Distribution Planning Code

By :

- TNB

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KeTTHA
KEMENTERIAN TENAGA, TEKNOLOGI HIJAU DAN AIR

Suruhanjaya Tenaga

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

5.1 Introduction

Introduction

5.1.1 The **Distribution Planning Code (DPC)** sets out the requirements for planning the **Distribution System** focusing on normal requirements of supply to **Users**. The **DPC** sets out the security and quality of supply characteristics and limits of the **Distribution System** and how these are achieved by cross reference to the **Distributor's Licence Standards** where appropriate. The **DPC** also includes **Demand** forecast data requirements for forward planning of the **Distribution System** and the **Transmission System**.

Introduction

5.1.2 Expansion and reinforcement of the **Distribution System** needs to be carried out regularly by each **Distributor** for several reasons including, but not limited to:

a) Network expansion to meet **Users" Demand**;

b) Network reinforcement to satisfy supply performance requirements;

c) Connection of **Users** to the **Distribution System**;

d) An introduction or reinforcement of a transmission bulk supply substation; and

e) Establishment of connections between **Distributors**.

Introduction

5.1.3 The lead-time for planning implementation depends on the type and scale of network expansion and/or reinforcement, and the need or otherwise to obtain statutory approvals or other consents. Therefore, **Distributors** and **Users** involved shall allow for a reasonable time period for exchanging of planning information and performing of the necessary planning studies and obtaining consents for implementation.

5.2 Scope

Scope

5.2.1 The **DPC** applies to the **Distributor**, **Consumers**, **Distributed Generators**, and **Embedded Distributors** connected to the **Distributor's Distribution System**. All **Distributors** and **Users** connected to the **Distributor's Distribution System** shall comply with the requirements of the **DPC**.

5.3 Objectives

Objectives

5.3.1 The objectives of the Distribution Planning Code are:

a) to enable the **Distributor's Distribution System** to be planned and designed so that the **Distribution System** operates within the supply performance and safety requirements specified in the **DPC** and **Electricity Supply Laws** and **Licence**;

b) to specify the security, quality of supply and the limits of frequency, voltage and voltage distortion normally provided by the **Distributor's Distribution System**;

c) to specify planning criteria and supply performance requirements to be used and satisfied by the **Distributors** during the planning stage;

Objectives

5.3.1 The objectives of the Distribution Planning Code are:

d) to specify requirements for determining **Demand** forecasts by the **Distributors** and **Users** connected to the **Distributor's Distribution System**; and

e) to establish requirements for provision of planning information from the **Distributor** and **Users**.

5.4 Planning and Design Criteria

5.4.1 General

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5.4.1.1 Each **Distributor** shall ensure that its **Distribution System** conforms to the provisions of the **Electricity Supply Laws** and conditions in the **Licence** placed on the **Distributor**.

5.4.1 General

5.4.1.2 The main objective of this section of the **DPC** is to outline normal requirements for the **Distributor** to comply with when assessing performance during the planning stage. These are basic requirements and do not prevent the **Distributor** from applying a higher performance standard than specified in this section.

5.4.1 General

5.4.1.3 The **Distributor** shall plan, develop and design its **Distribution System** according to the requirements not less than set in this section using the best engineering and prudent utility practices in so far as applicable. It is important to note that planning and design criteria are sets of requirements to be satisfied at the planning stage. These sets of criteria may or may not be the same as those required under operating situations.

5.4.1 General

5.4.1.4 Nothing in this **DPC** is intended to inhibit design innovation.

5.4.1 General

5.4.1.5 Where the **Distributor** is required by its **Licence** to produce and implement a **Licence Standard** covering the security and quality of supply, or other matters relevant to this **DPC** for the concurrence of the **Commission**, then the **Licence Standard** shall meet the normal requirements specified in this **DPC** and be published in Annex 1 of the **Distribution Code**.

5.4.1 General

5.4.1.6 Other standards referred to in this **DPC** are listed for convenience in Annex 2 of this **Distribution Code**.

5.4.2 Security Standards

5.4.2 Security Standards

5.4.2.1 Supply security of a **Distribution System** defines the availability of supply to **Users** following the occurrence of a supply interruption.

5.4.2 Security Standards

5.4.2.2 The level of security to be provided in the design of the **Distribution System** is as set out in **DPC** provision 5.4.2.3 with modifications as granted through derogation(s) for a particular Distributor/User.

5.4.2 Security Standards

5.4.2.3 The normal level of security for design of the **Distribution System** shall be as follows:

a) Sections of the **Distribution System** supplied at **Medium Voltage** will normally be provided with alternative circuits and/or other facilities such that for a single circuit outage, excepting a busbar outage, supplies shall be restored within a period of up to 4 hours, except that those parts of the **MV Distribution System** in areas of low load density or having a **Peak Demand** of less than 1 MW, may be restored in the time taken to repair or restore that part of the **Distribution System,** with a target restoration time of not more than 24 hours.

5.4.2 Security Standards

5.4.2.3 The normal level of security for design of the **Distribution System** shall be as follows:

b) Sections of the **Distribution System** supplied at **Low Voltage** shall be restored following an outage within the time taken to repair or restore that part of the **Distribution System** with a target restoration time of not more than 24 hours.

c) In the case of **Force Majeure** restoration may be delayed beyond 24 hours for the time taken to carry out repairs.

5.4.2 Security Standards

5.4.2.4 In designing the **Distribution System** to meet this normal security standard, the **Distributor** shall meet the following requirements:

i. During normal operation of the **Distribution System** and for any secured single circuit outage the loading on the **Distribution System** shall be maintained within the continuous ratings of the **Distribution Equipment** and the voltage shall be maintained within the limits specified in this **DPC**.

ii. The **Distributor** shall not take into account the output of any **Distributed Generating Unit** in maintaining the normal standard of security of supply.

5.4.2 Security Standards

5.4.2.5 Where a **Distributor** is required by **Licence** to produce and implement a **Licence Standard** covering security of supply then the security standard shall not be lower than provision 5.4.2.3.

5.4.2 Security Standards

5.4.2.6 The normal level of security required by provision 5.4.2.3 does not preclude the **Distributor** from adopting a higher level of security on a non-discriminatory basis.

5.4.2 Security Standards

5.4.2.7 The normal level of security specified in provision 5.4.2.3 does not apply to the circuit that connects the **User's** installation to the **Point of Common Coupling (PCC)** with other **Users** of the **Distribution System**. The security level for such circuits may be specified by the **User** and provided by the **Distributor** on a non-discriminatory basis in line with the **Distributor's** statement on connection charges required by the **Licence** and according to the **Users** requirements, with the following qualifications:

a) The normal supply arrangement to a **Consumer** or **Distributed Generator** is for a single circuit supply from the **PCC** unless the **Consumer** or **Distributed Generator** requests a higher level of security.

5.4.2 Security Standards

b) The supply connection to an **Embedded Distributor** shall be that required to meet the normal security standard specified in provision 5.4.2.3 or a higher standard requested by the **Embedded Distributor** to meet the **Embedded Distributor's Licence Standard** or other standard adopted by the **Embedded Distributor**.

5.4.3 System Frequency

5.4.3 System Frequency

5.4.3.1 During normal steady-state operational conditions the **System** frequency is maintained by the **Grid System Operator** to within ±1% of the nominal value of 50Hz, that is, between 49.5Hz and 50.5Hz. The **System** frequency could also rise to 52Hz or fall to 47Hz in exceptional circumstances.

5.4.3 System Frequency

5.4.3.2 The **Distributor's Distribution System** and any **User** connections to that **Distribution System** shall be designed to operate within the normal operating frequency range of 49.5Hz and 50.5 Hz and withstand short time operation within the range 47Hz and 52 Hz.

5.4.4 Steady-State Supply Voltage Variation

5.4.4 Steady-State Supply Voltage Variation

5.4.4.1 Steady-state Voltage Variation under Normal conditions

5.4.4.1.1 Under normal conditions, when all circuit elements are in service, the voltage at all points in the **Distributor's Distribution System** including the points before the **Users Connection Point** shall be planned to be maintained as follows:

a) **Medium Voltage** of 6.6 kV, 11 kV, 22kV, and 33 kV within ± 5% of nominal voltage; and

b) **Low Voltage** of 400 V and 230 V within +10% % and -6% of nominal voltage.

5.4.4 Steady-State Supply Voltage Variation

5.4.4.2 Steady-state Voltage Variation under Contingency Condition

5.4.4.2.1 Under contingency condition, when one or more circuit elements are on outages, the steady-state voltage at all points in the **Distributor's Distribution System** including the points before the **User's Connection Point** shall be planed to be maintained as follows:

a) **Medium Voltage** of 6.6 kV, 11 kV, and 33 kV within ± 10% of nominal voltage; and

b) **Low Voltage** of 400V and 230 within +10% -6% of nominal voltage.

5.4.4 Steady-State Supply Voltage Variation

5.4.4.3 Steady-State Voltage Variation at the Interfaces With Transmission Bulk Supply Substation

5.4.4.3.1 In planning the **Distribution System** involving interface with the **Transmission System**, the **Distributor** shall take into account steady-state voltage variation limits as specified in provision CC6.2.4 of the **Grid Code**.

5.4.4 Steady-State Supply Voltage Variation

5.4.4.3 Steady-State Voltage Variation at the Interfaces With Transmission Bulk Supply Substation

5.4.4.3.2 Any extension or connection to the **Distributor's Distribution System** shall be designed in such a way that it does not adversely affect the voltage control employed on the **Distributor's Distribution System**. Information on the voltage regulation and control arrangements on the **Distribution System** will be made available by the **Distributor** to the **User** on the request of the **User**.

5.4.5 Short Duration Supply Voltage Variation

5.4.5 Short Duration Supply Voltage Variation

5.4.5.1 Short duration supply voltage fluctuations 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.

5.4.5 Short Duration Supply Voltage Variation

5.4.5.2 Under fault and circuit switching conditions in the **Distributor's** own **Distribution System** or in other interconnected **Systems** including the **Transmission System**, the voltage may fall and rise momentarily. The fall and rise in voltage will be affected by the type and location of faults, and earthing of the neutral points of the **Distributor's Distribution System, Transmission System and User's System.** Short duration voltage fluctuations may also arise due to switching on the **Distribution System**, including the use of auto-reclosing, which gives rise to temporary interruptions. Short duration voltage fluctuations may also arise due to the switching of **User** loads and from the operation of **User Equipment**.

5.4.5 Short Duration Supply Voltage Variation

5.4.5.3 The electromagnetic environment of the **Distribution System** is described in Malaysian Standards MS 1760 based on (**IEC** 61000-2-8), MS **IEC** 61000-2-2, MS IEC 61000-2-4 and MS IEC 61000-2-12 which describe the frequency and severity of voltage fluctuations experienced on **Distribution Systems** over a period of time.

5.4.5 Short Duration Supply Voltage Variation

5.4.5.4 These voltage fluctuations may result in mal-operation of voltage-sensitive **Equipment** connected to the system. Both **Distributors** and **Users** shall take adequate measures to limit the frequency, magnitude and duration of such voltage fluctuations. **Distributors** and **Users** shall be aware of their responsibilities in limiting the impacts of the short duration voltage fluctuations as follows:

a) The **Distributor** shall investigate complaints from **Users** on short duration voltage fluctuations and make proposals to reduce the frequency, magnitude and duration of the voltage fluctuations originating from the **Distributor's** own **Distribution System** to the level required as per the Distribution Code. In case, a User requires protection beyond the level specified in the Distribution Code, he shall install suitable protection devices designed to limit the fluctuations to that required by his system.

5.4.5 Short Duration Supply Voltage Variation

b) **Users** with voltage-sensitive loads or intending to connect voltage sensitive loads to the **Distribution System** shall take into account this short duration variation in voltage in planning their installation and selecting **Equipment** from appropriate specifications or standards to ensure sufficient intrinsic immunity to short duration voltage fluctuations

c) This initiative will ensure minimum deterioration of performance or lapse in operation of sensitive equipment due to short duration voltage fluctuations.

5.4.5 Short Duration Supply Voltage Variation

5.4.5.5 In line with MS 1760: 2004, the **Distributor** shall make available, upon the request of **Users** appropriate information at any monitored point in the network on the magnitude, duration and number of short duration voltage fluctuations for any given period of time.

5.4.6 Power Quality and Disturbing Loads

-Dr.Fuad

5.4.7 Superimposed Signals

5.4.7 Superimposed Signals

5.4.7.1 Where a **User** intends to install mains borne signalling **Equipment** which may superimpose signals on the **LV Distribution System**, the **User's Equipment** shall comply with **IEC** standard 61000-3-8 as amended from time to time. Where a **User** proposes to use such **Equipment** to superimpose signals on the **LV Distribution System**, the prior agreement of the **Distributor** is required.

5.4.8 Transient Overvoltages

5.4.8 Transient Overvoltages

5.4.8.1 Typical Basic Impulse Insulation Levels (BIL) of the **Distribution System** are as given in the following table 5.3. The **Customer's Plant** and **Apparatus** shall be compatible with the insulation levels of the **Distribution System**. The **Distributor** shall inform the **User** on request, the Basic Insulation Level of the **Distribution System**.

Table 5.3: Basic insulation level (BIL)

System Voltage (kV)	BIL (kV)
33	170
22	125
11	75
6.6	75

5.4.9 Short Circuit Levels

5.4.9 Short Circuit Levels

5.4.9.1 The **Distribution System** shall be planned such that the maximum sub-transient three phase symmetrical short circuit fault levels are not greater than 90% of the design short circuit break and make capacity of switchgear connected to the **Distribution System** and within 90% of the short time current rating of **Equipment** connected to the **Distribution System**.

5.4.9 Short Circuit Levels

5.4.9.2 Short circuit levels shall be calculated in accordance with **IEC** 60909 and take account of the contribution of generating units and motors to short circuit level.

5.4.9 Short Circuit Levels

5.4.9.3 The **User** shall ensure that the short circuit rating of the equipment to be connected to the **Distributor's Distribution System** is not less than the design fault level at the point of connection.

5.4.9 Short Circuit Levels

5.4.9.4 The **Distributor** shall upon the request of the **User** provide details of the design short circuit level and the actual prospective maximum and minimum short circuit levels and the corresponding X/R ratio at the **Connection Point** and any future changes envisaged.

5.5 Specification of Equipment

Specification of Equipment

5.5.1 **Plant** and **Apparatus** to be connected to the **Distribution System** and at the **User** interface is required to meet and conform to relevant technical standards and be compatible with the parameters (voltage, frequency, current rating and short circuit current rating and insulation level) of the **Distribution System**. These relevant technical standards shall include:

a) Malaysian National Standards (MS);

b) International, European technical standards, such as **IEC**, ISO and EN standards; and

c) Other national standards such as BS, DIN and ASA.

d) License Standards.

e) The **Distributor's** own standards and specifications.

Specification of Equipment

5.5.2 The **User** shall ensure that the specification of **Plant** and **Apparatus** at the **Connection Point** shall be such as to permit operation within the applicable safety procedures agreed between the **Distributor** and the **User**.

5.6 Earthing

Earthing

5.6.1 Earthing of the **User's** installation shall be in accordance with the **Electricity Supply Laws** and compatible with the earthing arrangements on the **Distribution System**.

Earthing

5.6.2 The **Distributor** shall provide details of the **Distribution System** earthing arrangements to the **User** on reasonable request of the **User.**

5.7 Protection and Control

-Hj.Subian

5.8 Distributed Generation Planning and Design

-En.Saharudin

5.9 Distribution System Planning

Distribution System Planning

5.9.1 **Distributors** and **Embedded Distributors** shall prepare **Distribution System Plans of their Distribution System** by applying the best engineering practices in a **Distribution System Plan,** and shall be reviewed and updated in an annual **Distribution System Planning Review**.

Distribution System Planning

a) **Distribution System Plan**

The **Distributor** shall carry out planning studies to derive a **Distribution System Plan** for developing a target network for the next 5 years for the 33 kV **Distribution System** and for the next 3 years for the 11 kV **Distribution System**. The **Distribution System Plan** shall include the following items:

i. **Demand** forecast;

i. target network;

ii. existing and planned distribution network development including the requirements for equipment replacement and technology upgradation;

Distribution System Planning

iv. staged development from the first year to the fifth year including network replacement, strengthening and expansion taking into account the power flows, proposed power quality, circuit capacities, loadings, short-circuit levels, protection requirements, security of supply, power requirements etc;

v. summary of network replacement, strengthening and expansion and the associated costs;

vi. target performance;

vii. any other relevant plans for improving the network performance;

The **Distributor's Distribution System Plan(s)** shall be sent to the Commission for information and review to provide inputs for future Distributor‟s Distribution System Plans.

Distribution System Planning

b) Distribution System Planning Review

The **Distributor** shall perform a rolling annual **Distribution System Planning Review** covering a 5-year period based on the **Distribution System Plan** taking into account changes in the load forecast and performance diagnosis. This review shall include all the items as per the Section 5.9.1(a).

c) Embedded Distribution System Plan

The **Embedded Distributor** shall carry out the planning studies similar to the Distributors as per the Section 5.9.1(a). It shall be sent to the Commission, and the Commission may review and approve the Embedded Distribution System Plan, if it considers necessary.

d) Embedded Distribution System Planning Review

The **Embedded Distributor** shall perform a rolling annual **Distribution System Planning Review** covering a 5-year period based on the **Embedded Distribution System Plan** taking into account changes in the load forecast and performance diagnosis. This review shall include all the items as per the Section 5.9.1(b). It shall be sent to the Commission, and the Commission may review and approve the Embedded Distribution System Plan, if it considers necessary.

5.10 Demand Forecasts

5.10.1 General

5.10.1 General

5.10.1.1 The **Distributor** is required by provision PC5.1 of the **Grid Code** to prepare **Demand** forecasts of the **Distributor's Area of Supply** according to the timescales, methods and procedures referred to in the **Grid Code.**

5.10.1 General

5.10.1.2 The required **Demand** forecasts cover the following planning horizons;

a) Short-term – one to two years

b) Medium-term – two to five years

c) Long-term – six to ten years

5.10.1 General

5.10.1.3 **Demand** forecasts are provided for each of the bulk supply transmission substations connected to the **Distributor's Distribution System** in a format specified in the **Grid Code**. Form 5A of Schedule 5 of the **Data Registration Code** specifies the detailed **Demand** forecast information to be submitted by the **Distributor** to the **Grid System Operator**.

5.10.1 General

5.10.1.4 In order for the **Distributor** to prepare **Demand** forecasts, the following **Users** connected to the **Distributor's Distribution System** may be requested by the **Distributor** to submit **Demand** forecasts to the **Distributor** and shall submit the **Demand Forecasts** requested in the timescale requested:

a) **Consumers** with a **Peak Demand** of 5 MW or more.

b) **Embedded Distributors.**

c) **Distributed Generators** with generating plant capacity exceeding 5MW.

5.10.2 Consumers Demand Forecast

5.10.2 Consumers Demand Forecast

5.10.2.1 **Consumers** with **Peak Demand** of 5 MW or more shall on the request of the **Distributor** submit annually the following **Demand** forecast to the **Distributor** in the timescale requested:

a) forecast of a typical weekly **Demand** profile in MW and MVAr, in half-hourly intervals for the next financial year of the **Distributor**;

b) monthly energy consumption in MWh and the corresponding monthly **Peak Demand** in MW and MVAr for the **Distributor's** next financial year; and

c) an annual load forecast in MW and MVAr for the next five financial years ..

5.10.2 Consumers Demand Forecast

5.10.2.2 Form 5B of Schedule 5 of the **Data Registration Code** specifies the detailed **Demand** forecast information to be submitted by a **Consumer** to the **Distributor**.

5.10.3 Embedded Distributors Demand Forecast

5.10.3 Embedded Distributors Demand Forecast

5.10.3.1 Embedded Distributors connected to the Distributor‟s Distribution System shall on request of the Distributor submit annually the following Demand forecasts to the Distributor in the timescale requested:

a) forecast of typical weekly import and/or export **Demand** profile in MW and MVAr, in half-hourly intervals for the next financial year of the **Distributor**;

b) monthly energy import and/or export in MWh and the corresponding monthly **Peak Demand** export and/or import in MW and MVAr for the **Distributor's** next financial year; and

c) annual import and/or export **Demand** forecast in MW and MVAr for the next five financial years**.**

5.10.3 Embedded Distributors Demand Forecast

5.10.3.2 Form 5C of Schedule 5 of the **Data Registration Code** specifies the detailed **Demand** forecast information to be submitted by an **Embedded Distributor** to the **Distributor**.

5.10.4 Distributed Generators Generating Plant Output Forecast

-En.Saharudin

5.10.5 Factors to be considered for Demand Forecasts

5.10.5 Factors to be considered for Demand Forecasts

5.10.5.1 In determining Demand forecasts, Distributors and Users will take into consideration the following relevant factors:

a) category of **Consumers** and energy use intensity;
b) economic growth factors;
c) state and local authorities land use zoning;
d) types of commercial activities;
e) historical energy and **Demand** trends;
f) generating plant output and export; and
g) any other necessary factors reasonably considered.

5.11 Information to Users

5.11.1 Load Profiles and Characteristics at Connection Points

5.11.1 Load Profiles and Characteristics at Connection Points

5.11.1.1 For the purpose of planning a connection to the **Distributor's Distribution System**, **Users** may require information related to load profiles and power quality characteristics. The **Distributor** shall make available such information upon the reasonable request of a **User** connected to the **Distribution System** or any **User** who intends to connect to the **Distributor's Distribution System**. In order to provide this information the **Distributor** shall maintain records of Load Profiles and Power Quality Characteristics as specified in Sections 5.11.2 and 5.11.3 of the **DPC**.

5.11.2 Load Profiles

5.11.2 Load Profiles

5.11.2.1 The **Distributor** shall maintain records of load profiles and characteristics at the points of interface, namely transmission bulk supply substations, **Distributed Generators**, and interconnection with **Embedded Distributors**. The load profiles shall be recorded at the following points on the last Wednesday of each month:

a) all incoming feeders at the interface with the transmission grid, distributed generation incoming feeders, and points of interconnection with **Embedded Distributors**; and

b) all outgoing feeders to the **Distributor's Distribution System** from the bulk supply transmission substations.

5.11.2 Load Profiles

5.11.2.2 The load readings in MW, MVAr, MWh, MVArh and voltage in kV shall be recorded in a half-hourly interval for all incoming feeders in (a) above. For all outgoing feeders in (b), MW and MVAr and/or current (A) readings in a half-hourly interval shall be recorded.

5.11.2 Load Profiles

5.11.2.3 Form 5E of Schedule 5 of the **Data Registration Code** specifies the load profile data to be recorded by the **Distributor**, the required recording period and the parameters to be determined from the load profile.

5.11.3 Power Quality Characteristics

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