Distribution Operating Code

By :

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KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

Suruhanjaya Tenaga

Distribution Code Awareness Programme Funded by Akaun Amanah Industri Bekalan Elektrik (AAIBE)

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This Programme is Funded by Akaun Amanah Industri Bekalan Elektrik （AAIBE）

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Introduction to Distribution Operating Code (DOC)

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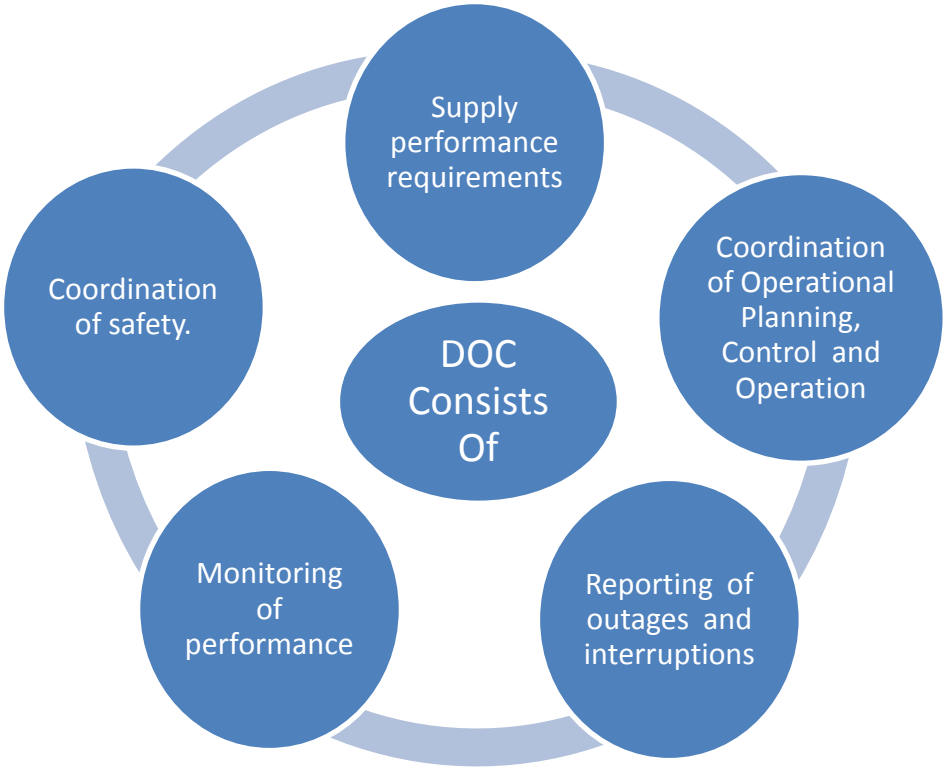
What is Distribution Operating Code?

- Requirements for operating the Distributor's Distribution System



Distribution Operating Code
6.1 - Introduction

Operation of Distribution System

Operational Planning, maintenance, inspection scheduling, switching operations plans

Perform voltage and power flow controls -ensure the Distribution System operated within supply performance requirements

Monitor Distribution System performance through measurements and records -ensure compliance with supply performance requirements;

Reports of Distribution System performance –include outages and interruptions as required

Perform switching operations -restore supply (network element outages), Equipment maintenance, diverting power flows

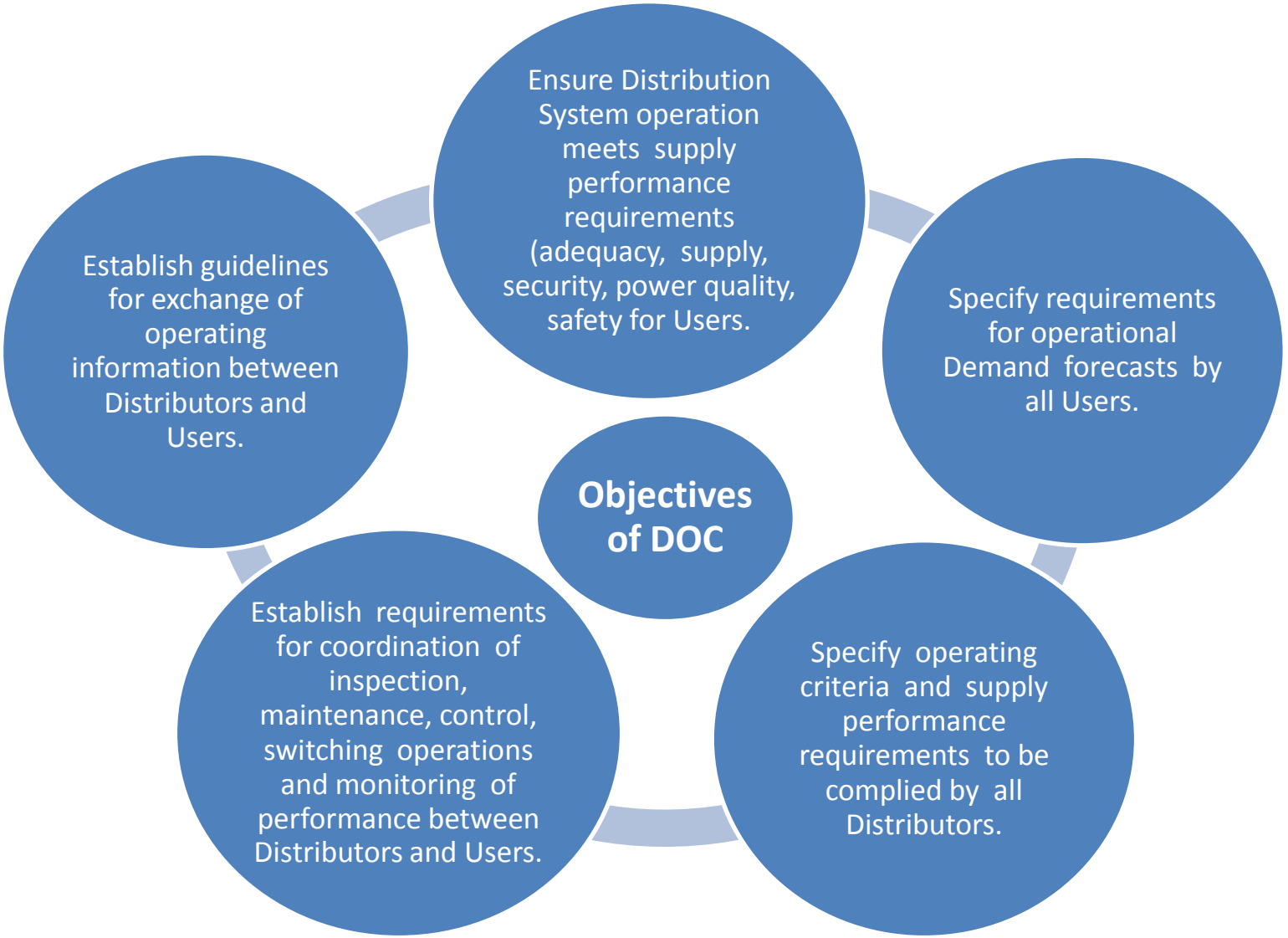
Ensure safety of operating staff, contract personnel and public (according to Electricity Supply Laws and Licence.)

Scope of DOC

Applies to - Distributors, Consumers, Distributed Generators and Embedded Distributors (unless stated), all users connected to Distributor's Distribution System

Distribution Operating Code

6.3 - Objective



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Annual Operation Plan

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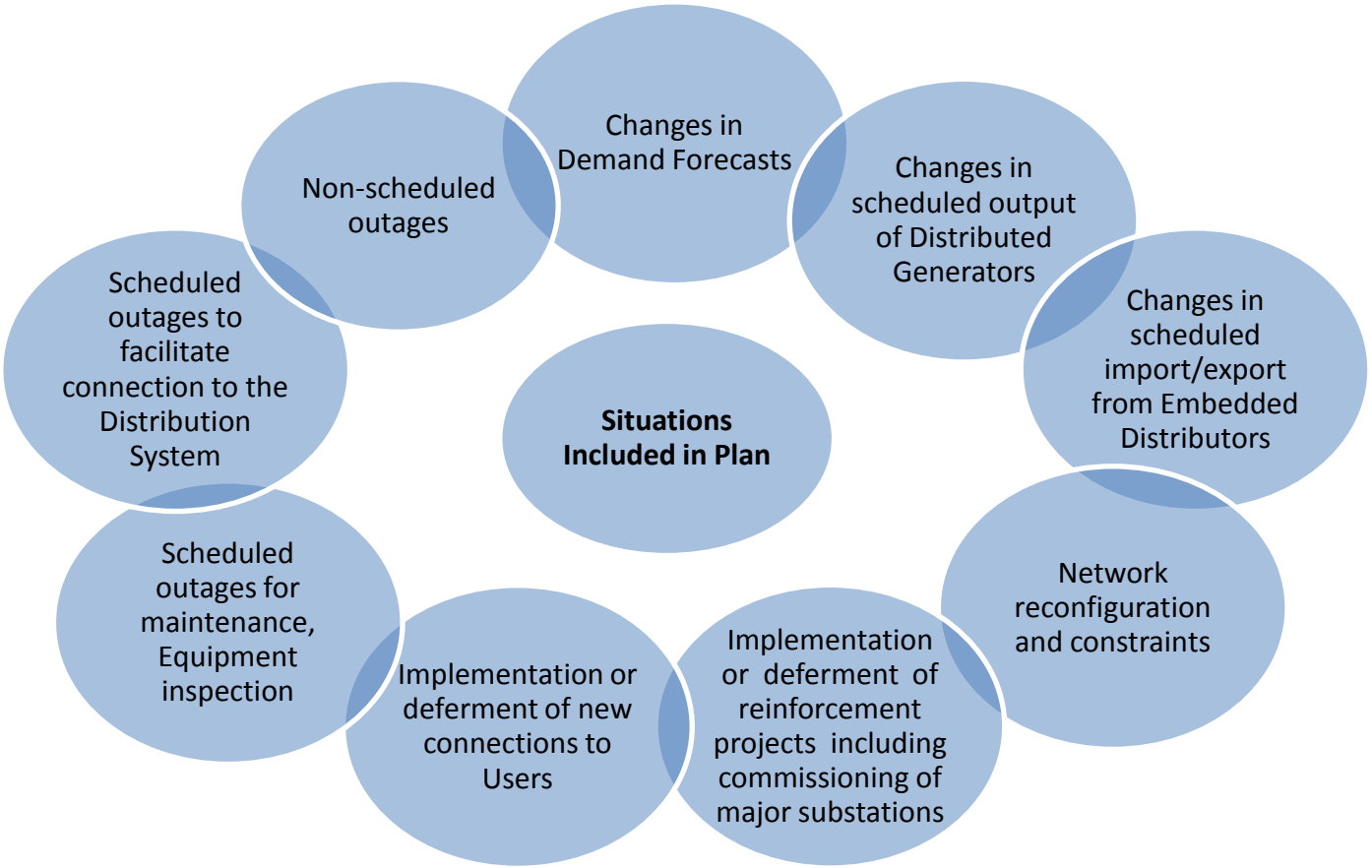
What is Annual Operation Plan?

- Strategies on how the Distribution System shall be operated under normal and abnormal situations.



Criteria of Annual Operation Plan

When establishing the operation plan, Distributor shall employ the best engineering and prudent utility practices. The Distributor must adhere to the Operational Planning requirements of the Grid Code.

Distributor shall establish an Annual Operation Plan setting out the operating strategies, network configuration and Distribution System outages and User System outages covering the Distributor's next financial year (review monthly).

Due to preparing the Annual Operation Plan, Distributor may require information from Users. Distributor shall inform User of the requirement and give an ample time to collect the data.

If actions by Users needed to complete the plan, Distributor will discuss and finalise with those Users in reasonable time the details of action needed. Users are obliged to take action as requested.

Operational Demand
&
Generation Forecast

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Distribution Operating Code
6.4 – Distribution Operational Planning

- Introduction to General Forecast
- Provision 5.10.1.1 of the Distribution Planning Code (DPC) requires Distributor to prepare Demand forecasts including short-term forecast for Operational Planning.
- Demand forecasts needed to prepare necessary Annual Operation Plan.
- Major changes in load consumption forecast or generation output forecast would require the Distributor to make adjustments to the Annual Operation Plan.
- Where a User has been requested to provide Demand forecasts under provision stated in the DPC, the User must inform the Distributor of such changes.

Consumer

Consumers with Peak Demand of 5 MW or more must inform Distributor the following changes to the load forecast submitted under provision 5.10.2.1 of the DPC 1 month before the implementation of the changes.

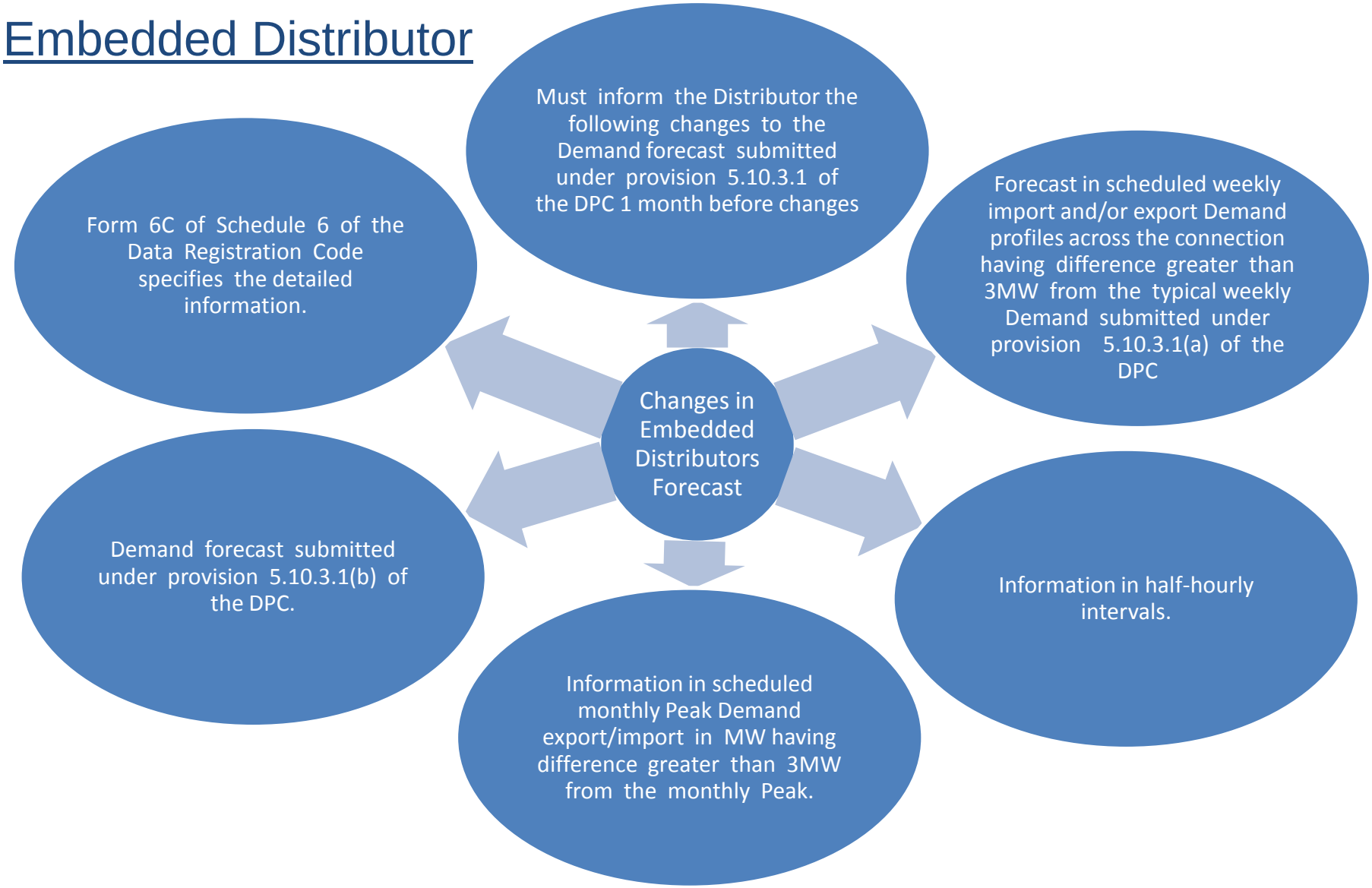
Changes in Consumer's Demand Forecast

Form 6B of Schedule 6 of the Data Registration Code specifies the detailed information.

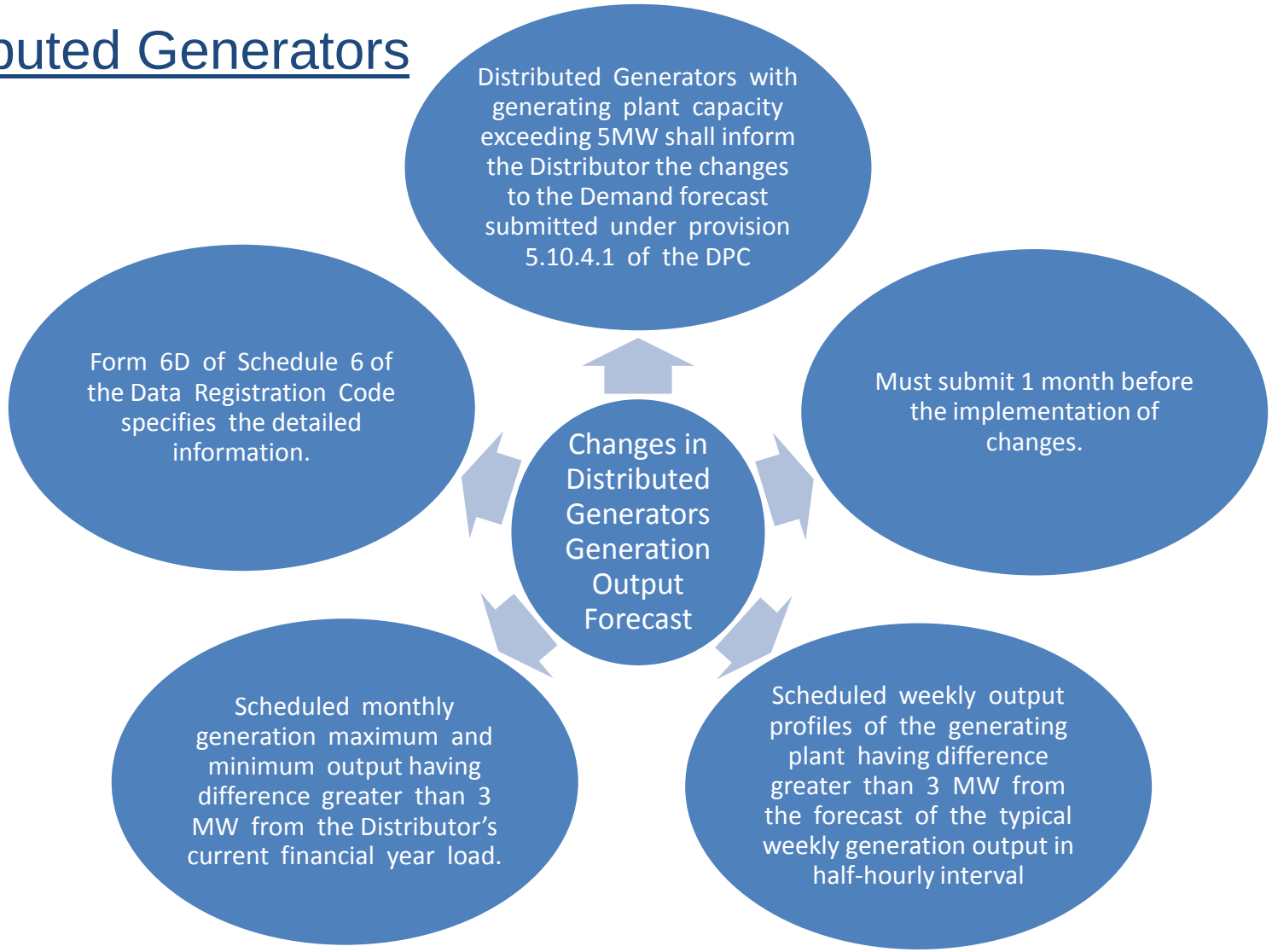
Scheduled weekly Demand profiles having a difference greater than 3 MW from the typical weekly Demand profile submitted under rovision 5.10.2.1(a) of the DPC, in half-hourly intervals

Scheduled monthly Peak Demand in MW having a difference greater than 3 MW from the monthly Peak Demand forecast submitted under provision 5.10.2.1(b) of the DPC

Embedded Distributor



Distributed Generators



Annual Operation Data

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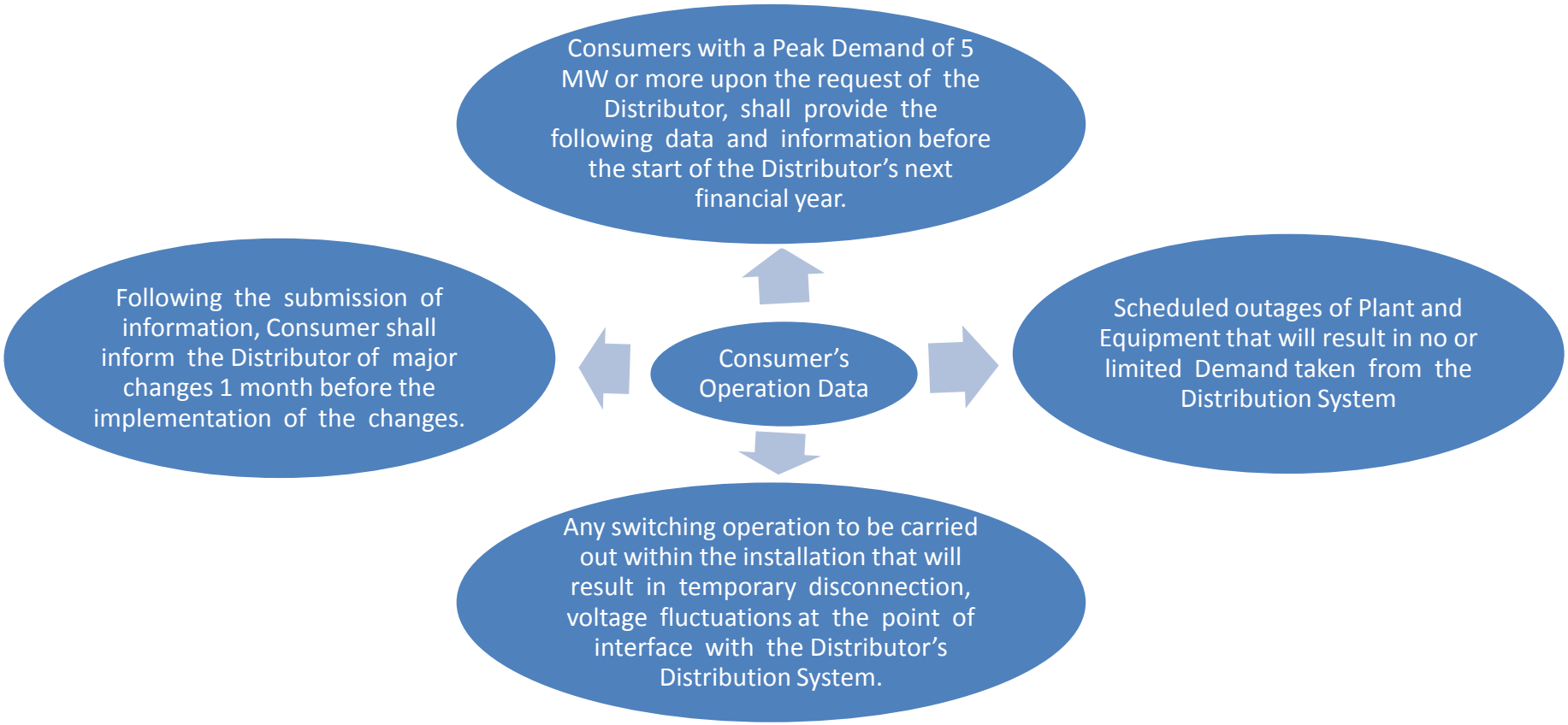
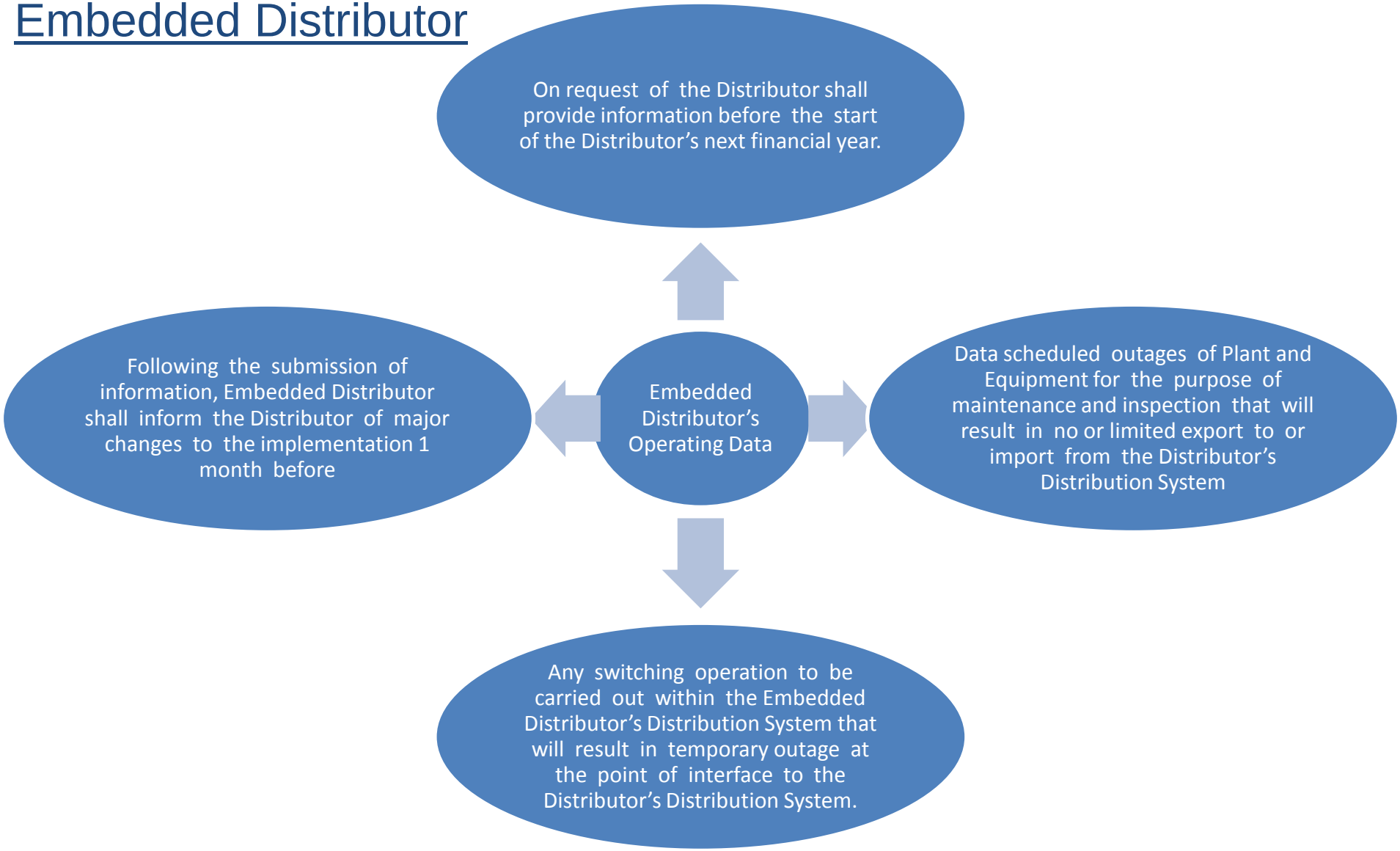
Consumer

Introduction to Annual Operation Data

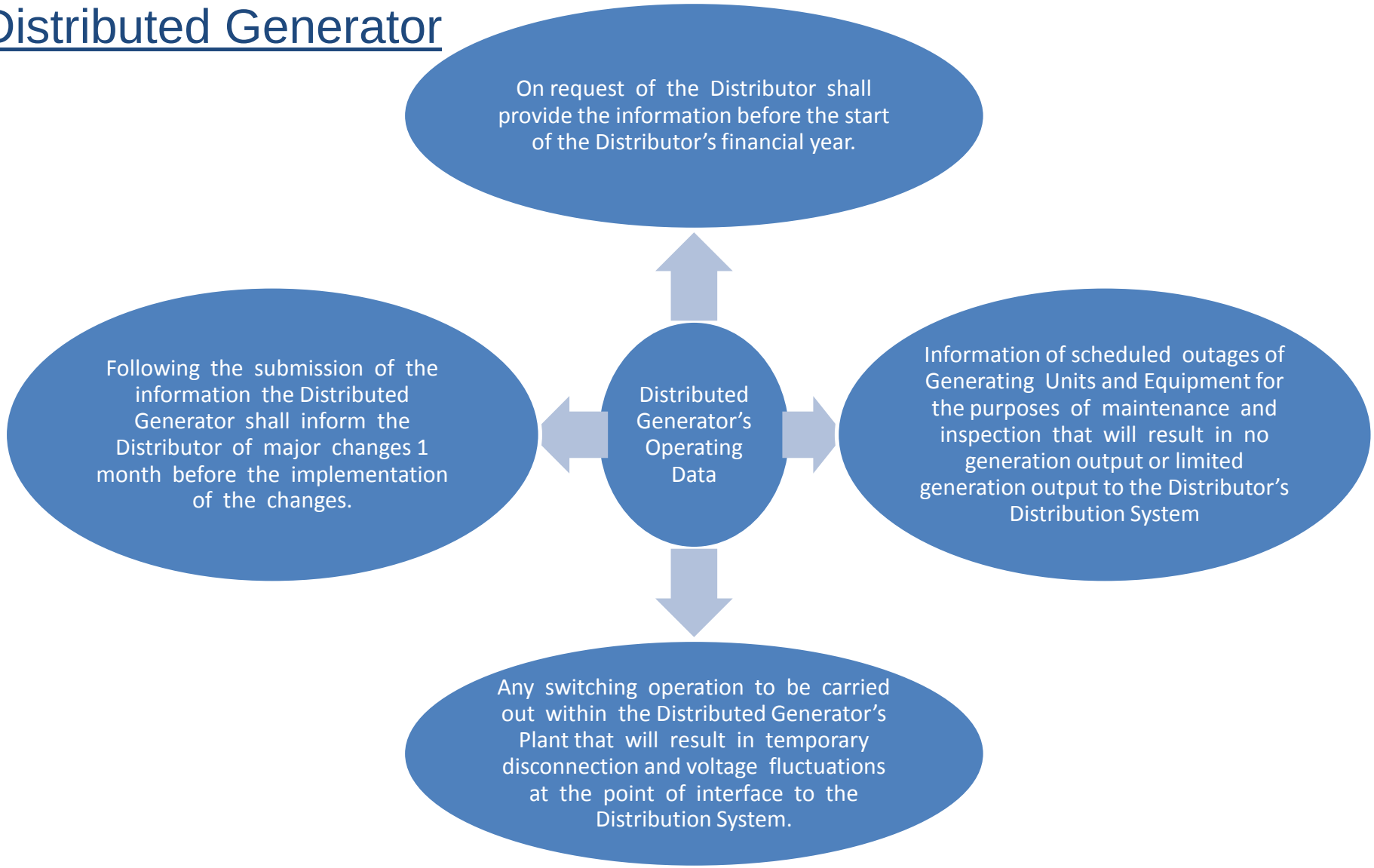
- Users requested by the Distributor shall provide information on scheduled outages and switching operations.



Embedded Distributor



Distributed Generator



Operation Criteria

Introduction

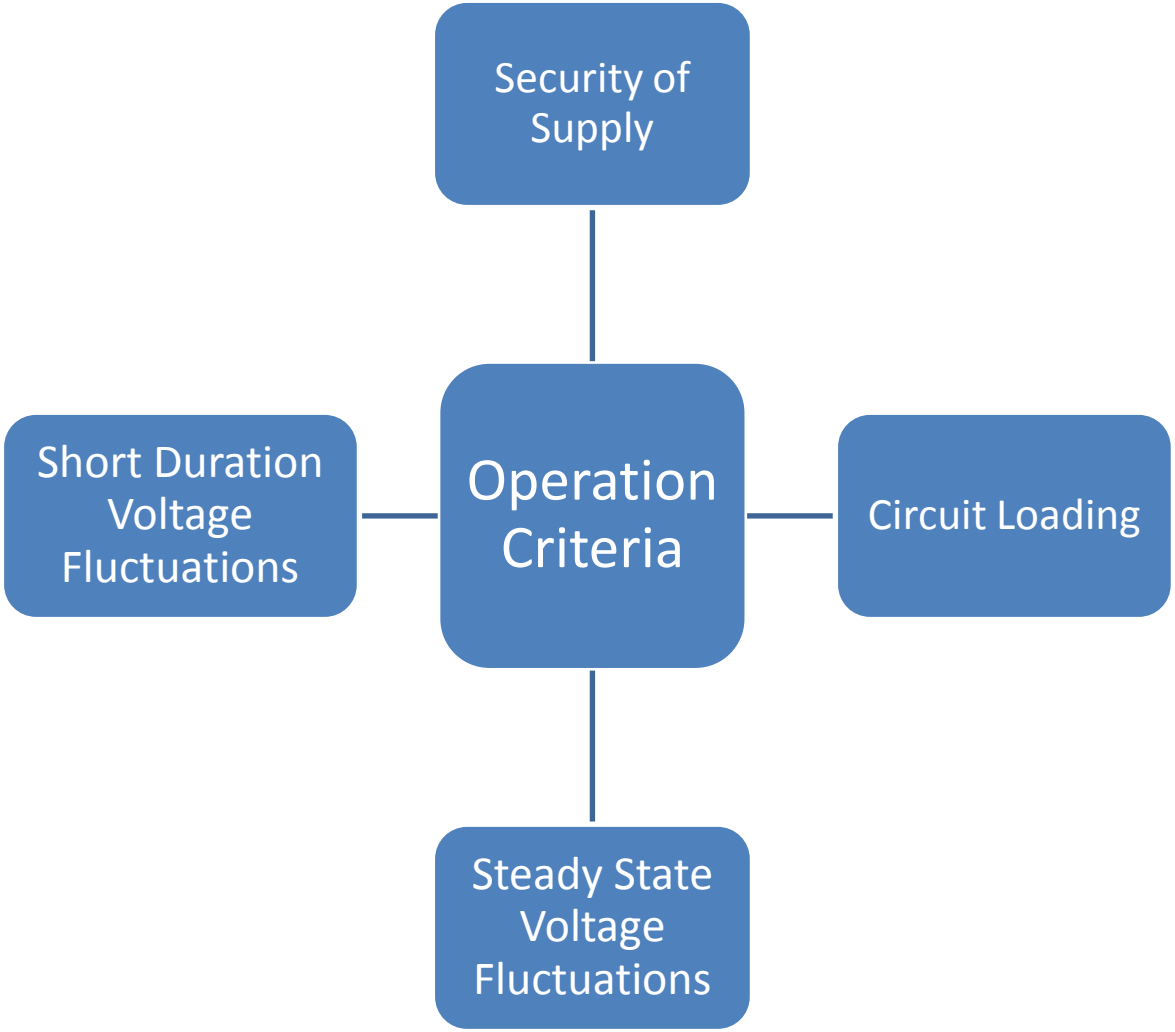
1

- Objective : To outline **normal** requirements to be complied by Distributors in maintaining network performance during operating the system and to be taken account in Operational Planning.

2

- Each Distributor must operate and maintain its Distribution System according to the requirement using the best engineering and prudent utility practices as far as applicable.
- Operating performance criteria are sets of requirements to be satisfied in day to day operation and consistent with the planning criteria (Refer DPC section 5.4)

Distribution Operating Code
6.5 – Operation Criteria



Distribution Operating Code
6.5 – Operation Criteria

Security of Supply	Circuit Loading
• Supply security to Users is concerned with availability of supply following a circuit outage or supply interruption. • Availability of supply depends on the security provided at the planning stage (DPC 5.4.2) and agreements for security of connections to Users. • Security of supply and restoration times also depend on protection and control systems, sequence of switching operations, and availability of reserve capacity of the network. • In anticipating the occurrence of supply interruptions, during the establishment of the Annual Operating Plan, the Distributors shall develop contingency plans including switching operations sequence, network reconfigurations, provision of sufficient portable, backup or standby supplies to restore supplies according DPC 5.4.2. • Where Distributor has a separate agreement with a User for maintain security of supply, Distributor shall honour the requirements, terms and conditions as state in agreement.	• Provision 5.4.2.3 (a) specifies that the Distribution System must planned so that the required security levels are achieved under normal operation of the Distribution System, and for any single circuit outage, the loading on the Distribution System shall be maintained within the continuous ratings of the Distribution Equipment. • In operational timescales may consider loading of equipment, line and cables to their cyclic or emergency ratings in order to meet security requirements and to maintain supplies. • Distributors shall take into consideration overload settings of relevant Protection Equipment.

Distribution Operating Code
6.5 – Operation Criteria

Steady State Voltage Fluctuations	Short Duration Voltage Fluctuations
• DPC 5.4.4 specifies the planning criteria for steady state voltage levels under normal conditions and contingency conditions and for the different classes of User. These steady state voltage levels shall also be complied with in operational timescales including Operational Planning • Where Distributor has a separate agreement with a User for maintain steady state voltage fluctuation, Distributor shall honour the requirements, terms and conditions as state in agreement.	• Include voltage dips, voltage swells, momentary interruptions and temporary interruptions in supply and these events are part of the electromagnetic environment for the electrical supply network. • Under fault and circuit switching conditions in the Distribution System, Transmission System and User Systems, the voltage may fall and rise momentarily. • The short duration fall and rise in voltage will be affected by: 1. The type of faults, location of faults, and earthing of the neutral points of the Transmission System, Distributor's System and User Systems 2. Switching operation on the Distribution System, including the use of auto-reclosing, which gives rise to temporary interruptions. 3. Switching operation of User loads and operation of equipment. • The DPC sets out the Distributors and Users responsible to minimize the frequency, duration and magnitude of voltage variations . • The Distributors need to provide information upon request of Users on the expected magnitude, duration and number of short duration voltage variations.

Monitoring & Testing of Performance

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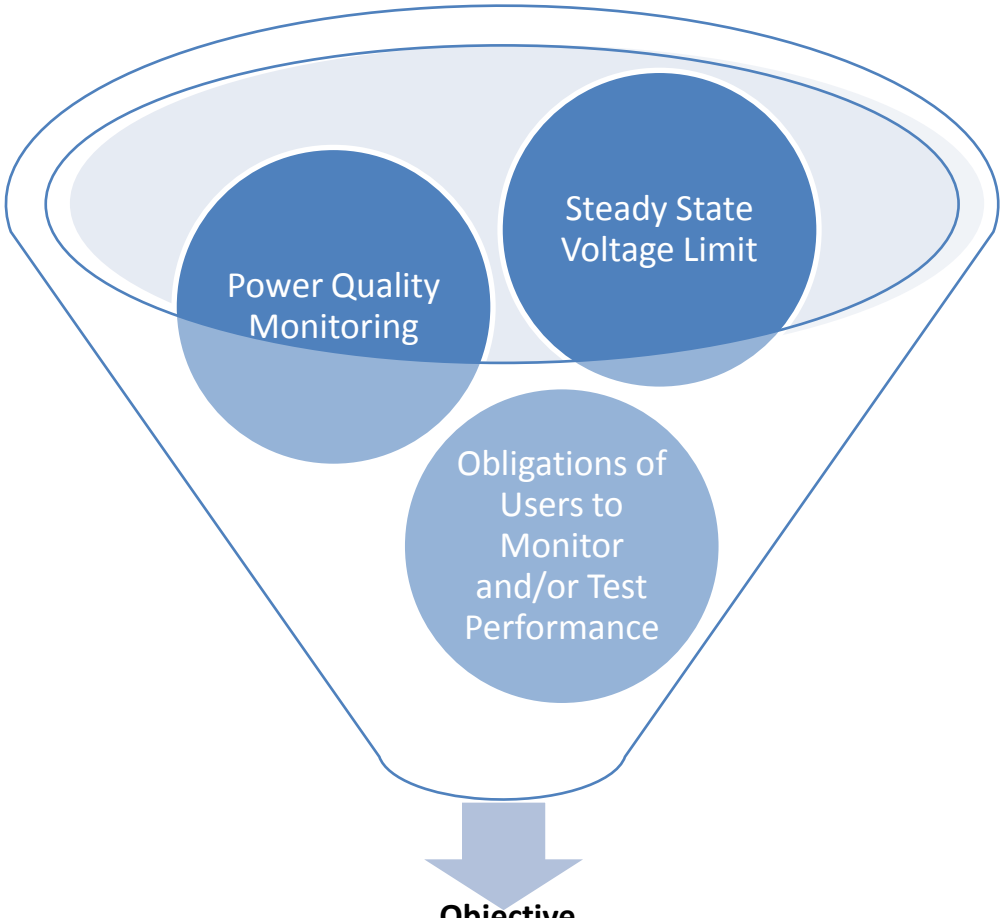
Distribution Operating Code
6.6 – Monitoring and Testing Performance



Objective

To ensure that the Distribution System is operated efficiently and within the requirements of the Electricity Supply Laws the Licence and the Distribution Code, and is required to carry out monitoring and/or testing on the Distributor's Distribution System to confirm that the technical performance is within the limits specified in the Distribution Code

Steady State Voltage Limits

The Distributor shall maintain records of steady-state voltage performance at selected points of the system including but not limited to the following:

(a) All bulk transmission substations;
(b) Representative 33 kV substations; and
(c) All interface points with Embedded Distributors and Distributed Generators and Consumers connected to the Medium Voltage Distribution System.

Distributor will determine the required frequency of tests and shall test voltage performance during peak and light load periods.

If results show that the steady state voltage is outside the required limits:-

→ Distributor shall where possible immediately rectify the situation if the voltage setting is within the control of the Distributor.

→ Distributor will advise the User and the User must immediately take the necessary actions to adjust the voltage within the required limits if the voltage setting is within the control of a User.

Safety Requirements

Operational Responsibilities

* On sites which contain both Distributor-owned Equipment and User- owned Equipment which operate at Medium Voltage, the Distributor and User shall record the respective ownership of Equipment in a written agreement between the Distributor and User together with the responsibilities for control, operation and maintenance of the respective Equipment.

* Furthermore, they must make sure all coordinate the naming and numbering of Equipment to ensure there is no duplication or conflict in the naming and numbering of Equipment at the interface of the Distributor and User.

Safety Coordination

The safety coordination procedures to be adopted by the Distributor and Users for work or testing at the interface between the Distributor and the User shall include the following prerequisites:

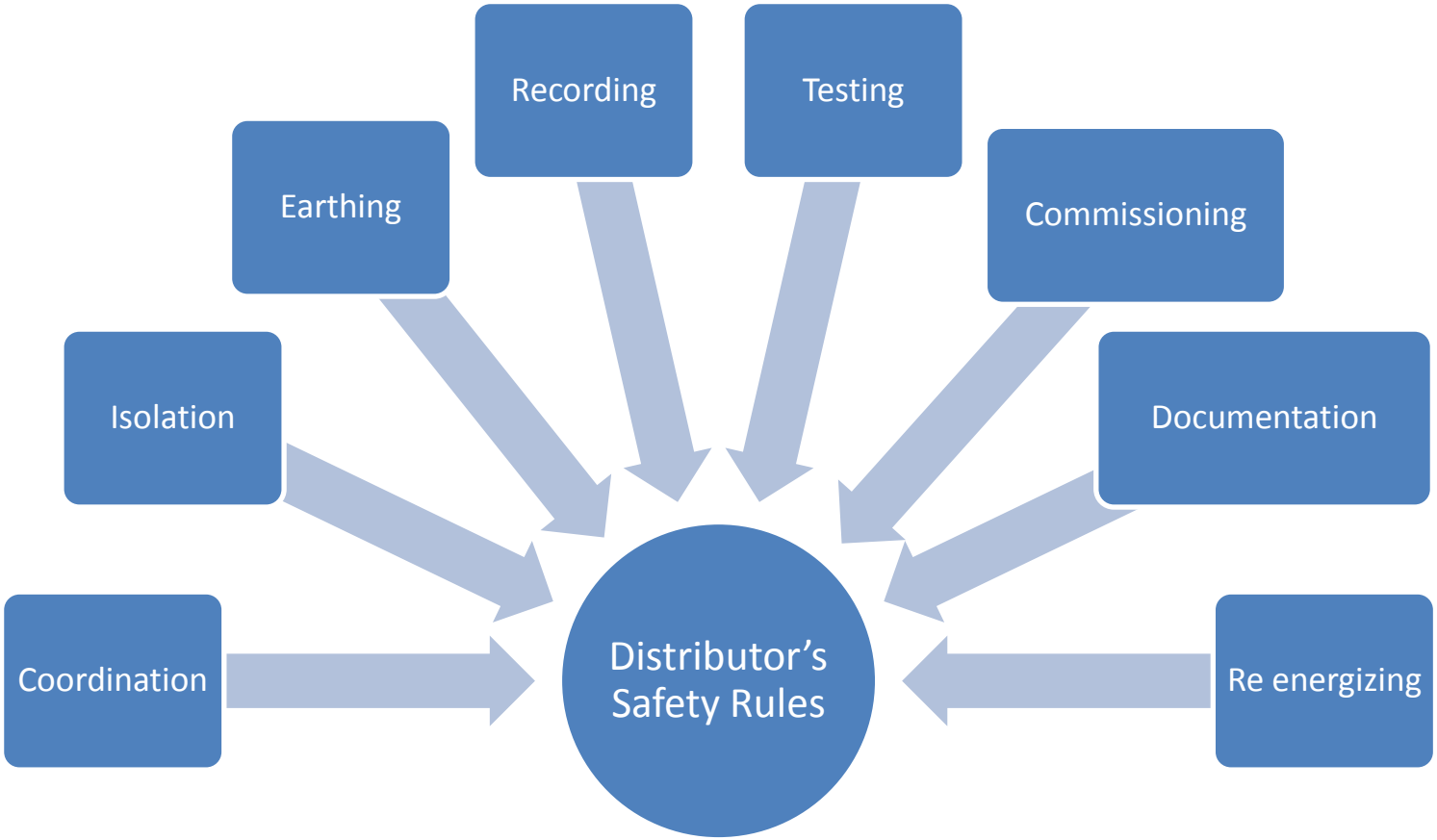
(a) at each Connection Point between the Distributor and User, the boundary of ownership and operational responsibilities is clearly defined as specified in provision 6.7.1.1;

(b) the Distributor and the User shall provide each other with the operating diagrams of their respective side of the Connection Point;

(c) the names of persons responsible for operation on the Distributor's and User's Systems; and

(d) the Distributor and the User shall exchange information on safety rules and/or safety instructions as practiced in their respective Systems.

All switching must carried out according to the procedures which shall include as follows:



Competency of Persons

The Distributor and Users are required to maintain adequate staff properly trained for the administration, operation and maintenance and must make the competency.

Reporting of Accidents

Part VII of the Act specifies the requirements for notification, for investigation by the Commission, of a serious accident resulting in loss of life or injury to any person or serious damage to property. In cases of less serious damage to equipment or property or where incidents are due to animals, birds, trees or other vegetation, the Distributor may, in order to expedite restoration of service to Consumers, proceed to restore the facility to a safe and working state, prior to any investigation and site visit by the Commission, providing that all required documentation has been provided to the Commission.

Operational Requirements

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Distribution Operating Code

6.8 - Operational Requirement

6.8.1 Distribution System Control Structure

Distribution system operation consists of :
Control Centre (CC) *and/or*
Customer Management Centre (CMC)

Structure/organization may vary from one Distributor to another.

Purpose::

a. To monitor, control and operate part of the Distributors Distribution System by team operators on a 24 hours basis.
b. Communicate with consumer, Distributed Generators, Embedded Generators, and GSO.
c. Deal with operation of MV Distribution System (Not Exceed 50kV)
d. To provide enquiry service and central location for reporting loss of supply and others incidents.

6.8.2 Operational Liaison Arrangements.

1. To co-ordinate the operation of the Medium Voltage Distribution System, the Distributor and Users connected to the Medium Voltage Distribution System shall maintain communications and exchange information on Operations and/or Events on the Distribution System or the Systems of Users which have had or may have had, or will have or may have an effect on the Distributor's Distribution System or the System of any User as required in this section of the DOC.

2. Upon receipt of the notification, each party involved will make appropriate assessment of the Operations and/or Events and take appropriate actions to minimize or eliminate any adverse effects of such Operations and/or Events on Users.

- 6.8.2.2 Notification of Operations
- 6.8.2.3 Notification of Events
- 6.8.2.4 Reporting of Significant Incidents by Users

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6.8.2.2 Notification of Operations

Distributed Generators, Consumers and Embedded Distributors are required to notify the Distributor of any Operation that will have or may have an effect on the MV Distribution System including but not limited to the following:

(a) Scheduled outages of Plant and/or Equipment which has been reported and arranged in accordance with provisions in Section 6.4 of the DOC;

(b) Switching operations that will result in temporary disconnection at the point of interface to the Distributor's MV Distribution System;

(c) Switching operations for paralleling of Systems;

(d) Generating Unit synchronizing; and

(e) Operations with implications for voltage control.

6.8.2.3 Notification of Events

Distributed Generators, Consumers and Embedded Distributors are required to notify the Distributor of any Event in their System which has had or may have had an effect on the MV Distribution System including but not limited to the following:

(a) the activation of any alarm or indication of any abnormal operating conditions;

(b) breakdown of or faults on, forced or partial outages of Plant and/or Apparatus including Protection and controls;

(c) increased risk of inadvertent Protection operation;

(d) operation of Plant and/or Apparatus either manually or automatically; and

(e) occurrence of voltage levels outside the required limits;

6.8.2.2 Notification of Operations	6.8.2.3 Notification of Events
The notification to the Distributor shall be given : 1. Sufficient detail describing the operations and locations of Equipment. 2. Shall be provided before the implementation of the operations in a reasonable time period to allow the Distributor to make the necessary assessment of the implications of the operations.	The notification to the Distributor shall be given: 1. Sufficient detail to describe the Event and locations of Equipment. 2. Immediately by phone after the Event has occurred to allow for the Distributor to make the necessary assessment on the implications of the Event and if necessary to make adjustment to the Distribution System.

In case of any Operation/ Event in the MV Distribution System/ Transmission System/ Systems of Users, which in the opinion of the Distributor will have/ has had or may have effects on Systems of other connected Users, the Distributor will inform the other Users of such operations/Events (after occurrence) in a reasonable time to allow the other Users to make assessment of the implications of the operations and/or take necessary action to minimize or eliminate any adverse impacts of the operation on the other Users' installation, Plant and Equipment.

6.8.2.4 Reporting of Significant Incidents by Users

1. Distributed Generators
2. Consumers
3. Embedded Distributions

→ Distributors → Commission

Summary of significant incidents according to Users Category (Distributed Generators/ Consumers/ Embedded Distributors) shall be submitted by the Distributor to the Commission on a monthly basis.

Written report to the Distributors not less than 7 days after significant accident

Immediately verbally inform the Distributor of the Significant Incident, under sections 6.8.2.2 and 6.8.2.3, providing the details of sequence of events known at that time leading to the Significant Incident

6.8.3 Notification of Scheduled Outages and Interruptions

1. The Distributor shall inform Users of a scheduled supply interruption at least three days before the Event stating the date, time and duration of the interruption.

2. When a supply interruption has occurred due to a forced outage of Equipment, the Distributor shall make all reasonable efforts to provide accurate information to Users on the expected duration of the interruptions and the time that supplies will be restored.

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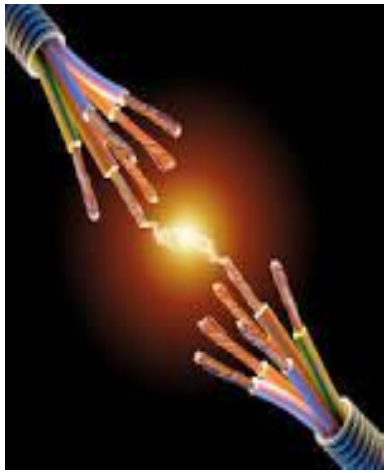
6.8.4 Restoration of Supply

1. The Distributor in restoring supply to Users following supply interruptions shall meet the security level and operation criteria as specified in Section 6.5 of the DOC.

2. When the supply interruption to Users is as a result of multiple contingencies, then the Distributor shall make all reasonable efforts to restore supply and

3. If supply is not restorable within 12 hours, the Distributor shall make reasonable efforts to inform affected Users of the situation.



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6.8.5 Recording System Outage and Interruption

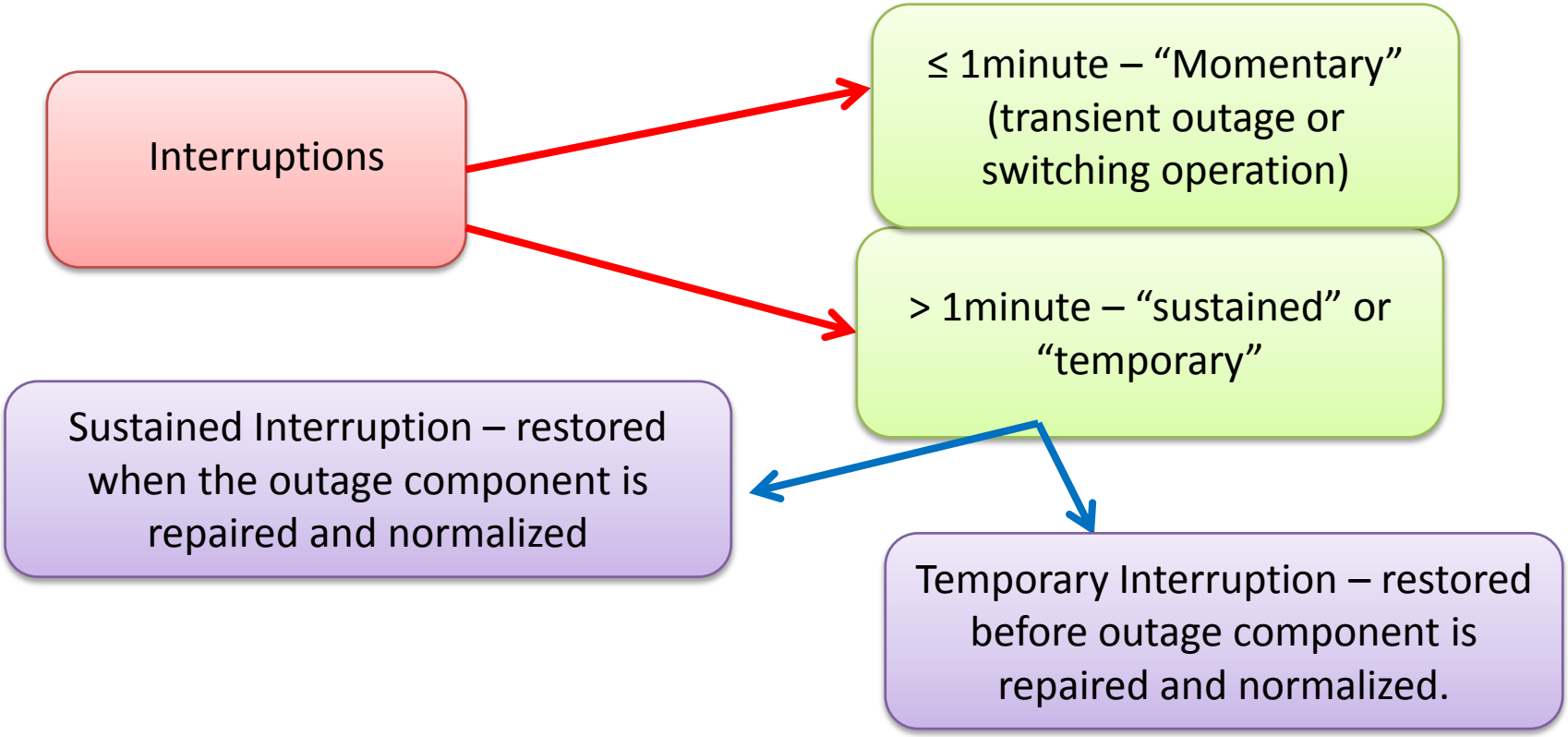
6.8.5.1 Distributor required;

a) Establish a system of reporting and recording of Operations and Events – Outages & Interruptions.

b) Provide summary of reliability performance indices below and as determined by Commission:

SAIFI	• System Average Interruption Frequency Index for sustained interruption (excluding momentary interruptions) in interruptions/ customer over a pre defined area and period of time.
SAIDI	• System Average Interruption Duration Index for sustained interruptions momentary interruptions) in minutes/customer over a pre defined area and period of time.
CAIDI	• Customer Average Interruption Duration Index is the average time required to restore services to the average customer for sustained interruptions (excluding momentary interruptions) in minutes/ customer over a pre defined area and period of time.

All interruptions (planned or unplanned) are reported & recorded for reliability index computation.



**Interruptions triggered by the grid failures that effect Distribution System- must be recorded by Distributor and used in computing the reliability indices.

6.8.5.2 All interruption shall be recorded & reported by Distributor inline with the Licence Standard

Demand Control & Emergency Operations

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Distribution Operating Code

6.9 – Demand Control & Emergency Operations

Distribution Operating Code
6.9 – Demand Control & Emergency Operations

6.9.1 General

GSO under Sec. OC4 (Warn & instruct Distributor)

↓

Distributors (Undertake demand reduction)

Follow as in DOC:

6.9.3 Automatic Low Frequency Load Disconnection

6.9.4 Automatic Low Voltage Load Disconnection

6.9.5 Manual Disconnection of Users

6.9.6 Rota Demand Control to Manage Longer Term Emergencies

and

Follow relevant section of the Grid Code:

(a) reducing Consumer Demand;
(b) disconnecting Consumers;
(c) automatic under frequency load-shedding or disconnection;
(d) automatic under voltage load- shedding or disconnection;
(e) emergency manual disconnection of Consumer Demand; and
(f) rota disconnections for energy saving.

6.9.2 Responsibilities of the Distributor and Users

-6.9.2.1- Distributor

Planning and co-ordination with Users connected to the Distribution System to establish an Emergency Load Curtailment Plan.

6.9.2.4 -Users;

-co-operate with the Distributor in the preparing and implementing for safeguarding the Distribution System and/or Grid System.

Details in Emergency Load Curtailment Plan:

a) Quantum of Demand reduction, locations and effected Users;
b) Circumstances and condition for implementing the load reductions for the scenarios in provision DOC section 6.9.1;
c) The required response from each User to the warnings issued by the GSO as specified in section OC4 of the Grid Code; and
d) Supply restoration procedure.

6.9.2.2 The Emergency Load Curtailment Plan shall also make provision for Demand control which may be required by the Distributor for emergency situations that may arise on the Distribution System.

6.9.2.3 On the request of the GSO, the Distributor shall furnish the Emergency Load Curtailment Plan to the GSO in a time frame as mutually agreed with the GSO.

6.9.3 & 6.9.4 Automatic Low Frequency & Low Voltage Load Disconnection

- Low Frequency
- Low Voltage

1) GSO may achieve demand reduction by means of related relays to disconnect Demand from the Distribution System in accordance with provision.
2) GSO will from, to time inform the Distributor on the quantum (in percentage of the Peak Demand) of Demand to be disconnected at each step following continuous decline of System frequency/voltage.
3) On receipt of this information from the Grid System Operator, the Distributor in consultation with Users connected to the MV Distribution System shall immediately review the Emergency Load Curtailment Plan and make appropriate changes to the load-shedding scheme.
4) Upon the request of the Grid System Operator, the Distributor shall submit the revised Emergency Load Curtailment Plan in a reasonable time.

6.9.5 -Manual Disconnection of Users

6.9.5.1 - In Emergency Load Curtailment Plan, a list of Demand / Users to be disconnected manually need to provide by Distributor as required under OC4.8 (Grid Code.)

6.9.6 -Rota Demand Control to Manage Longer Term Emergencies

6.9.6.1- In Emergency Load Curtailment Plan, a list of Demand / Users to be disconnected manually need to provide by Distributor as required under OC4.9 (Grid Code).

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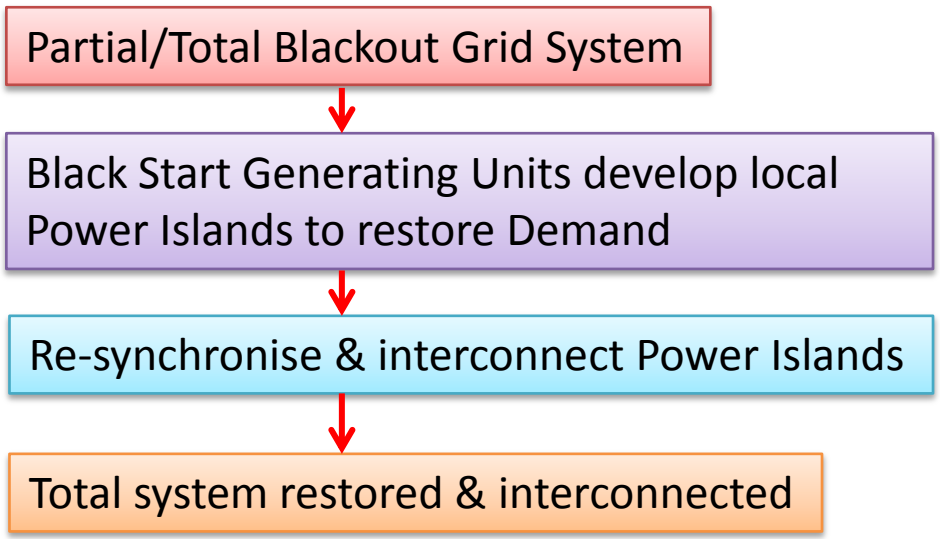
6.9.7 – Black Start

6.9.7.1 General - Grid System Restoration Plan



6.9.7.1.2 - During a Black Start recovery situation, the GSO shall initiate the implementation of the Grid System Restoration Plan and all Users will be required to operate according to the instructions of the Distributor.

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6.9.7.2 Black Start Distributed Generating Units

6.9.7.2.1 Black Start Distributed Generating Units – Generating Units that connect to Distribution System.

6.9.7.2.2 Distributor and the Distributed Generators with the advice / permission of the GSO will be responsible for establishing a Distribution System Recovery Plan for recovery from a Partial Blackout or Total Blackout.

Distribution System Recovery Plan

Objective

Distributor to restore supply to parts of the Distribution System in view of the likely protracted recovery time for the Grid System and as a contribution to the recovery of the Grid System.

System Detail

(a) list of Black Start Generating Units and their capabilities and limits
(b) parts of the Distribution System to be supplied by individual Distributed Generating Units as separate islands;
(c) synchronizing points between the islands and between the Distribution System and the Grid System.

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