

If the generator feels that the results of the impact assessment are manageable, the generator will request a meeting to develop a scope so that the Distribution Utility can prepare an estimate and an Offer to Contract.

If the generator decides to proceed:

- Both parties agree to, and sign, scope of project; and
- Generator pays for preparation of estimate by the Distribution Utility, host distribution network and Transmission Utility as required.

Steps 9,10 &11 Prepare Estimate and Present Offer to Connect

The Distribution Utility must notify the Transmission Utility and/or host distribution network (as required) within 10 days of receiving payment and notification that a generator has decided to proceed and an estimate is to be prepared.

The Distribution Utility shall prepare a detailed estimate of the project based on the scope defined in step 8.

The Distribution Utility must prepare their portion of the Offer to Connect within 90 days of receipt of payment from the generator. In any event, the Distribution Utility has up to 30 days from the date of receipt to incorporate the estimate of the Transmission Utility or host distribution network.

If the generator decides to proceed after reviewing the Offer to Connect:

- All parties agree to, and sign, Connection Cost Agreement (CCA);
- Generator agrees to payment schedule for work required by the Distribution Utility and/or Transmission Utility/host distribution network;
- All parties commit to schedules, information exchange, scope of work; and
- Generator must work closely with the Distribution Utility, and any other organizations from which work, inspections, approvals or licences are required to prevent delays

Steps 11, 12, 15 & 14 – Implementation

Timing:

- Time from commitment to proceed to final connection to be negotiated in Connection Cost Agreement;
- Distribution Utility initiates the work to be done to facilitate the connection;
- Generator initiates the activities identified as it's responsibility; and
- Transmission Utility and/or host Distribution Utility initiates the work to be done to facilitate connection.

Both parties committed to project and generator committed to project and generator commits to obtain required approvals:

- Generator prepares detailed engineering drawings;

- Generator submits all detailed plans to the Distribution Utility for Plan Approval process (including detailed single line diagram, interface protection); and
- Generator submits information to Distribution Utility for design review (including detailed single line diagram, interface protection and metering details) (Recommend that generator provide this information to Distribution Utility within 30 days of signing of the Connection Agreement (CCA) so that design review can be done in timely manner)

Distribution Utility performs design review to ensure detailed engineering is acceptable and informs generator:

- Interface protection design review;
- Distribution Utility reviews detailed single line diagram and interface protection to ensure acceptability; and
- Line/equipment upgrades are completed.

Generator receives interface protection design review from Distribution Utility:

- Generator tenders and awards contracts for equipment;
- Build – including the Distribution Utility and other approvals;
- Connection work; and
- Line/equipment upgrades are completed.

Generator constructs facility and applies for the Distribution Utility Electrical Inspection to receive Authorisation to Connect.

Step 15. – Connection Agreement

The generator and the Distribution Utility agree to, and sign, Connection Agreement.

The Distribution Utility and Transmission Utility/host distribution network review existing agreements for required revisions.

Note: A temporary connection agreement for the purpose of connection for commissioning and verification may be signed at this point while negotiating final Connection Agreement.

Step 16. – Commissioning and Verification

Generation facility commissioning and testing:

- Generator arranges for commissioning and testing of the generation facility;
- Distribution Utility witnesses and verifies and verifies the commissioning process; and

- Transmission Utility/host Distribution Utility witness and verify the commissioning process as required.

Step. 17 – Completion

Process Complete – generation facility fully connected and operational.

E.1.4 CONNECTION OF A LARGE EMBEDDED GENERATION FACILITY

Large Embedded Generation Facility Connection Process

Greater than 10 MW

Step 1. – Initial Contact

Customer proposing the installation of a generation facility contacts the Distribution Utility for information. The Distribution Utility may also guide the generator to contact the Transmission Utility additional connection information. Since it is likely that the generator may be planning on selling power to the grid, the generator may also need to contact the Energy Commission regarding licence applications.

Step 2. – Provision of Information

Distribution Utility to make the information available to the proponent in a timely manner. Information Package includes:

- Description of the connection process (basis in the National Electricity Distribution Code – this incorporates the Distribution Utility’s specifics – contact numbers etc. and reiterates/stresses the need for the Distribution Utility authorization to connect);
- Approvals needed by the Distribution Utility for connection;
- Technical requirements including metering;
- Contractual requirements (Connection Agreement);
- Application forms; and
- Informs generator of need to contact Transmission Utility.

The Distribution Utility provides information on Electrical Safety Requirements and their Plan Approval process.

Step 3. - Generator Development Plan

Generator reviews relevant information from Distribution Utility and puts together an installation plan:

- Size/type of generation facility;
- Load displacement/isolated from distribution network/grid connection; and
- Project plan – who needs to be included/when

Step 4. – Initial Consultation (No Charge)

Generator requests preliminary meeting and submits basic information. Information includes:

- The name-plate rated capacity of each unit of the proposed generation facility and the total name-plate rated capacity of the proposed generation facility at the connection point;
- The fuel type of the proposed generation facility;
- The type of technology to be used; and
- The location of the proposed generation facility including address and account number with the Distribution Utility where available.

Within 15 days of receipt of basic information and request for meeting, the Distribution Utility meets with the generator to review plans at basic level:

- Location of existing distribution facilities in reference to proposed generation facility;
- Rough estimate on time and costs which could be associated with project; and
- Basic feasibility of project.

Step 5. - Application for Impact Assessment

Generator applies for an impact assessment from the Distribution Utility and makes payment with application. Impact assessment may also be required from Transmission Utility and/or host distribution network. Projects greater than 10 MW will also require a System Impact Assessment. The Distribution Utility will collect payment from generator and forward both payments and application information on behalf of generator to Transmission Utility and host distribution network.

In addition to the information provided in step 4, the following information is also required:

- Single line diagram of the proposed connection; and
- A preliminary design of the proposed interface protection.

Step 6. – Impact Assessment

The Distribution Utility performs an impact assessment of proposed generation on the distribution network and customers:

- Voltage impacts;
- Current loading;
- Fault currents; and

- Connection feasibility and identification of line/equipment upgrades required, distribution or transmission system protection modifications, etc.

Timing

Time to review and inform from receipt of application:

- Up to 90 days.

The Distribution Utility requests and receives an impact assessment of proposed generation on Transmission Utility, host distribution network, and customers. Transmission Utility/host Distribution Utility will prepare impact assessment as required. The geographic Distribution Utility is only responsible for timely delivery of information specific to their distribution network.

Generator wants to know:

- Connection feasibility and cost;
- Metering requirements; and
- Distribution Utility requirements.

Assumes generator/consultant will design generation facility, including interface protection to achieve the required functionality. Distribution Utility will review this design within one month of Connection Cost Agreement (CCA) signing.

Steps 7 & 8 Decision to Proceed and Establish Scope of Project

If the generator decides to revise the original plans based on results of impact assessment, the generator must re-submit the revised plans for another review by going back to step 5. Any change in design, equipment, or plans requires notification to the Distribution Utility.

If the generator feels that the results of the impact assessment are manageable, the generator will request a meeting to develop a scope so that the Distribution Utility can prepare an estimate and an Offer to Connect.

If the generator decides to proceed:

- Both parties agree to, and sign, scope of project; and
- Generator pays for preparation of estimate by the Distribution Utility, host Distribution Utility and Transmission Utility as required.

Steps 9, 10, 11 Prepare Estimate and Present Offer to Connect

The Distribution Utility must notify the Transmission Utility and/or host distribution network (as required) within 10 days of receiving payment that the generator has decided to proceed and an estimate is to be prepared.

The Distribution Utility shall prepare a detailed estimate of the project based on the scoped defined in step 8.

The Distribution Utility must prepare their portion of the Offer to Connect within 90 days of the receipt of payment from generator, In any event, the Distribution Utility has up to 30 days from date of receipt to incorporate the estimate of the Transmission Utility or the host Distribution Utility.

If the generator decides to proceed after reviewing the Offer to Connect:

- All parties agree to and sign, Connection Cost Agreement (CCA);
- Generator agrees to payment schedule for work required by Distribution Utility and/or Transmission Utility/host
- Distribution system;
- All parties commit to schedules, information exchange, scope of work; and
- The generator must work closely with the Distribution Utility and any other organizations from which work, inspections, approvals or licences are required to prevent delays

Steps 12, 13, 14 – Implementation

Timing

- Time commitment to proceed to final connection to be negotiated in Connection Cost Agreement;
- Distribution Utility indicates the work to be done to facilitate the connection;
- Generator initiates the activities identified as its' responsibility; and
- Transmission Utility/host and Distribution Utility initiates the work to be done to facilitate connection

Both parties committed to project and generator commits to obtain required approvals:

- Generator prepares detailed engineering drawings;
- Generator submits all detailed plans to the Distribution Utility for Plan Approval process (including detailed single line diagram, interface protection); and
- Generator submits information to Distribution Utility for design review (including detailed single line diagram, interface protection and metering details) (Recommend that generator provide this information to the Distribution Utility within 30 days of signing the Connection Cost Agreement (CCA) so that design review can be done in a timely manner).

Distribution Utility performs design review to ensure detailed engineering acceptable and informs generator:

- Interface protection design review;
- Distribution Utility reviews detailed single line diagram and interface protection to ensure acceptability; and
- Recommend that this review be complete before equipment purchase.

Generator receives interface protection design review from Distribution Utility:

- Generator tenders and awards contracts for equipment;
- Build – including the Distribution Utility and other approvals;
- Connection work; and
- Line/equipment upgrades are completed.

Generator constructs facility and applies for the Distribution Utility Electrical Inspections to receive Authorisation to Connect.

Step 15 – Connection Agreement

The generator and Distribution Utility agree to, and sign, Connection Agreement.

The Distribution Utility and Transmission Utility/host Distribution Utility review existing agreements for required revisions.

Note: A temporary connection agreement for the purpose of connection for commissioning verification may be signed at this point while negotiating final Connection Agreement.

Step 16 Commissioning and Verification

Generation facility commissioning testing:

- Generator arranges for commissioning and testing of the facility;
- Distribution Utility witnesses and verifies the commissioning process; and
- Transmission Utility/host and Distribution Utility witness and verify the commissioning process as required.

Step 17 Completion

Process Complete – generation facility fully connected and operational.

E.2 TECHNICAL REQUIREMENTS

LIST OF ACRONYMS

CSA Canadian Standards Association

IEC International Electrical Code

IEEE Institute of Electrical and Electronic Engineers

OESC Ontario Electrical Safety Code

Technical Requirements for Generator Connection

Point of Connection

The point of connection (also may be referred to as point of common coupling) will be identified in the design and on the single line diagram. The Distribution Utility will coordinate design, construction, maintenance and operation of the facilities on its side of the point of connection. The applicant is responsible for the design, construction, maintenance and operation of the facilities on its side of the point of connection unless described otherwise in an interconnection agreement.

Note: On the generator's side of point of connection, the equipment shall be approved in accordance with rule 2-004 of the Ontario Electrical Safety Code (OESC).

1. Isolation at the Point of Isolation

A means of isolation must be provided by the generator and must be in compliance with the OESC. The Distribution Utility's practice may require its own additional means of disconnection on the Distribution Utility's side of the point of connection.

2. Interconnecting Grounding

Generation facilities and the associated interconnection systems must be grounded as per manufacturer's recommendations and the OESC, as well as taking into account the normal practices of the Distribution Utility.

Interconnection of three phase transformers, and transformer grounding systems on three phase distribution networks shall be co-coordinated with the Distribution Utility and shall not cause voltage disturbances or disrupt co-ordination of distribution network ground fault protection.

3. Voltage Regulation, IEEE 1547, CSA Standard CAN3-C235-83

CSA Standard CAN3-C235-83 provides general guidelines as to appropriate distribution

system steady state service voltage levels. The generation facility must operate satisfactorily within the extreme voltage level variation limits shown in these standards. Voltage regulation is the responsibility of the Distribution Utility.

3.1 Steady-State Voltage , CSA Standard CAN 3-C235

Customers connected to the feeder must be supplied with adequate voltage levels, as per CSA Standards CAN3-C235 for the following situations: with and without the generation facility generating power for minimum and maximum feeder loading conditions.

3.2 Voltage Fluctuation, CSA CAN 3-325-83, Requirements for Facilities of 10 MW and Larger

Adequate voltage regulation shall be maintained under a variety of operating conditions. During normal operation, and whenever possible, the generation facility shall be loaded and unloaded gradually to allow adequate time for regulating devices to respond.

3.3 Synchronization, IEEE 1547 Requirements for Facilities of 10 MW and Larger

The generator shall parallel with the distribution network without causing a voltage fluctuation of flicker greater than those specified by the above standards at the point of connection.

Note: OESC rule 84-006 covers the synchronization of parallel generators.

3.4 Voltage Unbalance

Where the distribution network supplies single-phase loads, some unbalances are inevitable. The generation facility should be capable of operating under these conditions and shall not cause further deterioration of existing unbalance conditions.

4. Power Factor, IEEE 1547, CSA C107.1

The generator's system is not required to be capable of adjusting the power factor but shall operate in the preferred range of 0.9 lag to 0.95 lead. If the generation facility disturbs the distribution network voltage levels at the point of connection then the generator may be required to operate its facility within a smaller range or take other compensatory measures. Field settable fixed and dynamic power factor correction techniques may be used if consultation with the Distribution Utility reveals no adverse effect on the distribution network. For generators that are inactive, the reactive power compensation at the generating units should be sufficient so as not to cause any material increase in the reactive power requirements at the transmission system transformer station due to operation of the nits, at any distribution feeder load conditions.

For inverter based generator facilities power factor limits will be as given in the MicroPower Connect guidelines.

5. Equipment Ratings and Requirement

The generation facility interface equipment must be compatible with LDC equipment ratings at the connection voltage (maximum voltage, basic impulse limit, short circuit ratings, capacity, etc) and the incorporation of the added generation facility must not result in any distribution network equipment operating beyond the distribution network operational rating. A Distribution Utility shall review the equipment ratings for the purpose of assessing integration of the generation facility with the distribution

network. The equipment ratings that shall be reviewed include but not limited to the following:

5.1 Equipment Thermal Loading

All existing Distribution Utility's equipment in distribution and transmission stations shall not be overloaded beyond acceptable limits under all operating conditions of the generation facility. This equipment includes feeder conductor, line voltage regulators, regulating stations, reclosers, circuit breakers and transformers.

Assuming that under existing operating conditions there is no overloaded equipment, the study will be conducted for minimum load conditions and maximum generation including all existing generation facilities already existing on the feeder. The load flow study will identify the potential overload of the existing equipment.

5.2 Impact of Generation facility Fault Contribution on Equipment Rating

The generation facility will contribute to the total fault current. The distribution network's interrupting devices shall be able to interrupt the maximum fault current that will flow through the devices. All the distribution network's electrical equipment has to be able to withstand the fault current passing through it for the required time for the protection to clear the fault.

The fault interrupting rating of the existing interrupting devices and the fault withstanding rating of the electrical equipment shall be higher than the maximum fault current possible to flow through the equipment.

Where the generator causes these limits to be exceeded, distribution network equipment replacement or fault current limiting devices may be required.

5.3 Voltage Regulating and Metering Devices

The Distribution Utility's system has been designed for unidirectional flow of power from source (i.e. station) to the customer. Therefore the voltage regulating and metering devices are designed to correctly operate in these conditions. The connection of generating facilities to the distribution feeder could cause the power flow to be reversed through the power equipment, which will create difficulties to properly regulate the voltage or to measure the energy, respectively.

Where it is possible for power to flow in reverse through the existing voltage regulating devices and/or the metering points, the regulating devices and metering devices shall be suitable for such bi-directional flow.

The study will be conducted for minimum load and maximum generation condition. The direction of the power flow through voltage regulating devices connected between the generation facility and the transformer station will be verified including line voltage regulators, regulating stations and transformers' under load tap changer, at the distribution station and transformer station. Also all metering devices, either for billing purpose or monitoring reasons will be verified.

6. Cease to Energize

The Distribution Utility will review the generator's design to ensure that the facility will cease to energize automatically from the distribution network's supply under the conditions identified in this section.

Important considerations in this design review:

As per IEEE 1547

To maintain the reliability of the distribution network, the Distribution Utility may use automatic re-closing. The applicant needs to be aware of line re-closing when designing the system protection schemes to ensure that it de-energizes the distribution network prior to automatic re-close of the distribution network's breakers or line reclosers. The Distribution Utility must

review to ensure that the generator's design will de-energize the generation facility prior to auto-reclose operation of feeder tripping devices

As per IEEE 1547 and OESC 84-008 (b)

After a disturbance on the distribution network, no reconnection shall take place until the distribution network voltages and frequency are within the limits specified in SCA CAN3-C235 standard.

The generator's interconnection system shall include an adjustable delay (or a fixed delay of 5 minutes) that may delay reconnection for up to 5 minutes after the distribution network's steady state voltage and frequency are restored to the ranges identified above.

6.1 Loss of LDC Supply Resulting in the Formation of an Island, IEEE 1547 CSA C22.2 N0. 107.1, OESC 84-008 (loss of Supply Authority Voltage)

6.1.2 Unplanned Islanding

The applicants system shall cease to energize the distribution network following the formation of an unintentional island.

6.1.3 Planned islanding

Where planned islanding is allowed, the generator and the Distribution Utility will jointly agree to all requirements.

6.2 Over-Current Protection Coordination Due to Generation Facilities Fault Contribution IEEE 1547 and OESC 84-014 (System Protection Devices)

Any element of the interconnection system external to the generation facility, but ahead of the point of connection, should be installed in a fail-safe manner with self-checking features or redundant protection functions for large generators.

Equipment and conductors shall be provided with over-current protection from each source of supply. The generation facilities protection system shall be capable of automatically isolating the generator from the distribution network for the following:

- Internal faults within the facility; and/or
- External faults within the distribution network.

The protective device selectivity and sensitivity have to be maintained over the range of minimum to maximum fault currents with infeed from the generator.

Where the primary connection of the generation facility transformer is Wye-(Y) grounded, the sensitivity of the ground fault protections could become deficient, as zero sequence current will have an additional ground path through the transformer to the distribution network. The ground fault occurring within the protected zone has to be seen by the ground fault protections with and without transformer connected.

6.5 System Voltage Changes Beyond the Over or Under Voltage Range, IEEE 1547

Over and under voltage and over and under frequency protection is required at the generation facilities interconnection point.

The set points and clearing times for over or under voltages and over or under frequencies are dependent upon the magnitude of voltage and frequency variations and generator size. For details see relevant clause of IEEE 1547. Generator equipment should be approved to CSA 107.1 or other acceptable standard.

Note: OESC rule 84-014 states that each parallel power generation facility installation shall be provided with such additional devices that are required for system stability and equipment protection.

7 Revenue Metering

Revenue Metering shall be in accordance with *Canada's Electricity and Gas Inspection Act, R.S. 1985, C.E-4*

8. Feeder Relay Directioning

The existing over-current protections in the distribution network are typically designed to clear line and ground faults occurring downstream from their location, as the source feeding the fault is only the transformer station. Connecting a generation facility provides another source supplying the fault, and the fault contribution from the facility might cause protection to operate non-selectively for reverse faults, out of the protected zone.

If the maximum reverse fault current through a non-directional fault-interrupting device exceeds the setting of the device, the fault-interrupting device shall be provided with a directional feature to prevent tripping for reverse fault current flow. The phase protection could be replaced with an impedance relay (21) if required.

The main concern is the infeed from the generation facility with Wye-(Y) grounded connection on the HV of the interface transformer for faults on the adjacent feeders. The generator may consider adding a reactor <5 ohm in the neutral of the generator's transformer, within the constraints of the over-voltages.

9. Monitoring, IEEE 1547, OESC & Transmission Utility Requirements for Facilities of 10 MW and Higher

A generation facility connected to the point of connection, rated at greater than 250 kVA, shall have provision for monitoring connection status, real power output, reactive power output, and voltage either at the point of connection or aggregate connection, as required by the Distribution Utility. The monitoring equipment shall either be installed, or there shall be adequate provision in the design, to allow future installation of such equipment if not required at the time of interconnection. When the implementation of data telemetry is required, the Distribution Utility and the generator will mutually agree upon communication media options.

Note: At the generator's side of the point of connection, the equipment shall be approved as per rule 2-022 of the OESC. The installation shall be inspected as per rule 2-004 of the OESC.

10. Power Quality

The generator shall not significantly impact the power quality of the system. If there are negative impacts once the generation facility is in service, they will be required to disconnect until appropriate measures have been taken to prevent negative impacts to the distribution network and the customers it serves.

10.1 Flicker, IEEE 1547, IEC 61000-3-7

The generation facility not cause objectionable flicker on the distribution network. It is recognised that flicker is a site dependent condition. Loss of synchronism protection may be required to be incorporated by the generator, if necessary, to limit flicker.

10.2 Harmonics, IEEE 1547, IEC 61000-3-6

Inverter connected generation facilities are expected to comply with CSA 22.2 No 107.1 current distortion limits.

For inverters only capable of operating in voltage follower mode, voltage harmonic distortion limits are not specified, but may be addressed by the Distribution Utility. Inverters certified to CSA 107.1 are considered to meet these requirements. The CSA standard excludes current harmonics due to voltage distortions in the distribution network.

10.3 Limits of DC Injection, IEEE 1547

The generation facility shall not inject a d.c. current greater than 0.5% of the unit rated output current after a period of six cycles following energizing of the distribution network.

10.4 Protection from Electromagnetic Interference (EMI), IEEE 1547, C37.90

The influence of EMI should not interfere with operation of the generation facility's interconnection system.

10.5 Surge Withstand Performance, IEEE 1547, C62.42.2 or C37.9.90, OESC 84-014

The interconnection system shall have the capability to withstand voltage and current surges

10.6 Paralleling Device, IEEE 1547

The interconnection system paralleling-device shall be capable of withstanding 220% of the interconnection system rated voltage.

APPENDIX F: PROCESS FOR CONNECTING ANOTHER DISTRIBUTION UTILITY

EXAMPLE OF A PROCESS

FOR CONNECTIONS BETWEEN DISTRIBUTION UTILITIES

Step 1 – Connection Request

- An embedded Distribution Utility submits its request to the host Distribution Utility, summarizing in writing the required initial and ultimate load requirements, the required in-service date and any other specific requirements.
- The host Distribution Utility carries out a preliminary review and determines the scope and estimated cost of preparing a System Impact Study.
- The host Distribution Utility responds in writing within 30 days of receiving the Embedded Distribution Utility's request.

Step 2 - System Impact Study

- Upon receipt of a purchase order or equivalent from the embedded Distribution Utility, the host Distribution Utility, in cooperation of the applicant, studies in detail all options and recommends the preferred option. The results of the study are documented in a system impact study report. This report provides the embedded Distribution Utility with preliminary information regarding the work required to provide the requested supply, the required capital contribution and the expected lead-time.
- The host Distribution Utility completes the system impact study within 60 days of receiving the embedded Distribution Utility's purchase order to proceed. If, despite the host Distribution Utility's best efforts, the 60 day target cannot be met, the host Distribution Utility notifies the embedded Distribution Utility in writing and provides a new target completion date.

Step 3 – Connection Application

- The embedded Distribution Utility reviews the system impact study report and decides whether or not to proceed.
- To proceed, the embedded Distribution Utility submits a connection application, provides all necessary Registered Planning Information and issues a purchase order or equivalent for preparation of detailed engineering specifications.
- The embedded Distribution Utility submits a connection application to the host Distribution Utility within 30 days of receiving the system impact study report.

Step 4 – Engineering Specifications and Cost Sharing Arrangements

- Upon receipt of a purchase order or equivalent from the embedded Distribution Utility, the host Distribution Utility prepares detailed engineering specifications for required system enhancements, obtains cost estimates for the specified work and determines cost sharing arrangements.
- The host Distribution Utility provides, in writing, a project description and letter of intent that includes:
 - A description of the proposed project;
 - A summary of work to be performed by the host Distribution Utility;
 - A summary of work to be performed by the embedded Distribution Utility;
 - The host Distribution Utility’s capital investment in the project; and
 - The embedded Distribution Utility’s financial contribution to the project.
- The host Distribution Utility provides the required project description and letter of intent within 90 days of receiving the connection application from the embedded Distribution Utility.

Step 5 – Formal Approval and Agreement

- Upon receipt of a signed Letter of Intent from the embedded Distribution Utility, the host Distribution Utility seeks formal approval from its Executive and from the Ontario Energy Board (if necessary).
- The host Distribution Utility prepares a Connection Agreement that outlines the obligations of the host Distribution Utility and the embedded Distribution Utility. This Agreement will serve as a legally binding and enforceable agreement between the two parties.
- The host Distribution Utility obtains required approvals and drafts a Connection Agreement within 60 days (90 days if Regulatory approval is required) of receiving the signed Letter of Intent from the embedded Distribution Utility.

Step 6 – Construction

- Acquisition of any required property or property rights;
- Construction of the host Distribution Utility's new or modified system facilities;
- Modification of up-stream transmission facilities (if necessary);
- Construction of embedded Distribution Utility's approved connection facilities;
- Typical construction lead times include:
 - New or upgraded distribution lines: 6 months
 - Upgraded Distribution Substations: 12 months
 - New Distribution Stations: 18 months for <50kV, 24 months for >50kV;
 - New or upgraded transmission facilities: 24 months.
- If construction lead times differ from above, the host Distribution Utility will inform the embedded Distribution Utility, in writing, of the actual lead time requirements for the specified work.

Step 7 – Connection

- Commissioning and verification that all connection requirements have been met.
- Connection.