Mauritius National Grid Code

System Operation Code

Version December 2022

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SYSTEM OPERATIONS CODE - PART A - INTEGRATED RESOURCE PLANNING

SOC 1 INTEGRATED RESOURCE PLANNING

SOC 1.1 Purpose and Scope

The **Single Buyer** will be responsible for planning the development of the **System**

The **Authority** will provide the **Single Buyer** with policy guidelines from the **Ministry** for the development of the system such as policy objectives regarding the use of primary energy sources for generating electricity, future technologies, etc.

The **Single Buyer** will also develop procedures for development of an **Integrated Resource Plan**, engaging key electricity sector stakeholders in a collaborative process.

The objective of the **Integrated Resource Planning (IRP)** is to define the development (upgrading and expansion) of the Transmission and Distribution Systems as well as the indicative incorporation of new generation resources based on policy guidelines provided by the **Authority**, in order to guarantee the quality and reliability of electricity supply for the nation and the economic players.

The IRP horizon analysis shall be 10 years and the plan shall be updated yearly with the most recent updated information available such as policy guidelines, load forecasts, expected commercial operational date of key ongoing projects, fuel prices, new generation technologies and prices, etc.

In the elaboration of the **IRP** the **Single Buyer** shall specifically considers the location of renewable and other generation sources.

For the purposes of this section, the **Single Buyer** will be responsible for the following:

- Development and yearly update of the **Integrated Resource Planning**,
- the collection of data from electricity sector participants;
- consultations with the **Authority**, the Mauritius Renewable Energy Agency (MARENA) and other electricity sector participants (independent power producers, **Large Users**, etc.); and
- the conduct of any relevant forecast.

The following will be required to provide information and collaborate with the **Single Buyer** in the elaboration of the **IRP**:

a) **Generators** (connected to the 22 kV voltage level and above),
b) **Users** connected (or planning to be connect) to the **Transmission System** or to the **Distribution System,**
c) **the System Operator** Licensee
d) **Transmission Licensee**, and
e) **Distribution Licensee.**

SOC 1.2 Planning Process

SOC 1.2.1 Introduction

The **Single Buyer** and the **System Operator** will carry out the planning of the **System**: long and medium term planning will be the responsibility of the **Single Buyer**; short

term planning (operational planning) will be responsibility of the **System Operator**.

The **Single Buyer** is responsible for the long-term planning, leading the **Integrated Resource Planning (IRP)** process that defines the development of the grid and generation resources based on policy guidelines provided by the **Authority** from the **Ministry**. Other concerned institutions in the development of the electricity sector (such as MARENA, Ministry of Environment, etc.) may be consulted by the **Single Buyer** as needed.

The **System Operator** is responsible for operational planning as prescribed under section SOC 2.

SOC 1.2.2 Long-Term Planning (IRP)

The Long-Term Planning horizon shall be of 10 years. Updates of the long-term plan will be made every year reflecting any new information that may significantly impact the investment programs such as policy guidelines, load forecasts, expected commercial operational date of key ongoing projects, fuel prices, new generation technologies and prices, etc

To ensure that the **Single Buyer** timely receives the information required for its planning duties, and to ensure the quality of such information, the **Single Buyer** shall establish a modern data collection, verification and sharing system with the **Authority**, and **Licensees** required to support the **IRP** long term planning process.

The **Single Buyer** will lead the long-term planning process, establishing the objectives and metrics of the **IRP**, based on policy guidelines provided by the **Authority** from the **Ministry** and communicating those to all stakeholders, informing the public (including the **Authority** and **Licensee**s) of the status and outcome of the planning process.

Load forecasting by **Substation** (or groups thereof) will be the responsibility of the **Distribution Licensee** and the **Single Buyer** considering, among others: projections of economic and population growth, and energy savings projections prepared by **EEMO**. This information will be the aggregated by the **Single Buyer** to include transmission losses to produce a system load forecast

The **Single Buyer** shall develop an interim indicative generation least cost expansion plan based on the load forecasts, status of ongoing key generation projects, status/age of existing generators running as base, semi-base or peaking units, fuel prices/efficiencies/load factors of the generators running as base, semi-base or peaking, share of variable renewable energy, environmental impacts and government policy objectives among others. Based on this interim generation least cost expansion plan, the **Single Buyer**, in coordination with the respective Licensees, will develop the **Transmission** and **Distribution** planning studies according to the planning criteria established in the **Transmission** and **Distribution Codes**. Finally, the **Single Buyer** will confirm or update the interim indicative generation plan and produce the final **Integrated Resource Plan**.

The **Single Buyer** shall calculate the rate impacts of selected scenarios considered in the IRP that will be reviewed by the **Authority**.

It is anticipated that the **Ministry** will be responsible to provide policy guidelines as to the supply technologies modelled within the study, and that feasibility studies needed to determine viable technologies are the responsibility of the **Ministry**. The **Licensees** will approve the integration of any technologies for operational purposes and the **Authority** will review rates impacts.

The **Authority** will review and approve the final IRP and any revisions thereof in consultation with the **Ministry**.

The next table summarizes the anticipated **IRP** inter-agency roles and

responsibilities.

Table 1: Inter-Agency Roles and Responsibilities for Long-Term Planning.

Responsibility	Government Policy	System Operator	Licensees	URA
Policy Guidelines	MEPU develops	Informed	Informed	Informed
Objectives and Metrics	Informed	Develops	Informed	Informed
Energy Efficiency and Demand	EEMO develops	Informed	Informed	Informed
Load Forecast	Projected growth of the economy and population	Informed and provides opinion	Single Buyer, and Distribution Licensee	Informed
Supply Technologies and Feasibility Studies	MEPU	Non-objection for feasibility of connection	Non-objection for feasibility of connection	Informed
Indicative Generation Least Cost Expansion Plan	MEPU: policy on primary energy sources for electricity	Informed and provides opinion	Single Buyer responsible	Informed
Transmission & Distribution Planning Studies	Informed	Informed and provides opinion	Single Buyer responsible for transmission, Distribution licensee responsible for distribution	Informed
Integrated Resource Plan	Informed	Informed	Single Buyer	Review with targets of RE penetration
Information collection and Stakeholder Process	Participant	Develop systems and coordinates	Participant	Participant

SOC 1.2.3 Operational Planning

The **System Operator** is responsible for operational planning in compliance with the requirements of section SOC 2 of the **System Operations Code** and the policy objectives set forth in an approved **Integrated Resource Plan**.

SOC 1.3 Planning Timescales

The IRP process above should operate on an annual cycle. The cycle commences

with the development of the **System** demand forecast in Q4 (year n), then the development of the **Substation Demand** forecast in Q1 (year n+1), and is completed with the production of the **IRP** in Q2 (year n+1).

Table 2: IRP Timescales

Period	Output	Developed by
Year n (end of Q4)	Substation Demand forecast	Single Buyer and Distribution Licensee and Large Users (if applicable)
Year n+1 (end of Q1)	System Demand forecast	Single Buyer
Year n+1 (end of Q1)	Interim indicative Generation Least Cost Expansion Plan	Single Buyer
Year n+1 (end of Q2)	Integrated Resource Plan (generation including RE sources, transmission, distribution)	Single Buyer

Generation Interconnection studies shall be undertaken by the **System Operator** or a third-party consultant pre-approved by the **System Operator** outside the IRP process. New load information from **Large Users** connection requests will be used to inform the demand forecasts. The timescales required to undertake the new **Interconnection** studies necessary to plan the **System** will vary depending on the driver for the studies and the ability to obtain consented routes.

SYSTEM OPERATIONS CODE - PART B - OPERATIONAL PLANNING AND DISPATCH

SOC 2 OPERATIONAL PLANNING

SOC 2.1 Introduction

Part B (Operational Planning and Dispatch) of the **System Operations Code** sets out the roles and responsibilities of the **System Operator, Generators, Transmission Licensee, Distribution Licensee,** and other **Users** connected to the **System**, in the process for the dispatch of generation and demand-side resources.

Fuel cost is one of the most significant components of electricity cost. The efficient use of fuel is imperative to drive electricity prices down. Economic load dispatch is a necessary tool to assist in the minimization of generation cost.

Scheduling the operations of **Generating Units** to produce energy at the lowest cost with minimum impact on the environment to reliably serve customers, considering system security criteria, contractual obligations, operational limits of generation and transmission facilities, the possibility of **Generator** and transmission outages (contingencies) is a major component of operations planning.

The scheduling of the **Generating Units** depends upon the **System** load demand profile, the Least Cost operation of **System**, the availability, parameters and variable operating costs of **Generating Units**, the flexibility of operation of **Generating Units**, environmental impacts constraints on the **Transmission System**, security requirements, and **System** losses.

SOC 2.2 Objective

The **objectives** of Part B the **System Operations Code** are:

a. to set out roles, responsibilities and process for the dispatch of generation and demand-side resources in meeting the electricity demand at least cost subject to operating constraints and system security criteria;
b. to enable the **System Operator** to coordinate generator maintenance outages with **Transmission** and **Distribution System** outages as far as possible in advance to allow the **System Operator** to maintain system security and reliability; and
c. to ensure fair and equitable treatment of all **Generator** operators connected to the **System Operator** grid while minimising impact on the environment.

Part B of the **System Operations Code** sets out the **procedures** for:

a. Elaboration of the demand forecast,
b. Elaboration of the **Generator** and **Transmission System Outage** plan,
c. Notification from **Generators** to the **System Operator** regarding availability and capability of **Generation Units**,
d. Obtaining pertinent Network data from **Users** directly connected to the **Transmission or Distribution Systems** to allow consideration of transmission constraints,
e. Production of a least cost generation schedule with minimum impact on the environment (unit commitment and generation dispatch),
f. Dispatch for Operations (real time dispatch),
g. Safety Coordination,
h. Contingency Planning, including System Restoration Procedures; and
i. Incident Information Reporting.

SOC 2.3 Scope

This Part B of the **System Operations Code** applies to the **System Operator**, and to the following parties:

a. **Generator**s with **Generating Unit (s)** being dispatched by the System Operator,
b. **Transmission Licensee**,
c. **Distribution Licensee**,
d. **Users** connected directly to the **Transmission System**,
e. **Large Users** connected directly to the **Distribution System**, and
f. **Users** who can provide demand reduction in real time.

SOC 2.4 Roles and Responsibilities

SOC 2.4.1 The Authority shall be responsible for monitoring and enforcement of:

a. the application of Part B of the **System Operations Code** by the **System Operator**; and
b. compliance of **Generators, Transmission Licensee, Distribution Licensee** and **Users** to the dispatch (via their licenses).

SOC 2.4.2 The System Operator

a. The **System Operator** shall;
    i. apply Part B of the **System Operations Code**;
    ii. schedule and dispatch all generation resources (including energy storage units within their technical capabilities and designed for dispatching) and demand-side resources to least cost whilst maintaining the prescribed system security criteria and ensuring minimum impact on the environment.
    iii. provide regular reports to the **Authority** as prescribed in the sections of this **Code**;
    iv. maintain data for the auditing of the dispatch function;
    v. disclose to **Generators** upon request the reasons for **Dispatch Instructions**; and
b. monitor and enforce compliance of demand-side resources with Part B of **the System Operations Code** (via their customer agreements).Under operating conditions where available generation capacity and demand side resources are insufficient to meet the demand, the **System Operator** may take actions that may not be in line with Part B of the **System Operations Code** and notify the **Authority** accordingly.
c. Under normal operating conditions any contractual requirements that restrict **Dispatch Instructions** from the **System Operator** shall apply. Under emergency operating conditions the **System Operator** may override these contractual requirements and enforce **Dispatch Instructions** on all **Generator**s, and the **Authority** notified accordingly, provided that the **Generator** is able to comply with **System Operator** instruction within statutory limits**.**

SOC 2.4.3 Generators

A **Generator** shall take into consideration all prevailing constraints, technical and/or economical, prior to submitting information required under this Part B of the **System Operations Code**.

SOC 2.5 Phases for Planning the Operation of the System

The **System Operator** starts planning for the reliable and secure operation of the system several years ahead of the operation's day. This planning is done in several phases covering different time scales, each phase covering increasing level of detail. The following phases are defined:

Table 3: Operational Planning Phase

Phase	Description
Operations Planning 2-3 calendar years ahead. Period may be sub-divided in: • long-term: 2-3 years ahead; • mid-term: 1 year ahead; and • short-term: current year (year 0)	Load Forecasts Generation, Transmission and Distribution Outage Plans, based on current and planned generation forecast.
Programming 1 to 4 weeks ahead	Adjustments to Load Forecast Scheduling of availability and dispatch of Generation and demand-side resources Adjustments to outage plans
Control Day Ahead	Adjustments to Load Forecast Adjustment of availability and dispatch of Generation and demand-side resources Adjustments to outage plans

SOC 3 CONFIDENTIALITY

All information provided to the **System Operator** marked as "**Confidential**" shall be treated in accordance with the corresponding Non-Disclosure Agreements between the parties.

SOC 4 OPERATIONAL PLANNING FOR DISPATCH

The Operations Planning is concerned with:

a. Dispatch data Registration;

b. Demand forecasting;

c. Outage planning and data provision;

d. **Operating Margin**;

e. Merit Order System; and

f. Unit commitment, scheduling and economic dispatch.

SOC 4.1 DISPATCH DATA REGISTRATION (DDR)

SOC 4.1.1 Introduction

The Data Registration sets out a unified listing of all data required by the **System Operator** and **Single Buyer** from **Generator**s and by **Generator**s from the **System Operator** for dispatch.

The Code specifies the procedures and timing for the supply of data, for routine updating and for recording temporary or permanent changes to data.

SOC 4.1.2 Objective

The objective of the DDR is to:

a. List and collate all the data to be provided by each category of **Generator** to

the **System Operator** and **Single Buyer** under this Part B of the **System Operations Code**;

b. List all data to be provided by the **System Operator** and **Single Buyer** to each category of **Generator** under this Part B of the **System Operations Code**.

SOC 4.1.3 Scope

The **Users** to which the DDR applies are the **Generator**s under the terms of the **Generation Code**;

SOC 4.1.4 Data categories and stages in registration

Within the Data Categories and Stages in Registration each item of data is allocated to the four categories.

a. Operational Data as required by this Part B of the **System Operations Code**.
b. Data Required for Demand Forecasting
c. Data required from **Generator**s in accordance with the Merit Order provisions of the Generation Code.
d. Design Data for **Generator** modelling for system simulations

SOC 4.1.5 Responsibility for submission and updating of data

In accordance with the provisions of the various sections of this Part B of the **System Operations Code**, each **Generator** must submit data as summarized, listed and collated in the Schedules described in the **Generation Code** or **Distribution Code.**

The data must be submitted to the **System Operator** and **Single Buyer**. The name of the person at the **Generator** who is submitting each Schedule of data must be included.

The data may be submitted via a computer link if such a data link exists between a **Generator** and the **System Operator** and **Single Buyer** or utilizing a data transfer media, such as USB drive, CD ROM, Cloud technology, etc. after obtaining the prior written consent from the **System Operator** and **Single Buyer**.

SOC 4.1.6 Changes to **Generator**s' data

The **Generator** shall promptly notify the **System Operator** and **Single Buyer** of any change to data which is already submitted and registered with the **System Operator** and **Single Buyer** in accordance with each section of this Part B of the **System Operations Code**.

SOC 4.1.7 Data not supplied

If a **Generator** fails to supply data when required by any section of this Part B of the **System Operations Code**, the **System Operator** with the support of the **Single Buyer** will jointly estimate such data if and when, in the view of the **System Operator**, it is necessary to do so.

If the **System Operator** and **Single Buyer** fails to supply data when required by any section of this Part B of the **System Operations Code**, the **Generator** to whom that data ought to have been supplied, will estimate such data if and when, in the view of that **Generator**, it is necessary to do so.

Such estimates will, in each case be based upon data supplied previously for the same Plant or Apparatus or upon corresponding data for similar Plant and/or Apparatus or upon such other information as the **System Operator** and **Single Buyer** or that **Generator**, as the case may be, deems appropriate.

The **System Operator** and **Single Buyer** will advise a **Generator** in writing of any estimated data it intends to use relating directly to that **Generator**'s Plant and/or Apparatus in the event of data not being supplied.

The **Generator** will advise the **System Operator** and **Single Buyer** in writing of any estimated data it intends to use in the event of data not being supplied.

SOC 4.2 Demand Forecast

SOC 4.2.1 Introduction

In order for the **System Operator** to operate the **System** efficiently and to ensure maximum **System** security and reliability, there is a need for **Users** and specified **Generator**s to provide **Demand** and generation output information to the **System Operator**.

The **Distribution Licensee and the Single Buyer** shall be responsible for the elaboration of the load forecasts.

The **System Operator** shall validate the demand forecasts provided and ensure their consistency with historical demand patterns and expected system developments.

The information to be provided under this Section is required to enable the **System Operator** to maintain the integrity of the **System**.

Where Demand data is required from the **Users**, this means the Active (MW) Demand for electricity at the respective **Interconnection Boundary** with the **Users**. The **System Operator** may, in certain cases, specify that the Demand data shall include the Reactive (MVAR) Demand.

The information to be provided to the **System Operator** shall be in writing or otherwise instructed. References to data to be supplied on an hourly basis refers to it being supplied for each period of 60 minutes ending on the hour in each day.

SOC 4.2.2 Objective

This section applies to the **System Operator** and the following **Generator**s and **Users**:

a. Dispatchable and non-dispatchable **Generator**s;
b. Variable Renewable Energy Generation Station (**VRGS);**
c. **Single Buyer,** representing its customers connected directly to the **Transmission System**; and
d. **Distribution Licensee,** representing its customers connected to the **Distribution System**.

The objectives of section SOC 4.2 are as follows:

a. to specify the requirement for the **Single Buyer, Distribution License** and **Users** to provide unbiased forecasts of **Active Demand** and **Reactive Demand** when requested on the **Transmission System** within specified timescales. These forecasts are used by the **System Operator** for the **Operational Planning Phase**, **Programming Phase,** and **Control Phase**;
b. to describe information to be provided by **Users** to the **System Operator** in the post **Control Phase**; and
c. to describe certain factors to be taken into account by the **System Operator** and **Users** when preparing forecasts of both **Active Demand** and **Reactive Demand** on the **Transmission System** and the **Distribution System**.

The following sub-sections outline the obligations on the **Single Buyer**, **Generators** and other **Users** regarding the preparation of forecasts of **Active Demand**, **Reactive Demand** and **VRGS** output for the **Transmission and Distribution Systems**, and set out the timescales within which the **Single Buyer** and **Distribution Licensee** shall provide forecasts of **Active Demand** (MW) and **Reactive Demand** (MVAR) when requested to the **Single Buyer**, and the timescales within which the **System Operator** shall provide forecasts to **Generator**s and **Users**.

These demand forecasts are required for certain operational purposes, specifically the **Operational Planning Phase** requires annual forecasts of both **Active Demand** and **Reactive Demand** (if required) on the **Transmission System** for the succeeding 3 years; the **Programming Phase** requires weekly forecasts of both **Active Demand** and **Reactive Demand** (if required) on the **Transmission System** for the period 1 to 4 weeks ahead; and the **Control Phase** requires daily forecasts of Demand data on the **Transmission System** for the day ahead.

The following table summarizes the data to be provided during the different time scales:

Table 4: Demand Forecast Timescales and data requirements

Phase	Applicable Parties	Forecast Data	Time period for which forecast data is required
Operational Planning Phase 3 Years ahead (End of December each Year)	**Single Buyer, Distribution Licensee** and **Large Users**. Planned contractual obligation export of co-generation plants.	Hourly forecast of **Active** and **Reactive Demand** (if required)	For Day of **Large Users**' Max Demand, Day of System Summer/Winter Peak, and Day of System Minimum.
Programming Phase 8 Weeks ahead (By 10:00h each Friday)	**System Operator, Distribution Licensee** and **Large Users** Planned contractual obligation export of co-generation plants.	Hourly forecast of **Active** and **Reactive Demand** (if required). Hourly export for co-generation plants.	8 weeks ahead for **Large Users**. 2 weeks ahead for co-generation plants with contractual obligation export.
Control Phase Day ahead (By 11:00hr the day ahead)	**System Operator, Distribution Licensee** and **Large Users**. **Users** subject to **Demand Control** connected to the 22 kV voltage level or above. Update of co-**Generator** export.	**User**'s hourly forecast of **Active** and **Reactive Demand** (if required) Expected **Demand Control** Update co-generation export	24 hours, commencing at 00:00h of next day

SOC 4.2.3 Demand Forecast Data Requirements

SOC 4.2.3.1 Operational Planning Phase

No later than the end of October each year, the **Single Buyer** shall notify each **Large User, Distribution Licensee** and the **System Operator** in writing of the forecast information listed below for each of the following 2 operational years (Year 1 and Year 2):

a. the date and time of the forecast annual peak **Active Demand** on the

Transmission System at annual Maximum Demand Conditions; and

b. the date and time of the forecast annual minimum Active Demand on the Transmission System at Average Minimum Demand conditions.

By the end of December of each year, the Single Buyer, Distribution Licensee and Large Users, shall provide to the System Operator in writing, the forecast information listed below for each of the succeeding 3 operational years (Year 1, Year 2 and Year 3):

- Single Buyer and Distribution Licensee:
  - Forecast profiles of aggregated hourly Active Power Demand, at the Interconnection Boundaries with the Transmission System, for the day specified by the System Operator as the day of forecast annual peak Demand. These forecasts shall reflect annual Maximum Demand Conditions;
  - Forecasts of the profile of hourly Active Demand, at the Interconnection Boundaries with the Transmission System, for the day specified by the System Operator as the day of forecast minimum Demand at Average Minimum Demand Conditions.
- Large Users:
  - Forecast profiles of hourly Active Power Demand, at the Interconnection Boundary, for the day of that User's maximum Demand and for the day specified by the System Operator as the day of forecast annual peak Demand. These forecasts shall reflect annual Maximum Demand Conditions;
  - Forecasts of the profile of hourly Active Demand for the day specified by the System Operator as the day of forecast minimum Demand at Average Minimum Demand Conditions.

Large User's, Distribution Licensee's and the Single Buyer's forecasts of both Active Demand and Reactive Demand (if required) on the Transmission System provided to the System Operator must reflect the best estimates of its forecast requirements.

The System Operator shall use the information supplied to it to prepare forecasts of Active Demand on the Transmission System for use in the Operational Planning Phase.

SOC 4.2.3.2 Programming Phase

For the period of 4 weeks ahead the, Distribution Licensee and the Large Users connected to the 22 kV voltage level or above, shall supply to the System Operator in writing by 10:00 hours each Friday hourly profiles of Demand for Active Power (MW) at their respective Interconnection Boundaries.

The System Operator shall use the information supplied to it in preparing its forecasts of Demand for Active Power on the Transmission System for the purposes of the Programming Phase.

SOC 4.2.3.3 Control Phase

One day ahead of the operation day, the Distribution Licensee and the Large Users connected to the 22 kV voltage level or above, shall notify the System Operator of any planned Demand Control on any Interconnection Boundary.

Any changes to the planned Demand Control notified to the System Operator shall be informed to the System Operator as soon as possible.

SOC 4.2.3.4 Post Control Phase

Each Large User connected to the 22 kV voltage level or above and the Distribution

Licensee shall supply MW profiles for the previous calendar day of the amount and duration of **Demand** reduction achieved from the use of **Demand Control** on an hourly basis;

SOC 4.2.4 **VRGS** Generation Short term Resource Forecasting

The **System Operator** requires the **VRGS** connected to the 22 kV voltage level or above with Registered Capacity above 2 MW, to provide quality resource forecast from reputable and industry proven methods, and/or in accordance with the requirements of a **CA**, **IA**, **PPA** or **ESPA**. The forecast should provide the following information:

The Forecasts shall be submitted by means of an electronic interface to the **System Operator**.

This requirement can be withdrawn/redefined if so agreed between the **System Operator** and the **Generator** in each particular case.

SOC 4.2.4.1 One Day-Ahead Production Forecast

An hourly production forecast in kW for the following day of the VRGS Facility. The One Day Ahead Production Forecast shall be submitted by 17:00 hours on the previous day.

SOC 4.2.4.2 Revised Forecast

In addition to the One Day Ahead Production Forecast, the VRGS shall also submit to the **System Operator** at every interval of 30 minutes, a revised forecast for the next half hour from the VRGS Facility ("**Revised Forecast**").

The **System Operator** is required to consolidate forecasting functions in a single provider to assure uniformity of quality and improved forecasting prediction capacity, and to share the costs among the users.

SOC 4.2.5 Co-generation and Waste-to-Energy Short term Resource Forecasting

To the extent that a host process, in the case of Cogeneration Plants or Waste-to-Energy Plants, is the driver of the export power to the grid, and this export power is a contractual obligation such an entity shall submit:

a. a two (2) week projection with an hourly resolution of their export expectation to the **System Operator** every Friday by 10:00h or within 24 hours of request.
b. a 24-hour projection for the next day starting at 00:00h, every day by 11:00hr

This information will be used by the **System Operator** to optimize the expected output of the dispatchable **Generating Units** on the Grid. The Forecasts shall be submitted by means of an electronic interface to the **System Operator**.

SOC 4.2.6 Distributed Generation information

Non-dispatchable conventional **Distributed Generators** connected to the 22 kV voltage level shall submit a **Generation** forecast to the **System Operator**. This forecast shall be with the schedule (day ahead, before certain limit hour) and time resolution (by default, hourly values) required by the **System Operator** for its security studies and preparation of the **Generation** schedule. This requirement can be withdrawn/redefined if so agreed between the **System Operator** and the **Generator** in each particular case.

SOC 4.2.7 Consideration Regarding Demand Forecasts

The following factors shall be taken into account when conducting Demand

forecasting in the **Operational Planning Phase**:

i. Historic Demand Data;
ii. Weather forecasts (Responsibility for weather correction of **User**'s loads rests with the **User**);
iii. Historic Demand trends;
iv. Incidence of major events or activities;
v. **Generating Unit Active Power** generation forecasts or schedules;
vi. Demand transfers (load reconfiguration);
vii. Planned Demand reduction (e.g. block load shedding); and
viii. Any other factor reasonably considered necessary that may impact the Demand forecast.

The following factors shall be taken into account when carrying out Demand forecasting in the **Programming and Control Phases**:

i. Historic Demand data including **Transmission System** Losses;
ii. Weather forecasts and the current and historic weather conditions;
iii. The incidence of major events or activities which are known to **System Operator** in advance;
iv. **Demand Control** of 1 MW or more; and
v. Other information supplied by **Users**.

The **System Operator** shall produce forecasts of Demand using a forecasting methodology taking into account the above factors to produce, by statistical means, unbiased forecasts of Demand including that to be met by Generating Plant.

SOC 4.3 Outage Planning and Data Provision

SOC 4.3.1 Introduction

This section of Part B of the **System Operations Code** is concerned with the coordination through various timescales of planned outages of **Generating Units** and outages of **Plant** and **Apparatus** on the **Transmission and Distribution Systems**, due to commissioning, testing, repair, refurbishment and maintenance requirements.

Section SOC 4.3 establishes procedures to enable the collection of such outage data from **Generators**, **Transmission and Distribution Licensees**, and **Users** as is required by the **System Operator** to comply with the requirements of the **System Operations Code**, **Generation Code, Transmission Code and Distribution Code.**

The means of providing the information to the **System Operator** and its confirmation includes any non-transitory written form which enables the recipient to retain the information.

In general terms, from the point of view of the system, there is a preferred time period for planned outages of **Generating Units**, and parts of the **Transmission and Distribution Systems**. These preferred time periods are determined by reference to the excess of the total capacity of Generating Plant available over the sum of Demand plus the **Operating Margin** at the relevant time. From the point of view of the generators, other considerations need to be included in the elaboration of the outage plan, such as the running hours of units and manufacturer's recommendations of scheduled maintenance and preventive maintenance.

In this Part B of the **System Operations Code**, "**Year 0**" means the current calendar year at any time, Year 1 means the next calendar year at any time, Year 2 means the calendar year after Year 1, and so on.

Generator Units connected at voltage levels below 22 kV will not be considered in

the **Generator Outage Planning**.

SOC 4.3.2 Objective

The main objective of section SOC 4.3 is to ensure, as far as possible, that the **System Operator** co-ordinates, optimizes and approves Outages of **Generating Units** and **VRGS** taking into account **Transmission and Distribution System** Outages in order to minimize the number and effect of constraints on the **Transmission and Distribution System** and in order to ensure that, so far as possible, forecast Demand plus the **Operating Margin** is met.

To achieve the main objective, this section sets out the Operational Planning Procedures, information required and typical timetable for the co-ordination of outage requirements for Plant and Apparatus to be provided by **Generators**, **Transmission** and **Distribution Licensees**, and **Users**.

The **System Operator** shall, in relation to all matters to be undertaken pursuant to this Part B of the **System Operations Code**, including the co-ordination of **Generator** and **Transmission** and **Distribution System** outages, act reasonably and in good faith in the discharge of its obligations.

SOC 4.3.3 Timescales and data

The following summarizes the information to be provided by **Users** and **Generator**s to the **System Operator** in the timescales indicated.

SOC 4.3.3.1 Generation Outage Planning timescale

A. By 1st June year 0, The Generator shall inform the System Operator on the number of running hours remaining, for its different units to operate as from 1 January of year 1, until the next major maintenance is due. This estimate will be based on the maintenance plan of year 0 and forecasted hours (provided by system operator) that the generator will be on grid.
B. By End June of year 0, the **System Operator** makes available to **Generators** and **Users** the expected dispatch program for years Y1 through Y3. This program is to be taken from the most recent update of the **Integrated Resource Plan**;
C. By End of July of Year 0, the **System Operator** with the support of **the Single Buyer** should receive from **Generators** their respective maintenance requirements for year 1, and any tentative planned refurbishment or repairs scheduled for years 2 and 3;
D. During the month of August each year the **System Operator** and **Generators** shall make their best efforts to agree on a final maintenance plan for year 1 subject to the security requirements of the system, the security of the generating units of the Generators, and the specified duration of the maintenance periods;
E. By end of August of year 0 the System Operator shall issue the Final **Generation Maintenance Plan** for year 1 to the **Authority** for information;
F. By 15 September of year 0, the **System Operator** with the support of the **Single Buyer** shall elaborate an indicative generator maintenance plan for years 2 and 3 for internal use with the objective to detect in advance possible adverse situations with regards to reserve operation margins; and
G. During the current year of operation (year 0), the **System Operator** shall make its best effort to accommodate unplanned outage requests by **Generators**.
H. In the event that, during Year 0, after having finalised the **Generation Outage Plan** or during year 1, an unexpected breakdown is experienced by the **Generator**, the **System Operator** will determine if the **Generation Outage Plan** needs to be reviewed accordingly

SOC 4.3.3.2 Transmission and Distribution Outage Planning timescale

The planning of **Transmission** and **Distribution System Outage**s is dependent on the schedule of **Generator** and **VRGS** Outages.

The procedure set out below is to be followed in each calendar year:

a) By November 1st each year, **Users**, **Transmission** and **Distribution** licensees, submit to the **System Operator** details of the maintenance outages (commencing date and duration in days) for year 1. For years 2 and 3 only construction and/or refurbishment information is required;
b) By January each year the **System Operator** issues a **Transmission** and **Distribution System** outage plan for year 1 to the **Authority**;
c) By January each year the **System Operator** with the support of the **Single Buyer** shall elaborate an indicative transmission and distribution system outage plan for years 2 and 3 for internal use with the objective to detect in advance possible adverse situations with regards to bottlenecks or other constraints in the transmission or distribution system; and
d) During the current year of operation (Year 0), the **System Operator** shall make its best efforts to accommodate unplanned outage requests by **Users**, **Transmission** and **Distribution** licensees.

SOC 4.3.4 Generation Outage Planning Process

The **System Operator** shall endeavour to schedule Outages in a non-discriminatory manner as far as **System** security constraints allow. The **System Operator,** the **VRGS** and **Generator** shall make best efforts to ensure that interconnection and other related facilities are maintained within the periods stipulated for scheduled maintenance of the Generating Unit.

The following guidelines shall apply for the elaboration of the **Generation Maintenance Plan**:

Guidelines with respect to **Maintenance Outages** (maintenance requirements informed by Generators and the **VRGS** by October 1st each year (year 0) for year 1):

i. The **Generator** and the **VRGS** must ensure that outages occur in the specified periods according to the respective **PPA**, **CA**, or **ESPA** or any agreement, and the **System Operator** may not request to change the time of the outage to a period outside of this period;
ii. The **System Operator** may not request to change the duration of the outage requested by the **Generator**.

Guidelines with respect to changes to **Maintenance Outages**:

i. Not less than thirty (30) days prior to a **Maintenance Outage** previously scheduled. For system security reasons, **the System Operator** may request that the **Generator** or the **VRGS** defers or changes the duration of such **Maintenance Outage**;
ii. Subject to **Good Utility Practice**, the **Generator** or the **VRGS** shall use reasonable efforts to comply with this change request and reschedule such deferred maintenance to a subsequent date mutually agreed upon between the **Parties.** In this case, the **System Operator** will provide a revised generation plan for the Generator, so that the maintenance period does not exceed the maintenance plan as detailed in the operation and maintenance manual, for safety of the generating unit;
iii. Any justified incremental direct costs to be incurred by the **Generator** or the **VRGS** caused by the change in the **Maintenance Schedule** shall be

compensated by the **System Operator** or as specified in the respective **PPA, CA** or **ESPA** or any agreement. In such cases, the **Authority** shall be involved in the review of the claim and corresponding payment (in case it applies)

Guidelines with respect to **Scheduled Outages** (outage requirements informed by Generators or the **VRGS** with less than 3 months advance notice):

i. The Generator or **VRGS** must inform the **System Operator**: reason for the outage; nature of the maintenance or other activity to be carried out during the outage; and the date or dates of beginning of the outage(s) and its duration(s).
ii. The Scheduled Outage shall be granted if the following conditions are satisfied:
    a. The **System Operator** is informed: 2 working days prior to an outage of less than 2 days of duration; 7 days prior to an outage of 2 to 5 days of duration; and 21 days prior to an outage of more than 5 days of duration;
    b. The **Generator** or the **VRGS** uses its best endeavours to accommodate objections or concerns expressed by the **System Operator** (within 24 hours for an outage of less than 2 days of duration and within 48 hours for an outage of more than 2 days of duration) to the requested Scheduled Outage; and
    c. The Generator or the **VRGS** ensures that the outages will take place during low demand hours

The **Generator** outage planning process is described below:

a) By July 1st each year, the **System Operator** with the support of the **Single Buyer** makes available to **Generators** and **Users** the expected dispatch program for years Y1 through Y3. This program is to be taken from the most recent update of the **Integrated Resource Plan**;
b) The **System Operator** shall develop a **Generation Maintenance Plan** for three (3) years in advance. The first year shall be sufficiently detailed with less detail for the following years 2 and 3. The plan which shall incorporate statutory maintenance requirements shall be reviewed annually and updated as may be necessary;
c) **Generators** shall submit to the **System Operator** by end of July each year a rolling three-year plan for the scheduled maintenance requirement for their facility beginning in January of the following year. The **System Operator** shall obtain scheduling information from **Non-dispatchable Generators** where it considers it appropriate and relevant. The scheduling information for **Non-dispatchable Generators** shall specify the following on an individual Generating Unit basis:
    i. the period the unit is required;
    ii. the planned half-hourly output; and
    iii. any other information the **System Operator** reasonably considers necessary.
d) During the current year of operation (Year 0), the **System Operator** shall make its best efforts to accommodate unplanned outage requests by **Users**, **Transmission** and **Distribution licensees**.
e) The **Generator Maintenance Plan** shall be strictly followed throughout the year, unless there are unplanned **Scheduled Outages** authorized by the **System Operator** or changes to **Maintenance Outages** required by the **System Operator** due to system security reasons;
f) During the current year of operation (year 0), the **System Operator** shall make its best efforts to accommodate unplanned **Generator** outage

requests as per the guidelines above.

SOC 4.3.5 Transmission Outage Planning Process

The planning of **Transmission System Outage**s is dependent on the schedule of the **Generator** and the **VRGS**.

The **System Operator** shall plan **Transmission System Outage**s required in Years 2 and 3 as a result of construction or refurbishment works taking due account of known requirements. It is not anticipated that any detail of maintenance outages on the **Transmission System** will be available 2 or 3 years ahead.

The planning of **Transmission System Outage**s required in Years 0 and 1 ahead shall, in addition, take into account **Transmission System Outage**s required as a result of maintenance.

Transmission System Outages and **Generating Unit** Outages shall be coordinated so that, in general, **Generating Unit** Outages shall take precedence over **Transmission System Outage**s but subject always, in any particular case, to the **System Operator**'s discretion to determine otherwise on the basis of reasons relating to the proper operation of the **Transmission System**.

SOC 4.3.5.1 Long Term Transmission Outage Plan (year 2-3)

By November 1st each year, **Users** and **Transmission Licensee** shall send information to the **System Operator** for years 2 and 3, regarding construction and refurbishment expected schedules.

By January 1st each year, the **System Operator** shall draw up a draft **Transmission System Outage** plan covering the period Years 2 and 3 for the **System Operator**'s internal use and shall notify each **User** in writing of those aspects of the draft plan which may operationally affect such **User** including, in particular, proposed start dates and end dates of relevant **Transmission System Outage**s. The **System Operator** shall indicate to a **Generator**, restrictions on the scheduling and dispatch of **Generating Units** that may be required to allow the security of the **Transmission System** to be maintained in accordance with the License requirements.

SOC 4.3.5.2 Medium Term Transmission and Distribution Outage Planning - Year 1

By November 1st each year **Users**, shall submit to the **System Operator** details of any maintenance outages required at the **Interconnection Boundary** for the following year 1.

By November 1st the **Transmission Licensee** and the **Distribution Licensee** shall also submit scheduled maintenance outages in their respective systems for Year 1, to be included in the transmission outage plan.

By January 1st each year the **System Operator** shall issue the **Transmission and Distribution System Outage** plan for Year 1 taking into account outages required as a result of maintenance work. A copy of this **Transmission and Distribution System Outage** Plan shall be submitted to the **Authority**.

The **System Operator** shall notify the **Transmission** and **Distribution Licensees** in writing of those aspects of the plan which may operationally affect the licensees including, in particular, proposed start dates and end dates of relevant **Transmission or Distribution System Outage**s. The **System Operator** shall also indicate where a need exists to use emergency switching, emergency load management or other measures including restrictions on the scheduling and dispatch of **Generating Units** to allow the security of the **Transmission and Distribution System** to be maintained.

SOC 4.3.5.3 Short Term Transmission and Distribution Outage Plan - Operational Planning – Year 0

The **System Operator** shall keep the **Transmission System Outage** Plan updated during Year 0 to take account of unplanned outages and changes to outage durations of **Generators, VRGS** and **Transmission or Distribution System** Equipment.

The **System Operator** shall keep the **Transmission and Distribution System Outage Plan** updated during Year 0 to take account of unplanned outages and changes to outage plans and durations of both **Distributed Generator**s and **Distribution System** Equipment.

SOC 4.3.5.4 Transmission and Distribution Outage Planning - Programming Phase

Each Friday the **System Operator** shall update the **Transmission** and **Distribution System Outage plans** for the following one-week period beginning at 13:00 hours.

The **Transmission System Outage** plan for the week ahead shall determine the Transmission Constraints which impact on the Unit Commitment Schedule which the **System Operator** prepares each working day in accordance with SOC 4.6.

The **System Operator** shall notify each **User** in writing of those aspects of the plan which may operationally affect such **User** including in particular proposed start dates and end dates of relevant **Transmission** and **Distribution System** Outages. The **System Operator** shall also indicate where a need exists to use emergency switching, emergency load management or other measures including restrictions on the dispatch of **Generating Units** or **DGS** to allow the security of the Transmission and **Distribution System** to be maintained.

During the **Programming Phase** each **User** and the **System Operator** shall inform each other immediately if there is any requirement to depart from the Outages and actions determined and notified under this subsection.

SOC 4.4 OPERATING MARGIN

SOC 4.4.1 Introduction

Section SOC 4.4 sets out the types of reserves making up the **Operating Margin** that the **System Operator** may use in the **Control Phase**.

SOC 4.4.2 Operating Margin Constituents

The **Operating Margin** comprises Contingency Reserve plus Operating Reserve. The **Operating Margin** provides against uncertainties in Availability of **Generating Units** and in Demand forecasts

Contingency Reserve is the margin of Generation Capacity required in the period from 24 hours ahead down to real time, over and above the forecast Demand. It is provided by **Generating Units** that are not required to be synchronized but which must be held Available to Synchronize within a defined timescale.

Operating Reserve consists of Spinning Reserve and 15-minutes Reserve (to compensate for variation of the Variable Generation supply). Operating Reserve provides spare Generation Capacity for Frequency control in real time (Spinning Reserve) and quick time contingency (15-minutes Reserve) and is provided by **Generating Units** that are either synchronized or can be synchronized within minutes.

SOC 4.4.3 Contingency Reserve

The **System Operator** shall determine the amount of Contingency Reserve required for each hour up to 24 hours ahead, taking due consideration of relevant factors, including but not limited to the following;

a. Availability and historical reliability performance of individual **Generating Units**;
b. Notified Risks of Trip of individual **Generating Units**; or
c. Demand forecasting uncertainties.

SOC 4.4.4 Operating Reserve

The **System Operator** shall determine the amount of Spinning Reserve and 15-Minute Reserve that must be available to it from **Generating Units** at any time to ensure **System** security. The **System Operator** Operating Reserve Policy shall take due consideration of relevant factors, including but not limited to the following:

a. the magnitude of the largest **Active Power** infeed from **Generating Units**;
b. the predicted Frequency drop following loss of the largest infeed as may be determined through simulation using a dynamic model of the total **System**;
c. the extent to which **Demand Control** can be implemented;
d. the cost of providing Operating Reserve at any point in time; and
e. ambient temperature and current weather conditions, insofar as they may affect, directly or indirectly, Generating Unit and/or **Transmission System** reliability.
f. Availability of water for hydro power plants
g. Variability of intermittent renewable generation.
h. Technical capabilities of **Energy Storage Systems**
i. Forecast from VRGS.
j. Technical issues on synchronized Generating Units with a risk of tripping

The **System Operator** shall keep records of the Operating Reserve Policy and of significant alterations to it as determined by the above and any other factors.

SOC 4.5 MERIT ORDER SYSTEM

The **System Operator, with the support of the Single buyer,** shall establish a **Merit Order System,** based on the real or contracted Variable Operating Cost component of each **Generating Unit** or **Generation Station**, whichever is applicable.

The Variable Cost of each Generating Unit or Generation Station is the sum of the Variable Operating & Maintenance Cost (VOM) and the Fuel Cost. In mathematical form:

Merit Order Cost (MUR/MWh) = Fuel Cost (MUR/MBTU) x Optimal Load Heat Rate (MBTU/MWh) + VOM (MUR/MWh).

This information allows the **System Operator** to rank the **Generating Units** in the order of their Optimal Load Point cost of operation.

The **Authority** shall validate the calculations made by the **System Operator**.

The commitment and de-commitment (unit commitment) of units in the cost optimization process shall be guided by a number of parameters including load, availability of units, the merit order ranking, start-up costs, minimum start-up and shut-down times, and up and down ramp rates of generating units, as well as other system constraints, security criteria and required operating margin. Once committed, the dispatch level of each **Generating Unit** or **Generation Station** shall be determined by the application of the equal incremental cost principles in economic dispatch as described in sub-section SOC 5.2.2.1.

The **Generating Units** Committed and Scheduled in accordance with the Merit Order ranking shall be selected for generation dispatch subjected but not limited to the following factors for each **Generator** or Generation Station:

a) real or contracted Fuel Price;

b) real or Contracted Variable Operations and Maintenance Price;
c) declared and projected (MW) capability;
d) declared and contracted operating characteristics including inter alia:
    a. Heat Rate Characteristics (Real or contracted),
    b. start-up cost of the units,
    c. minimum start-up and shut-down times of the units, and
    d. up and down ramp rates.
e) Transmission Penalty Factor (if applicable);
f) Network stability and security;
g) Spinning and Other Operating Reserves;
h) Units that have been declared based on their contract, as Take-As- Available, are not influenced by the merit order and equal incremental cost optimization processes.

SOC 4.5.1 Notification of Merit Order

The **System Operator** shall notify the **Generator,** as to the relative position of its dispatch-able **Generating Unit**(s) in the Merit Order in terms of ranking number each Week.

SOC 4.5.2 Fuel Data

The Merit Order shall be revised by the **System Operator** on an ongoing basis to reflect the latest available information which includes changes in delivered fuel prices as they occur, consistent with the fuel procurement cycle for each Generating Facility and updates in VOM consistent with the **Generator**'s reporting or business cycle. Updated Merit Order must be declared at the beginning of each Month. Where there is the need to adjust this Merit Order within this monthly cycle, the updated Merit Order must be declared within 24 hours of being effected.

Generator shall provide the latest fuel cost and/or VOM information to the **system Operator** for its **Generating Units** within 24 hours of a request or from the time when such information becomes available.

SOC 4.5.3 Heat Rate Data

Heat Rate is computed by dividing the total energy content of fuel consumed for electricity generation by the resulting net energy generation. The Basis of the value should always be expressed as either Lower Heating Value (LHV) or Higher Heating Value (HHV). The basis of the heating value provided shall be consistent with the relevant contractual arrangements and the capability of the generation technology employed.

The Heat Rate data for each Generating Unit is necessary to determine its variable fuel operating cost. All contracts for new thermal generating capacity shall have a guaranteed Heat Rate curve or point.

All thermal **Generators** must supply a guaranteed heat rate curve to the **System Operator** and Single Buyer.

If the **System Operator** has sufficient reasons to believe that the Heat Rate of a Generating Unit which does not have a guaranteed curve or point, has changed significantly within the Month or since the last test (due to rehabilitation, damage etc.) the **System Operator** shall inform the **Single Buyer** accordingly. The **System Operator** in collaboration with the **Single Buyer** may request the **Generator** to conduct a Heat Rate Test following IEC standards testing conditions and certified by an Independent Engineer and update the Heat Rate curve for such a Generating Unit. All costs associated with the Heat Rate test shall be the responsibility of the **Generator**.

The **Generator** may request a heat rate test of its own unit if it can provide

information to substantiate that it has made improvements in the performance of its Unit(s). No more than two such requests will be accommodated within any calendar year.

The **Authority** shall be advised and duly notified beforehand when such tests are contemplated and carried out and reserves the right to witness all such tests.

SOC 4.6 UNIT COMMITMENT SCHEDULING AND DISPATCH

It is the **System Operator**'s obligation to prepare a unit commitment and dispatch schedule which reasonably reflects the likely **System** conditions. This schedule shall be prepared for the following Week and revised on a daily basis, except for weekend days and public holidays. The scheduling of **Generating Units** shall be in accordance with the latest available information, subject to relevant technical constraints.

Each **Generator** must submit to the System Control Centre by approved communication means a declaration of plant availability and capability, and any other information as agreed between the **Generator** and the **System Operator** from time to time. This data is to be declared to the **System Operator** in order to facilitate the timely preparation of a Unit Commitment Schedule.

The weekly unit commitment schedule and dispatch forecast carried out by the **System Operator** shall not be regarded by any **Generator** to be a **Dispatch Instruction** but shall be provided as a service to **Generator**s for planning purposes.

The daily revision of the unit commitment and dispatch schedule shall at all times take precedence over the weekly schedule.

SOC 4.6.1 Preparation of Unit Commitment and Dispatch Schedule

In the preparation of unit commitment and dispatch schedule, the **System Operator** shall take into consideration, among other things pertinent to commitment schedule, the following factors:

a. Forecasted Demand and geographical Demand distribution;
b. Each **Generator**'s declaration of each Generating Unit(s) MW capability and availability;
c. **Generator**'s contracted operating characteristics;
d. Contracted and declared Heat Rate curve or point;
e. Fuel prices and constraints;
f. **System** reserve requirements;
g. **System** stability implications, frequency and voltage control; and
h. **System** constraints including line and transformer loading capabilities and grid stability.
i. Minimize network losses
j. Planned outages on the transmission and distribution systems
k. Minimum Load of **Generators**

Monday - Friday: The daily schedule of expected availability and generation dispatch shall be prepared by **System Control Centre** and made available to the **System Control Engineer** or designated officer(s) by 1 p.m. each day for the 24-hour period starting 1 p.m. to 1 p.m. the following day.

Saturday-Sunday: The daily schedule of expected availability and generation levels for the weekend shall be done and made available to the **System Control Engineer** or designated officer(s) by 1 p.m. on the Friday preceding the weekend. This schedule shall cover the period from Friday 1 p.m. to Monday 1 p.m.

To facilitate preparation of these schedules, the **Generator** shall make a declaration of plant availability and capability over the scheduled period and any other information, as agreed between the **Generator** and the **System Operator** from time

to time for remaining hours in the current day starting at 11 am.

The specific procedure for receiving data and making notification of commitment of **Generating Units** for dispatch shall be based on the following:

a. An agreed and approved means of communication between the **Generator** and **System Control Engineer** with adequate backup in case of the failure of this approved means; and
b. Where a Generator becomes aware of any changes in these declared values or other data subsequent to the declaration, then the Generator shall without delay notify the System Control Engineer.

SOC 4.6.2 Dispatcher Training Simulator (DTS)

The **System Operator** shall maintain a functional Dispatcher Training Simulator as part of its SCADA system.

The **System Operator** shall request all the data required from each **Generator** as specified in section SOC 17 and as required under sub-section SOC 4.1. DSC 3.1.

The Dispatcher Training Simulator shall be used to validate historical actions taken and to train **System** operators in the management and control of the **System**.

The DTS should also be used to test the adequacy of the **System Operator**'s **System Restoration Procedures** and to guide the development of any new Operating Policy and Procedure.

Generators shall provide information requested by the **System Operator** to facilitate its maintenance of an accurate and functional Dispatcher Training Simulator.

SOC 5 DISPATCH FOR OPERATIONS

This section of Part B of the **System Operations Code** is concerned with defining the operational responsibilities of the **System Operator** and **Generator**s in respect of dispatch and the dispatch processes active during real time operation of the **System**, and covers the following areas:

a. SCADA System Real Time Update (demand and **Generator** availability and capability);
b. Unit commitment and dispatch real time update;
c. Generating Unit synchronization;
d. Frequency (including AGC) and voltage control;
e. Reserve margin monitoring and control;
f. Dispatch deviation tracking and reporting.

SOC 5.1 SCADA SYSTEM UPDATE

SOC 5.1.1 Real Time Demand Forecast

The **System Operator** shall update the daily projected Demand Forecast in real time with consideration for the change in demand influencing factors such as temperature, humidity, weather and change in customer expected use based on actual demand trend.

The **System Control Engineer** will keep the unit commitment and dispatch model in the SCADA system updated with the revised demand forecast.

SOC 5.1.2 Real Time **Generator** Availability and Capability Update

The **System Operator** shall update the Availability and Capability of each **Generator** in the SCADA system in real time based on information obtained from communicating with the **Generator**s.

The **Generator** shall notify the **System Operator** as soon as possible of any factors

which will or are likely to, affect the power output capability, flexibility, response or cost of production of any of its **Generating Units**.

Generating Units and apparatus shall not be taken out of service or rendered unavailable without reference to the **System Operator** except in cases of Emergency. In such cases the **System Control Engineer** shall be informed as soon as possible of the action taken.

A **Generator** experiencing an unplanned outage of any of its **Generating Units** shall inform the **System Operator** as soon as possible of all relevant details concerning this outage. As soon as the cause of the outage has been properly assessed and a recovery plan established, the **Generator** shall inform the **System Operator** of the expected time and the condition under which the Generating Unit shall return to service.

The actual time that the outage occurred and the Generating Unit was returned to service and any other information deemed to be important in relation to the outage shall be logged by the **System Control Engineer**.

SOC 5.2 Unit Commitment and Dispatch Real Time Update

Generation and delivery or transfer of electricity into the Grid, to the extent allowed by **Transmission System,** operating constraints and the dynamic operating characteristics of available **Generating Units**, among other things, shall be based on equal incremental cost principles.

In order to efficiently operate and manage the **System** Grid in a safe, secure and economic manner, the **System Operator** will require accurate and timely information on the **Generating Units**, including availability, efficiency and technical operating capability.

This section outlines the procedures used to determine how individual **Generating Units** are operated simultaneously to achieve these objectives based on the information received by the **System Operator**.

SOC 5.2.1 Unit Commitment Update

The **System Operator** shall update the planned unit commitment schedule based on new real time information obtained from **Generator**s and a revised demand forecast.

The **System** operation shall issue timely instructions to **Generator**s to start their **Generating Units** and place them into service to meet the anticipated Demand.

Each **Generator** is required to ensure that their Generating Unit is prepared and available at their declared capability to respond to a **Dispatch Instruction** from the **System Operator** based on the required unit commitment schedule.

SOC 5.2.2 Dispatch Instructions

This clause sets out the procedures for issuing **Dispatch Instructions** to dispatchable **Generating Units** and the responsibilities of the **System Control Engineer** and the Generating Unit Operation Engineer.

The **System Control Engineer** must ensure that all available dispatchable **Generating Units**, including the **Energy Storage Units**, are used within their allowed technical capabilities, to provide Real Power, Reactive Power and Ancillary Services (including frequency control, and contingency and operating reserves contributing to the Operating Margin) in order to achieve a least cost operation of the **System** subject to technical constraints, operational constraints and security criteria.

The **Energy Storage Units** shall be utilized fully according to their technical capabilities for the following:

a) Voltage control,

b) Active Power reserve for System frequency regulation,
c) Black Start, and
d) Energy arbitrage to avoid high electricity production costs by transferring load from high demand to low demand periods.

SOC 5.2.2.1 Real Power (MW) Dispatch

Real Power (MW) dispatch shall be based on an Equal Incremental Cost principle to minimize the variable operating cost. **Dispatch Instructions** are normally given on a half hourly basis or anytime that is warranted by the operational requirements of the **System**.

The Equal Incremental Cost Principle states that, to achieve the most economic dispatch of power generation each Generating Unit on line, should operate at the same **System** wide point of Incremental Cost to serve a given load, unless the limit of capacity of a Generating Unit or other imposed constraints prevents it from reaching that cost. The Incremental Cost is the cost required to produce an additional MWh of energy above a base amount.

SOC 5.2.2.2 Reactive Power (MVAR) Dispatch

Reactive Power (MVAR) is dispatched at the discretion of **System Control Engineer** to maintain the **System** voltage within the tolerable limits. Under normal operating conditions each **Generation Unit** shall be at least capable of operating at any point within the provided **P-Q Capability Diagram** as required in the **Generation Code.**

All **Generator**s are required to provide the **Generator** capability curve for the unit upon request by the **System Operator**. The **System Operator** shall at all times use the most economical choice available to manage the system voltage.

SOC 5.2.2.3 Ancillary Service

The **System Operator** subject to the approval of the **Authority** may contract with suitably qualified **Generator**s for ancillary services (voltage support, frequency control, reserve support, black start capability, etc.) to the extent that it does not violate the **PPAs, CAs** or **ESPAs** or any agreements.

SOC 5.2.2.4 Non-dispatchable Plant

Non-dispatchable **Generating Units** shall operate as agreed upon between the **System Operator** and the **Generator**.

The **System Operator** shall inform such **Generator**s where there is a need for outage on the Generating Unit or of any incident which would affect the operations or safety of the Generating Unit.

During an Emergency, or where there is life and property at risk, the **System Operator** and/or the **Generator** reserves the right to disconnect and so isolate any Generating Unit without prior notification. However, both Parties must communicate immediately once the risk has been neutralized, to inform of the action taken and why it was necessary to take such action without prior notice. The **Authority** must be informed of such actions

The **Generator** shall communicate with the **System Control Engineer** or designated officer(s) on matters of switching and Synchronization during normal operations and in the event of **System Emergency**.

SOC 5.3 INSTRUCTION TO SYNCHRONIZE/DESYNCHRONIZE

The times at which a **Generator** shall be synchronized and desynchronized shall be directed by the **System Control Engineer** or designated officer(s).

SOC 5.4 FREQUENCY AND VOLTAGE CONTROL

SOC 5.4.1 Frequency and Voltage Management

Adherence to the frequency and voltage standards shall be the responsibility of the **System Control Engineer** or designated officer(s) who shall issue to each **Generator** the required **Dispatch Instructions** for **Real Power** (MW) and **Reactive Power** (MVAR) output if needed, in accordance with the declared operating limits of each **Generating Unit** as agreed upon between the **System Operator** and the **Generators** to ensure adherence to these operating standards.

Automatic Generation Control (AGC) can be used to perform frequency control by sending signals to generator to adjust output.

All **Generating Units** with **Registered Capacity** greater than 10 MW shall have the capability to connect to and participate on the Automatic Generation Control (AGC), unless otherwise agreed with the **System Operator**

.

The SCADA/EMS system shall have the capability to facilitate the use of AGC. The range of control afforded by the implementation of AGC shall be the subject to the Generator's PPA.

SOC 5.4.2 System Control Centre Responsibility

The **System Control Engineer** shall be responsible for issuing any instruction necessary to:

a. Maintain the voltage on the **Transmission System** in within the limits specified in the **Transmission Code** for **Normal** and **Contingency Conditions**;
b. Maintain the **System** frequency within the limits of 50 Hz ± 0.75 Hz.
c. Operate the **System**, as far as is reasonable, with sufficient **Active and Reactive Power** reserve capacity to carry its expected **Demand** to ensure safe, reliable, and economic operation of the **System**, including the designation of **Generating Units** to operate in dispatch or spinning reserve mode

SOC 5.4.3 Generator Responsibility

The **Generating Station Operations Engineer** shall be responsible for:

a) ensuring that the **Generating Unit's** mode of operation is as designated by the **System Control Engineer**;
b) ensuring that **Generating Units** operate by controlling either the Active Power output or the System frequency according to the instructions of the **System Operator** and subject to the frequency response requirements under the connection conditions of the **Generation Code**;
c) ensuring that **Generating Unit's**(s') automatic voltage regulators are in service continuously. The **System Control Engineer** shall be informed whenever a **Generating Unit** is operating without its automatic voltage regulator, **Reactive Power** limiters or power system stabilizers; and
d) notifying immediately the **System Control Engineer** of any unusual voltage, frequency or power condition or any disturbances occurring upon any **Generating Unit**.
e) ensuring that the **Generating Unit's** operation complies with any requirement of the Codes

In the event of a sudden change in **Transmission System** voltage, the **Generating Station Operations Engineer** or designated officer(s) shall not take action to override automatic **Reactive Power** generation response, unless instructed otherwise by the

System Control Engineer (or designated officer (s)) or unless immediate action is necessary to comply with stability limits or declared constraints of the **Generating Station Apparatus**.

SOC 5.5 OPERATING RESERVE MONITORING AND MANAGEMENT

SOC 5.5.1 Spinning Reserve

The **System Operator** shall ensure operation with a minimum **Spinning Reserve** margin as per the **System Operator**'s Operating Reserve Policy of this **Code**. The determination of the **Spinning Reserve** margin shall be based on economics and **System** security considerations.

The **System Operator** may from time to time review its Operating Reserve Policy subject to the approval of the **Authority**.

SOC 5.5.2 Operating Reserve

The **System Operator** shall co-ordinate Scheduled Outages such that the 15-Minutes Reserve margin and the Operating Reserve margin are maintained in accordance to the **System Operator**'s Operating Reserve Policy. This shall allow the **System** to be able to accommodate the largest **Generating Units** being forced out of service and still maintain adequate available Capacity to meet **System** Demand.

The 15-Minutes Reserve margin shall comprise units which are synchronized and can provide real power within 15 minutes. –

In the case of **System Emergency** and unplanned outages, the Scheduled Outages of **Generating Units** shall be rescheduled if possible, to maintain the defined reserve margin in accordance to the **System Operator**'s Operating Reserve Policy.

SOC 5.6 DISPATCH DEVIATION TRACKING AND REPORTING

The **System Operator** shall keep a record of all **Dispatch Instructions** and the compliance of each **Generator** with the instructions received.

Each **Generator** shall keep a record of all **Dispatch Instructions** received and their level of compliance.

Dispatch deviation shall be calculated by the **System Operator** for all dispatchable **Generator**s. This information shall be used to calculate the dispatch deviation penalties for **Generator**s which have a dispatch deviation penalty as part of their **PPA** or **ESPA** or any agreement.

SYSTEM OPERATIONS CODE - PART C – SYSTEM OPERATIONS

SOC 6 SYSTEM CONTROL

SOC 6.1 Purpose and Scope

The objective of the section SOC 6 is to set out the requirements that the **System Operator** and each **User** shall fulfil regarding the following:

a) the responsibilities for control of **Equipment**,
b) the implementation of a system of documentation including system diagrams and recording of operational events, and
c) the establishment of a suitable communication system.

The requirements of this section apply to the **System Operator** and each **User**.

In this section SOC 6, the term **User** refers to any person using the **Transmission System** or the **Distribution System**, including **Generators, Transmission Licensee, Distribution Licensee** and other **Large Users** and **Large Customers**

SOC 6.2 Control responsibilities

The **System Operator** and **Users** shall jointly agree and outline in writing schedules specifying the responsibilities for control of **Equipment**. These shall ensure that only one party is responsible for any item of **Plant** or **Apparatus** at any one time.

The **System Operator** and each **User** shall at all times have nominated an **Operations Engineer** (or designated officer), who shall be responsible for daily technical and dispatching instructions and for the co-ordination of safety of their respective **Electrical Facilities** pursuant to this sub-section SOC 6 and section TC 8 of the **Transmission Code**.

SOC 6.3 Control Documentation

The **System Operator** and **Users** shall maintain a suitable system of documentation (electronic or manual) which records all relevant operational events that have taken place on the **Transmission System** or any other **User System** connected to it and the co-ordination of relevant safety precautions for work.

All documentation relevant to the **Operation** of the **Transmission System** and **Distribution System**, and safety precautions taken for work or tests, shall be held by the **System Operator** and the appropriate **User** for a period of not less than five years.

SOC 6.4 System Diagrams

Diagrams illustrating sufficient information for the **User Operations Engineer** and **System Operations Engineer** to carry out their duties shall be exchanged by the **System Operator** and the appropriate **User** according to section TC 8.4 of the **Transmission Code**.

SOC 6.5 Communications

Where the **System Operator** reasonably specifies the need, suitable communication systems shall be established between the **System Operator** and **Users** to ensure the **System Control** is carried out in a safe and secure manner.

Where the **System Operator** reasonably decides a backup/alternative routing of communication is necessary to provide for the safe and secure **Operation** of the **System** the means shall be agreed with the appropriate **Users**.

Schedules of telephone numbers/call signs shall be exchanged by the **System**

Operator and the appropriate User to enable the System Control to be efficiently coordinated.

The System Operator and appropriate Users shall establish 24-hour availability of personnel with suitable authorization where the joint operational requirements demand it.

Where a Generator's System (or part thereof) is, by agreement, under the control of the System Operator, then for the purposes of communication and co-ordination in operational timescales the System Operator may (for those purposes only) treat that Generator's System (or part thereof) as the System Operator's System. For communications for other purposes the System Operator shall treat the Generator System as a User's System.

SOC 7 SWITCHING INSTRUCTIONS

SOC 7.1 Purpose and Scope

The objective of the section SOC 7 is to set out the requirements and procedure the System Operator and each User shall fulfil regarding the switching operations in Medium Voltage and High Voltage Equipment.

Medium Voltage and High Voltage switching shall only be carried out with the permission of the System Control Engineer (or designated officer) except under Emergency State.

Persons required to carry out Medium Voltage and High Voltage switching must be specifically certified and authorized by the System Operator to carry out such switching.

In this section SOC 7, the term User refers to any person operating, building, making repairs, refurbishments or maintaining Medium Voltage and High Voltage Equipment, including as the case may be Generators, Transmission Licensee, Distribution Licensee and other users (Large Customers).

SOC 7.2 Procedures for Switching Operations

The following procedures shall be adhered to when carrying out Medium Voltage and High Voltage switching Operations:

1. When switchgear, normally operated to the instruction of the System Control Engineer, or someone delegated by the System Control Engineer, has been operated without instruction from the System Control Engineer, the person that carried out the operation under concern shall notify the System Control Engineer immediately. Switchgear normally operated to the instruction of the System Control Engineer shall not be closed without his permission;
2. The System Control Engineer shall ensure that any instruction for switching issued by him is repeated phrase by phrase as received and at the termination of the message is read back to him in full by the recipient;
3. Any instruction issued by the System Control Engineer relating to the operation of switchgear shall, be written down and every such instruction shall be repeated phrase by phrase as received. At the termination of the message it shall be read back in full to the sender to ensure that the instruction has been accurately received.
4. Instructions from the System Control Engineer shall be carried out without delay and at the time of completing, the operation or sequence of operations shall be reported back to the System Control Engineer; and
5. An operator shall inform the System Control Engineer immediately of any objection to any instruction. The System Control Engineer shall then

investigate the matter and if necessary, refer it to higher authority endowed with the necessary powers of authority, to make a determination on such matters.

SOC 8 DEMAND CONTROL (TRANSMISSION SYSTEM)

SOC 8.1 Introduction

This Section presents the provisions made by the **System Operator** and procedures to be followed by the **System Operator** and **Users** to allow a reduction of **Demand** in the event that there is insufficient **Generation** available to meet the **Demand** in all or any part of the **Transmission System** and/or in the event of problems on the **Transmission System**, including, without limitation, in the event of both a steady state shortfall of generation and a transient shortfall of generation following a sudden loss of generation.

In this section, **User** means those users connected to the **Transmission System**.

SOC 8.2 Objectives

The objectives of this section are to

a. define methods of **Demand Control** and the procedures governing their implementation; and
b. establish the obligations of the **System Operator** and **Users** as regards the development of procedures, and exchange of the information required for the implementation of **Demand Control**.

The **System Operator** shall ensure that all **Parties** affected by **Demand Control** are treated equitably and that **Demand Control** is used as last resort.

SOC 8.3 Methods of Demand Control

Demand Control can be implemented in a number of ways, including:

a. shedding of **Demand** by automatic **Under-Frequency Relays**;

b. emergency manual **Demand Shedding**; and

c. planned rota **Demand Shedding**.

d. automatic low **Voltage Demand Shedding**;

The **System Operator** shall define the procedures for the implementation of the manual **Demand** shedding and the setting of the automatic **Under-Frequency Relays**, which should be submitted to the **Authority** for approval.

SOC 8.3.1 Interruptible loads

The obligations of the **System Operator** and **Users** in respect of the means of **Demand Control** are set out in the **System Operations Code**. All plans and implementation of **Demand** de-energisation shall give due consideration to critical **Customers** such as big industries, airports and hospitals.

SOC 8.3.2 Shedding of Demand by Automatic Under-Frequency Relays

The **System Operator** shall use automatic **Demand** shedding by **Under Frequency Relays** to address short-term imbalances between the bulk **System Generation** and **Demand**, following the tripping of **Generation**. It is a method of safeguarding the stability of the **Transmission System** when other actions, such as the use of the **Operating Margin**, have failed to stabilize or contain the **Frequency** within the limits under **Normal Conditions** specified in the Transmission System Frequency Standards section of the **Transmission Code** (TC 3.4.2)

The automatic **Demand** shedding by **Under Frequency Relays** shall be activated when the frequency drops to 48.6 Hz or below. There shall be at least 6 levels for the automatic **Demand** shedding operating without intentional delay. The **Frequency** values at which each of the 6 levels are activated shall be the ones in Table 5. The minimum amount of **Demand** to disconnect by each level shall be determined by the **System Operator** through dedicated electrical studies to be approved by the **Authority**.

Table 5. Automatic Demand shedding by Under Frequency Relays

Level	Frequency (Hz)
1	48.6
2	48.4
3	48.2
4	48.0
5	47.8
6	47.6

A load shedding table specifying the pre-selected feeders to disconnect at each level shall be computed considering the most stringent conditions, including the tripping of a large **Generating Unit** at peak time and at minimum load conditions. After 2 activations of the **Under-Frequency Relays**, the feeders on the first 2 levels shall be swapped with the feeders on the lower levels so as not to penalize the same **Customers**/**Users** each time.

SOC 8.3.3 Emergency Manual Demand Shedding

The **System Operator** may implement emergency manual **Demand** shedding to maintain the stability of the **Transmission System**, to cover a developing **Generation** shortfall or to relieve overloads or depressed voltages in the **Transmission System** or a part of it.

Manual **Demand** shedding may also be performed when a **Generating Unit** trips under low **Spinning Reserve** conditions and the **System Frequency** stabilizes above the value of the frequency for the first level of automatic **Demand** shedding by **Under Frequency Relays** and below the lower bound of the frequency range for **Normal Conditions** defined in the **Transmission Code**. The **System Control Engineer** may remotely open as many loaded feeders as necessary to restore the **System** frequency within safe operating limits. Once additional **Generating Units** have been synchronized and the **Grid** conditions are stable, the disconnected feeders shall be closed

SOC 8.3.4 Planned Rota Demand Shedding

In the event of a sustained period of shortfall in the **Generation** and **Demand** balance, either for the **Transmission System** as a whole or for significant parts of the **System**, the **System Operator** shall implement manual shedding of **Demand** on a rota basis.

When implementing the planned rota **Demand** shedding the **System Operator** shall use reasonable measures to ensure that available power is shared among affected **Parties** on an equitable basis subject to approval by the **Authority**.

SOC 8.3.5 Automatic Low Voltage Demand Shedding –

The **System Operator** may from time to time determine that there is a requirement for automatic disconnection of **Customer Demand** by **Under Voltage Relays**, in order to limit the consequences of the loss of a **Generation Unit**(s), or an event on the **Total System**, which otherwise would result in part of the **Total System** with voltages outside the statutory levels.

The **System Operator** may exercise the required automatic **Demand** disconnection by **Under Voltage Relays** at the level of the **Transmission System**. However, depending on the extent of **Demand** disconnection required, and in order not to disconnect more **Customer Demand** than reasonably required in response to a specific incident or set or circumstances, it may be preferable that automatic **Demand** disconnection by **Under Voltage Relays** is carried out at the level of the **Distribution System**.

On request by the **Transmission Licensee**, the **Distribution Licensee** shall co-operate with the **Transmission Licensee** as to the design and implementation of **Under Voltage Relays** at locations on the **Distribution System**. The **System Operator** will retain full control over the enabling/disabling of the **Under-Voltage Relays**, and the voltage settings at which **Under Voltage Relays** will be initiated in each circumstance.

SOC 9 DEMAND CONTROL (DISTRIBUTION SYSTEM)

SOC 9.1 Introduction

This section establishes the requirements for the **System Operator, Users** and **Customers** of the **Distribution System**, in certain circumstances, to permit reductions in total **Demand** in the event of insufficient **Generation** being available to meet total **Demand** or to avoid disconnection of **Customers** and **Users** or in the event of breakdown and/or overloading on any part of the **Transmission** and/or **Distribution Systems**.

The **Demand Control** procedures ensure that hardship to **Users** and **Customers** is minimized and that in so far as is practicable, all parties affected are treated equitably.

SOC 9 specifies the following means of reducing **Demand**:

a) Automatic low **Frequency** or low voltage **Demand** disconnection;

b) Customer or User Demand Reduction including **Voltage** Reduction;

c) Customer or User Demand Reduction instructed by the **System Operator** or the **Transmission** or **Distribution Licensees**;

d) Emergency manual **Demand** disconnection;

The term **Demand Control** is used to describe any or all of these methods of achieving a Demand reduction.

Where **Demand Control** is exercised by the **System Operator** it shall be done in a manner that in so far as reasonably practicable does not discriminate against any **Customer** or **User** and shall use reasonable endeavours to ensure that the burden is shared fairly among **Customers and Users**. Exemptions may apply to vital and priority **Customers** and **Users** as defined by the **Authority**.

SOC 9.2 Objective

To establish procedures to enable the **System Operator** to achieve a reduction in **Demand** that shall either avoid or relieve operating problems on the **Transmission System** and / or the **Distribution System**, in whole or in part, in a manner that does not unduly discriminate against or unduly prefer any one or group of **Customers** or

Users in accordance with the **Distribution System License**.

SOC 9.3 Scope

SOC 9 applies to the **System Operator,** the **Distribution Licensee** and all **Users** of the **Distribution System**.

Implementation of **Demand Control** by the **System Operator** may affect all **Customers** or specific **Users** connected to the **Distribution System** and where applicable, contractual arrangements between the **Distribution System Licensee** and their **Customers** and **Users** shall reflect this.

SOC 9.4 Methods of demand control

a. **Customer** or **User Demand** may be disconnected automatically at selected locations in accordance with the requirements of the **Transmission Code** and/or **Distribution Code**, in the event of a sudden fall in **Frequency**. Such an arrangement shall be carefully coordinated as part of an overall scheme and may take into account any operational requirements or essential load.
b. Automatic disconnection by **Under Voltage Relay** may be used to discriminately disconnect **Customers** or **Users** at **MV** in order to maintain voltage within acceptable limits, so as to avoid widespread load shedding.
c. Deliberate reduction of voltage may be used to achieve a temporary reduction in load **Demand**, for instance operating transformers' tap changers or **Reactive Power** compensation **Equipment**.
d. Emergency manual load shedding may be carried out on the **Distribution** or **Transmission Systems** for reasons of shortfall in supply or other reasons.
e. In the event of a sustained period of shortfall then planned rotating load shedding may be used to share the available power among affected **Customers** and **Users.**

SOC 9.5 Implementation of demand control

Where **Demand Control** is exercised by the **System Operator** in order to safeguard the **Distribution System**, the **System Operator** shall liaise with and inform the **Distribution Licensee** accordingly as far as it is practicable.

Where **Demand Control** is exercised by the **Distribution Licensee** upon instruction or request from the **System Operator** in order to safeguard the **Total System,** then the **Distribution Licensee** is required to respond to these requests promptly but shall liaise with and inform **Users** and **Customers** connected to the **Distribution System** as far as it is practical.

Procedures for load shedding including exemption policies, load shedding rotation and **Customer/User** communications shall be contained in the distribution load shedding plan approved by the **Authority**.

SOC 10 OPERATIONAL COMMUNICATION (TRANSMISSION SYSTEM)

SOC 10.1 Introduction

This section sets out the requirements for the exchange of information between the **System Operator** and **Users** in relation to **Operations** and/or **Incidents** which have had or will have (or may have) an **Operational Effect**:

a) on the **Transmission System** in the case of an **Operation** on a **User System,** and
b) on a **User System** in the case of an **Operation** on the **Transmission System**.

This section also sets out the procedure for issuing warnings in the event of a risk of serious and widespread disturbance of the whole, or part of, the **Transmission System**.

For the purposed of this section, **Users** mean **Generators**, the **Distribution Licensee** and any **User** connected to the **Transmission System**.

SOC 10.2 Objective

The exchange of information is needed in order that the implications of an **Operation** and/or **Incident** can be considered and the possible risks arising from it can be assessed and appropriate action taken by the relevant party in order to maintain the integrity of the **Transmission System** and the **Users' Plant** and **Apparatus**. This section does not seek to deal with any actions arising from the exchange of information, but merely with the exchange of information itself.

SOC 10.3 Key Personnel List

All **Users** shall notify the **System Operator** of:

a. the identities of and contact details for the Plant Manager, who shall be responsible for general communications and contract management, the **Operations Engineer** or designated officer, who shall be responsible for daily technical and dispatching instructions; and
b. any changes from time to time in the identities of and contact details for such persons.

SOC 10.4 Requirement to notify operations

The following are examples of situations where notification shall be required if they will or may have an **Operational Effect**:

a. the implementation of a planned outage of **Plant and/or Apparatus**;

b. the planned **Operation** (other than, in the case of a **User**, at the instruction of the **System Operator**) of any circuit breaker or isolator or any sequence or combination of the two;

c. voltage control;

d. where an operational Instruction to be issued may have an **Operational Effect** on another **User's System, Plant or Apparatus**;

e. where the **Plant** is expected to be operated in excess of its rated capability and may present a hazard to Persons;

f. where there is an expectation of abnormal operating conditions;

g. where there is increased risk of inadvertent **Operation** of **Protection**; and

h. in relation to major testing, commissioning and maintenance.

SOC 10.5 Nature of Notification for an Operation

In the case of an **Operation** on the **Transmission System** which will or may have an operational **Effect** on a **User System**, the **System Operator** shall notify the **User** whose **System** will or may be affected.

In the case of an **Operation** on a **User System** which will have or may have **Operational Effect** on the **Transmission System**, the **User** shall notify the **System Operator**. The **System Operator** shall notify any other **Users** on whose **Users Systems** the **Operation** will or may have an **Operational Effect**.

A notification under this section must be given as far in advance as practicable and in any event shall be given in sufficient time as shall reasonably allow the recipient to consider and assess the implications and risks arising.

SOC 10.6 Warnings

A warning shall be issued by the **System Operator** to **Users** who may be affected

when the System Operator anticipates there is a risk of widespread and serious disturbance to the whole, or part of, the Transmission System.

The warning shall contain such information as the System Operator reasonably considers necessary in order to explain the nature and extent of the anticipated disturbance to the Users provided that sufficient time is available to the System Operator prior to the issue of the warning and that such information is available to the System Operator.

For the duration of a warning each User in receipt of the warning shall take the necessary steps to warn its operational staff and maintain its Electrical Facilities in the condition in which it is best able to withstand the anticipated disturbance.

Scheduling and Dispatch in accordance with Part B of the System Operations Code may be affected during the period covered by a warning. Further provisions on this are contained in Part B of the System Operations Code.

SOC 10.7 Major Incidents

The System Operator may determine that an Incident shall be classified as a Major Incident. The Major Incident shall be reported in writing by the System Operator to the affected Users.

Without limiting this general description, a Major Incident shall include as a minimum any combination of or all of the following:

a. The Incident has not been planned by the System Operator;
b. The Incident affects at least two thousand customers [or another amount determined by the Authority]; and
c. Lasts for at least three (3) hours.

SOC 11 OPERATIONAL COMMUNICATION (DISTRIBUTION SYSTEM)

SOC 11.1 Introduction

This section specifies the notification requirements regarding Operational Effects that may occur or have occurred as a result of an Incident and/or Operation

For the purpose of this section, the term Users refers both to Customers connected to MV and Distributed Generators.

SOC 11.2 Objective

The exchange of information is needed in order that the implications of an Operation and/or Incident can be considered and the possible risks arising from it can be assessed and appropriate action taken by the relevant party in order to maintain the integrity of the Distribution System and the Users' Plant and Apparatus. This section does not seek to deal with any actions arising from the exchange of information, but merely with the exchange of information itself.

SOC 11.3 Communication Procedure

The System Operator, the Distribution Licensee and each User connected to the Distribution System shall nominate officers and agree communication channels to make effective the exchange of information required in this section.

When the Operational Effect involves several Customers connected at LV, the System Operator shall communicate with the Distribution Licensee who shall in turn communicate with the affected LV Customers using the mass media.

A notification under this section shall be given as far in advance as possible and in the event of an Incident shall be given in sufficient time as shall reasonably allow the recipient to reasonably consider and assess the arising implications and risks.

SOC 11.4 Notification of Operations

In the case of an **Operation** on a **User System** connected to the **Distribution System**, which shall have or may have an **Operational Effect** on the **Distribution System**, the **User** shall notify the **System Operator** in accordance with this section.

In the case of an **Operation** on the **Distribution System** or an **Operation** on the **Transmission System**, which in the opinion of the **System Operator**, shall have or may have an **Operational Effect** on a **User System** connected to the **Distribution System**, the **System Operator** shall notify the **User**.

The following are examples of situations where notification shall be required:

a. the implementation of a **Scheduled Outage** of **Plant** and/or **Apparatus** which has been arranged pursuant to SOC 4.

b. the operation of any **Circuit Breaker** or isolator or any sequence or combination of the two including any temporary **Equipment** overloads, **System** parallels, or **Generating Unit** synchronization which has an impact on the operations of the **User**.

SOC 11.5 Notification of Incidents

In the case of an **Incident** on a **User System** connected to the **Distribution System**, which has had or may have had an **Operational Effect** on the **Distribution System** or on the **Transmission System**, the **User** shall notify the **System Operator** in accordance with this section.

In the case of an **Incident** on the **Distribution System** or on the **Transmission System**, which in the opinion of **the System Operato**r, shall have or may have an **Operational Effect** on a **User System** connected to the **Distribution System**, the **System Operator** shall notify the **User** in accordance with this section.

The following are examples of situations where notification shall be required if they have or may have an **Operational Effect:**

a. the actuation of any alarm or indication of any abnormal operating condition;

b. adverse weather conditions being experienced;

c. breakdown, **Faults**, or temporary changes in the capabilities of, **Plant** and/or **Apparatus** including **Protection**; and

d. increased risk of inadvertent operation of **Protection Equipment**.

SOC 11.6 Form of Notification

A notification by the **System Operator** of an **Operation** and/or **Incident** on the **Distribution System** or by an **Incident** on a **User's System**, shall describe the **Operation** in detail and include information on relevant previous **System** conditions.

The notification shall be of sufficient detail to enable the recipient of the notification to reasonably consider and assess the implications and consequences arising from the **Operation** on the **Distribution System** and shall include the name of the individual reporting the **Operation** on behalf of the **System Operator**.

Where a **User** is reporting an **Operation** or an **Incident** on the **User's System**, the notification to the **System Operator** shall describe the **Operation** or **Incident** and shall contain where relevant the information which the **User** has in relation to that **Incident** or scheduled/planned action affecting the **User's System**. The **System Operator** may pass on the information contained in the notification to other affected **Users** with affected **User Systems**.

SOC 11.7 Major Incidents

Refer to section SOC 10.7 above

SOC 12 MAINTENANCE STANDARDS

SOC 12.1 Introduction and Scope

All **Plant** and **Apparatus** on the **System** shall be operated and maintained in accordance with equipment manufacturers' recommendations and **Prudent Utility Practice** and in a manner that shall not pose a threat to the safety of employees or the public.

The **System Operator** shall establish a **Transmission System and Distribution System Maintenance Policy** which shall be reviewed and approved by the **Authority**.

The **Transmission Licensee** and the **Distribution Licensee** shall keep maintenance records relating to its maintenance of **Plant** and **Apparatus**.

Either **Party** shall have the right to inspect the test results and maintenance records relating to the other **Party's Plant** and **Apparatus** at any time.

The **Protection** system settings shall be reviewed every time there is a relevant change in the **Grid**. The fitness of the **Protection** system shall be assessed on a regular basis as part of a maintenance programme.

SOC 12.2 Competency of Staff

The **System Operator** shall have in place training polices that serve to ensure that persons planning, designing, constructing, operating, maintaining, testing and controlling the **Transmission** and **Distribution Systems** are competent for the tasks to be undertaken. The policies shall include refresher training at appropriate intervals to maintain the validity of the required skills.

The **System Operator** shall maintain records of training given and issue certificates indicating the areas of competency of the persons trained.

SOC 12.3 Requirement for Inspection

All **Plant** and **Apparatus** that will form part of the **Transmission System** and the **Distribution System** will only become part of the **Transmission System** and the **Distribution System** following inspection and approval by a **Certified Electrical Inspector** within the approved category.

SOC 13 CONTINGENCY PLANNING

SOC 13.1 Introduction

The **System Operator** shall have adequate policies and procedures in place to respond to a **Total System Shutdown** or major **System Incident** that will have widespread implications for electricity supply to the population. Users shall be aware of these policies and procedures, and cooperate fully in their implementation, through which the **System Operator** can return the **System** to normal operating conditions.

SOC 13.2 Objectives

The objectives of this section are:

a) to require the **System Operator** to develop a general **System Restoration Strategy** to adopt in the event of **Total System Shutdown** or **Major System Failure**;
b) to require the **System Operator** to produce and maintain comprehensive **System Restoration Procedures** covering **Total System Shutdowns** and **Major System Failures**;

c) to provide for the cooperation of **Users** with the formulation and execution of **System** restoration procedures;
d) to provide for the development and implementation of communications between the **System Operator** and **Users** when dealing with a **System Incident**; and
e) to ensure the **System Operator** and User personnel who will be involved with the implementation of **System Restoration Procedures**, are adequately trained and familiar with the relevant details of the procedures.

SOC 13.3 Scope

Requirements of this section applies to:

a) **System Operator**;
b) **Transmission Licensee**;
c) **Distribution Licensee**;
d) **Generators**; and
e) **Users** connected to the **Transmission** or **Distribution Systems**.

SOC 13.4 System Restoration Strategy

The **System Operator** shall develop a **System Restoration Strategy** to be implemented in **System Emergency** conditions such as **Total System Shutdown** and other **Major Incidents**. The overall objectives of the **System Restoration Strategy** shall be as follows:

a. Restoration of the **Transmission System** and associated **Demand** in the shortest possible time, taking into account **Generator** capabilities, and **Transmission System** operational constraints;
b. Re-synchronization of parts of the **Transmission System** which have lost synchronism with each other; and
c. to provide for effective communication routes and arrangements to enable senior management representatives of the **System Operator** and **Users**, who are authorized to make binding decisions on behalf of the **System Operator** or a **User** to communicate with each other during a **System Incident**.

The **System Restoration Strategy** shall provide for the detailed implementation of the following:

a. Provision shall be included for the implementation of a communication system that remain operational during a **Total System Shutdown**
b. Notification by the **System Operator** to **Transmission Licensee**, **Distribution Licensee**, **Generators** and **Large Users** that a **Total System Shutdown** or a major **System Incident** has occurred and that the **System Operator** intends to implement **System** restoration procedures;
c. Identification of separate groups (**Power Islands**) of **Generators** together with complementary local **Demand**; and step by step integration of these **Power Islands** into larger sub-**Systems** to return the **Transmission System** to normal operating conditions.

The **System Restoration Strategy** shall also provide for the issue of any dispatch instructions necessitated by the **System** conditions prevailing at the time of the **System Incident**.

SOC 13.5 System Restoration Procedures

The **System Operator** is responsible for the control of the **Transmission System** and the **Distribution System**.

Following a **Major System Failure**, the restoration of the System shall be managed through the implementation of a **System Restoration Strategy** developed by the

System Operator under the requirements of section SOC 13.4.

All Generators shall comply with instructions issued by the System Operator pursuant to the implementation of the System Restoration Strategy, unless these instructions have a negative impact on the safety or security of the Generator's plant.

It should be recognized by Generators that the restoration of the System needs to be flexible and Generators shall comply with instruction issued by the System Operator during an event even if they conflict with the System Restoration Strategy.

SOC 13.6 User responsibilities

Each Generator shall follow the System Operator's instructions during a System Restoration process, subject to safety of personnel, the System Operator's and the Generator's Plant and Apparatus.

It shall be the responsibility of the Generator to ensure that any of its personnel who may reasonably be expected to be involved in System Restoration Procedures are familiar with, and are adequately trained and experienced in their standing instructions and other obligations so as to be able to implement the procedures notified by the System Operator.

SOC 13.7 Black Start Procedure

The procedure for a Black Start situation shall be that specified by the System Operator at the time of the Black Start situation. Generators shall abide by the System Operator instructions during a Black Start provided that the instructions are to operate within the operating parameters of each Generator.

The System Operator may issue instructions to a Generator with Black Start capability relating to the start of a Generator when an external power supply, such as stand-by diesel-based generator or battery-based energy storage system, is made available to it.

The System Operator shall also issue instructions relating to the restoration of Demand.

Black Start instructions shall be implemented in accordance with the following procedures:

a. a Generator with Black Start capability shall start-up as soon as possible and within one hour of an instruction from the System Operator to initiate start-up. The Generator shall confirm to the System Operator when start- up has been completed;
b. following such confirmation, the System Operator shall endeavour to stabilize that Generator by instructing the restoration of appropriate demand following which the System Operator may instruct the start-up and synchronization of the remaining available Generators at that Generating Facility and their loading with appropriate Demand to create a Power Island;
c. if during this Demand restoration process any Generator cannot keep within its safe operating parameters because of Demand conditions, the operator of the Generator shall inform the System Operator and the System Operator shall, where possible, either instruct Demand to be altered or shall re-configure the Transmission System or shall instruct a User to re-configure its System in order to alleviate the problem being experienced by the Generator.

The System Operator shall have procedures in place for emergency restoration of the System following events such as cyclones, lightning and torrential rains.

These Procedures shall be reviewed and updated by the **System Operator** and may be incorporated into other procedures developed in accordance with the **System Operations Code**.

The **System Operator** shall inform **Generator**s of the end of a Black Start situation and the time at which the **Transmission System** resumed normal operation.

All notifications must be made promptly. Notifications by the **System Operator** to **Users** and responses may be made by telephone but must be confirmed within 30 minutes in writing. Where information is requested in writing throughout this Code, facsimile transmission or other electronic means as agreed with the **System Operator** in writing may be used.

SOC 13.8 Re-Synchronization Procedures

Where there is no **Total System Shutdown** but parts of the **Transmission System** are out of synchronism with each other, the **System Operator** shall instruct **Users** to regulate generation output or Demand to enable the separate parts to be re-synchronized. The **System Operator** shall inform the relevant **Users** when re-synchronization has taken place.

The **System Operator** shall issue whatever revised **Dispatch Instructions** are required to enable re-Synchronization and to return the **Transmission System** to normal operation.

SOC 13.9 Major System Failure Procedures

Major System Failures are unpredictable both with respect to timing and the resulting implications. The **System Operator** shall establish procedures for determining when an incident on the **System** shall be considered a **Major System Failure** and also establish outline procedures for handling these **Major System Failures.**

During a **Major System Failure**, normal communication channels for operational control communication between the **System Operator** and **Users** shall continue to be used.

During the event of a **Major System Failure**, the following general procedures shall apply to restore power System-wide:

a) designate **Generating Units** with Black Start Capabilities to commence restoration;
b) restart these designated **Generating Units**;
c) establish a transmission line pathway to another Generating Unit which is to be restarted while clearing all Load in this pathway;
d) establish a manageable distribution load preferably adjacent to the Generating Unit;
e) start and synchronize the Generating Unit;
f) repeat procedures (d) to (e) above until all **Generating Units** required to restore power are brought back into service; and
g) gradually return Load to the **System** while ramping up the power output of the **Generating Units** until the **System** is totally restored.
h) Procedures (d) to (g) shall be used to restore the **System** after a partial **System** shutdown.

SOC 13.10 Major System Failure Communications

The **System Operator** and **Generator**s shall ensure that there are suitable communication channels available and established protocols, including the responsibilities of senior members of staff, to facilitate the co-ordination of activities after a **Major System Failure**.

The **System Operator** and all **Users** shall maintain lists of telephone contact numbers at which, or through which, senior management representatives nominated for this purpose and who are fully authorized to make binding decisions on behalf of the **System Operator** or the relevant **User** can be contacted day or night.

The lists of telephone contact numbers shall be provided in writing prior to the time that a **Generator** connects to the **Transmission System** and must be up-dated and circulated to all relevant parties, in writing, whenever the information changes. Notifications and responses shall be made normally by telephone but must be confirmed in writing within 30 minutes.

All **Major System Failure** communications between the senior management representatives of the relevant parties with regard to the **System Operator's** role in the **Major System Failure** shall be made via the **Emergency Operation Centre** if such a **Centre** has been established.

SOC 13.10.1 System Alerts/Warnings

In the event of **Major System Failures**, such as **Total System Shutdown** or a **System** separation, the **System Operator** shall issue promptly an alert warning to all **Users**.

The form of the alert warning will be:

a. This is an alert timed at hours;

b. There is a (**Major System Failure**) at ..... (place);

c. A system normalization procedure is being implemented;

d. Standby for further instructions.

SOC 14 INCIDENT INFORMATION SUPPLY

SOC 14.1 Introduction

This section of the **System Operations Code** requires the **System Operator, the Distribution Licensee, Users** or **Generators** to issue notices of all Incidents on their respective **Systems** that have or may have implications for the **Transmission System**, **Distribution System** or a **User's System**.

The **System Operator** shall determine if an **Incident** should be classified as a **Major System Failure.**

Sub-section SOC 13.10 set out the procedures for reporting and subsequent assessment of **Major System Failures**.

Where a **Significant Incident** has been declared, the **System Operator** shall inform the **Authority** of such **Significant Incident** and may request an investigation be carried out by an investigation panel designated by the **Authority**. The composition of such investigation panel shall be appropriate to the **Incident** to be investigated.

Where there has been a series of **Significant Incidents** (that is to say, where a **Significant Incident** has caused or exacerbated another **Significant Incident**) the **System Operator** may determine that the investigation should include some or all of those **Significant Incidents**.

Sub-section SOC 14.5 requires the **System Operator** or a **Generator** to prepare a preliminary written Incident report within 24 hours of the Incident;

For a **Major System Failure**, a written report is required within 15 days of the Incident.

In addition, section SOC 14.5 contains requirements governing the content of **Major**

System Failure reports, the circulation of these reports, and their subsequent assessment and review by the **Code Review Panel**.

Incident reporting must also comply with internal procedures developed by the **System Operator**.

SOC 14.2 Objective

The objectives of section SOC 14 are:

a) to specify the obligations of the **System Operator** and **Generators** regarding the issue of notices of Incidents on their respective **Systems**;
b) to ensure notices of **Incidents** provide sufficient detail to allow recipients of such notices to fully assess the likely implications and risks and take the necessary actions required to maintain the security and stability of the **Transmission System, Distribution System** or a **Generator' s System**;
c) to specify the arrangements for reporting Incidents that the **System Operator** has determined to be a **Major System Failure**; and
d) to provide for the review of all **Major System Failure** reports by the **Code Review Panel** to assess the effectiveness of policies adopted in accordance with this **System Operations Code** and the other **Codes**.

SOC 14.3 Notification of Incidents

The **System Operator** and **Generators** shall issue notifications of **Incidents** on their respective **Systems** that have had or may have implications for the **Transmission** or **Distribution System**. Where information is requested in writing throughout this **Code**, facsimile transmission or other electronic means as agreed with **System Operator** in writing may be used.

Without limiting the requirements of this **Code**, Incident notifications shall be issued for the following, subject to sub-section SOC 14.3.1; where **Plant** has been **Operated** in excess of its rated capability and presented a hazard to persons;

The activation of any alarm or indication of any abnormal operating condition; adverse weather conditions being experienced; breakdown of, faults on or temporary changes in the capabilities of **Plant**; breakdown of or faults on control, communication and Metering equipment; and increased risk of inadvertent **Operation** of protection devices, relays or **Equipment**.

SOC 14.3.1 Incidents on the Transmission System

In the case of an Incident on the **Transmission System**, which has had or may have an **Operational Effect** on a **Generator's System**, the **System Operator** shall notify the **Generator** whose **Generation System** will be, is, or has been affected.

SOC 14.3.2 Incidents on a **Generator**'s System

In the case of an Incident on a **Generator's System**, which has had or may have an **Operational Effect** on the **Transmission System** or the **Distribution System**, the **Generator** or the **Distribution Licensee** shall notify the **System Operator**. Following notification by the **Generator**, the **System Operator** shall notify any other **Users** whose systems will be, or have been affected.

SOC 14.4 Form of Notification

Incident notifications must be issued promptly. Notifications and responses to notifications may be made by telephone or the mass media, but shall be confirmed in writing within one (1) hour or as soon as it is practical to do so.

The appropriate party shall issue a notification (and any response to questions asked) of any Incident that has arisen independently of any other Incident.

The notification shall;

a. be of the Incident (but is not required to state its cause);

b. be of sufficient detail to enable the recipient of the notification to reasonably consider and assess the implications, and risks arising; and include the name of the individual reporting the Incident on behalf of the **System Operator** or the **User**.

The recipient of a notification may ask questions to clarify the notification and the provider of the notification shall, insofar as they are able, answer any questions raised.

An Incident notification shall be given as soon after the **Incident** as possible to allow the recipient to consider and assess the implications and risks arising from the **Incident**.

SOC 14.5 Major System Failure Reporting

The contents of a **Major System Failure Report** are indicated in SOC 18.1

Preliminary report: The **System Operator** must produce a preliminary written Incident report within 48 hours.

Full report: The **System Operator** must produce a full written **Major System Failure** report within 30 business days a **Major System Failure**.

A **Generator** shall produce a **Major System Failure** Report within 20 days of a **Major System Failure** caused by its **Generation System**. This is to facilitate the **System Operator** preparing its **Major System Failure Report** within 30 days for submission to the **Authority.**

Written reporting of **Major System Failures** by the **System Operator** to **Generators:**

a) In the case of a **Major System Failure** reported by the **System Operator** to a **Generator,** the **System Operator** shall provide a full written **Major System Failure** report to the Authority.
b) Upon the request of the **System Operator**, a **Generator** shall provide a report of the **Incident** to the **System Operator**. The **System Operator** may use the information contained from an **Incident** report from a **Generator** therein in preparing the written report.

Written reporting of **Major System Failures** by **Generators** to the **System Operator**:

a) In the case of an **Incident**, that has been reported by a **Generator** to the **System Operator** and determined by the **System Operator** as a **Major System Failure**, the **Generator** shall provide a full written **Major System Failure** report to the **System Operator**.
b) The **System Operator** shall not pass this report to other affected **Users** but may use the information contained therein in preparing a **Major System Failure** report to the **Authority**.

Copies of any **Major System Failure** Report must be submitted to the **Authority**, **Transmission Licensee**, **Distribution Licensee** and **Single Buyer Licensee**.

SOC 14.6 Form of Significant Incident Report

A full **Major System Failure** report prepared by the **System Operator** shall be sent to the **Authority**. The full **Major System Failure** report shall contain confirmation of the **Major System Failure** notification together with full details relating to the **Major System Failure**.

The **Major System Failure** report should, as a minimum, contain the following:

a) date and time of **Major System Failure**;
b) location;
c) **Apparatus** involved;
d) brief description of the **Major System Failure**;
e) causes of the failure;
f) details of any **Demand Control** undertaken;
g) effect on other **System Users** including, where appropriate: duration of **Incident** and estimated date and time of return to normal service;
h) effect on **Generation** including **Generation** interrupted; frequency response achieved; MVAR performance achieved; and estimated date and time of return to normal service;
i) measures and procedures taken to restore the **System**;
j) measures that should be taken to avoid a recurrence of the failure; and

The above list is not intended to be exhaustive to this section.

SOC 15 SAFETY COORDINATION

SOC 15.1 Introduction

This section specifies the Safety Management system criteria, specified by the **System Operator,** to be applied by the **Transmission or Distribution Licensee, as applicable,** to meet statutory requirements and License conditions and obligations.

Similar criteria and standards of Safety Management systems shall be provided by other **Users** of the **Transmission** and **Distribution Systems** when carrying out work or tests at the operational interface with the **Transmission or Distribution Licensee, as applicable.**

SOC 15.2 Objectives

To lay down the Safety Management criteria to be applied to ensure safety of persons working on the **Transmission and Distribution Systems** and at or across operational and Ownership Boundaries.

SOC 15.3 Scope

This section specifies the Safety Management criteria that applies to the **Transmission or Distribution Licensee, as applicable,** and the following **Users** of the **Transmission and Distribution Systems**:

a. **Generator**s;
b. **Large Customers**;
c. Any other party reasonably specified by the **Transmission or Distribution Licensee, as applicable,** including **Users** connected at High, Medium or Low Voltage for appropriate sections of section SOC 15 when necessary;
d. Agents of the **Transmission or Distribution Licensee, as applicable,** or **Users** working on the **Transmission** or **Distribution System** or at or across operational boundaries;

SOC 15.4 Procedures

The Safety Management principles and procedures (Safety Management system) for ensuring the health and safety of all relevant personnel shall be specified by the **System Operator** and **Users** for work on their respective systems or Plant or

apparatus connected to them.

The **Transmission or Distribution Licensee, as applicable,** shall specify the Safety Management system applicable at operational boundary points and proper documentation of the safety precautions to be taken shall be maintained.

Authorized Persons

a. The **Transmission or Distribution Licensee, as applicable,** shall at all times have nominated 'Authorized Person (s)' to be responsible for the coordination of safety including the work of control, Operation, Maintenance or testing of Plant or apparatus forming part or connected to the **Transmission** or **Distribution System** as per the Licensee's Safety Rules Manual and Procedures.
b. The **User** shall at all times have nominated 'Authorized Person(s)' to be responsible for the coordination of safety including the work of control, Operation, Maintenance or testing of Plant or apparatus owned by the **User** and connected to the **Transmission** and **Distribution System** as per the Licensee's Safety Rules Manual and Procedures.
c. The **User** shall confirm nominated 'Authorized Person(s)' in writing to the **Transmission or Distribution Licensee, as applicable**.

There shall be joint agreement between the **Transmission or Distribution Licensee, as applicable,** and **Users** which specifies responsibility for system or control Equipment which shall ensure that only one party is responsible for any item of Plant or apparatus at any one time.

The **Transmission or Distribution Licensee, as applicable,** and each **User** shall maintain a suitable system of documentation which records all relevant operational Events that have taken place on the **Transmission** or **Distribution System** or other system connected to it and the co-ordination of relevant safety precautions for work.

System diagrams which show sufficient information for control personnel to carry out their duties shall be exchanged between the **Transmission or Distribution Licensee, as applicable,** and **User** as required.

SOC 15.5 Safety at the Transmission/Distribution Licensee / User Interface

SOC 15.5.1 Safety Requirements at the Interface

The following procedure set down the basic safety requirements at the **Transmission or Distribution Licensee, as applicable,** and **User** interfaces. These procedures are necessary to ensure the safety of all who may have to work at either side of the interface or on the interface (boundary):

a. Written rules shall be specified by the **Transmission or Distribution Licensee, as applicable,** and safe working and communicating procedures shall be available and used by all persons who may have to work at or use the facilities provided at the Interface;
b. Electrical Equipment connected to either side of the interface and interface Equipment shall be under the control of a named person at either side;
c. Each item of Equipment shall be controlled by only one identifiable person at any one time;
d. Adequate means of isolation shall be provided at the interface to allow work to be carried out safely at either side of the interface;
e. Where necessary to prevent danger adequate facilities for Earthing shall be provided at either side of the interface to allow work to be carried out safely at the interface or at either side of the interface;
f. Adequate working space, adequate means of access and egress and, where necessary, adequate lighting shall be provided at all electrical Equipment

on or near which work is being done in circumstances which may cause danger;

g. All electrical Equipment shall be suitably identified where necessary to prevent danger;
h. Electrical installations and Equipment shall comply with the relevant Statutory Requirements as set down in the respective Code

SOC 15.5.2 Maintenance

The **Transmission or Distribution Licensee, as applicable,** shall ensure that it's electrical installations and any Equipment within it:

a. are maintained in a safe condition as per manufacturer manual and **Prudent Utility Practice**; and
b. complies with Occupational Safety and Health Act 2005 and associated Regulations.

Users shall insure that their electrical installations and any Equipment within it:

a. are maintained in a safe condition as per manufacturer manual and **Prudent Utility Practice**; and
b. complies with Occupational Safety and Health Act 2005 and associated Regulations.

SOC 15.6 Safety Procedures

Operation and Maintenance of the **Users**' Equipment shall only be carried out by Authorized Person(s). Before first Commissioning the Plant, operating procedures shall be agreed with the **Transmission or Distribution Licensee, as applicable**.

Instructions for operating and / or Earthing the **Users**' electrical Equipment shall be clearly displayed in the **Users**' Medium and High Voltage switch room.

The Safety Rules Manual details the Safety Procedures to be observed for all personnel working on or in close proximity to **Transmission System** and **Distribution System** Plant or Equipment.

The **User**'s Safety Procedures shall apply to the **Users**' 'Authorized Persons' at the **User**'s Plant or Equipment at the interface.

SOC 16 OPERATIONAL METERING AND DATA ACQUISITION

Operational metering and data acquisition requirements for the System Operator Control Centre shall be specified in the **System Operator**'s SCADA Policy.

SYSTEM OPERATIONS CODE - PART D – INFORMATION EXCHANGE

SOC 17 INFORMATION EXCHANGE

SOC 17.1 Introduction

This section provides a summary of all the information and data, as specified in the Generation, Transmission, Distribution and System Operations Code, that is required to be exchanged by the concerned parties.

The following information is indicated in the table below:

- Code and Section where details of the provision can be found
- Data Item Name
- Summarized description of the requirement
- Frequency of exchange:
    - static data is submitted once but update when characteristics or settings of equipment change, are modified or updated as required by the National Grid Code.
    - dynamic data is interchanged when conditions arise as per requirements of the National Grid Code
- Source of the information
- Destination of the information

Table 6 Information Exchange Requirements

Code	Section	Item	Comment	Frequency	From	To
TC	TC 3.4.2	Transmission System Studies Demand data	a) active and reactive consumption b) models for complex loads (frequency, voltage) static and dynamic dependence	yearly	a) Distribution Licensee b) System Operator c) Users connected to the Transmission System	Single Buyer
TC	TC 3.4.3 TC 18	Transmission System Studies Transmission System data	a) Power transformers b) Transmission Lines and cables	Static	a) Transmission Licensee b) Users connected to the Transmission System	Single Buyer
TC	TC 3.4.4	Transmission System Studies Generating Units data	a) real and reactive power capabilities (static) b) dynamic models for generating units and control systems	Static	Generators connected to the Transmission System	System Operator and Single Buyer
TC	TC 3.4.5	Transmission System Studies Other data	a) settings of protection relays b) Circuit Breaker and Protection relay operating time and operating sequences	Static	Users connected to the Transmission System, including Distribution Licensees, Large Customers and Generators	System Operator and Single Buyer

Code	Section	Item	Comment	Frequency	From	To
TC	TC 5.3.2	Method of Interconnection	a) updated data requested under TC 3; b) details of the Protection arrangements and settings including the Project drawings described in Section TC 8.4.1; c) copies of all Safety Rules and Local Safety Procedures applicable at User Site which shall be used at the System Operator/User interface; d) information to enable the System Operator prepare the Site Responsibility Schedules on the basis of the provisions set out in Section TC 19.1; e) Operation Diagram for all HV Apparatus on the User side of the Interconnection Boundary; f) proposed name of the User Site; g) a list of Safety Coordinators; h) a list of the telephone numbers for Joint System Incidents notifications and communications; i) a list of managers or nominated representatives who have been duly authorized to sign Site Responsibility Schedules on behalf of the User; and j) information to enable System Operator to prepare Site Common Drawings.	Prior to Completion date	User	System Operator and Single Buyer
TC	TC 6	Power Quality Standards	All data required according to section TC 6 regarding power quality: Harmonic Voltage and current distortion, voltage fluctuations and phase unbalance.	Dynamic	User	System Operator
TC	TC 8.3 and TC 19.1	Site Related Conditions Site Responsibility Schedules	a Site Responsibility Schedule shall be produced for System Operator and Users with whom they interface	Static	User	System Operator
TC	TC 8.4.1	Site Related Conditions Project Drawings	Project drawings detailing the User Interconnection Facilities, Protection and control	Static	User	System Operator

Code	Section	Item	Comment	Frequency	From	To
			Apparatus and the Transmission System Electrical Facilities at the Interconnection Site			
TC	TC 8.4.2 and TC 19.2	Site Related Conditions Operation Diagrams	Prepared by the User for each Interconnection Site at which an Interconnection Boundary exists The Operation Diagram shall include all HV Apparatus and the connections to all external circuits and incorporate numbering, nomenclature and labelling according to the system used by the System Operator	Static	User	System Operator
TC	TC 8.4.3	Site Related Conditions Site Common Drawings	Site Common Drawings shall be prepared for each Interconnection Site and shall include Interconnection Site layout drawings, electrical layout drawings, common protection/control drawings and common services drawings	Static	System Operator and User	System Operator and User
TC	TC 8.6	Maintenance Standards	The User shall maintain a log containing the test results and maintenance records relating to its Electrical Facilities at the Interconnection Boundary and shall make this log available when requested by the System Operator. The System Operator shall maintain a log containing the test results and maintenance records relating to its Electrical Facilities at the Interconnection Boundary and shall make this log available when requested by the User.	Dynamic	System Operator and User	System Operator and User
TC	TC 16	Testing, monitoring and investigation	Any exchange information required by these activities as required in the TC	Upon request	System Operator and User	System Operator and User

Code	Section	Item	Comment	Frequency	From	To
DC	DC 3.4.1	Standard Planning Data Interconnection Studies Energy and Demand Forecasts	Where the Distribution Licensee considers it necessary for the purpose of interconnection studies, , the User connected at MV shall provide the Distribution Licensee with its Energy and Demand forecasts at each Interconnection Boundary at least for the three succeeding years. This forecast data, for the first year shall include monthly Energy and Demand forecasts, while the remaining two years shall include only annual forecasts.	Upon request	Users connected at MV	Distribution Licensee who informs Single Buyer
DC	DC 3.4.2	Standard Planning Data Distribution System Data	All the data relevant to the Distribution System. This network data shall include at least the following: a. Transformers (including voltage regulators) - MVA rating, primary and secondary winding voltages, windings interconnection, sequence impedances, X/R ratio, tap ranges, tap settings, emergency ratings, etc. b. Electric Lines - rated line voltage, conductor type, and type of construction, thermal ratings, emergency rating, and sequence impedances, etc. c. Distributed Generating Units shall be modelled by their Active Power and Reactive Power capabilities for steady state analyses. For dynamic analysis more detailed Models are required. The DGS shall be represented using the information specified in DC 5.6.1. d. Other parameters - In order to develop a Grid reliability data bank outage rates and durations for all major Equipment are also required.	Static	Distribution Licensee	System Operator and Single Buyer

Code	Section	Item	Comment	Frequency	From	To
DC	DC 3.4.3	Standard Planning Data User System Data	All data specified under section DC 4.4.3		Users connected at LV	Distribution Licensee
DC	DC 4.6.1 and DC 4.6.2	Distributed Generation Provision of information	Distributed Generators shall apply and provide to the Distribution Licensee, via the application form process defined by the Distribution Licensee, information on the Generating Station and the proposed interface arrangements between the Generating Station and the Distribution System. The details of information required shall vary depending on the type and size of the Generating Unit and the characteristics of the Interconnection Boundary. This information shall be provided by the Generator at the reasonable request of the Distribution Licensee.	Upon request	Distributed Generators	Distribution Licensee
DC	DC 4.6.3	Distributed Generation Provision of information	Where a Generating Station is intended for Parallel Operation with the Distribution System the following additional information shall be provided by the Distribution Licensee to the Distributed Generator: a. Settings of the Protection relays of the feeder on which the Generation is to be connected, and of any other relay with which coordination is required b. Equipment, cabling, switchgear, metering requirements c. Substation site and building requirements (dimensions, access, planning permission, Earthing, lighting and heating)	as required	Distribution Licensee	Distributed Generators
DC	DC 4.8 and DC 4.9	Protection Requirements	All information required by the System Operator regarding for the purpose of protection coordination	as required	Distribution Licensee	System Operator

Code	Section	Item	Comment	Frequency	From	To
DC	DC 4.12	Testing and Commissioning	All information required from Generators during tests and commissioning	as required	Conventional generator or RE DGS connected to MV	System Operator
DC	DC 5	Distribution System Interconnection	Information required from users connected at MV and LV	as required	Users connected at MV and LV	Distribution Licensee
DC	DC 6	Power Quality Standards	All data required according to section DC 7 regarding power quality: Harmonic Voltage and current distortion, voltage fluctuation, phase unbalance and limitations of DC injection	Dynamic	User	Distribution Licensee
DC	DC 8.3 and DC 21.1	Site Related Conditions Site Responsibility Schedules	a Site Responsibility Schedule shall be produced for System Operator and Users with whom they interface	Static	User	System Operator
DC	DC 8.4.1	Site Related Conditions Project Drawings	Project drawings detailing the User Interconnection Facilities, Protection and control Apparatus and the Transmission System Electrical Facilities at the Interconnection Site	Static	User	Distribution Licensee
DC	DC 8.4.2 and DC 21.2	Site Related Conditions Operation Diagrams	Prepared by the User for each Interconnection Site at which an Interconnection Boundary exists The Operation Diagram shall include all HV Apparatus and the connections to all external circuits and incorporate numbering, nomenclature and labelling according to the system used by the System Operator	Static	User	System Operator
DC	DC 8.4.3	Site Related Conditions Site Common Drawings	Site Common Drawings shall be prepared for each Interconnection Site and shall include Interconnection Site layout drawings, electrical layout drawings, common protection/control drawings and common services drawings	Static	System Operator and User	System Operator and User
DC	DC 10	Testing and monitoring	Any exchange information required by these activities as required in the DC	Upon request	System Operator and User	System Operator and User

Code	Section	Item	Comment	Frequency	From	To
DC	DC 16	Special System Tests	Any exchange information required by these activities as required in the DC	Upon request	System Operator and User	System Operator and User
SOC	SOC 1	Integrated Resource Planning	The Single Buyer shall engage all relevant stakeholders in the elaboration of the IRP, including licensees (generation, transmission, distribution, system operator) and the Authority	Yearly	Licensees and the Authority	Single Buyer
SOC	SOC 4.1	Operations Planning - Dispatch Data Registration	The Data Registration sets out a unified listing of all data required by the System Operator from Generators and by Generators from the System Operator for dispatch.	As specified in the Code	System Operators and Generators	System Operators and Generators
SOC	SOC 4.2	Operations Planning - Demand Forecast	Users, the Distribution Licensee and specified Generators to provide Demand and generation output information to the System Operator	As specified in the Code	Users, the Distribution Licensee and Specified Generators	System Operator who informs the Single Buyer
SOC	SOC 4.3	Operations Planning - Outage Planning	Coordination through various timescales of planned outages of Generating Units and outages of Plant and Apparatus on the Transmission and Distribution Systems, due to commissioning, testing, repair, refurbish and maintenance requirements. Collection of data is required from Generators, Transmission and Distribution Licensees, and Users	As specified in the Code	Generators, Transmission and Distribution Licensees, and Users	System Operator who informs the Single Buyer
SOC	SOC 4.5	Operations Planning - Merit Order	Generator shall provide the latest fuel cost and/or VOM information to the System Operator for its Generating Facilities within 24 hours of a request or from the time when such information becomes available. All thermal Generators must supply a guaranteed heat rate curve to the System Operator.	Upon request	Generators	Single Buyer who informs the System Operator

Code	Section	Item	Comment	Frequency	From	To
SOC	SOC 4.6	Operations Planning - Unit Commitment Scheduling and Dispatch	Each Generator must submit to the System Control Centre a declaration of plant availability and capability, and any other information as agreed	As specified in the Code	Generators	System Operator
SOC	SOC 5	Operations Planning - Dispatch for Operations	Generators shall notify the System Operator as soon as possible of any factors which will or are likely to, affect the power output capability, flexibility, response or cost of production of any of its Generating Units. The System Operator will require accurate and timely information on the Generating Units, including availability, efficiency and technical operating capability.	As specified in the Code	Generators	System Operator
SOC	SOC 6.2	System Control Responsibilities	The System Operator and Users shall jointly agree and outline in writing schedules specifying the responsibilities for control of Equipment. These shall ensure that only one party is responsible for any item of Plant or Apparatus at any one time. The System Operator and each User shall at all times have nominated an Operations Engineer, who shall be responsible for daily technical and dispatching instructions and for the co-ordination of safety of their respective Electrical Facilities pursuant to this sub-section SOC 6 and section TC 8 of the Transmission Code.	As specified in the Code	System Operators and Users	System Operators and Users
SOC	SOC 6.3	System Control Documentation	The System Operator and Users shall maintain a suitable system of documentation which records all relevant operational events that have taken place on the Transmission System or any other User System connected to it and the co-ordination of relevant safety precautions for work.	As specified in the Code	System Operators and Users	System Operators and Users

Code	Section	Item	Comment	Frequency	From	To
SOC	SOC 6.4	System Control System Diagrams	Diagrams illustrating sufficient information for the User Operations Engineer and System Operations Engineer to carry out their duties shall be exchanged by the System Operator and the appropriate User according to section TC 8.4 of the Transmission Code.	As specified in the Code	System Operators and Users	System Operators and Users
SOC	SOC 10	Operational Communication - Transmission System	Exchange of information between the System Operator and Users in relation to Operations which have had (or may have had) or will have (or may have) an Operational Effect: a. on the Transmission System in the case of an Operation on a User System; and b. on a User System in the case of an Operation on the Transmission System.	As specified in the Code	System Operators and Users	System Operators and Users
SOC	SOC 11	Operational Communication - Distribution System	Exchange of information so that the implications of an Operation and/or Incident can be considered and the possible risks arising from them can be assessed and appropriate actions taken by the relevant Parties in order to maintain the integrity of the Total System and the Users' Plant and Apparatus. For the purpose of this section, the term Users refers both to Customers connected to MV and Distributed Generators.	As specified in the Code	Users MV and Distributed Generators	System Operator
SOC	SOC 14	Incident Information Supply	System Operator, Users or Generators shall issue notices of all Incidents on their respective Systems that have or may have implications for the Transmission System, Distribution System or a User's System. The System Operator shall determine if an Incident should be classified as a Major System Failure.	As specified in the Code	System Operator, Users, Generators	System Operator, Users, Generators

Code	Section	Item	Comment	Frequency	From	To
SOC	SOC 15	Safety Coordination	Safety Management system criteria shall be specified by the System Operator, and applied by the Transmission or Distribution Licensee, as applicable, to meet statutory requirements and License conditions and obligations. Similar criteria and standards of Safety Management systems shall be provided by other Users of the Transmission and Distribution Systems when carrying out work or tests at the operational interface with the Transmission or Distribution Licensee, as applicable.	As required	System Operator	Transmission, Distribution Licensee, Users
GC	GC 2.1.2 and GC 16	Generation Data Requirements	Generators shall submit the data specified to the Single Buyer and System Operator to carry out the appropriate System planning and operational studies and also to execute Dispatch Instructions. The System Operator shall forward the relevant information to other Licensees, where needed. The required data includes: rated capacity (MW, MWVAR), modeling for use in the System Operator's, Single Buyer's simulation software and other various data as specified in the Generation Code	As specified in the Code	Generator	System Operator and Single Buyer
GC	GC 2.1.14.4	Interconnection Boundary Diagrams and protection schemes	i. Protection and Metering single line diagrams; ii. Tripping logic diagrams; iii.AC and DC schematic diagrams for the Interconnection and Generating Unit Protection schemes; iv. Setting calculations and setting lists for the interconnection and Generating Unit Protection schemes including opening/closing time for main Circuit Breakers;	As specified in the Code	Generator	System Operator and Transmission Licensee

Code	Section	Item	Comment	Frequency	From	To
			v. Substation Equipment single line diagram; and vi.Any other information that may be required.			
GC	GC 2.4.1	Inspection of Generation Stations	The System Operator and the Transmission Licensee have the right to inspect any aspect of the Generator's Electrical Facilities in so far as that plant is pertinent to the provision of capacity and/or energy to the System, or to the safe and secure operation of the System, in order to verify the correct operation of all equipment including controls, Circuit Breakers, Protection relays (and relay settings), metering and telemetering. The Generator shall keep records to provide verification of tests and maintenance, in accordance with IA, PPA or ESPA, by the System Operator.	As required	Generator	System Operator and Transmission Licensee
GC	GC 6.1	Communication and Reporting Designated Contact Person	The System Operator shall at all times have a person designated as the System Control Engineer. Each Generator shall at all times have a person designated as the Operations Engineer in charge of operation and control of each Generating Unit.	As required	Generator and System Operator	Generator and System Operator
GC	GC 6.2	Communication and Reporting System Control Centre record of dispatch	A record of events shall be kept at the System Control Centre, as specified in the Generation Code	As specified in the Code	System Operator	Generator

Code	Section	Item	Comment	Frequency	From	To
GC	GC 6.3	Communication and Reporting Generator Operations Log	The Generator shall maintain an accurate and up-to-date Operations Log. The purpose of this Operations Log is to record significant events, plans, requests and instructions. Entries into the Operations Log should be made on a daily basis and should include, as necessary, the following	As specified in the Code	Generator	System Operator
GC	GC 11.1	Ownership, Operation and Maintenance Schedules	Schedules specifying the ownership and the responsibilities for Operation and Maintenance shall be jointly agreed by the System Operator and the appropriate Generator for each location where either an Operational Interface or joint responsibilities exist.	As required	Generator and System Operator	Generator and System Operator
GC	GC 11.2	Maintenance of Schedules and Diagrams	All schedules and diagrams shall be maintained by the System Operator and appropriate Generator and exchanged as necessary to ensure they reflect the current agreements and network configuration.	As required	Generator and System Operator	Generator and System Operator
GC	GC 12	Testing and Compliance Monitoring	Any exchange information required by these activities as required in the GC 12	Upon request	Generator and System Operator	Generator and System Operator
GC	GC 13	Monitoring and Control	Any exchange information required by these activities as required in the GC 13	As specified in the Code	Generator and System Operator	Generator and System Operator

SOC 18 APPENDIXES

SOC 18.1 APPENDIX A: FORM OF MAJOR INCIDENT REPORT

Form of **Major Incident** Report

1. Time and date of **Major Incident**;
2. Location;
3. **Plant** or **Apparatus** directly involved (not merely affected by the Incident) including numbers and nomenclature;
4. Description of Significant Incident including probable causes and any damage to **Plant** or **Apparatus**;
5. **Demand** in MW and/or **Generating Unit** output in MW interrupted and duration of interruption;
6. **Generating Unit** change in availability;
7. **Generating Unit** Frequency response (MW correction versus time achieved subsequent to the **Major Incident**);
8. **Generating Unit** MVAR performance (change in output subsequent to the **Major Incident**);
9. Estimated or actual time and date of return to service and/or return to pre-Incident availability; and
10. Any other relevant material.