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Preface
1. Industry Structure

The **Electricity Industry** comprises the following principal bodies:-

a) The TSO operates the **Transmission System**. The **Transmission System** transports the electricity, generated by **Generating Units**, to and from the **Distribution System**, through which most **Customers** will be supplied. Some **Generating Plant** is connected directly to the **Distribution System** and is referred to as generation. **EirGrid** holds the TSO Licence.

b) The **Transmission System Asset Owner (TAO)** owns the **Transmission System**. **ESB** holds the TAO Licence.

c) The **DSO** is responsible for operating and maintaining a secure, reliable and efficient electricity **Distribution System** in accordance with its **DSO Licence** obligations. The **Distribution System** transports electricity to or from the **Transmission System** or from **Generation Units** to the final **Customer**. **ESB Networks Ltd.** holds the DSO Licence.

d) The **Distribution System Asset Owner (DAO)** owns the **Distribution System**. **ESB** holds the DAO Licence.

e) **Suppliers** supply electricity to **Customers**. For this purpose, **Suppliers** will be entitled to use both the **Transmission System** and the **Distribution System** for the transport of electricity from **Generating Units** to **Customers**.

f) **Generators** generate electricity which is fed onto the **Transmission** or **Distribution Systems**. **Generating Units** are classified according to their voltage, output power and whether or not they are subject to **Central Dispatch** by the TSO.

g) **Customers** purchase electricity from **Suppliers**. Some **Customers** have their own **Generating Plant** for supplying all or part of their own needs. These are referred to as **Customers with CHP** or **Customers with Auto-production**.

h) **Dispatchable Demand Customers** are **Customers** who are subject to **Central Dispatch** and have a **Demand Reduction** capability of 4MW or more.

i) The **Commission for Energy Regulation** was established by the **Act** to regulate the new electricity industry. This later became the **Commission for Regulation of Utilities (CRU)**.

j) The **Single Electricity Market (SEM)** is the wholesale all-island electricity market.

2. Use of the Distribution System

Use of the **Distribution System** may involve any of the following transactions:

a) A connection at entry to or exit from the **Distribution System**. An entry point is the connection between the **Distribution System** and the **Transmission System** or a **Generating Plant**. An exit point is the connection between the **Distribution System** and the **Customer's premises**.

b) Use of the **Distribution System** to transport electricity between entry and exit points.

c) Construction of a **Connection Point**.

d) Work and/or **Operation** associated with **Equipment** at the interface with the **Distribution System**.
3. Distribution Code and Other Documentation

The Distribution Code has been prepared by ESB Networks Ltd. under the terms of the Act. This defines the technical aspects of the working relationship between DSO and all Users of the Distribution System, to ensure an efficient, co-ordinated and economical system for electricity distribution. It also enables ESB Networks Ltd. to comply with its obligations under its DSO Licence and the Grid Code.

The relationship between the Grid Code and Distribution Code is shown diagrammatically in Figure 1.

Users connected to the Distribution System shall comply with the relevant sections of the Distribution Code. The categories of Users of the Distribution System are described in Figure 2 and the sections of the code which apply to each User is shown in Figure 3. Users shall also comply with the requirements of the Act and other relevant legislation, which from time to time comes into force. They shall also be required to enter into technical and other agreements. Customers and Generators shall be required to have Connection Agreements with the DSO and Suppliers shall be required to enter into use of system agreements with the DSO.

There are a number of technical documents annexed to the Distribution Code. Users are bound to comply with the requirements of these documents as appropriate to their circumstances.

4. Structure of Distribution Code

The Distribution Code is divided into five parts as follows:

a) The Distribution General Conditions (DGC) sets out the legal framework guiding the Operation of the Distribution Code.

b) The Distribution Planning Code (DPC) contains details of the standard of supply offered as well as the design principles to which the Distribution System is constructed. The DPC enables Users to obtain from DSO certain information on the Distribution System in certain circumstances.

c) The Distribution Connection Conditions (DCC) provides details of the technical and other requirements to be met by those requiring connection to the Distribution System. Special conditions pertaining to Generators are contained in DCC9.

d) The Distribution Operating Code (DOC) deals with the various operational matters affecting Users such as providing forecasts of Demand, planning Distribution System outages, generation outages, Transmission System outages, reporting of operational changes and Events, safety matters and procedures for dealing with emergency situations.

e) The Distribution Data Registration Code summarises in tabular form the data requirements under the Distribution Code.

5. Assumptions and Commentary

The DSO fully reserves its right to seek additions and amendments to the draft code at any time through the appropriate channels.
Figure 1

The Distribution Code

Grid Code and Distribution Code Boundaries

National Control Centre

Transmission System

Distribution System

Information

TSO

DSO

Dispatchable Demand Customers > 4MW

Transmission Connected Customers

Generators

Suppliers

DSO

Embedded Generation

DSO Connected Wind Generation >5 MW

Generation <5 MW

Customers

Suppliers

Subject to Central Dispatch and Scheduling

Not Subject to Central Dispatch and Scheduling

The Grid Code

The Distribution Code

Figure 1
6. CATEGORIES OF USERS OF THE DISTRIBUTION SYSTEM

A1. **Generating Plant >10MW** and subject to **Central Dispatch**
A2. **Generating Plant >2MW** and not subject to **Central Dispatch**
A3. **Generators <2MW**
A4. **Customers with CHP** or **Customers with Auto-production**
A5. **Customers with stand-by Generators**

B1. **Major Customers (Customers connected at High Voltage)**
B2. **Customers connected at Medium Voltage**
B3. **Industrial and commercial Customers connected at Low Voltage**
B4. **Domestic Customers**
B5. **Dispatchable Demand Customers**

C. **Suppliers**

D. **The DSO**

Figure 2
### 7. SECTIONS OF THE DISTRIBUTION CODE APPLYING TO PARTICULAR CATEGORIES OF USERS OF THE DISTRIBUTION SYSTEM

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<td>D</td>
<td>D</td>
<td>R</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>DOC11</td>
<td>D</td>
<td>D</td>
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<td>R</td>
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<tr>
<td>DDRC</td>
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<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>

Figure 3

- **Not Applicable**
- **D** Applicable with specific obligations
- **R** Relevant for information but no specific obligations.

**Note:** Customers represented in Categories A4 and A5 must comply with the code sections relevant to that category and additionally to the relevant sections of the category of Customer to which they belong.
Distribution General Conditions
DGC DISTRIBUTION GENERAL CONDITIONS

DGC1 INTRODUCTION

DGC1.1 Whilst each code in the Distribution Code contains the rules and provisions relating specifically to that code, there are provisions which are of more general application. These are covered in the code, Distribution General Conditions (DGC).

DGC2 OBJECTIVE

DGC2.1 The Distribution General Conditions contain provisions that are of general application to all provisions of the Distribution Code. Their objective is to ensure, to the extent possible, that the various sections of the Distribution Code apply consistently to all electricity Customers.

DGC3 SCOPE

DGC3.1 The Distribution General Conditions apply to all Users.

DGC4 ASSISTANCE IN IMPLEMENTATION

DGC4.1 The DSO Licence imposes a duty upon the DSO to implement and enforce the Distribution Code. In order to do this the DSO may need access across boundaries, services, and facilities from Users or to issue instructions to Users, for example to isolate or disconnect Plant or apparatus. It is considered that these cases will be exceptional and it is not, therefore, possible to envisage precisely or comprehensively what the DSO might reasonably require in order to carry out its duty to implement and enforce the Distribution Code.

DGC4.2 All Users are required to abide by the Distribution Code and also to provide the DSO with such rights of access, services and facilities and to comply with such instructions as it may reasonably require to implement and enforce the Distribution Code.

DGC5 UNFORESEEN CIRCUMSTANCES

DGC5.1 If circumstances arise which the provisions of the Distribution Code have not foreseen, the DSO shall to the extent reasonably practicable in the circumstances, consult promptly and in good faith with affected Users in an effort to reach agreement as to what should be done. If agreement cannot be reached in the time available the DSO will determine what is to be done.

DGC5.2 Whenever the DSO makes a determination, it shall have regard, wherever possible to the views expressed by Users, and in any event, to what is reasonable in all the circumstances.

DGC5.3 Each User shall comply with all instructions given to it by the DSO following such a determination provided that the instructions are consistent with the then current technical parameters of the particular User’s system registered under the Distribution Code. The DSO shall promptly refer all such unforeseen circumstances and any such determination to the Distribution Code Review Panel (DCRP) in accordance with DGC7.2.
DGC6  HIERARCHY

DGC6.1 In the event of any conflict between the provisions of any direction of the Commission for Regulation of Utilities on the one hand and the provisions of the Distribution Code on the other, the provisions of such direction shall prevail (provided that such direction or ruling is binding upon the person to whom it is addressed).

DGC6.2 In the event of any conflict between the provisions of the Distribution Code and any contract, agreement or arrangement between the DSO and a User, the provisions of the Distribution Code shall prevail unless the Distribution Code expressly provides otherwise.

DGC7  DISTRIBUTION CODE REVIEW PANEL

DGC7.1 The DSO shall establish and maintain a Panel which, shall be a standing body, to carry out the functions referred to in DGC7.2

DGC7.2 The Panel shall:

   a) Keep the Distribution Code and its working under review.
   b) Review all suggestions for amendments to the Distribution Code which the Commission for Regulation of Utilities or any User may submit to the DSO for consideration by the Panel from time to time.
   c) Recommend to the DSO amendments to the Distribution Code that the Panel feels are necessary or desirable and the reasons for the recommendation.
   d) Issue guidance in relation to the Distribution Code and its implementation, performance and interpretation when asked to do so by any User.
   e) Consider what changes are necessary to the Distribution Code arising out of any unforeseen circumstances referred to it by the DSO under DGC5.

DGC7.3 The Panel shall consist of:

   a) Chairperson and two persons appointed by, and representing the DSO,
   b) One person appointed by and representing the Commission for Regulation of Utilities,
   c) One person representing the TSO,
   d) One person representing Generators with Embedded Generation,
   e) One person representing Major Customers,
   f) One person representing Public Electricity Supplier
   g) One representative of the Electro Technical Council of Ireland (ETCI).
   h) One representative of independent Suppliers.
   i) Representatives of other users of the Distribution System as proposed by the Panel and approved by the Commission for Regulation of Utilities.

DGC7.4 The Panel shall establish and comply at all times with its own rules and procedures relating to the conduct of the business, such rules and procedures to be known as the Constitution and Rules of the Panel, which shall be approved by the Commission for Regulation of Utilities.

DGC7.5 The DSO shall submit all proposed amendments to the Distribution Code (regardless of which party proposes such amendments) to the Panel for discussion.

DGC7.6 The DSO shall, from time to time or at the behest of the Commission for Regulation of Utilities, having regard to the recommendations of the Panel, submit a revised Distribution Code to the Commission for Regulation of Utilities for approval.
DGC8 COMMUNICATIONS BETWEEN THE DSO AND USERS

DGC8.1 Unless otherwise specified in the Distribution Code the methods of operational communication and data transfer shall be agreed between the DSO and Users from time to time.

DGC9 EMERGENCY SITUATIONS

DGC9.1 Users should note that the provisions of the Distribution Code may be suspended, in whole or in part, pursuant to any directions given and / or orders made by the Minister under the provisions of the Act.

DGC10 CODE RESPONSIBILITIES

DGC10.1 The Distribution Code sets out the procedures and principles governing the relationship between the DSO and all Users of the Distribution System.

DGC11 DEROGATIONS

DGC11.1 Single Derogations

If a User finds that it is, or will be unable to comply with any provision of the Distribution Code, then it shall without delay report such non-compliance to the DSO and shall, subject to the provisions of DGC11.2 make such reasonable efforts as are required to remedy such non-compliance as soon as reasonably practicable.

DGC11.1.1 Where the non-compliance is:

a) with reference to Plant and / or apparatus connected to the Distribution System and is caused solely or mainly as a result of a revision to the Distribution Code; or
b) with reference to Plant and / or apparatus which is connected, approved to connect, or for which approval to connect to the Distribution System is being sought;

and the User believes either that it would be unreasonable (including cost and technical considerations) to require it to remedy such non-compliance or that it should be granted an extended period to remedy such non-compliance it shall promptly submit to the Commission for Regulation of Utilities a request for a single derogation from such provision in accordance with the requirements of DGC11.3 and shall provide the DSO with a copy of such application.

DGC11.2 Class Derogations

If a User believes that:

(a) a Class of Persons who are Users; or
(b) persons using a Class of Plant and/or Apparatus connected to the Distribution System;

is, or are, or will be, unable to comply with any provision of the Distribution Code they should promptly submit a request for a class derogation to the DCRP.

DGC11.2.1 If the DCRP believes either that it would be unreasonable (including cost and technical considerations) to require the relevant Class of Persons, or persons using the relevant Class of Plant and/or Apparatus (collectively “the Class”), to remedy such non-compliance or that the Class should be granted an extended period to remedy such non-compliance the DCRP on behalf of (a) or (b) above shall promptly approve the submission of a Class Derogation request covering (a) or (b) above to the DSO for assessment. The DSO will request an assessment from the TSO and assess the Class Derogation request themselves.

(a) If the DSO supports the request for a Class Derogation, the DSO will submit the Class Derogation request including the DSO and TSO assessment to the Commission for Regulation of Utilities in accordance with the requirements of DGC11.3. or
(b) If the DSO does not support the request for a Class Derogation, the DSO will refer the request for a Class Derogation back to the DCRP.
A request for derogation from any provision of the Distribution Code shall contain:

a) the issue number and the date of the Distribution Code provision against which the non-compliance or predicted non-compliance was identified;

b) identification of the Plant and/or apparatus the Class of Persons who are Users, or the Class of Plant and/or Apparatus in respect of which a derogation is sought and, if relevant, the nature and extent to which the non-compliance exists;

c) identification of the provision with which the User is, or will be, unable to comply;

d) the reason for the non-compliance; and

e) the date by which compliance will be achieved (if remedy of the non-compliance is possible) subject to DGC11.2 (b).

A standard Distribution Code derogation application forms are included in Annex 2.

If the DSO finds that it is, or will be, unable to comply with any provision of the Distribution Code, then it shall, subject to the remaining provisions of DGC11 make such reasonable efforts as are required to remedy such non-compliance as soon as reasonably practicable.

In the case where the DSO requests a derogation, the DSO shall submit the information set out in DGC11.3 to the Commission for Regulation of Utilities.

On receipt of any request for derogation, the Commission for Regulation of Utilities shall promptly consider such request and provided that the Commission for Regulation of Utilities considers that the grounds for the derogation are reasonable, the Commission for Regulation of Utilities shall grant such derogation unless the derogation would, or it is likely that it would have a material adverse impact on the security and Stability of the Distribution System and/or the Transmission System or imposes unreasonable costs on the Operation of the Distribution System or Transmission System or on other Users. In its consideration of a derogation request by a User, the Commission for Regulation of Utilities may contact the relevant User and/or the DSO to obtain clarification of the request to discuss changes to request. Where the derogation may have an impact on the Transmission System, the DSO shall liaise with the TSO prior to providing an assessment to the Commission for Regulation of Utilities.

Derogation from any provision of the Distribution Code shall contain:

a) The issue number and the date of the Distribution Code provision against which the derogation applies;

b) Identification of the provision with which the derogation applies;

c) Identification of the Class of Persons who are Users, Plant and/or apparatus in respect of which a derogation applies and, if relevant, the nature and extent to which the derogation applies including alternate compliance provision;

d) The reason for the non-compliance requiring derogation;

e) The date by which the derogation ends if compliance will be achieved, or by which such derogation expires.

To the extent of any derogation granted in accordance with this DGC11, the DSO and/or the User (as the case may be) shall be relieved from its obligation to comply with the applicable provision of the Distribution Code and shall not be liable for failure to so comply but shall comply with any alternate provision as set forth in the derogation.

DSO shall:

a) Keep a register of all derogations which have been granted, identifying the name of the person, or the Class of Persons who are users or Class of Plant and/or Apparatus, in respect of whom the derogation has been granted, the relevant provision of the Distribution Code and the period of the derogation; and

b) On request from any User, provide a copy of such register of derogations to such User.

Where a material change in circumstance has occurred a review of any existing derogations, and any derogations under consideration, may be initiated by the Commission for Regulation of Utilities at the request of the Commission for Regulation of Utilities, DSO, or User.
DPC DISTRIBUTION PLANNING CODE

DPC1 INTRODUCTION

DPC1.1 The Distribution Planning Code (DPC) specifies the technical and design criteria and the procedures to be complied with by the DSO in the planning and development of the Distribution System. It also applies to Users in the planning and development of their installations in so far as they affect the Distribution System.

DPC1.2 The Users' requirements may necessitate the reinforcement of, or an extension, to the Distribution System and for reinforcement of, or extension to, the relevant transmission / distribution interface capacity, such work being identified by the DSO or TSO as appropriate.

DPC1.3 The time required for the planning and development of the Distribution System and any consequential requirement of the interface with the Transmission System, shall depend on the type and extent of the necessary reinforcement and / or extension work, the time required for obtaining planning permission and wayleaves, including any associated hearings, and the degree of complexity in undertaking the new work while maintaining satisfactory security and quality of supply.

DPC1.4 Reference is made in the DPC to the DSO supplying information or advice to Users. For avoidance of doubt, unless the context otherwise requires, such information or advice shall be provided by the DSO as soon as practical following a request by the User (whether during the application for connection process or otherwise).

DPC2 OBJECTIVES

DPC2.1 The objectives of the Distribution Planning Code are to:

a) Enable the Distribution System to be planned, designed and constructed to operate economically, securely and safely.

b) Facilitate the use of the Distribution System by others and to specify a standard of supply to be provided.

c) Provide sufficient information for a User to assess opportunities for connection and to plan and develop the User's installation so as to be compatible with the Distribution System.

d) Formalise system planning data requirements.

DPC3 SCOPE

DPC3.1 The Distribution Planning Code specifies the planning and design requirements for the Distribution System.

DPC3.2 The Users to whom the Distribution Planning Code applies are those who use or intend to use the Distribution System and comprise the following:

a) All Generators
b) All Customers connected to the Distribution System
c) Suppliers
d) TSO
**DPC4**

**DESIGN STANDARDS**

**DPC4.1 Frequency**

**DPC4.1.1** The Frequency of supply is outside the control of the DSO however the expected standard Frequency range is as follows:

The **Transmission System Frequency** is nominally 50Hz:

- Normal operating range: 49.8Hz to 50.2Hz
- During system disturbances: 48.0Hz to 52.0Hz
- During exceptional system disturbances: 47.0Hz to 52.0Hz

**DPC4.2 Voltage**

**DPC4.2.1** The **Distribution System** includes networks operating at the following nominal and Declared Supply voltages:

**TABLE 1 – DISTRIBUTION NOMINAL VOLTAGES**

<table>
<thead>
<tr>
<th>Nominal Voltages</th>
<th>Declared Supply Voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Voltage (LV)</td>
<td>230 volts – phase to neutral</td>
</tr>
<tr>
<td></td>
<td>400 volts – phase to phase</td>
</tr>
<tr>
<td>Medium Voltage (MV)</td>
<td>10,000 volts (10kV)</td>
</tr>
<tr>
<td></td>
<td>20,000 volts (20kV)</td>
</tr>
<tr>
<td>High Voltage (HV)</td>
<td>38,000 volts (38kV)</td>
</tr>
<tr>
<td></td>
<td>110,000 volts (110kV)</td>
</tr>
<tr>
<td></td>
<td>110,000 volts (110kV)</td>
</tr>
</tbody>
</table>

**DPC4.2.2** The **DSO** shall operate the **Distribution System** so as ensure that the voltage at the supply terminals, as defined in EN 50160, complies with +/- 10% of the Declared Supply Voltages given in Table 1 above. The Low Voltage range tolerance shall be 230V +/- 10%. The resulting voltage at different points on the system depends on several factors, but at the Connection Point with Customers can be expected to be in accordance with Table 2 under steady state and normal operating conditions.

**TABLE 2 – OPERATING VOLTAGE RANGE**

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Highest voltage</th>
<th>Lowest voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>230V</td>
<td>253V</td>
<td>207</td>
</tr>
<tr>
<td>400V</td>
<td>440V</td>
<td>360</td>
</tr>
<tr>
<td>10kV</td>
<td>11.1kV</td>
<td>Variable according to operating conditions. Information on particular location on request by the User concerned</td>
</tr>
<tr>
<td>20kV</td>
<td>22.1kV</td>
<td></td>
</tr>
<tr>
<td>38kV</td>
<td>43kV</td>
<td></td>
</tr>
<tr>
<td>110kV</td>
<td>120kV</td>
<td></td>
</tr>
</tbody>
</table>

Higher maximum voltages can arise at the **Connection Point** with **Generators** as per Table 5 in clause DCC10.5.

**DPC4.2.3** The **Distribution System** and any **User** connections to that system shall be designed to enable normal operating **Frequency** and voltages supplied to **Customers** to comply with European Standard EN 50160:1995 **Voltage Characteristics of Electricity Supplied by Public Distribution System**. Characteristics of the voltage, **Frequency**, dips, interruptions, **Unbalance** and **Harmonics** are set out in this **GENELEC** approved standard (Item 1, in Annex 1). It should be noted that the standard describes the main characteristics of the voltage that may be expected at the supply terminals under ‘normal’ operating conditions.
DPC4.2.4 For the avoidance of doubt, any per unit voltage values stated in any Connection Network Code, shall be deemed to refer to declared supply voltage given in TABLE 1 above. Operational voltages shall be kept within the limits given in Tables 2, Table 5 and Table 6a respectively.

DPC4.3 Earthing Requirements

DPC4.3.1 The treatment of the neutral is different for the various supply voltages. The present treatments are described below but these could change in the future.

DPC4.3.2 The electrical installations of all new consumers connected at Low Voltage shall be protected by the TN-C-S system unless otherwise advised in line with the requirements of the National Rules for Electrical Installations – ETCI (Item 14, Annex1).

DPC4.3.3 The main Earthing terminal block shall be connected via an appropriately sized main protective conductor to the incoming DSO neutral conductor. An Earthing conductor of appropriate size should be taken from the main Earthing terminal to the consumer’s earth electrode.

DPC4.3.4 For voltages above LV the following applies:

Voltage Neutral Treatment

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>10kV</td>
<td>Isolated neutral throughout the country except in parts of Dublin and Cork City where it is either directly earthed or earthed through a 2 Ohm or 4 Ohm resistor so as to limit single-phase earth fault current to 1500 Amps (typical).</td>
</tr>
<tr>
<td>20kV</td>
<td>Earthed through a 20 Ohm resistor which limits earth fault current to 500 amps.</td>
</tr>
<tr>
<td>38kV</td>
<td>Earthed through an arc suppression coil (series inductance) at source 110kV substations.</td>
</tr>
<tr>
<td>110kV</td>
<td>Effectively earthed neutral system with an earth fault factor less than 1.4.</td>
</tr>
</tbody>
</table>

DPC4.3.5 With the exception of LV networks where the TN-C-S system is permitted, multiple zero phase sequence paths are currently prohibited in the design of the Distribution System.

DPC4.4 Security of Supply

DPC4.4.1 The security standard for the Distribution System is set out in Distribution System Security and Planning Standards (Item 11, Annex 1).

DPC4.4.2 The DSO shall use reasonable endeavours to maintain a supply from the system. This cannot be ensured, since faults, planned Maintenance and new works outages and other circumstances outside DSO’s control can cause interruptions. On such occasions, the DSO shall use reasonable endeavours to restore the supply or connection as soon as practicable but shall be under no liability for any direct or indirect damage or associated loss incurred by the User.

DPC4.4.3 Restoration times are cited in the Customer Charter (Item 2, Annex 1). Guidelines for different outage types are as follows:

Fault Outages: The DSO shall endeavour to restore access to the system within twenty-four hours. In major storm conditions the outage duration may be longer and, in such circumstances, the DSO shall endeavour to keep the User advised of progress.

Planned Outages: The DSO shall endeavour to give three days’ notice of planned supply interruptions. In some situations, to facilitate emergency repairs or local outages affecting a small number of Customers, shorter notice may be given.
Supply Curtailments: In some circumstances, it may be necessary to request Customers to reduce load or to use standby supplies where appropriate. In these situations the DSO shall endeavour to maintain access to the system. In extreme cases where this may not be possible the DSO shall endeavour to provide two days’ notice to the User.

Load Shedding: In extreme situations there may be generation shortages and load shedding may be required. In these circumstances the DSO shall notify Customers if possible but as this is an emergency situation this may not be possible.

DPC4.4.4 The DSO may disconnect Users under certain circumstances. These circumstances shall include:

a) Where the Customer’s installation or use of electricity is such as to interfere with the satisfactory Operation of the Distribution or Transmission System or to cause electrical disturbance to other Customers.

b) Where the DSO considers that the Customer’s installation is in a potentially dangerous condition.

c) Where alterations, repairs, renewal or Maintenance of the Distribution System or DSO assets or means of connection require the de-energisation of the Connection Point.

d) Where a Customer extends supply for use by another party whom the DSO considers to be a separate Customer.

e) In any other circumstances in which discretion is necessary or appropriate to enable the DSO to comply with the Distribution Code and/or to operate the Distribution System in accordance with Good Industry Practice or is required by any law, direction, rule or regulation having the force of law.

DPC5 TRANSFER OF PLANNING DATA

DPC5.1 Planning Information to be provided by Users

DPC5.1.1 Users of the Distribution System shall provide sufficient planning data / information as can reasonably be expected to be made available, when requested by the DSO from time to time to enable the DSO to comply with the requirements under its DSO Licence.

DPC5.1.2 Generators, Customers connected to the Distribution System including Dispatchable Demand Customers and Suppliers shall provide planning data for specific future time periods updated annually as necessary and including projected Demand requirements, anticipated changes in maximum Demand, or generating capacity, as appropriate. The data and timescales over which the data is required is given in Distribution Operating Code 1 (DOC1) and the associated data schedule is Schedule 2 of the Distribution Data Registration Code (DDRC).

DPC5.1.3 In addition to periodic updates of planning information a User shall give adequate notice of any significant change to their system or operating regime to enable the DSO to prepare its development plans and implement any necessary system modifications. In the event of unplanned changes in a User’s system or operating regime a User shall notify the DSO as soon as is practically possible to ensure any necessary measures can be implemented.

DPC5.1.4 Users shall also provide details of reactive compensation Plant directly or indirectly connected to the Distribution System other than at Low Voltage, including its rating and operational control.

DPC5.1.5 Users may be required to provide the DSO with detailed data relating to the interface between their system and that of the Distribution System covering circuit parameters, switchgear and Protection arrangements of Equipment directly connected to or affecting the Distribution System to enable the DSO to assess any implications associated with these points of connection.
DPC5.2 Information to be Exchanged

DPC5.2.1 On the request of a User, the DSO shall provide such information, as may be reasonably required, on the design and other characteristics of the Distribution System.

DPC5.2.2 Where the DSO proposes to make certain modifications to its system or where it has received information from a User under DPC5.1 above, which may impact on other User installations then the DSO will notify Users of the proposal, subject to any constraint of confidentiality or timing.

DPC5.2.3 The DSO shall provide information on request to Users regarding the local network conditions to enable them to determine their Protection requirements.

DPC5.2.4 Where the Users installation is connected to the busbars of the Distribution System sufficient details may need to be exchanged with respect to User / the DSO Ownership Boundary to enable an assessment to be made of transient over-voltage effects. The request for information may be initiated by either the DSO or the User.

DPC5.2.5 Information may be exchanged between the DSO and the User on fault infeed levels at the feeding busbar or point of connection to the Distribution System as appropriate, in the form of

- Three phase and single phase earth short circuit infeed.
- The X/R ratio under three phase fault conditions.

DPC5.2.6 Information shall be exchanged between the DSO and User on Demand transfer capability where the same Demand can be supplied from alternate User points of supply. This shall include the proportion of Demand normally fed from each point of supply and the arrangements (manual or automatic) for transfer under planned/fault outage conditions.

DPC5.3 Planning Studies

DPC5.3.1 In order to facilitate connections to the Distribution System the DSO shall prepare on request a study showing the implications of a connection at a particular point on the system.

DPC5.3.2 Under the terms of the DSO Licence a reasonable charge may be levied by the DSO for the planning study. Details of these charges are set out in Guide to the Process for connection to the Distribution System (Item 3, Annex 1).

DPC5.3.3 Users or potential Users shall provide to the DSO information regarding the proposed facility including load details, interface arrangements, proposed Connection Point and import / export requirements.

DPC5.3.4 The studies shall normally be prepared within 28 days after the date of receipt of the information or the agreement of the person making the request to pay the cost of the study, whichever is the longer. In the case of Generators and Major Customers seeking connection, depending on the nature and complexity of the request, this period may extend up to 100 days or a further 28 days from the receipt of planning information from the TSO whichever is the greater.

DPC5.3.5 Details of the procedures for application for connection to the Distribution System are contained in Guide to the Process for connection to the Distribution System (Item 3, Annex 1).

DPC5.3.6 Rules applied by the DSO in determining the connection requirements are outlined in the Distribution System Security & Planning Standards (Item 11, Annex 1).

DPC5.3.7 Where such information is available the DSO shall provide on request a statement of present and future circuit capacities, forecast power flows and loadings on part or parts of the Distribution System specified in the request and shall include Fault Levels at each distribution node covered by the request. The DSO may levy a charge for the provision of this statement as approved by the Commission for Regulation of Utilities on account of the reasonable costs incurred by the DSO in preparing this statement. The statement shall be prepared within 28 days after the date of receipt of the information or the agreement of the person making the request to pay the cost of the statement, whichever is the longer. In the case of Generators and Major Customers seeking connection this period may extend up to 110 days depending on the nature and complexity of the request.
DPC5.3.8 The dates given in this DPC5.3 are target dates only and do not constitute a legal commitment. The DSO shall however use reasonable endeavours to abide by them.
Distribution Connection Conditions
DCC DISTRIBUTION CONNECTION CONDITIONS

DCC1 INTRODUCTION

DCC1.1 It is necessary to require certain minimum technical, design and operational criteria to be met by Users’ Plant and apparatus in order to maintain, insofar as is permitted by Good Industry Practice, Stable and secure Operation of the Distribution System for the benefit of all Users and for the Protection of the Distribution System and Users’ Plant and apparatus directly connected to the Distribution System.

DCC1.2 The Distribution Connection Conditions (DCC) establish certain principles and standards relating to the provision of the connection, method of connection, and technical and performance standards.

DCC1.3 The DCC specifies the information to be provided by Users to ensure that adequate provision can be made by the DSO for new connections or increases in existing load. It also applies to Generators who operate in parallel with the Distribution System, where a connection is required.

Prospective Users shall provide to the DSO in good time all the details set out in this section.

DCC1.4 In conjunction with the connection conditions, there are Connection Agreements, which are bilateral agreements between the DSO and each User, and which contain the detail specific to each User’s connection to and use of the Distribution System. The Connection Agreement requires the User and the DSO to comply with the terms of the Distribution Code.

DCC2 OBJECTIVE

DCC2.1 The connection conditions define the minimum standards for the method of connection to the Distribution System and the technical, design and operational standards to which Users connecting to the Distribution System shall comply.

DCC2.2 The connection conditions specify the technical arrangements required at the Ownership Boundary between the Distribution System and the installation of the User and is applicable at all voltage levels covered by the Distribution Code.

DCC2.3 The connection conditions outline the types of signals and indications that will be required to be made available to the DSO by each User.

DCC3 SCOPE

DCC3.1 The connection conditions apply to the DSO and to all Users connected to or planning a connection to the Distribution System.

DCC4 INFORMATION REQUIRED FOR CONNECTION

DCC4.1 For connections at Low Voltage it is possible in most cases to assess whether a proposed connection is acceptable, and to determine the necessary supply arrangements, from analysis of the following data:

a) Maximum kVA requirements.

b) Type and electrical loading of Equipment to be connected, such as number and size of motors, cookers, showers, space and water electrical heating loads and nature of Disturbing Loads e.g. welding Equipment.

c) The date when connection is required.

If a preliminary examination of this data indicates that more detailed information is reasonably required then it shall be provided to the DSO upon request.

DCC4.2 Information Requirements and timeframes for quotation and connection are provided in Guide to the Process for connection to the Distribution System (Item 3, Annex 1). This also contains
references to the application forms that Users requiring a connection or extension to the Distribution System are obliged to complete. Copies of this document are available on request from the DSO or by download from www.esb.ie/esbnetworks.

DCC4.3 For connections at High and Medium Voltages the provisions of DCC4.1 also apply. Additionally, the following information may be required as detailed in the Distribution Data Registration Code (DDRC) Schedule 5.

a) All Types of Demand

(i) Maximum Active Power requirements.
(ii) Maximum and minimum Reactive Power requirement.
(iii) Type of load and control arrangements (e.g. type of motor start, controlled rectifier or large motor drives).
(iv) Maximum load on each phase.
(v) Maximum Harmonic currents that may be imposed on the Distribution System.
(vi) Details of cyclic load variations or fluctuating loads (as below).

b) Disturbing Loads

Comprehensive schedule of installed new Equipment including details of Disturbing Loads. These are loads which have the potential to introduce Harmonics, Flicker or Unbalance to the system. This could adversely affect the supply quality to other Customers. Disturbing Loads could be non-linear loads, power converters/regulators and loads with a widely fluctuating Demand. The type of load information required for motive power loads, welding Equipment, Harmonic producing or non-linear loads and generating Equipment can be obtained from the DSO on request.

In the case of compensating Equipment associated with Disturbing Loads, details and mode of Operation to be provided so as to ensure compliance with emission limits specified in DCC5.8.3.

c) Fluctuating Loads

Details of cyclic variation, and where applicable the duty cycle, of Active Power (and Reactive Power if appropriate), in particular:

(i) The rates of change of Active Power and Reactive Power, both increasing and decreasing;
(ii) The shortest repetitive time interval between fluctuations in Active Power and Reactive Power; and
(iii) The magnitude of the largest Step Changes in Active Power and Reactive Power, both increasing and decreasing

DCC4.4 In some cases, more detailed information may be required to permit a full assessment of the effect of the User’s load on the Distribution System. Such information may include an indication of the pattern of build-up of load and a proposed Commissioning programme. This information shall be specifically requested by the DSO when necessary and shall be provided by the User within a reasonable time.

DCC4.5 Users shall contact the DSO in advance if it is proposed to make any significant change to the connection, electric lines or electric Equipment, install or operate any generating Equipment or do anything else that could affect the Distribution System or require alterations to connection.

DCC4.6 Users shall provide to the DSO any information reasonably required by the DSO about the nature, or use by the User, of electrical Equipment on the Users’ premises

DCC5 CONNECTION ARRANGEMENTS
DCC5.1 Connection Voltage

DCC5.1.1 During the application for connection process the DSO shall, in consultation with the User, specify the voltage level to which a User will be connected in accordance with normal practice for the type of load to be supplied and network characteristics.

DCC5.1.2 Generally, the voltage level will be the minimum nominal voltage in standard use on the system, (subject to DCC5.1.3), assessed against:

a) Satisfactory Operation of the installation
b) Isolation of disturbance from other Customers
c) Lifecycle costs
d) Cost of connection

DCC5.1.3 Ongoing development of the Distribution System is leading to a newer and more efficient voltage regime. The 10kV nominal system is being converted progressively to 20kV while the 38kV system is being curtailed in favour of the 110kV and 20kV systems. Because of this:

- Connections at 10kV shall have provision for conversion to 20kV at the same time as the local network is being converted.
- The DSO shall advise prospective Customers at the time of application if there are firm plans to change from 38kV to 110kV or 20kV Operation at a future date. In such cases Customers shall make provision for such a changeover.

DCC5.1.4 The DSO may, on occasion, specify a different connection voltage from normal in order to avoid potential disturbances caused by the User’s apparatus to other Users of the Distribution System or for other technical reasons or may agree alternative methods for minimising the effects of Disturbing Loads.

DCC5.2 Information provided by DSO

Based on the information provided by the User for a connection to the Distribution System, the DSO shall prepare a statement containing as many of the following elements as are necessary for, or relevant to, the proposed installation:

a) Nominal voltage at which connection will be made
b) Method of connection, extension and / or reinforcement details
c) The normal impedance to source at the point of connection
d) Method of Earthing
e) Maximum import capacity
f) Individual Customer limits relating to:
   (i) Harmonic distortion
   (ii) Voltage Flicker
   (iii) Unbalance

g) Expected lead time of providing connection (following formal acceptance of terms for supply).
h) Cost of connection

DCC5.3 Ownership Boundaries

DCC5.3.1 The point at which supply is given or taken between the Distribution System and User’s installation shall be agreed between the DSO and the User as required.

DCC5.3.2 For LV supplies the DSO’s responsibility extends up to the Customer’s Connection Point which is normally:

a) In major installations:
   At the main fuses on the supply side of Customer’s main Circuit Breaker.
b) In single domestic premises at the Connection Point of Customers tails on the supply
The National Code of Practice for Customer Interface (Item 4, Annex 1) contains the rules for interface connections and Users shall comply with its provisions.

DCC5.3.3 For High Voltage supplies the ownership boundaries shall be subject to specific agreement between the parties in each case. Changes in the boundary arrangements proposed by either party shall be agreed in advance.

DCC5.3.4 All Equipment at the Ownership Boundary shall meet the design principles contained in DPC4 and DCC5. Connections for entry to and exit from the Distribution System shall incorporate a means of disconnection of the User's installation by the DSO.

DCC5.3.5 The respective ownership of Plant or apparatus shall be recorded in a written agreement between the DSO and the User or in diagrammatic form, as required. In the absence of a separate agreement between the parties to the contrary, construction, control, Operation and Maintenance responsibilities follow ownership.

DCC6 TECHNICAL REQUIREMENTS FOR CONNECTIONS

DCC6.1 Connection Standards

DCC6.1.1 A connection to the Distribution System may be by means of an overhead line, an underground cable or a combination of both. The network configuration at the Connection Point may take a number of forms suitable to the nature of the load and network arrangements.

DCC6.1.2 All Equipment in an installation connected to the Distribution System shall be designed, manufactured, tested and installed in accordance with all applicable statutory obligations and shall conform to the relevant ETCI, CENELEC or IEC standards current at the time of the connection of the installation to the Distribution System.

DCC6.1.3 If there is no relevant European specification, such other relevant standard which is in common use in the European Union, as current at the date of the User's applicable Connection Agreement, shall apply. If the DSO considers it necessary, however, the DSO may notify Users that supplemental specifications and / or standards shall be complied with, in which case User Plant and apparatus shall so comply.

DCC6.1.4 All Equipment in an installation connected to the Distribution System shall be suitable for use at the operating Frequency of the Distribution System and at the voltage and short-circuit rating of the Distribution System as shown in Table 3, at the Connection Point. The DSO may require certification that the Equipment has been designed and installed in a satisfactory manner. The DSO may also seek evidence that the Equipment has been tested for conformance with the standards.

DCC6.1.5 For Users connected at Low Voltage, installations shall comply with the National Rules for Electrical Installations produced by the ETCI (Item 14, Annex 1) and any other rules and regulations issued by ETCI from time to time. Users complying with these rules and regulations shall be deemed to comply with the requirements of the Distribution Code as regards design and safety. The DSO may seek evidence that the Equipment has been tested for compliance with standards.

DCC6.1.6 Before entering into a Connection Agreement it will be necessary for the DSO to be reasonably satisfied that the User's system at the boundary with the Distribution System shall comply with the appropriate requirements of the Distribution Code and when applicable the National Code of Practice for Customer Interface.

DCC6.2 Protection Requirements

DCC.6.2.1 Users shall ensure that faults in the User's Plant and apparatus do not unreasonably cause disturbances to the Distribution System or to other Users. Without limiting this obligation, a User shall prior to connection of the User's installation to the Distribution System, install the Protection Equipment specified in DCC6.2.4.
DCC6.2.2 Faults on the Distribution System can cause damage to User’s Plant and apparatus. These faults could result in a loss of a phase, over voltage, or under voltage. The User shall take account of the established practices of the particular network to which a connection is to be made, and ensure that Protection installed by the User is compatible with that used by the DSO. The adequacy of the Protection installed by the User is the User’s responsibility.

DCC6.2.3 The User’s Protection arrangements at the Ownership Boundary including types of Equipment and Protection settings, shall be compatible with existing system conditions and the Distribution System Protection practice as specified by the DSO at the time of application. In particular

a) The maximum clearance times (from fault current inception to arc extinction) shall be within the limits established by the DSO in accordance with Protection and Equipment short circuit rating policy adopted for the Distribution System.

b) In connecting to the Distribution System the User should be aware that fast and slow speed automatic reclosing is a feature of power system Operation. This is characterised by sudden de/re-energisation of the power supply. Dead times are typically 0.3s, 1s and 10s at Medium Voltage and 3s and 60s on 38kV systems. All tripping and high speed reclosing on the 110kV system is three poles with a dead time of approximately 400mS.

c) Users should also be aware that disconnection of one or two phases only of a three phase system may be effected by distribution Protection arrangements for certain types of faults.

DCC6.2.4 The minimum Protection required for a User installation connected to the Distribution System will vary according to type, size, method of connection (loop/tail/tee) and Earthing of the User system. Low Voltage Customers shall comply with The National Code of Practice for Customer Interface (Item 4, Annex 1). Other User installations will vary. It is anticipated that a new connection may require all or some of the following Protection facilities:

a) Three phase overcurrent
b) Earth fault Protection (suited to the local supply system)
c) Distance
d) Inter-tripping
e) Other

DCC6.2.5 Interface Circuit Breakers shall be fitted with relays of a type acceptable to the DSO. These relays shall have three phase overcurrent elements and one earth fault element and shall have time-current characteristics complying with standard types A, B and C of IEC255. Maximum permissible relay settings at the Ownership Boundary, necessary to provide selectivity with the distribution Equipment, will be provided by the DSO., and these settings may be reviewed at any time in the future by the DSO. Distribution Protection aims to minimise the impact of faults including Voltage Dip duration and must not be adversely affected by the Customer’s Protection limitations.

a) In order to ensure satisfactory Operation of the Distribution System, Protection systems, operating times, discrimination, and sensitivity at the Ownership Boundary shall be agreed between the DSO and the User during the application for connection process, and may be reviewed from time to time by the DSO.

b) In order to cover a Circuit Breaker, or Equipment having similar function, failing to operate correctly to interrupt fault current on the system, Back-up Protection by Operation of other Circuit Breakers or Equipment having a similar function shall normally be provided.

c) Unless the DSO advises otherwise, it is not acceptable for Users to limit the fault current infed to the Distribution System by the use of Protection and associated Equipment if the failure of that Protection and associated Equipment to operate as intended in the event of a fault, could cause Equipment owned by the DSO to operate outside its short-circuit rating.
DCC6.2.6 Protection relays shall be commissioned on site by the User who shall ensure that the settings are below the maximum permitted levels. In certain cases the DSO may wish to witness these tests and it shall be the responsibility of the User to ensure that sufficient notice is given to the DSO in such cases. Users shall ensure that the Protection settings remain below the maximum permitted levels. This may require regular testing of the relays.

DCC6.3 Earthing

DCC6.3.1 Earthing of the part of the User's installation that is connected to the Distribution System shall comply with the requirements of DPC4.3.

DCC6.3.2 The arrangements for connecting the User's installation with earth shall be designed to comply with relevant ETCI requirements. For Medium Voltage Users and for High Voltage Users Conditions Governing Connection to the Distribution System: Connections at MV and 38kV and Generators at LV, MV and 38kV (Item 7, Annex 1) applies.

DCC6.3.3 The method of Earthing the Distribution System, for example, whether it is connected solidly to earth or through an impedance, shall be advised by the DSO. The specification of associated Equipment shall meet the voltages which will be imposed on the Equipment as a result of the method of Earthing.

DCC6.3.4 Users shall take precautions to limit the occurrence and effects of circulating currents in respect of neutral points connected with earth where there is more than one source of energy.

DCC6.4 Voltage Regulation and Control

Extensions or connections to the Distribution System shall be designed such that they do not prevent the necessary control of voltage on the Distribution System. Information on the voltage Regulation and control arrangements shall be made available by the DSO if requested by the User.

DCC6.5 Short-Circuit Levels

DCC6.5.1 The short circuit rating of User's Equipment at the Connection Point shall not be less than the design Fault Level of the Distribution System as shown in Table 3 below. The choice of Equipment for connection at Low Voltage may take into account attenuation in the service lines. The DSO shall take into account the contribution to Fault Level of the User's connected system and apparatus in the design of its system.

<table>
<thead>
<tr>
<th>Connection Voltage</th>
<th>Short Circuit Level (RMS Symmetrical) Normally</th>
<th>Short Circuit Level (RMS Symmetrical) Certain Designated Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV (Domestic)</td>
<td>9.0kA</td>
<td></td>
</tr>
<tr>
<td>LV (Ind/Comm)</td>
<td>37.0kA</td>
<td></td>
</tr>
<tr>
<td>10kV</td>
<td>12.5kA</td>
<td>20kA</td>
</tr>
<tr>
<td>20kV</td>
<td>12.5kA</td>
<td>20kA</td>
</tr>
<tr>
<td>38kV</td>
<td>12.5kA</td>
<td>20kA</td>
</tr>
<tr>
<td>110kV</td>
<td>26.0kA</td>
<td>31.5kA</td>
</tr>
</tbody>
</table>

In certain 220kV/110kV substations at 110kV busbars the design short circuit level is 40kA.

DCC6.5.2 The User's incoming supply shall be controlled by the User's main Circuit Breaker which shall be in accordance with a recognised international standard acceptable to the DSO.

DCC6.6 Insulation levels
DCC6.6.1 The design of an operators Equipment connected to the Distribution System shall be such as to enable it to withstand, under test, the AC and impulse (1.2/50 μs) voltages indicated in Table 4 below.

**TABLE 4 – INSULATION LEVELS**

<table>
<thead>
<tr>
<th>Voltage of Equipment</th>
<th>AC Withstand Level</th>
<th>Impulse Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV</td>
<td>3kV</td>
<td></td>
</tr>
<tr>
<td>10kV</td>
<td>50kV</td>
<td>125kV</td>
</tr>
<tr>
<td>20kV</td>
<td>50kV</td>
<td>125kV</td>
</tr>
<tr>
<td>38kV</td>
<td>95kV</td>
<td>250kV</td>
</tr>
<tr>
<td>110kV</td>
<td>230kV</td>
<td>550kV</td>
</tr>
</tbody>
</table>

DCC6.7 Capacitive and Inductive Effects

DCC6.7.1 The User shall, when applying to make a connection, provide the DSO with information as detailed in DPC4. Details shall be required of any capacitor banks and reactors connected at High Voltage, which could affect the Distribution System and which it is proposed to connect if agreed with the DSO. When requested by the DSO, details shall also be provided of distributed circuit capacitance and inductance. Sufficient detail is required for the following:

a) To verify that controlling Equipment of the Distribution System is suitably rated;

b) To show that the performance of the Distribution System will not be impaired; and

c) To ensure that arc suppression coils on the Distribution System neutral are correctly installed and operated.

DCC6.8 Voltage Disturbances

DCC6.8.1 Users of the Distribution System should not generate voltage disturbances at a level that would affect other Users. Users should in their own interest select Equipment that is capable of functioning satisfactorily in the presence of disturbances at the levels permitted by EN50160.

DCC6.8.2 It is a condition of connection that Equipment connected directly or indirectly to the Distribution System shall conform to the requirements of EU Directive 89/336/EEC (the EMC Directive) as amended.

DCC6.8.3 Loads and installations shall comply with the following emission limits. Special conditions for Generators are outlined in DCC10.6.1

a) **Voltage Flicker**

   (i) **Frequency** of occurrence: 0.22 per min – 600 per min

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>Pₜₛ</th>
<th>Pₚₜ</th>
</tr>
</thead>
<tbody>
<tr>
<td>38kV, MV, LV</td>
<td>0.7</td>
<td>0.5</td>
</tr>
</tbody>
</table>

   Pₜₛ: Short term Flicker severity

   – an index of visual severity evaluated over a 10 minute period.

   Pₚₜ: Long term Flicker severity

   – an index of visual severity evaluated over a 2 hour period.

   (ii) **Frequency** of occurrence: 0.02 per min – 0.22 per min

   Magnitude of up to 3% is permitted.

   (iii) **Frequency** of occurrence: <= 0.02 per min

   Magnitude of up to 5% is permitted.
b) Harmonic Distortion

(i) Individual Harmonic Orders:

<table>
<thead>
<tr>
<th>Harmonic Order</th>
<th>LV</th>
<th>MV</th>
<th>38kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.70</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>3</td>
<td>0.75</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>4</td>
<td>0.70</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>5</td>
<td>2.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>6</td>
<td>0.50</td>
<td>0.50</td>
<td>0.30</td>
</tr>
<tr>
<td>7</td>
<td>2.00</td>
<td>1.00</td>
<td>0.50</td>
</tr>
<tr>
<td>8</td>
<td>0.50</td>
<td>0.50</td>
<td>0.30</td>
</tr>
<tr>
<td>9</td>
<td>0.50</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>10</td>
<td>0.50</td>
<td>0.75</td>
<td>0.25</td>
</tr>
<tr>
<td>11</td>
<td>1.50</td>
<td>1.50</td>
<td>0.75</td>
</tr>
<tr>
<td>12</td>
<td>0.50</td>
<td>0.50</td>
<td>0.30</td>
</tr>
<tr>
<td>13</td>
<td>1.50</td>
<td>1.50</td>
<td>0.75</td>
</tr>
<tr>
<td>14</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>15</td>
<td>0.50</td>
<td>0.75</td>
<td>0.25</td>
</tr>
<tr>
<td>16</td>
<td>0.75</td>
<td>0.75</td>
<td>0.25</td>
</tr>
<tr>
<td>17</td>
<td>0.75</td>
<td>0.75</td>
<td>0.50</td>
</tr>
<tr>
<td>18</td>
<td>0.50</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>19</td>
<td>1.00</td>
<td>0.50</td>
<td>0.25</td>
</tr>
</tbody>
</table>

(ii) For Generators the Total Harmonic Voltage Distortion (THVD) limit is given in the table below:

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>% Harmonic Voltage Distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV</td>
<td>2.5</td>
</tr>
<tr>
<td>MV</td>
<td>2.0</td>
</tr>
<tr>
<td>38kV</td>
<td>1.5</td>
</tr>
</tbody>
</table>

c) Voltage Unbalance

The Unbalance caused by the connection of an individual installation shall not exceed 1.3% at the Point of Common Coupling (PCC).

DCC6.4 Under fault and circuit switching conditions the rated Frequency component of voltage may fall or rise transiently. The rise or fall in voltage will be affected by the method of Earthing of the neutral point of the Distribution System and voltage may fall transiently to zero at the point of fault. Sections 2 and 3 of EN 50160, as amended from time to time, contains additional details of the variations and disturbances to the voltage which shall be taken into account in selecting Equipment from an appropriate specifications for installation on or connected to the system.

DCC6.9 Power Factor and Phase Balance

DCC6.9.1 The Customer shall take all reasonable steps to operate the Plant and the facility to keep the power factor of the total load at the Connection Point for imported electricity between 0.90 lagging and unity and for exported electricity between 0.95 lagging and unity. Generators that are not PPM’s, must keep power factor between 0.92 and 0.95 lagging. For the purpose of this code, lagging power factor refers to the absorption of Reactive Power. These are minimum requirements. In certain instances specific requirements may apply in order to ensure that the DSO can comply with the requirements of the Grid Code.

DCC6.9.2 DSO phase balance requirements are covered in EN50160.
DCC7.1 The User may be required to provide such voltage, current, Frequency, Active Power and Reactive Power pulses that are considered necessary by the DSO to ensure adequate system monitoring. Details will be specified in the User’s Connection Agreement.

DCC7.2 **Centrally Dispatched Users** shall provide signals to the TSO as required by the Grid Code.

DCC7.3 If it is agreed between the DSO and the User that the DSO shall control the switchgear on the User’s system, the DSO shall install the necessary telecontrol outstation. Notwithstanding the above, it shall be the responsibility of the User to provide the necessary control interface for the switchgear of the User which is to be controlled.

DCC7.4 Metering principles applying to certain Users connected to the Distribution System are specified in the Metering Code.

DCC7.5 Specific metering arrangements depend on the load type, size and nature of the installations being connected. A consensus document has been agreed between the DSO and Consultants / Contractors Associations and this comprises the National Code of Practice for Customer Interface (Item 4, Annex 1).

DCC7.6 Personnel carrying out design or installation work for the Customer / operator interface with the DSO should familiarise themselves with and work to this code. Unusual situations may arise which are not covered by the code. In such circumstances the DSO will be available to deal with queries.

DCC8 **SPECIFIC ARRANGEMENTS**

DCC8.1 The specific arrangements for connection, including substation layout requirements, User Equipment and tariffs and metering are set out clearly in a number of documents. Annex 1 contains a list of these documents which are available from the DSO on request of the User or by download from www.esb.ie/esbnetworks. Users must comply with the provisions of the documents relevant to their installations.

a) Conditions for Connection to the Distribution System and General Conditions for Connection of Industrial and Commercial Customers and Generators to the Distribution System (Items 5 & 6, Annex 1)

b) Conditions Governing Connection to the Distribution System: Connections at MV and 38kV and Generators at LV, MV and 38kV (Item 7, Annex 1)

c) General Specification for MV Substation Buildings (Spec. No.13320) (Item 8, Annex 1)

DCC8.2 Service standards relating to Low Voltage (230 / 400V) supplies are covered in:

a) Customer Charter - ESB Networks Ltd. (Item 2, Annex 1)

The rules for Low Voltage supplies are published in somewhat greater detail in three other documents:

b) Conditions for Connection to the Distribution System and General Conditions for Connection of Industrial and Commercial Customers and Generators to the Distribution System (Items 5 & 6, Annex 1)

c) Domestic Supply: Procedures and Conditions for Supply to New House from Overhead Networks (Item 9, Annex 1)

d) Domestic Supply: Specification of Requirements for Supply to Housing Schemes. (Item 10, Annex 1)

Please note that all the documents referred to in DCC8 are subject to updating and change. At the time of any proposed new connection, only the up-to-date versions of these documents should be used.

DCC9 **ADDITIONAL REQUIREMENTS FOR ALL 110kV CONNECTED USERS**

DCC9.1 Plant Designations
DCC9.1.1 The name of the User site shall be designated by the User and subsequently approved by the DSO.

DCC9.1.2 The designation and proposed nomenclature of User Plant and apparatus connected to Distribution System shall be in accordance with the DSO standard practice which, in particular, is designed to ensure that designation and nomenclature avoids confusion. The User shall notify the designation and proposed nomenclature of Users’ Plant and / or apparatus to the DSO who may, if the DSO determines that such proposed designation may lead to confusion or does not conform to the DSO standard practice, notify a substitute designation which shall apply to such User Plant and / or apparatus.

DCC9.1.3 The DSO standard practice currently requires that, unless otherwise agreed with the DSO, the standards outlined in schedule 6 shall apply.

DCC9.1.4 Every User shall be responsible for the provision, erection and Maintenance of clear and unambiguous labelling showing the designation and nomenclature of its Plant and apparatus at the User site.

DCC9.2 Earthing

DCC9.2.1 The Earthing of all Users Plant and apparatus and provision of an Earthing system shall as a minimum requirement be in accordance with the recommendation contained in the Guide for Safety in Alternating Current Substations, ANSI/IEEE No. 80 1986

DCC9.2.2 The DSO shall consult with each User regarding the specification of the Earthing grid to be provided.

DCC9.2.3 Each User’s earth disconnects must be earthed directly to the main station earth grid.

DCC9.2.4 The User will be obliged to certify (by a competent body) that the remote earths have been Isolated from the User’s site plus any other affected third party sites and that adequate precautions shall be taken by the User to ensure that dangerous grid potential rises are not transferred outside the Earthing zone. The distribution station cannot be energised until this certification has been received by the DSO.

DCC9.2.5 Each User’s Earthing system shall be bonded to the distribution station earth grid so that both Earthing systems are effectively integrated.

DCC9.3 Design

DCC9.3.1 User Plant and apparatus shall be designed with the following minimum capabilities:

<table>
<thead>
<tr>
<th>Parameter (minimum)</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearance outdoor in air of live metal parts phase to earth</td>
<td>1100</td>
</tr>
<tr>
<td>Height of live parts above pedestrian passageways</td>
<td>3400</td>
</tr>
<tr>
<td>Height of bottom of unscreened live bushings above ground</td>
<td>2300</td>
</tr>
<tr>
<td>Height of live conductors above roadways</td>
<td>8000</td>
</tr>
</tbody>
</table>

DCC9.3.2 LV Cables and Wiring

DCC9.3.2.1 All multi-core control and Protection cables shall be provided with a suitable metallic screen. Facilities for Earthing these screens at the base of cabinets shall be provided.

DCC9.3.2.2 LV supply cable and auxiliary wiring shall be routed from the distribution station to each User’s control building through a mutually agreed cable corridor. The cables will be laid in concrete troughs with reinforced concrete covers, or as mutually agreed, to the User’s Marshalling rack, which will be situated near the distribution station.
DCC9.3.3 Locking

DCC9.3.3.1 The facility to lock in the open/closed position and interlocking facilities shall be provided by each User on appropriate disconnects and / or Circuit Breakers (with withdraw facilities) in order to ensure that the incoming feeder(s) to the facility can be safely Isolated when required by the DSO. The specific details of this requirement will be outlined at the design phase.

DCC9.3.4 110kV Step-up Transformers

DCC9.3.4.1 Generators shall provide on-load tap-changing (OLTC) facilities for all Generator transformers. Demand User are advised to provide on-load tap-changing (OLTC) facilities for all 110kV step-up transformers. All Users shall liaise with the DSO on the design specification for the performance of the tap-changing facility on 110kV connecter transformers.

DCC9.3.4.2 Generator transformer windings shall be connected in star (with the star point or neutral brought out) on the High Voltage side and in delta on the Low Voltage side.

Other 110kV step-up transformers may be connected either:

a) In delta on the Low Voltage side and in star (with the star point or neutral brought out) on the High Voltage side; or
b) In star on both High and Low Voltage sides with a delta tertiary winding provided.

DCC9.3.4.3 Provision should be made for the Earthing of the neutral of each transformer connected to the 110kV system by bringing out the neutral and ensuring that the insulation is such that the transformer can be operated unearthed.

DCC9.3.4.4 The DSO will provide the facility for the tripping of the 110kV step-up transformer HV Circuit Breaker from the User’s transformer Protection.

DCC9.4 User Protection

DCC9.4.1 Every User shall, acting in accordance with Good Industry Practice, be responsible, insofar as is reasonably practicable, for ensuring that faults on Plant and apparatus cause minimal disturbance to the power system. Faults on Plant and / or apparatus connected to the Distribution System should be cleared as soon as possible with no deliberate time delay introduced and in any event should be cleared within a maximum time of 120 milliseconds on the 110kV system.

DCC9.4.2 In order to ensure the secure Operation of the Distribution System and correct co-ordination and discrimination between faults on the Transmission System and Distribution System and the User’s system, settings for the User’s Protection systems that may have an Operational Effect, shall be notified to the DSO and it will be necessary for the DSO to, and the DSO may, prohibit the settings of some User Protection systems within certain ranges. Protection system where such limitations will apply include, but are not limited to:

a) Generation Unit under-frequency, over-current or distance Protection;
b) Transformer over-fluxing, over-current or distance Protection
c) Loss-of-mains Protection

A mechanism for the notification and where applicable approval and determination, of such settings will be set out in the User’s Connection Agreement or other agreements.

DCC9.4.3 The DSO shall provide the User the information and signals necessary for the interface co-ordination and Operation of the User’s Protection, in accordance with the relevant provisions of the Connection Agreement, other agreements and DCC9.3.4.4.

DCC9.4.4 Where it is feasible to do so DSO shall provide Circuit Breaker fail Protection on Grid Connection Point Circuit Breakers installed in new 110kV stations.
DCC9.5  Power Quality

DCC9.5.1  Users shall ensure that their connection to the Distribution System does not result in the level of distortion or fluctuation of the supply voltage on the Distribution System, at the Connection Point, exceeding that allocated to them following consultation with the DSO. Distortion and fluctuations limits are outlined in IEC/TR3 61000-3-6 (Harmonics) and IEC/TR3 61000-3-7 (Voltage Fluctuation). Users shall operate their Plant in a manner which will not cause the requirements contained in CENELEC standard EN 50160 to be breached.

DCC9.6  Signals to be provided by the User

DCC9.6.1  Each User shall provide such signals and indications in relation to the User’s Plant and apparatus as are required by the DSO (acting reasonably) in accordance with the Connection Agreement.

DCC9.6.2  Signals and indications required to be provided by Users will include but shall not be limited to the following:

a)  LV switchgear positions to the status of each 110kV connected transformer through a set of two potential free auxiliary contacts (one contact open and one contact normally closed when the Circuit Breaker is open) for each Circuit Breaker;

b)  kV at transformer Low Voltage terminals; and

c)  A minimum of four sets of normally open potential free auxiliary contacts in each transformer LV bay for fault indication.

d), e), f), g) and h) are applicable to Generators only:

d)  MW and +/-MVar at alternator terminals of each Generation Unit;

e)  kV at Generator transformer LV terminals

f)  Generator transformer tap position

g)  Measured or derive MW output on each fuel, from Generation Units that can continuously fire on more than one fuel simultaneously; and

h)  Where it is agreed between the DSO and the Generator that signals are not available on the HV terminals, +/-MW and +/-MVar shall be provided at the 110kV connector transformer Low Voltage terminals.

i)  Status of governor control system and any load limiters.

j) and k) are applicable to Demand Customers only:

j)  MW and +/-MVar at the HV terminals of the 110kV step-up transformer.

k)  110kV connector transformer tap position.

DCC9.6.3  Where signals or indications required to be provided by the User under DCC9.6.2 become unavailable or do not comply with applicable standards due to failure of the User’s technical Equipment or any other reason under the control of the User, the User shall, acting in accordance with Good Industry Practice, restore or correct the signals and / or indications as soon as possible.

DCC9.6.4  Signals to be provided to the User shall be presented in such form as is nominated by the DSO or TSO where appropriate.

DCC9.6.5  Where, the DSO, acting reasonably, determines that because of a modification to the Distribution System or otherwise to meet a Distribution System requirement, additional signals and / or indications in relation to the User’s Plant and apparatus are required, the DSO shall notify that requirement to the User. On receipt of such a notification the User shall promptly, and in accordance with Good Industry Practice, ensuring that such signals and / or indications are made available at the relevant marshalling rack.

DCC9.7  Power Supplies
DCC9.7.1 Each **User** shall provide:

a) 400V / 230V AC power supplies as required by the **DSO** for distribution station facilities, the capacity and detail of which shall be specified by the **DSO** and provided for in the **User’s Connection Agreement**.

b) A standby supply for all ac power supplies for distribution station facilities by a diesel **Generator**, unless alternative means are agreed with the **DSO**, such agreement not to be unreasonably withheld. In the event of loss of mains, standby supplies shall be capable of being sustained for a minimum of 10 hours.

DCC9.8 Commissioning and Notification

DCC9.8.1 The **DSO** and the **User** shall, in accordance with the provisions set out in the **Connection Agreement**, meet to discuss **Commissioning**, including **Commissioning** tests and **Grid Code** tests. The **User’s** obligations in relation to testing set out in this DCC9.8 are in addition to the requirements under the **Connection Agreement**.

DCC9.8.2 **Users** are required to carry out such tests (which are defined to be **Grid Code** tests) as required in order to confirm that the **User’s Plant** and apparatus meets all requirements of the **Grid Code** which must be met prior to operational date. The **DSO** may, under the **Connection Agreement**, notify to the **User** such **Grid Code** tests as it requires the **User** to carry out. The **DSO** may not necessarily test for DCC9.10.1.1 a), b), c), d) and e) but reserve the right to test to establish design and operational compliance. For the avoidance of doubt it is the responsibility of **Users** at all times to ensure their compliance with the **Grid Code** and testing successfully or otherwise shall not in any way diminish or reduce such responsibilities.

DCC9.8.3 Where **Commissioning** is likely to involve a requirement for a **Dispatch** for test purposes, the **User** shall, as soon as possible, notify the **TSO** of this requirement, including reasonable details as to the duration and type of testing required. **Users** shall give the **TSO** reasonable advance notice (being not less than fifteen (15) business days) of the time of carrying out of the **Commissioning** tests. The time and date of such **Commissioning** shall be reconfirmed not less than three (3) business days before the time of carrying out such tests. In the event that, having given such confirmation the **User** (acting reasonably) determines that such tests must be carried out prior to the time and date previously confirmed, then provided the **User** gives the **TSO** reasonable notice of the re-scheduled tests, the **User** shall not be deemed to have failed to give the notice required. The **User** shall as soon as it becomes aware of the same, subsequently notify the **TSO** of any material changes in the requirement and details so notified.

DCC9.8.4 The information provided under DCC9.8.3 is for indicative purposes only, and the **User** shall subsequently make a formal request to the **TSO** for a **Commissioning** test requiring a **Dispatch** in accordance with the following provisions of the DCC9.8, and shall not carry out such a **Commissioning** test except as **Dispatched** in accordance with DCC9.8.

DCC9.8.5 Commissioning Test

DCC9.8.5.1 **Users** shall make a request in writing to the **TSO** for every **Commissioning** test requiring **Dispatch**, in accordance with DCC9.8.4. Such request to include the following information:

DCC9.8.5.2 Details of the proposed **Commissioning** test;

DCC9.8.5.3 **Dispatches**, where necessary, required by the **User** for completion of the **Commissioning** test, if any, including the duration of the **Dispatch**. Where the **User** may not know the entire **Dispatches** required for completion of the test until part of the test is completed then the **User** when proposing the test shall:

a) Divide the **Commissioning** test in sections as appropriate;

b) Indicate and discuss which sections of the **Commissioning** tests can be completed in stages and which cannot;

c) Indicate possible variations of the **Commissioning** test for the sections which be completed in stages.
Additionally the factors which influence the completion of the stages should be outlined to the TSO, (namely, if the procedure to be followed for a certain stage depends on the outcome of a previous stage);

DCC9.8.5.4 The preferred time or times for the Commissioning test.

DCC9.8.5.5 The milestones for individual sections of Commissioning test (if any) which can be completed separately, and / or do not require to be repeated if the Commissioning test is interrupted by the TSO after the completion of each section.

DCC9.8.6 Generators will be subject to the Scheduling and Dispatch Codes a minimum of seven (7) days prior to the operational date and the Generation Unit will be available for Dispatch from the operational date.

DCC9.8.7 Following the connection date but not later that the operational date Users shall verify (by giving the TSO such evidence as it may reasonably require including, without limitation, the results of the relevant Commissioning test or Grid Code test) technical data provided under the Planning Code and other technical data which the TSO reasonably requires to be verified to assess the compliance with the Grid Code or the Connection Agreement.

DCC9.8.8 The values as confirmed or verified under DCC9.8 shall be included in the User's registered operating characteristics and Registered Data.

DCC9.9 Additional Requirements for Dispatchable Demand Customers

DCC9.9.1 Signals, Communications and Control

DCC9.9.1.1 The following signals and indications are required to be provided by Users to the TSO. They will include but shall not be limited to the following:

a), b) and c) are applicable to Dispatchable Demand Customers who represent Demand Side Units which consists of an Individual Demand Site:

   a) kW and +/-kVar at alternator terminals of each Generator where applicable;
   b) Measured or derived kW output for each Generator at the HV terminals of the transformer where applicable; and
   c) Demand Reduction aggregated at the HV terminals of the transformer.

d), e), f) and g) are applicable to Dispatchable Demand Customers who represent Demand Side Units which consists of an Aggregated Demand Site:

   d) The aggregated kW and +/-kVar aggregated at alternator terminals of each Generator where applicable;
   e) When requested by the TSO, the kW and +/-kVar of each Individual Demand Site at alternator terminals of each Generator where applicable;
   f) The aggregated measured or derived KW output for each Generator aggregated at the HV terminals of the transformer where applicable; and
   g) The aggregated Demand Reduction aggregated at the HV terminals of the transformer.

DCC9.9.1.2 Dispatchable Demand Customers shall provide the TSO the specification of the method of aggregation of SCADA from multiple sites. The minimum specifications shall be agreed with the TSO in advance.

DCC9.9.2 Responsible Operator

DCC9.9.2.1 For Dispatchable Demand Customers, the Control Facility shall be staffed by a responsible operator(s) who shall respond to communications from the TSO without undue delay (except where otherwise provided for by agreement between the Dispatchable Demand Customer and the TSO, such agreement not to be unreasonably withheld) and are of suitable experience and training and are authorised to perform functions on behalf of the Dispatchable Demand Customer as follows:
a) To accept and execute Dispatch Instructions;
b) To receive and acknowledge receipt of requests, for amongst other matters, Operation outside the declared values of Demand Reduction.

DCC9.9.2.2 A designated responsible operator shall be contactable by DSO or TSO at all times to discuss operational matters without undue delay and in any case within at most 1 hour. Following a request from DSO, the responsible operator shall be present at the Demand Side Unit control point without undue delay and in any case within two hours and shall be capable of taking any appropriate actions. The responsible operator shall be contactable 24 hours a day, 365 days a year. Specialist response shall be available on the next working day following a request from the DSO or TSO.

DCC9.9.2.3 The Responsible Manager shall be authorised to perform the following functions on behalf of the Dispatchable Demand Customer:

a) To make estimates in accordance with Good Industry Practice as to the Demand Reduction;
b) To make declarations of the Demand Reduction for each Demand Side Unit;
c) To communicate with respect to issues regarding outages of each DSU.

The Dispatchable Demand Customer may, from time to time, notify a replacement contact location and personnel, which meets the foregoing requirements.

DCC9.9.3 Supervisory Control and Data Acquisition (SCADA)

DCC9.9.3.1 SCADA remote terminal Equipment shall be required in the control room of the transmission station at the User site for the transmission of signals and indications to and from the NCC. The signals and indications which must be provided by Users for transmission by SCADA Equipment to the NCC are the signals and indications referred to under connection conditions together with such other information as the TSO may from time to time by notice to Users reasonably require.

DCC9.9.3.2 For Dispatchable Demand Customers, SCADA remote terminal Equipment shall also be required at the Control Facility for the transmission of signals and indications to and from the NCC. The signals and indications which must be provided by Dispatchable Demand Customers for transmission by SCADA Equipment to the NCC are the signals and indications referred to under connection conditions together with such other information as the TSO may from time to time, by notice to Dispatchable Demand Customers, reasonably require.

DCC9.9.3.3 Interface cabinets shall be installed in the control room of the transmission station at the or in Dispatchable Demand Customer’s Control Facility. Provision and Maintenance of wiring and signalling from the Dispatchable Demand Customer’s Plant and apparatus to the Dispatchable Demand Customer’s interface cabinet shall be the responsibility of the Dispatchable Demand Customer’s. The TSO shall provide the cables to interconnect these interface cabinets.

DCC9.9.4 Monitoring, Testing and Investigation

DCC9.9.4.1 The response of the Dispatchable Demand Customer’s Demand Side Units to Dispatch Instructions and compliance with their Availability Notice shall be monitored, tested and checked in accordance with OC8 and OC10 of the Grid Code.

DCC9.9.5 Scheduling and Dispatch of Demand Side Units

DCC9.9.5.1 Scheduling and declaration of availability of the Demand Side Units shall be in accordance with SDC1 of the Grid Code.

DCC9.9.5.2 The Scheduling, Dispatch and additional parameters required forDispatching a Demand Side Units shall be in accordance with SDC1A of the Grid Code.

DCC9.9.5.3 Dispatching of the Demand Side Units shall be in accordance with SDC2 of the Grid Code.
DCC9.6 Outage Planning

DCC9.6.1 The Dispatchable Demand Customers must adhere to the outage planning requirement as specified in OC2 of the Grid Code.

DCC9.7 Additional Connection Conditions

DCC9.7.1 Each Demand Side Unit shall, as a minimum, have the following capabilities:

   a) Able to provide Demand Reduction between 0 MW and the Demand Reduction Capability
   b) Max ramp up capability not less than 1.5% of Demand Reduction Capability per minute when the Demand Side Unit is in normal Dispatch condition
   c) Max ramp down capability not less than 1.5% of Demand Reduction Capability per minute when the Demand Side Unit is in normal Dispatch condition
   d) Minimum down-time capability not greater than 30 minutes for Demand Side Units
   e) Maximum down-time capability not less than 2 hours for Demand Side Units

Each Demand Side Unit with on-site generation, shall, as a minimum, have the following capabilities:

   f) Operate continuously at normal rated output at frequencies in the range 49.5Hz to 50.5Hz;
   g) Remain synchronised to the Distribution System at frequencies within the range 47.5Hz to 52.0Hz for a duration of 60 minutes;
   h) Remain synchronised to the Distribution System at frequencies within the range 47.0Hz to 47.5Hz for a duration of 20 seconds required each time the Frequency is below 47.5Hz;
   i) Remain synchronised to the Distribution System during a Rate of Change of Frequency of values up to and including plus or minus 1.0 Hz per second measured as a rolling average over 500 ms. Voltage dips may cause localised Rate of Change of Frequency values in excess of 1 Hz per second for short periods, and in these cases, the Demand Side Unit shall remain synchronised during Voltage dips at the HV terminals of 95% of nominal voltage (5% retained) for a duration of 0.6 seconds; The DSO may require lower or higher values to be used for Protection settings;

DCC9.7.2 Each Demand Side Unit will require electronic interface to receive Dispatch Instructions from the TSO.
Generator Requirements
**DCC10**

**GENERAL REQUIREMENTS FOR GENERATORS**

**DCC10.1** Introduction

**DCC10.1.1** Distribution Connection Code 10 (DCC10) is applicable to all existing or prospective Generators, including Customers with CHP, Customers with Auto-production and Generators using renewables or alternative sources of energy who are connected to the Distribution System. Customers with stand-by Generators who are connected to the Distribution System must comply with clause DCC10.9.

**DCC10.1.2** In addition to meeting the requirements of DCC10, Generators shall also comply with the requirements of the general conditions, the Planning Code, the connection conditions and other relevant sections of the Distribution Code. Generators that are subject to Central Dispatch shall additionally have to comply with relevant sections of the Grid Code.

**DCC10.1.3** If existing Generating Plant does not comply with the standards set down in, or cannot comply (for technical or economic or other reasons) with, the requirements of this section, they shall seek a derogation from the provision from the Commission for Regulation of Utilities.

**DCC10.1.4** The Generator shall initiate discussions at a sufficiently early stage in design to allow the DSO to examine the impact of the Generating Unit(s) on the Distribution System.

**DCC10.1.5** The DSO may refuse permission for the connection of a Generating Unit at a point on the Distribution System or require revision to design or technical parameters of the Generation Unit, or impose certain restrictions in order to ensure that security and quality of supply standards as specified in DPC4 are maintained. In such instances, the DSO shall provide sufficient supporting information to justify the refusal or the required revisions.

**DCC10.2** Specific Rules for Generators

**DCC10.2.1** The integrity of the Distribution System and the security and quality of supply to existing Users shall not fall below standard as a result of Generators operating in parallel (synchronised) with the Distribution System. Conditions for Operation shall guarantee the safety of:

- Members of general public
- Personnel
- Distribution Equipment

Supply quality to other Customers shall not fall below standard as a result of the presence or Operation of Generating Units.

**DCC10.2.2** Generating Units connecting to the Distribution System and operating in parallel with, or which are capable of being operated in parallel with the Distribution System shall comply with Conditions Governing Connection to the Distribution System: Connections at MV and 38kV and Generators at LV, MV and 38kV (Item 7, Annex 1). This document sets out the conditions to which Generating Units operating in parallel to the Distribution System shall comply.

**DCC10.2.3** Protection conditions and requirements set down in Conditions Governing Connection to the Distribution System: Connections at MV and 38kV and Generators at LV, MV and 38kV (Item 7, Annex 1) are to protect the Distribution System. The Generator is responsible for Protection of their personnel and Equipment and the efficient Operation of their Generating Unit.

**DCC10.2.4** Where a Generator Unit is to be installed in a premises the DSO shall be informed. The DSO shall have the right to inspect generating installations to ensure that the requirements are met. In some cases the DSO may require a demonstration by Operation of the Generator. Such demonstrations shall be by agreement with the User.

**DCC10.3** Provision of Information

**DCC10.3.1** Information required from Generators
Generators shall apply and provide to the DSO, via the application form process, information on the Generating Plant and the proposed interface arrangements between the Generating Plant and the Distribution System. The information required by the DSO before entering into an agreement to connect any Generating Plant to the Distribution System is shown below and is detailed in Schedules 1 (a), 1 (b) and 1 (c) in the Distribution Data Registration Code (DDRC).

a) Generating Plant Data:
   (i) Terminal Volts (kV)
   (ii) Rated kVA
   (iii) Rated kW
   (iv) Maximum Active Power sent out (kW), Reactive Power requirements (kVAr)
   (v) Type of Generating Plant – synchronous, asynchronous, etc.
   (vi) Type of prime mover;
   (vii) Anticipated operating regime of generation e.g. continuous, intermittent, peak lopping;
   (viii) Fault Level Contribution – a calculation sheet showing the fault current available from the Generators due to a metallic three-phase short circuit at the main incoming Circuit Breaker when all the Generators are operating. Account should be taken of any large motors in the installation (ref: IEC 909).
   (ix) Method of voltage control
   (x) Generator transformer details, as applicable; and
   (xi) Requirements for Top-up Supplies and / or Standby Supplies

Details will also be required on the following parameters:
   (i) Inertia Constant
   (ii) Stator resistance
   (iii) Direct Axis Reactance
   (iv) Time Constants: Direct Axis
   (v) Zero Sequence
   (vi) Negative Sequence
   (vii) Generator Transformer

   MW secs/MVA (whole machine)

   Sub-transient
   Transient
   Synchronous
   Sub-transient
   Transient
   Resistance
   Reactance
   Resistance
   Reactance
   Resistance
   Reactance
   MVA Rating

b) Other Plant and Equipment Details:

A comprehensive schedule of installed new Equipment including details of Disturbing Loads as per DCC4 is required.

c) Interface Arrangements:
   (i) The means of synchronisation between the DSO and User;
   (ii) Details of arrangements for connecting with earth that part of the Generating Plant directly connected to the Distribution System;
   (iii) The means of connection and disconnection which are to be employed; and
   (iv) Precautions to be taken to ensure the continuance of safe conditions if any earthed neutral point of the Generators system operated at High Voltage become disconnected from earth.

DCC10.3.2 The details of information required will vary depending on the type and size of the Generating Unit or the point at which connection is to be made to the Distribution System. This information shall be provided by the Generator at the reasonable request of the DSO.
DCC10.3.3  The DSO will use the information provided to model the Generator Unit to determine a technically acceptable method of connection. If the DSO reasonably concludes that the nature of the proposed connection or changes to an existing connection requires more detailed analysis then further information than that specified in DCC10.3.1 may be required.

DCC10.3.4  Additional information may be required from Generators larger than 2MW or connected at a voltage level above 20kV. This may include:

a) Technical Data

(i) Generating Plant information (impedance per unit on rating)
   Type of prime mover
   Rated MVA
   MW
   Type of excitation system

(ii) Automatic Voltage Regulator (AVR)
   A block diagram for the model of the AVR system including the data on the gains, forward and feedback gains, time constraints and voltage control limits.

(iii) Speed governor and prime mover data
   A block diagram for the model of the Generating Plant governor detailing the governor flyball, if applicable, and system control and turbine rating.

(iv) Generator excitation system

b) Capacity and standby requirements

(i) Registered Capacity and minimum generation of each Generating Unit and Power Station in MW.
(ii) Generating Unit and Power Station auxiliary Demand (Active and Reactive Power) in MW and MVAr, at Registered Capacity conditions.
(iii) Generating Unit and Power Station auxiliary Demand (Active and Reactive Power) in MW and MVAr, under minimum generation conditions.

DCC10.3.5  In normal circumstances the information specified above will enable the DSO to assess the connection requirements. Occasionally additional information may be required. In such circumstances, the information shall be made available by the Generator, at the reasonable request of the DSO.

DCC10.4  Information Provided by the DSO

DCC10.4.1  The DSO shall prepare a statement as per DCC5.2 for Generators applying for connection to the Distribution System.

DCC10.4.2  Where Generator paralleling or power export is intended the following additional information shall be provided including:

   a) Interface Protection settings
   b) Equipment, cabling, switchgear, metering requirements
   c) Substation site and building requirements (dimensions, access, planning permission, Earthing, lighting and heating)

DCC10.5  Technical Requirements

DCC10.5.1  Generating Plant Performance Requirements
a) All Centrally Dispatched Generating Units shall comply with the relevant sections of the Grid Code;

b) For Generators not subject to Central Dispatch the electrical parameters to be achieved at the Generating Unit terminals shall be specified by the DSO with the offer for connection;

c) Protection associated with Generating Plant shall be required to co-ordinate with the Distribution System Protection regarding:

(i) Clearance times for fault currents
(ii) Co-ordination with auto-recloser requirements
(iii) Protection settings of the controlling Circuit Breaker

Protection settings shall not be changed without agreement from the DSO.

These Protection requirements are additional to normal interface Protection requirements of the User;

d) The emission limit for Voltage Fluctuations and Flicker at the PCC caused by switching or continuous Operation of wind / wave turbine installations is $P_{st} = 0.35$ and $P_{lt} = 0.35$ where:

\[
P_{st}: \text{Short term Flicker severity} \\
\text{an index of visual severity evaluated over a 10 minute period.}
\]

\[
P_{lt}: \text{Long term Flicker severity} \\
\text{an index of visual severity evaluated over a 2 hour period.}
\]

These values are consistent with IEC 1000-3-7;

e) For Generators the Total Harmonic Voltage Distortion (THVD) limit is given in the table below:

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>Total Harmonic Voltage Distortion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV</td>
<td>2.5</td>
</tr>
<tr>
<td>MV</td>
<td>2.0</td>
</tr>
<tr>
<td>38kV</td>
<td>1.5</td>
</tr>
</tbody>
</table>

A schedule of individual Harmonic distortion limits shall be provided by the DSO where appropriate;

f) The maximum voltage at the Connection Point with a Generator is as per Table 5

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Highest voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>230V</td>
<td>253V</td>
</tr>
<tr>
<td>400V</td>
<td>440V</td>
</tr>
<tr>
<td>10kV</td>
<td>11.3kV</td>
</tr>
<tr>
<td>20kV</td>
<td>22.5kV</td>
</tr>
<tr>
<td>38kV</td>
<td>43.8kV</td>
</tr>
<tr>
<td>110kV</td>
<td>120kV</td>
</tr>
</tbody>
</table>

g) Each Generation Unit shall, as a minimum, operate continuously at normal rated output at the Distribution System Frequencies in the range of 49.5Hz to 50.5Hz. This requirement does not apply for Automatic Mains Failure Mode or Lopping Mode connections;

h) Each Generation Unit shall, as a minimum, remain synchronised to the Distribution System at Distribution System Frequencies within the range of 47.5Hz and 52.0Hz for a duration of 60 minutes. This requirement does not apply for Automatic Mains Failure Mode or Lopping Mode connections;
i) Each Generation Unit shall, as a minimum, remain synchronised to the Distribution System at Distribution System Frequencies within the range of 47.0Hz and 47.5Hz for a duration of 20 seconds required each time the Frequency is below 47.5Hz. This requirement does not apply for Automatic Mains Failure Mode or Lopping Mode connections;

j) Each Generation Unit shall, as a minimum, remain synchronised to the Distribution System during a Rate of Change of Frequency of values up to and including plus or minus 1.0 Hz per second measured as a rolling average over 500 ms. Voltage dips may cause localised Rate of Change of Frequency values in excess of 1 Hz per second for short periods, and in these cases, the clause DCC10.5.1.1 (l) supersedes this clause (DCC10.5.1.1 (j)). The DSO may require lower or higher values to be used for Protection settings. This requirement does not apply for Automatic Mains Failure Mode or Lopping Mode connections;

k) Each Generation Unit shall, as a minimum, remain synchronised to the Distribution System at normal rated output at Distribution System voltages within the ranges in Table 6A for Step Changes in the Distribution System voltage of up to 10%. This requirement does not apply for generator less than 100kW, Automatic Mains Failure Mode or Lopping Mode connections;

l) Each Generation Unit shall, as a minimum, remain synchronised during Voltage Dips at the HV terminals of the Generator transformer of 95% of nominal voltage (5% retained) for a duration of 150 milliseconds and remain synchronised during Voltage Dips at the HV terminals of the Generator transformer of 50% of nominal voltage (50% retained) for a duration of 450 milliseconds. This requirement does not apply for generators less than 100kW, Automatic Mains Failure Mode or Lopping Mode connections;

DCC10.6 Islanding

DCC10.6.1 It is conceivable that a part of the Distribution System, to which Generators are connected can, during emergency conditions, become detached from the rest of the system. The DSO may decide, dependent on local network conditions, if it is desirable for the Generators to continue to generate onto the islanded Distribution System.

DCC10.6.2 If not facilities exist for the subsequent resynchronisation with the rest of the Distribution System then the Generator shall under DSO instruction ensure that the Generating Plant is disconnected for resynchronisation.

DCC10.6.3 Under emergency conditions there is an expectation that some generation will continue to operate outside the statutory Frequency limits. However, for Generators connected to the Distribution System it is likely that this could mean connection within an automatic low Frequency load disconnection zone. Consequently, Generators should ensure that all Protection on Generating Plant should have settings to co-ordinate with those on the low Frequency load disconnection Equipment which will be detailed by the DSO on request.

DCC10.7 Black Start Capability

DCC10.7.1 Generators shall notify the DSO if its Generating Plant has a restart capability without connection to an external power supply, unless the Generator has previously notified the TSO accordingly under the Grid Code.

DCC10.8 Generating Plant Commissioning Tests

DCC10.8.1 Where the Generating Plant requires connection to the Distribution System in advance of the Commissioning date, for the purposes of testing, the Generator shall comply with the requirements of the Connection Agreement. The Generator shall provide the DSO with a Commissioning programme, approved by the DSO if reasonable in the circumstances, to allow Commissioning tests to be co-ordinated.
DCC10.9 Standby Generators

DCC10.9.1 Parallel Operation with the Distribution System is generally not permitted for standby Generators. Specific agreement of the DSO is required for parallel Operation.

DCC10.9.2 Customers with standby generation shall ensure that any part of the installation supplied by the Generating Plant has first been disconnected from the Distribution System and remains disconnected while the Generating Plant is connected to the installation. Methods of changeover and interlocking shall meet these requirements. See National Rules for Electrical Installations, Part 3.7 “Supplementary Requirements for Low Voltage synchronous Generator installations” (Item 15, Annex1).

DCC10.9.3 Low Voltage Generating Units must comply with the relevant requirements published by the ETCI and the National Code of Practice for Customer Interface (Item 4, Annex 1). Medium and High Voltage standby Generating Units are rare and requirements shall be provided by the DSO on application.

DCC10.10 Additional Requirements for 110kV Connected Generators > 2MW

DCC10.10.1 Operational Requirements

DCC10.10.1.1 Each Generation Unit shall, as a minimum, have the following capabilities:

a) Sustained Operation at the specified minimum generation within the range 49.8 to 50.1Hz;

b) Sustained Operation in accordance with the Reactive Power capability as required by DCC10.10.2 at Distribution System voltages within the ranges specified in DPC4.2.2, unless otherwise specified.

c) Remain synchronised to the Distribution System during a negative phase sequence load Unbalance in accordance with IEC 60034-1.

d) Minimum Load Not greater than 50% of Registered Capacity for CCGT Installations and not greater than 35% of Registered Capacity for all other Generation Units.

e) Ramp up capability Not less than 1.5% of Registered Capacity per minute when the unit is in the Normal Dispatch Condition.

f) Ramp down capability Not less than 1.5% of Registered Capacity per minute when the unit is in Normal Dispatch Condition.

g) Minimum up-time Not greater than 4 hours for thermal units

h) Minimum down-time Not greater than 4 hours for thermal units

i) Forbidden Zones Within the range between normal minimum load plus 5% and Registered Capacity less 10%, not more than 2 specified zones each not greater than 10% of Registered Capacity.

j) Block Loading Not greater than 10% of Registered Capacity

k) Time off-load before going into longer standby conditions Remain in a hot condition for at least 12 hours and remain in a warm condition for at least 60 hours.

l) Time to Synchronise (from instruction) Hot: Not greater than 3 hours
    Warm: Not greater than 8 hours
    Cold: Not greater than 12 hours
m) (i) Time from Synchronising to Minimum Load
   Hot: Not greater than 40 Minutes
   Warm: Not greater than 90 minutes
   Cold: Not greater than 180 minutes

   (ii) Time to de-load from Minimum Load to De-Synchronising
   Hot: Not greater than 40 minutes
   Warm: Not greater than 90 minutes
   Cold: Not greater than 180 minutes

n) Operating Reserve
   (i) POR (not less than 5% Registered Capacity)
      To be provided, at a minimum, at MW outputs in the range from 50% to 95% Registered Capacity, with provision in the range of 95% to 100% Registered Capacity to be not less than that indicated by a straight line with unity decay from 5% of Registered Capacity at 95% output to 0 at 100% output.

   (ii) SOR (not less than 5% Registered Capacity)
      To be provided, at a minimum, at MW outputs in the range from 50% to 95% Registered Capacity, with provision in the range of 95% to 100% Registered Capacity to not less than that indicated by a straight line with unity decay from 5% of Registered Capacity at 95% output to 0 at 100%.

   (iii) TOR1
      To be provided, at a minimum, at MW outputs in the range from 50% to 92% Registered Capacity, with provision in the range of 92% to 100% Registered Capacity to be not less than that indicated by a straight line with unity decay from 8% of Registered Capacity at 92% output to 0 at 100%.

   (iv) TOR2
      To be provided, at a minimum, at MW outputs in the range from 50% to 90% Registered Capacity, with provision in the range of 90% to 100% Registered Capacity to be not less than that indicated by a straight line with unity decay from 10% of Registered Capacity at 90% to 0 at 100%.

o) The DSO may request Generation Units of Registered Capacity greater than or equal to 60MW to have the capacity to operate under SFRS at all loads between SFRS Minimum Load and SFRS Maximum Load.

DCC10.10.1.2 Notwithstanding DCC10.10.1.1 Combustion Turbine Unit, hydro or other technology based Generation Units shall as appropriate, register and perform to Operating Characteristics giving maximum flexibility of Operation, consistent with their type and model of Generation Plant, in accordance with Good Industry Practice. Where appropriate, Operating Characteristics and in particular start times, should be registered separately for normal (planned) starts, and for starts required under conditions of system stress, such as following the loss of a Generation Unit. The Generator will maintain operational procedures and practices, which ensures that there are no unnecessary delays in responding to Dispatch instructions in accordance with the technical capabilities of the Generation Plant.

DCC10.10.1.3 Where the TSO or DSO approaches a Generator, the Generator will co-operate with the TSO or DSO in the development of procedures and facilities to improve the response of each Generation Unit during conditions of system stress, including for example, automatic start-up of fast-start Generation Units following a loss of a Generation Unit(s) or in advance of an anticipated loss of a Generation Unit(s). This shall be subject to agreement of the Generator that the procedures
are consistent with secure Operation of the Generator’s Plant, such agreement not to be reasonably withheld.

DCC10.1.4 Where start-up time of Generation Units exceeds 30 minutes, they shall be designed to have the capability, where supply from the Distribution System is lost, to reduce output to match house load an sustain Operation (i.e. tripping to Auxiliaries).

DCC10.1.5 Control synchronising shall be provided by Generators at Circuit Breakers identified by the DSO, which, depending on the Plant configuration may include:

a) The Generation Unit Circuit Breaker
b) The Generator transformer LV and HV Circuit Breakers

The DSO will provide to the Generator signals from the DSO operated Plant and apparatus as are required to facilitate synchronising on the Generator transformer HV Circuit Breaker, in accordance with the relevant provisions of the Connection Agreement.

DCC10.1.6 The synchronising facilities in DCC10.1.6 shall facilitate synchronising under the following conditions:

a) Distribution System Frequency within the limits 48.0Hz to 52.0Hz
b) Distribution System voltage within the limits 99kV to 123kV notwithstanding DCC10.10.2.

DCC10.1.7 Each Generation Unit shall be designed, where practicable, to mitigate the risk of common failure with other Generation Units. In particular each Generation Unit shall be designed so that it can operate with its essential auxiliaries supplied through the unit transformer which shall be connected between the Generation Unit Circuit Breaker and the Generator transformer LV terminals, or from another secure source as agreed with the DSO. Auxiliary Suppliers may, provided that they are in accordance with Good Industry Practice, be taken from an alternative source during Commissioning, testing, start-up or emergencies.

In the case of a CCGT installation, this applies to the Combustion Turbine Units only.

DCC10.2 Reactive Power Capability

DCC10.2.1 Each Generation Unit shall have the following Reactive Power capability as measured at their alternator terminals:

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>Connected at:</th>
<th>At 100% Registered Capacity</th>
<th>At 35% of Registered Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>99kV ≤ V ≥ 123kV</td>
<td>110kV</td>
<td>0.93 power factor leading to 0.85 power factor lagging</td>
<td>0.7 power factor leading to 0.4 power factor lagging</td>
</tr>
<tr>
<td>85kV ≤ V ≥ 99kV</td>
<td>Unity power factor to 0.85 power factor lagging</td>
<td>0.7 power factor leading to 0.4 power factor lagging</td>
<td></td>
</tr>
</tbody>
</table>

DCC10.2.2 At between Registered Capacity and 35% Registered Capacity, MVAr capability to be not less than indicated by a straight line drawn between the two points from the above, on a plot of MVAr capability against MW output.

DCC10.2.3 At below 35% Registered Capacity, MVAr capability to be not less than that at 35% Registered Capacity.

DCC10.2.4 The Generator transformer shall be designed such that the Reactive Power capability is possible over the full range of Distribution System voltages (Specified in DCC10.10.2.1)

DCC10.2.5 The DSO and the Generator will liaise on matters related to DCC10.2 at the design stage.
DCC10.3 Each Generation Unit must be fitted with a fast acting proportional turbine speed governor and unit load controller or equivalent control device to provide Frequency Response under normal operating conditions in accordance with OC4 of the Grid Code.

DCC10.4 All Generation Units shall be capable of contributing to control of the Distribution System voltage by continuous modulation of Generator voltage by means of a suitable continuous acting Automatic Voltage Regulation (AVR) which shall comply with BS4999 part 140 or equivalent European Standards and the characteristics of which have been accepted by the DSO prior to the connection date, such acceptance not to be unreasonably withheld.

DCC10.5 Each Generator transformer shall have on-load tap-changing (OLTC). The tap step shall not alter the voltage ratio at the HV terminals by more than 2.5% on the 110kV system.

DCC10.6 Protection

DCC10.6.1 Generators will provide:

a) Differential Protection on the Generator transformer. The connections between the Grid Connection Point Circuit Breaker and the HV terminals of the Generator transformer shall be included in the protected zone of this differential Protection.

b) Backup Protection (to the Distribution System) on Generation Units. The DSO acting reasonably shall require one or more of the following to be installed: Generator overcurrent Protection, voltage controlled Generator, overcurrent Protection or Generator distance Protection;

c) Under Frequency Protection; and

d) Generation Unit loss of excitation Protection.

DCC10.6.2 The DSO may require an individual Generator, or group of Generators, to install additional Protection and / or control schemes, where the DSO can reasonably show that it is prudent or necessary to do so. These schemes may include but are not limited to:

a) Generation Unit over/under-voltage Protection

b) Generation Unit over-frequency Protection

c) Generation Unit transformer neutral displacement voltage detection.

d) Loss of mains Protection (Rate of Change of Frequency or vector shift)

e) Generation Unit pole slip Protection

f) Power system stabiliser

DCC10.6.3 Distance Protection shall be provided by the DSO at the Connection Point Circuit Breaker of the Generator transformer.

DCC11 ADDITIONAL REQUIREMENTS FOR POWER PARK MODULES [PPMs]

DCC11.1 Objective
The primary objective of DCC11 is to establish the technical rules to which PPMs must comply in order to ensure that the DSO and the TSO can operate the Distribution System and Transmission System reliably, maximising non-synchronous Generation penetration on both systems.

DCC11.2 Scope
DCC11 applies wholly or in part to the following Users:

a) As depicted in Table 6, PPMs with Registered Capacity of 1 MW or more.

b) As depicted in Table 6x, PPMs with Registered Capacity less than 5 MW due to be developed on a Contiguous PPM Site where the development of the PPM results in the total Registered Capacity of PPM on the Contiguous PPM Site exceeding or remaining above 5 MW unless the DSO agrees that the Contiguous PPM Site is unrelated and independent of the PPMs already present in the Contiguous PPM Site.
c) As depicted in Table 6, PPMs with Registered Capacity less than 1 MW due to be developed on a Contiguous PPM Site where the development of the PPM results in the total Registered Capacity of PPMs on the Contiguous PPM Site exceeding or remaining above 1 MW unless the DSO agrees that the proposed PPM is unrelated and independent of the PPMs already present in the Contiguous PPM Site.

DCC11.3 Applicability

For the avoidance of doubt, where there is a conflict between the provisions of DCC11 and any other part of the Distribution Code this section (DCC11) shall take precedence.

An applicability matrix, which details the extent of application of DCC11 to various categories of PPMs, is given in Table 6 and Table 6x. For the purposes of this section, five categories of PPMs connection types are identified for reference. These are defined as follows:

Connection Type A
PPMs are classed as being connection type A when connected, at 110kV to a DSO operated 110kV busbar.

Connection Type B
PPMs are classed as being connection type B when connected at a Distribution System voltage (≤ 38 kV) to a dedicated PPM(s) transmission station. There are no load Customers connected to the DSO operated 38/20/10kV busbar.

Connection Type C
PPMs are classed as being connection type C when connected to the Distribution System, via a dedicated feeder, into an existing 110kV station.

---

1 Units permanently restricted by MEC to less than 5 MW shall not need to be controllable.
Connection Type D

PPMs are classed as being connection type D when connected to the Distribution System via a dedicated 38kV, 20kV or 10kV feeder into an existing 38kV distribution station.

Connection Type E

PPMs are classed as being connection type E when connected to an existing distribution line with load.

Table 6 and Table 6x and indicates how the various requirements outlined in DCC11, will apply to the connection types described above. In addition, centrally dispatched PPMs must comply with DCC10.5.1a. For avoidance of doubt, the MW shown in Table 6 and Table 6x refer to:

1. The MW of generation of an individual PPM; or
2. The sum of the MW of generation of Contiguous PPM Site that are not deemed to be independent.
# TABLE 6 - APPLICABILITY MATRIX for PPMs who are not included in Class Derogation for Mod#36

<table>
<thead>
<tr>
<th>Section</th>
<th>TOPOLOGY 1</th>
<th>TOPOLOGY 2</th>
<th>TOPOLOGY 3</th>
<th>TOPOLOGY 4</th>
<th>TOPOLOGY 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Ride-Through</td>
<td>DCC11.2</td>
<td>All</td>
<td>≥ 1 MW</td>
<td>≥ 1 MW</td>
<td>≥ 1 MW</td>
</tr>
</tbody>
</table>

**FREQUENCY**

| Tolerance over Frequency Range | DCC11.3.1 | All | All | All | All | All |
| Participation in High Frequency Control | DCC11.3.2.3 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Participation in Low Frequency Control | DCC11.3.2.3 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Adherence to Maximum Ramp Rates | DCC11.3.4 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Active Power Control Participation | DCC11.3.2.2 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |

**VOLTAGE**

| Voltage Control | DCC11.4 | DCC11.5.2.3 | All | ≥5 MW | N/A | N/A | N/A |
| Voltage Range | DCC11.4.2.1 | All | N/A | N/A | N/A | N/A |
| Power Factor | DCC11.4.3 | N/A | < 5 MW | All | All | All |
| Reactive Power Range | DCC11.4.5 | All | ≥5 MW | N/A | N/A | N/A |

**SIGNALS/COMMUNICATIONS/CONTROL**

| Signal List 1 | DCC11.5.1.1 | All | ≥1 MW | ≥1 MW | N/A | N/A |
| Signal List 2 | DCC11.5.1.2 | N/A | N/A | N/A | ≥1 MW | ≥1 MW |
| Signal List 3: Availability | DCC11.5.1.3 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Signal List 4: Active Power Control | DCC11.5.1.4 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Signal List 5: Frequency Control | DCC11.5.1.5 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Signal List 6: Meteorological Data | DCC11.5.1.6 | All | ≥10 MW | ≥10 MW | ≥10 MW | ≥10 MW |
| Signal List 7: DSO SCADA Signals | DCC11.5.1.7 | N/A | ≥2 MW | <5 MW² | ≥2 MW | <5 MW² | ≥2 MW | <5 MW² |
| Ability to Accept Control Signal- Active Power Control | DCC11.5.2.1 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Ability to Accept Control Signal- Frequency Control Curve Mode Change | DCC11.5.2.2 | All | ≥1 MW | ≥1 MW | ≥1 MW | ≥1 MW |
| Ability to Accept Control Signal- Voltage Control | DCC11.4.1 | All | ≥5 MW | N/A | N/A | N/A |
| Installation of recloser at the PPM site for network Protection | DCC11.5.2.8 | N/A | All | Medium Voltage Connections |
| Ability to receive Network Operator Initiated Shutdown command from DSO via DSO RTU³ | DCC11.5.2.4 | N/A | Medium Voltage Connections ≥ 2MW and <5MW |
| or ability to be remotely disconnected by DSO |

² In certain circumstances, depending on future changes to the network connection, topology, the amount of embedded generation on the particular network and system reasons, generators with an MEC <2MVA may be required to provide telecommunication infrastructure for SCADA.

³ As advised by DSO

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<table>
<thead>
<tr>
<th>Section</th>
<th>TOPOLOGY 1</th>
<th>TOPOLOGY 2</th>
<th>TOPOLOGY 3</th>
<th>TOPOLOGY 4</th>
<th>TOPOLOGY 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>via device located at or near PPM⁴</td>
<td></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to receive Network Operator initiated Shutdown command from DSO via DSO RTU</td>
<td>DCC11.5.2.4</td>
<td>N/A</td>
<td>38kV Connections ≥ 2MW and &lt;5MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to receive Network Operator Initiated Shutdown command from DSO or TSO via TSO RTU</td>
<td>DCC11.5.2.4</td>
<td>All</td>
<td></td>
<td></td>
<td>≥5 MW</td>
</tr>
<tr>
<td>Responsible Operator</td>
<td>DCC11.5.2.6.1</td>
<td>N/A</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Responsible Operator</td>
<td>DCC11.5.2.6.2</td>
<td>All</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Declarations</td>
<td>DCC11.5.4</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
</tr>
<tr>
<td>Resource Power Forecasts</td>
<td>DCC11.5.3</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
<td>≥30 MW</td>
</tr>
</tbody>
</table>

⁴ For medium voltage connections ≥ 2MW and <5MW, provided that adequate media coverage exists, remote operation of the recloser deployed to satisfy DCC11.5.2.8 may also be used to implement the requirements of DCC11.5.2.4 and DCC11.5.1.7.
### TABLE 6x – APPLICABILITY MATRIX for PPMs who are included in Class Derogation for Mod#36

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault Ride-Through</td>
<td>DCC11.2</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
</tbody>
</table>

#### FREQUENCY

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance over Frequency Range</td>
<td>DCC11.3.1</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Participation in High Frequency Control</td>
<td>DCC11.3.2.3</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Participation in Low Frequency Control</td>
<td>DCC11.3.2.3</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Adherence to Maximum Ramp Rates</td>
<td>DCC11.3.4</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Active Power Control Participation</td>
<td>DCC11.3.2.2</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
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</table>

#### VOLTAGE

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
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<tbody>
<tr>
<td>Voltage Control</td>
<td>DCC11.4</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Voltage Range</td>
<td>DCC11.4.2.3</td>
<td>All</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Power Factor</td>
<td>DCC11.4.3</td>
<td>N/A</td>
<td>&lt;5 MW</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Reactive Power Range</td>
<td>DCC11.4.5</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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</table>

#### SIGNALS/COMMUNICATIONS/CONTROL

<table>
<thead>
<tr>
<th></th>
<th>Section</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
<th>Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal List 1</td>
<td>DCC11.5.1.1</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Signal List 2</td>
<td>DCC11.5.1.2</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Signal List 3: Availability</td>
<td>DCC11.5.1.3</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Signal List 4: Active Power Control</td>
<td>DCC11.5.1.4</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Signal List 5: Frequency Control</td>
<td>DCC11.5.1.5</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Signal List 6: Meteorological Data</td>
<td>DCC11.5.1.6</td>
<td>All</td>
<td>≥10 MW</td>
<td>≥10 MW</td>
<td>≥10 MW</td>
<td>≥10 MW</td>
</tr>
<tr>
<td>Signal List 7: DSO SCADA Signals</td>
<td>DCC11.5.1.7</td>
<td>N/A</td>
<td>≥2 MW</td>
<td>≥2 MW</td>
<td>≥2 MW</td>
<td>≥2 MW</td>
</tr>
<tr>
<td>Ability to Accept Control Signal- Active Power Control</td>
<td>DCC11.5.2.1</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Ability to Accept Control Signal- Frequency Control Curve Mode Change</td>
<td>DCC11.5.2.2</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
<td>≥ 5 MW</td>
</tr>
<tr>
<td>Ability to Accept Control Signal- Voltage Control</td>
<td>DCC11.4.1</td>
<td>All</td>
<td>≥ 5 MW</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Installation of recloser at the PPM site for network Protection</td>
<td>DCC11.5.2.8</td>
<td>N/A</td>
<td>All Medium Voltage Connections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to receive Network Operator Initiated Shutdown command from DSO via DSO RTU⁵</td>
<td>DCC11.5.2.4</td>
<td>N/A</td>
<td>Medium Voltage Connections ≥ 2MW and &lt;5MW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>DCC11.5.2.4</td>
<td>N/A</td>
<td>Medium Voltage Connections ≥ 2MW and &lt;5MW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ability to be remotely disconnected by DSO via device located at or near PPM⁷</td>
<td>DCC11.5.2.4</td>
<td>N/A</td>
<td>38kV Connections ≥ 2MW and &lt;5MW</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

⁵ In certain circumstances, depending on future changes to the network connection, topology, the amount of embedded generation on the particular network and system reasons, generators with an MEC <2MVA may be required to provide telecommunication infrastructure for SCADA.

⁶ As advised by DSO

⁷ For medium voltage connections ≥ 2MW and <5MW, provided that adequate media coverage exists, remote operation of the recloser deployed to satisfy DCC11.5.2.8 may also be used to implement the requirements of DCC11.5.2.4 and DCC11.5.1.7.
DCC11.2 FAULT RIDE THROUGH REQUIREMENTS

DCC11.2.1 PPMs shall remain connected to the Distribution System for Voltage Dips on any or all phases, and shall remain Stable, where the Distribution System phase voltage measured at the Connection Point remains above the heavy black line in Figure 9.

Fault Ride Through Capability of Power Pack Modules

![Figure 9: Fault Ride-Through Capability for Controllable PPMs Connected to the Distribution System](image)

In addition to remaining connected to the Distribution System, the PPMs shall have the technical capability to provide the following functions:

a) During Voltage Dips the Controllable PPMs shall provide Active Power in proportion to retained voltage and maximise reactive current to the Distribution System, as set out in DCC11.2.2 (c). The provision of reactive current shall continue until the Distribution System voltage recovers to within the normal operational range of the Distribution System, voltage at which the PPMs is connected, as specified in Table 6A, or for at least 500ms, whichever is the sooner. The Controllable PPMs may use all or any available reactive sources, including installed statcoms or SVCs, when providing reactive support during Voltage Dips;

b) For Voltage Dips cleared within 140ms, the Controllable PPMs shall provide at least 90% of its maximum Available Active Power as quickly as the technology allows and in any event within 500ms of the voltage at the Connection Point recovering to the normal operating range, per Table 6A below, of the voltage level at which the PPMs is connected. For longer duration Voltage Dips, the Controllable PPMs shall provide at least 90% of its maximum Available Active Power within 1 second of the voltage at the Connection Point recovering to the normal operating range for the voltage at which it is connected.

c) During and after faults, priority shall always be given to the Active Power response as defined in DCC11.2.2 (a) and DCC11.2.2 (b). The reactive current response of the Controllable PPMs shall attempt to control the voltage back towards the voltage at which the PPMs is connected, recovering to its normal operating range as specified in Table 6A and should be at least proportional to the Voltage Dip. The reactive current response shall be supplied within the rating of the Controllable PPMs, with a Rise Time no greater than 100ms and a Settling Time no greater than 300ms. For the avoidance of doubt, the Controllable PPMs may provide this reactive response directly from individual Generating Units, or other additional installed dynamic reactive devices on the site, or a combination of both.

d) The Controllable PPMs shall be capable of providing its transient reactive response irrespective of the reactive control mode in which it was operating at the time of the Voltage
Dip. The **Controllable PPMs** shall revert to its pre-fault reactive control mode and set-point within 500ms of the voltage at which the **PPMs** is connected, recovering to its normal operating range as specified in Table 6A.

e) DSO may seek to reduce the magnitude of the dynamic reactive response of the **Controllable PPMs** if it is found to cause over-voltages on the **Distribution System**. In such a case, the DSO will make a formal request to the **Controllable PPMs**. The **Controllable PPMs** and the DSO shall agree on the required changes, and the **Controllable PPMs** shall formally confirm that any requested changes have been implemented within 120 days of receiving the DSO formal request.

| Description | Nominal Voltage | Normal Operating Range [kV]
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>10kV</td>
<td>9.6 11.3</td>
</tr>
<tr>
<td>MV</td>
<td>20kV</td>
<td>19.3 22.5</td>
</tr>
<tr>
<td>HV</td>
<td>38kV</td>
<td>35.6 43.8</td>
</tr>
<tr>
<td>110kV</td>
<td>110kV</td>
<td>99 123</td>
</tr>
</tbody>
</table>

DCC11.3 FREQUENCY REQUIREMENTS

DCC11.3.1 Frequency Ranges

**PPMs** shall have the capability to:

a) Operate continuously at normal rated output at frequencies in the range 49.0Hz to 51.0Hz

b) Remain connected to the **Distribution System** at frequencies within the range 47.5Hz to 52Hz for a duration of 90 minutes. Note that setting of the **Generator** interface **Protection** will determine actual Operation in this range.

c) Remain connected to the **Distribution System** at frequencies within the range 47.0Hz to 47.5Hz for a duration of 20 seconds required each time the **Frequency** is below 47.5Hz.

d) Remain connected to the **Distribution System** during **Rate of Change of Frequency** of values up to and including plus or minus 1.0 Hz per second measured as a rolling average over 500 ms. **Voltage dips** may cause localised **Rate of Change of Frequency** values in excess of 1Hz per second for short periods, and in these cases, the clause DCC11.2 supersedes this clause (DCC11.3.1(d)). The DSO may require lower or higher values to be used for **Protection** settings.

No additional **WTG** or **SG** shall be started while the **Frequency** is above 50.2Hz.

DCC11.3.2 Active Power Management

DCC11.3.2.1 A **PPM Control System** shall be installed by the **PPM** to allow for the provision of **Active Power Control** and **Frequency Response** from the **PPM**. The **PPM Control System** and **Frequency Response System** shall provide the functionality as specified in this section DCC11.3.2.

DCC11.3.2.2 Active Power Control

The **PPM Control System** shall be capable of operating each **WTG** or **SG** at a reduced level if the **Controllable PPM’s Active Power** output has been restricted by the **TSO** or **DSO**. In this **Active Power Dispatch Mode**, the **PPM Control System** shall be capable of receiving an on-line **Active Power Control Set-Point** sent by the **TSO** or **DSO** and shall commence implementation of the set-point within 10 seconds of receipt of the signal from the **TSO** or **DSO** as agreed between **DSO** and **TSO**.

The rate of change of output to achieve the **Active Power Control Set-Point** should be the **Active Power Control Set-Point Ramp Rate** setting of the **PPM Control System**, as advised by the **TSO** or **DSO**, as per DCC11.3.3. It is acknowledged that if the **Active Power** output of the **Controllable**

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8 DSO reserves the right to operating at voltages outside these ranges in emergency situations.
PPM is initially less than the Design Minimum Operating Level, and if the Controllable PPM is expected to increase its Active Power output, then it may not be able to achieve the specified ramp rate at first, due to WTG’s or SG’s going through a start-up sequence. In such a case, WTG’s or SG’s shall start up as quickly as the technology allows, and in any case, not longer than three minutes from the time the Active Power Control Set-Point was received.

DCC11.3.2.3 Frequency Response

DCC11.3.2.3.1 In Resource Following Mode, the Frequency Response System shall have the capabilities as displayed in the power-frequency response curve in Figure 10 where the power and Frequency ranges required for points A, B, C, D, E are defined below in Table 7 and Table 8. The Frequency Response System shall adjust the Active Power output of the Controllable PPM according to a Governor Droop, settable by the TSO in a range from 2% to 10% and defaulting to 4%, when operating in the ranges outside the deadband range F_B-F_C in the power-frequency response curve. Controllable PPM Frequency Response and Governor Droop shall be calculated with respect to Registered Capacity. A Controllable PPM can only give a low Frequency Response if the Active Power Control Set-Point is less than the Available Active Power.

DCC11.3.2.3.2 When in Active Power Control Mode, the Controllable PPM shall always operate in Frequency Sensitive Mode with a Governor Droop as set out in DCC11.3.4 and with a deadband of +/- 15mHz, or as otherwise agreed with the TSO.

![Figure 10 – Example of Power-Frequency Response Curve for Resource Following Mode](image)

DCC11.3.2.3.3 When acting to control system Frequency, the Controllable PPM shall provide at least 60% of its expected additional Active Power response within 5 seconds, and 100% of its expected additional Active Power response within 15 seconds of the start of the system Frequency excursion outside the range F_B-F_C, or in the case of a Controllable PPM in Active Power Dispatch Mode, when the system Frequency goes outside the deadband set out in DCC11.3.2.2.

DCC11.3.2.3.4 When the system Frequency is in the range F_C-F_D, the Controllable PPM shall ensure that its Active Power output does not increase beyond the Active Power value of the Controllable PPM when the system Frequency first exceeded F_C, due to an increase in Available Active Power in that period.

DCC11.3.2.3.5 If the Frequency drops below F_A, then the Frequency Response System shall act to maximise the Active Power output of the Controllable PPM, irrespective of the Governor Droop Setting.
If the **Frequency** rises above **F_D**, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable PPM** to its **DMOL** value. If the **Frequency** rises above **F_E**, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable PPM** to zero. Any **WTG** or **SG** which has disconnected shall be brought back on load as fast as technically feasible, provided the system **Frequency** has fallen below 50.2Hz.

**DCC11.3.2.3.6** Points ‘A’, ‘B’, ‘C’, ‘D’ and ‘E’ shall depend on a combination of the **Frequency**, **Active Power** and **Active Power Control Set-Point** settings. These settings may be different for each **PPM** depending on system conditions and **PPM** location. These settings are defined in Table 7.

### TABLE 7: FREQUENCY AND % AVAILABLE ACTIVE POWER SETTINGS FOR THE POINTS A, B, C, D AND E ILLUSTRATED IN FIGURE 10

<table>
<thead>
<tr>
<th>Point</th>
<th>Frequency (Hz)</th>
<th>PPM Active Power Output (% of Available Active Power)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>F_A</td>
<td>P_A</td>
</tr>
<tr>
<td>B</td>
<td>F_B</td>
<td>Minimum of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P_B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active Power Control Set-Point (converted to a % of Available Active Power)</td>
</tr>
<tr>
<td>C</td>
<td>F_C</td>
<td>Minimum of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P_C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active Power Control Set-Point (converted to a % of Available Active Power)</td>
</tr>
<tr>
<td>D</td>
<td>F_D</td>
<td>Minimum of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>P_D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Active Power Control Set-Point (converted to a % of Available Active Power) or DMOL</td>
</tr>
<tr>
<td>E</td>
<td>F_E</td>
<td>P_E = 0 %</td>
</tr>
</tbody>
</table>

Two settings for each of **F_A**, **F_B**, **F_C**, **F_D**, **F_E**, **P_A**, **P_B**, **P_C**, **P_D** and **P_E** shall be specified by the **TSO** at least 120 business days prior to the **Controllable PPM**’s scheduled operational date (refer to Table 8 below). The **PPM** shall be responsible for implementing the appropriate settings during Commissioning.

**DCC11.3.2.3.7** The table below, Table 8, shows the **Frequency** and **Active Power** ranges for **F_A**, **F_B**, **F_C**, **F_D**, **F_E**, **P_A**, **P_B**, **P_C**, **P_D** and **P_E**

### TABLE 8 – FREQUENCY AND ACTIVE POWER RANGES APPROPRIATE TO FIGURE 10

<table>
<thead>
<tr>
<th>Transmission System Frequency (Hz)</th>
<th>Available Active Power (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registered Capacity ≥ 5 MW</td>
<td></td>
</tr>
<tr>
<td><strong>F_A</strong> 47.0-49.5</td>
<td><strong>P_A</strong> 50-100</td>
</tr>
<tr>
<td><strong>F_B</strong> 49.5-50</td>
<td><strong>P_B</strong> 15-100</td>
</tr>
<tr>
<td><strong>F_C</strong> 50-50.5</td>
<td><strong>P_C</strong></td>
</tr>
<tr>
<td><strong>F_D</strong> 50.5-52.0</td>
<td><strong>P_D</strong> 15-100 but not less than DMOL</td>
</tr>
<tr>
<td><strong>F_E</strong></td>
<td><strong>P_E</strong> 0</td>
</tr>
</tbody>
</table>
For the *Frequency* values in Table 8 above, \( F_A \leq F_B \leq F_C \leq F_D = F_E \).

**DCC11.3.2.3.8** Alterations to the Controllable PPM’s Active Power output, triggered by *Frequency* changes, shall be achieved by proportionately altering the Active Power output of all available WTG or SG as opposed to switching individual WTG or SG on or off, insofar as possible.

**DCC11.3.2.3.9** No time delays, such as moving average *Frequency* filters, other than those necessarily inherent in the design of the Frequency Response System shall be introduced. The Frequency Response System shall continuously monitor the system *Frequency* in order to continuously determine the Controllable PPM’s appropriate Active Power output by taking account of the Controllable PPM’s Available Active Power or Controlled Active Power.

**DCC11.3.2.3.10** If the system *Frequency* rises to a level above \( F_E \), as defined by the power-frequency response curve in Figure 10, it is accepted that WTGs or SGs may disconnect. Any WTG or SG which has disconnected shall be brought back on load as fast as technically feasible (provided the system *Frequency* has fallen below 50.2Hz).

**DCC11.3** Procedure for Setting and Changing the Power-Frequency Response Curves

Two power-frequency response curves (Curve 1 and Curve 2) shall be specified by the TSO at least 120 business days prior to the PPM’s scheduled operational date. The PPM shall be responsible for implementing the appropriate settings during Commissioning. The Frequency Response System shall be required to change between the two curves within one minute from receipt of the appropriate signal from the TSO. The TSO shall give the PPM a minimum of 2 weeks if changes to any of the curve’s parameters (i.e. \( F_A, F_B, F_C, F_D, F_E, P_A, P_B, P_C, P_D \) or \( P_E \)) are required. The PPM shall formally confirm that any requested changes have been implemented within two weeks of receiving the TSO’s formal request.

**DCC11.3.4** Ramp Rates

**DCC11.3.4.1** The PPM Control System shall be capable of controlling the ramp rate of its Active Power output. There shall be three ramp rate capabilities, designated Resource Following Ramp Rate, Active Power Control Set-Point Ramp Rate, and Frequency Response Ramp Rate. The PPM Control System shall operate the ramp rates with the following order of priority (high to low): Frequency Response Ramp Rate; Active Power Control Set-Point Ramp Rate; Resource Following Ramp Rate. The Resource Following Ramp Rate shall be used during Start-Up, normal Operation, and shutdown. The TSO shall specify the Resource Following Ramp Rate and the Active Power Control Set-Point Ramp Rate in percentage of Registered Capacity per minute. The Frequency Response Ramp Rate shall be the maximum possible ramp rate of the Controllable PPM agreed with the TSO and with the characteristics as set out in PPM1.5.2.2.2. It is acknowledged that rapid change in the resource magnitude may cause temporary deviations from the ramp rate settings of the Controllable PPM, but these deviations should not be allowed to exceed 3% of Registered Capacity.

**DCC11.3.4.2** It shall be possible to vary the Resource Following Ramp Rate and the Active Power Control Set-Point Ramp Rate each independently over a range of between 1% and 100% of Registered Capacity per minute.

**DCC11.3.4.3** Procedure for Setting and Changing the Ramp Rate Control

The ramp rate settings shall be specified by the TSO at least 120 business days prior to the PPM’s scheduled operational date. The PPM shall be responsible for implementing the appropriate settings during Commissioning. The ramp rate settings may need to be changed from time to time depending on system needs. The TSO shall formally give the PPM a minimum of two weeks’ notice if a change is required. The PPM shall formally confirm that any requested changes have been implemented within two weeks of receiving the TSO’s formal request.
VOLTAGE REQUIREMENTS

For DSO type A Controllable PPM's irrespective of Registered Capacity and DSO type B Controllable PPM's with Registered Capacity ≥5MW, under steady state conditions, the Voltage Regulation System shall be capable of implementing the following Reactive Power control modes, as specified in DCC11.5.2.3, which shall be available to the DSO or TSO as agreed between DSO and TSO.

Controllable PPM's shall have a continuously-variable and continuously-acting Voltage Regulation System with similar response characteristics to a conventional AVR and shall perform generally as described in BS4999 part 140, or equivalent European Standards.

The Voltage Regulation System Slope Setting shall be capable of being set to any value between 1 % and 10 %. The setting shall be specified by the DSO at least 120 business days prior to the Controllable PPM's scheduled operational date. The Controllable PPM shall be responsible for implementing the appropriate settings during Commissioning. The slope setting may be varied from time to time depending on system needs. The DSO shall give the Controllable PPM a minimum of two weeks' notice if a change is required. The Controllable PPM shall formally confirm that any requested changes have been implemented within two weeks of receiving the DSO's formal request.

The speed of response of the Voltage Regulation System shall be such that, following a Step Change in voltage at the Connection Point, the Controllable PPM shall achieve 90 % of its steady-state Reactive Power response within 1 second. The response may require a transition from maximum MVAr production to maximum MVAr absorption or vice-versa. If the Step Change results in a Voltage Dip then clause DCC11.2 takes precedence.

Additional Requirements for Type A Controllable PPM’s

DSO type A Controllable PPM's irrespective of Registered Capacity shall remain continuously connected at maximum Available Active Power or Controlled Active-Power output for normal and disturbed system conditions and for Step Changes in voltage of up to 10%. The ranges that may arise during disturbances or following faults are given in Table 6A.

Power Factor

PPMs, with connection types B with a Registered Capacity of <5MW and connection types C and D shall have a settable power factor in the range of 0.92, such that vars are absorbed by the PPM from the Distribution System, and unity, as measured at the Connection Point. This power factor range is illustrated in Figure 11. The setting shall be specified by the DSO at least 120 business days prior to the PPM’s scheduled operational date. The PPM shall be responsible for implementing the appropriate settings during Commissioning. The power factor setting may be varied from time to time depending on system needs. The DSO shall give the PPM a minimum of two weeks’ notice if a change is required or an agreed date for the change to be implemented by the PPM. The PPM shall formally confirm that any requested changes have been implemented within two weeks of receiving the DSO’s formal request or on the date agreed with the DSO, as appropriate. PPMs, with connection type E, shall keep power factor between 0.92 and 0.95, as measured at the Connection Point, such that vars are absorbed by the PPM from the Distribution System. For avoidance of doubt, at power levels of less than 12% of Registered Capacity, the Reactive Power at the Connection Point can vary up to a maximum of 12% of – the Registered Capacity value, expressed in MVAR [importing VArS]. This power factor range is illustrated in Figure 12.
DCC11.4.4 Type A Controllable PPM’s 110kV Step-up Transformer

DCC11.4.4.1 The 110kV step-up transformer shall be designed such that the Reactive Power capability is possible over the full range of 110kV voltage specified in Table 6A.

DCC11.4.4.2 Each 110kV step-up transformer shall have on-load tap changing facilities. The tap step shall not alter the voltage ratio at the HV terminals by more than 2.5% or as agreed with the DSO.

DCC11.4.4.3 110kV step-up transformers shall be connected either:

- In delta on the Low Voltage side and in star (with the star point or neutral brought out) on the High Voltage side; or
- In star on both higher and Low Voltage sides with a delta tertiary winding provided.
DCC11.4.4 Provision should be made for the **Earthing** of the 110kV neutral of any transformer connected to the 110kV system by bringing out the neutral and ensuring that the insulation is such that the transformer can be operated unearthed.

DCC11.4.5 **Reactive Power Capability**

DSO type A **Controllable PPM’s** and DSO type B **Controllable PPM’s** with **Registered Capacity ≥ 5MW**, operating in power factor control mode, voltage control mode or constant **Reactive Power mode** shall be at least capable of operating at any point within the P-Q capability ranges illustrated in Figure 13, as measured at the **Connection Point** and shall be capable of providing this capability over the full range of voltages specified in Table 6A.

Referring to Figure 13:

- Point A represents the minimum **MVar** absorption capability of the **Controllable PPM** at 100% **Registered Capacity** and is equivalent to 0.95 power factor with the PPM importing vars;
- Point B represents the minimum **MVar** production capability of the **Controllable PPM** at 100% **Registered Capacity** and is equivalent to 0.95 power factor with the PPM exporting vars;
- Point C represents the minimum **MVar** absorption capability of the **Controllable PPM** at 12% **Registered Capacity** and is equivalent to the same **MVar** as point A;
- Point D represents the minimum **MVar** production capability of the **Controllable PPM** at 12% **Registered Capacity** and is equivalent to the same **MVar** as point B;
- Point E represents the minimum **MVar** absorption capability of the **Controllable PPM** at the cut-in speed of the individual WTGs or SGs;
- Point F represents the minimum **MVar** production capability of the **Controllable PPM** at the cut-in speed of the individual WTGs or SGs;

It is accepted that the values of points E and F may vary depending on the number of WTGs or SGs generating electricity in a low-resource scenario;

![Figure 13](image)

Figure 13 represents the minimum expected **Reactive Power** capabilities of the **Controllable PPM**. The **Controllable PPM** is obliged to tell the DSO if it can exceed these capabilities, and submit the actual P-Q capability diagram based upon the installed **Plant** and **Collector Network** characteristics to the DSO during **Commissioning**.
DCC11.5 SIGNALS, COMMUNICATIONS & CONTROL

DCC11.5.1 Signals from the PPM to TSO

Signals from the PPM to the TSO shall be broken up into a number of logical groups. There are different requirements for PPMs depending on the PPM’s MEC size. Refer to Table 6 and Table 6x for a summary of the signal requirements for different PPM MEC.

The following groups shall apply:

- Signals List #1 - applies to PPM connection types B and C.
- Signals List #2 - applies to PPM connection types D and E.

In addition, PPMs shall be required to provide certain signals from signals lists 3, 4, 5, 6 and 7. These lists relate to:

- Signals List #3 - PPM availability data;
- Signals List #4 - PPM Active Power Control data;
- Signals List #5 - Frequency Response System data;
- Signals List #6 - PPM meteorological data;
- Signals List #7 - DSO SCADA signals.

DCC11.5.1.1 Signals List #1

The PPM shall make the following signals available at the TSO Telecommunications Interface Cabinet located at the PPM site:

a) Active Power output (MW) at the Connection Point;
b) Available Active Power (MW) at the Connection Point;
c) Reactive Power output/Demand (+/-MVar) at the Connection Point;
d) On/off status indications for all Reactive Power devices exceeding 5 MVAR;
e) Circuit Breaker position indication shall be required. These may include indications from HV as well as MV Circuit Breakers on individual WTG or SG circuits. Signals from individual WTG or SG Circuit Breakers shall not be required. The actual Circuit Breaker signals required shall be specified by the TSO and subsequently advised by the DSO, at least 60 business days prior to the PPM’s scheduled operational date.
f) ON/OFF status of TSO remote control enabled switch, which disables the ability of the TSO to send commands to the PPM.
g) Voltage (kV) at the Connection Point
h) For DSO type A connected PPMs the following additional signals are required:
   - 110kV step-up transformer OLTC tap positions
   - Voltage in kV at the 110kV step-up transformer Low Voltage terminals
   - Voltage Regulation Set-Point (in kV)
   - A minimum of four sets of normally open potential free auxiliary contacts in each 110kV step-up transformer Low Voltage bay for fault indication

DCC11.5.1.2 Signals List #2

The PPM shall make the following signals available at the TSO Telecommunications Interface Cabinet located at the PPM site:

a) Active Power output (MW) at the Connection Point;
b) Available Active Power (MW) at the Connection Point;
c) Reactive Power output/Demand (+/-MVar) at the Connection Point;
d) Voltage (kV) at the Connection Point
e) Circuit Breaker position indication shall be required. These may include indications from HV as well as MV Circuit Breakers on individual WTG or SG circuits. Signals from

9 Typically the position indication from capacitor/SVC circuit breakers
individual WTG or SG Circuit Breakers shall not be required. The actual Circuit Breaker signals required shall be specified by the TSO and subsequently advised by the DSO at least 120 business days prior to the PPM’s scheduled operational date.

DCC11.5.1.3 Signals List #3
DCC11.5.1.3.1 The PPMs, with an MEC in excess of 10 MW, shall make available the following signals at the TSO Telecommunications Interface Cabinet located at the PPM site:

a) PPM availability data (0-100% signal);
   For Wind Farm Power Stations only:
   b) Indication for percentage of the WFPM’s WTG that are shutdown due to high-wind-speed conditions (0-100% signal);
   c) Indication for percentage of the WFPM’s WTG that are shutdown due to low-wind-speed conditions (0-100% signal).

DCC11.5.1.3.2 For PPMs where the WTG or SG are widely dispersed over a large geographical area and rather different weather patterns are expected for different sections of the PPM site, the above data set (specified in DCC11.5.1.3.1) shall be provided for a number of groups of WTG or SG (e.g. 1 signal for each group of XX WTG or SG within the PPM site). It is expected that WTG or SG within an individual group shall demonstrate a high degree of correlation in Active Power output at any given time. The actual signals required shall be specified by the TSO and subsequently advised by the DSO, at least 120 business days prior to the PPM’s scheduled operational date.

DCC11.5.1.4 Signals List #4
The PPM shall make the following signals available at the TSO Telecommunications Interface Cabinet located at the PPM site:

a) PPM Active Power Control Set-Point value (MW);
   b) PPM Active Power Control status indication (ON/OFF).

DCC11.5.1.5 Signals List #5
The PPM shall make the following signals available at the TSO Telecommunications Interface Cabinet located at the PPM site:

a) Frequency Response System mode signal (i.e. power-frequency response curve 1 or 2);
   b) Frequency Response System status indication (ON/OFF).

DCC11.5.1.6 Signals List #6
DCC11.5.1.6.1 PPMs, with an MEC in excess of 10 MW, shall make the following signals available at the TSO Telecommunications Interface Cabinet located at the PPM site:

Wind Farm Power Station Only

   [Units, Ranges ]
   a) Wind speed (at hub height or as to be agreed with the TSO) – measurand signal;  
      [m/s, 0-70 ]
   b) Wind direction (at hub height or as to be agreed with the TSO) – measurand signal;
      [deg, 0-360 ]

Solar Farm Power Station Only

   a) Solar Irradiance – measured signal 
      [W/m², 0 - xxx]

All:
DCC11.5.1.6.2 The meteorological data signals shall be provided by a dedicated Meteorological Mast located at the PPM site or, where possible and preferable to do so, data from a means of the same or better accuracy. For PPMs where the WTG or SGs are widely dispersed over a large geographical area and rather different weather patterns are expected for different sections of the PPM, the meteorological data shall be provided from a number of individual Meteorological Masts, or where possible and preferable to do so, data from a source of the same or better reliability for groups of WTG or SGs (e.g. 1 set of meteorological data for each group of XX WTG or SGs within the PPM site). It is expected that WTG or SGs within an individual group shall demonstrate a high degree of correlation in Active Power output at any given time. The actual signals required shall be specified by the TSO no more than 120 business days prior to the PPM’s scheduled operational date.

DCC11.5.1.7 Signals List #7

The following data signals and commands shall be provided by PPMs:

a) MW
b) MVAr
c) kV

DCC11.5.1.8 Time Delays and data quality

DCC11.5.1.8.1 A digital signal change from the PPM shall be relayed to the TSO Telecommunications Interface Cabinet within 1 second of the associated change of state event. An analogue signal change shall be relayed within 5 seconds and with an error of 0.5% or less, with the exception of the Meteorological Data as required by DCC11.5.1.6.1, which shall be updated within 5 seconds and with and error of 2.5% or less.

DCC11.5.2 Control Signals from DSO/TSO to PPM

The control signals described in DCC11.5.2 shall be sent from DSO or TSO to the PPM. The PPM shall be capable of receiving these signals and acting accordingly.

DCC11.5.2.1 Active Power Control

An Active Power Control Set-Point signal shall be sent by TSO to the PPM Control System. This set-point shall define the maximum Active Power output permitted from the PPM. The PPM Control System must be capable of receiving this signal and acting accordingly to achieve the desired change in Active Power output. This signal shall most likely be in the form of a single analogue value and a strobe pulse to enable. The PPM is required to make it possible for the TSO to remotely enable/disable the Active Power Control function in the PPM Control System. The associated status indication is described in DCC11.5.1.4.

DCC11.5.2.2 Frequency Response

This signal shall be sent by TSO to the PPM in the event that a change from power-frequency response curve 1 to power-frequency response curve 2, or vice versa, is required. The PPM is required to make it possible for the TSO to remotely enable/disable the Frequency Response System. The associated status indication described in DCC11.5.1.5.

DCC11.5.2.3 Voltage Control

For DSO type A Controllable PPM’s irrespective of Registered Capacity and DSO type B Controllable PPM’s with Registered Capacity ≥5MW, under steady state conditions, the Voltage
The Regulation System shall be capable of implementing the following Reactive Power control modes which shall be available to the DSO or TSO as agreed by DSO and TSO:

a) The Controllable PPM shall be capable of receiving a power factor control (PF) set-point to maintain the power factor set-point at the Connection Point;

b) The Controllable PPM shall be capable of receiving a Reactive Power Control (Q) set-point to maintain the Reactive Power set-point at the Connection Point;

c) The Controllable PPM shall be capable of receiving a Voltage Regulation (kV) set-point for the voltage at the Connection Point. The Voltage Regulation System shall act to regulate the voltage at this point by continuous modulation of the Controllable PPM’s Reactive Power output, without violating the voltage Step Emissions limits as set out in the IEC standard 61000-3-7:1996 Assessment of Emission limits for fluctuating loads in MV and HV power systems. The Controllable PPM’s Reactive Power output shall be zero when the voltage at the Connection Point is equal to the Voltage Regulation Set-point.

d) A change to the power factor control (PF) set-point, Reactive Power control (Q) set-point, Voltage Regulation (kV) set-point or Reactive Power control mode shall be implemented by the Controllable PPM within 20 seconds of receipt of the appropriate signal, within its Reactive Power capability range as specified in DCC11.4.5

e) One Reactive Power control mode shall be operational at all times with the facility to toggle between each of the Reactive Power control modes as instructed by the DSO or TSO, as agreed by the DSO and TSO. Toggling between Reactive Power controllers shall be smooth in transfer i.e. the Controllable PPM shall calculate and implement an appropriate set-point when transferring to the new control mode. The set-point calculated for the new control mode shall be consistent with the MVar output at that time.

DCC11.5.2.4 Network Operator Initiated Shutdown

This signal shall facilitate the disconnection of the PPM under Black Start conditions and / or if the PPM has to be disconnected for operational reasons.

For 38kV connections, it shall be possible for DSO to send a trip and / or inhibit signal\textsuperscript{10} to the Circuit Breaker at the PPM Connection Point. The signal shall open the Circuit Breaker and switch off the auto-reclosing.

For MV connections:

a) It shall be possible for DSO to send a trip and / or inhibit signal\textsuperscript{11} to the Circuit Breaker at the PPM Connection Point. The signal shall open the Circuit Breaker and switch off the auto-reclosing, or

b) A switching device capable of being remotely operated by DSO shall be installed at or near the PPM Connection Point.

DCC11.5.2.5 Time Delays and Data Quality

A digital output command from the TSO Telecommunications Interface Cabinet shall be relayed to the PPM Equipment within 1 second of the associated change of state event. A set-point output signal shall be relayed within 5 seconds and with an error of 0.5% or less.

DCC11.5.2.6 Responsible Operator

DCC11.5.2.6.1 A designated responsible operator shall be contactable by DSO or TSO at all times to discuss operational matters without undue delay and in any case within at most 1 hour. Following a request from DSO, the responsible operator shall be present at the PPM’s Connection Point without undue delay and in any case within two hours and shall be capable of taking any appropriate

\textsuperscript{10} Refer to Table 6 or Table 6x.

\textsuperscript{11} Refer to Table 6 or Table 6x.
actions. The responsible operator shall be contactable 24 hours a day, 365 days a year. Specialist response shall be available on the next working day following a request from the DSO or TSO.

DCC11.5.2.6.2 For DSO type A connected PPMs a designated responsible operator shall be contactable by the DSO and TSO at all times to discuss operational matters without undue delay and in any case within 15 minutes. Following a request from the DSO, the responsible operator shall be present at the PPM’s Connection Point without undue delay and in any case within one hour and shall be capable of taking any required appropriate actions. The responsible operator shall be contactable 24 hours a day, 365 days a year.

DCC11.5.2.7 Data and Communications Specifications

DCC11.5.2.7.1 The location of the TSO Telecommunications Interface Cabinet shall be agreed between the DSO and the PPM at least 120 business days prior to the PPM’s scheduled operational date. A standard interface for signals will be made available to the PPM by the TSO.

DCC11.5.2.7.2 The necessary communications links, communications protocol and an individual PPM signal list shall be specified by the TSO/DSO as appropriate, at least 120 business days prior to the PPM’s scheduled operational date. Current applicable standards shall apply and the accuracy class for signals shall comply with the prevailing European Standard at that time.

DCC11.5.2.7.3 For loss of communications links, persistence (i.e. continuing to operate with the most recent data set) shall be used in terms of set-points until the designated responsible operator has been contacted by the DSO/TSO as appropriate.

DCC11.5.2.7.4 If Active Power Control, Frequency Response or Voltage Regulation facilities at the PPM become unavailable, the PPM shall contact TSO or DSO without undue delay.

DCC11.5.2.7.5 Where signals or indications required to be provided by the PPM under DCC11.5 become unavailable or do not comply with applicable standards due to failure of the PPM’s technical Equipment or any other reason under the control of the PPM, the PPM shall, acting in accordance with Good Industry Practice, restore or correct the signals and / or indications as soon as possible.

DCC11.5.2.8 Installation of MV recloser at PPM site
In order to provide adequate Protection to MV networks connecting to the PPM Power Station an MV recloser shall be installed in the DSO’s MV substation at the PPM Power Station site.

DCC11.5.3 Resource Power Forecasts
MW forecasts shall be provided by PPMs with an MEC in excess of 30 MW. These forecasts shall be provided at 10:00 a.m. on a daily basis for the following 48 hours for each 30 minute time-period, by means of an electronic interface in accordance with the reasonable requirements of TSO’s data system.

DCC11.5.4 PPM Power Station MW Availability Declarations
PPMs with an MEC in excess of 30 MW shall submit PPM MW availability declarations whenever changes in PPM availability occur or are predicted to occur. These declarations shall be submitted by means of an electronic interface in accordance with the reasonable requirements of TSO’s data system.

DCC11.6 DYNAMIC MODELS FOR PPM POWER STATIONS

DCC11.6.1 Wind Turbine Generator Dynamic Models
The TSO requires suitable and accurate dynamic models for all Generators connected to, or applying for a connection to, the Transmission System or the Distribution System in order to assess reliably the impact of the Generator’s proposed installation on the dynamic performance and security and Stability of the power system.
Modelling requirements for thermal and hydro Generators are processed on the identification by the applicant of the relevant PSS/E\textsuperscript{12} library model and the provision of the applicable data parameters as set out in DCC11.3.4. Where there are no suitable library models available, specially written models are supplied. These are known as “user-written models”.

**DCC11.6.2 Requirement to Provide a Dynamic Model**

Each PPM with a Registered Capacity of 5MW or greater shall provide to the DSO, for onward transmission to the TSO, a dynamic model, or shall provide an unambiguous reference to a dynamic model previously provided to the DSO or the TSO, appropriate for the PPM. If all the WTGs or SGs in the PPM are not identical, the model shall incorporate separate modules to represent each type of WTG or SG. Appropriate data and parameter values must be provided for each model.

The model shall be provided in PSS/E format, or in such other format as may be agreed between the PPM and the TSO.

The models for WTGs or SG and the PPM (computer software based on a mathematical representation of the behaviour of the machine) must be able to calculate how quantities such as Active Power output, Reactive Power output, turbine speed etc. vary as factors such as the voltage at the Connection Point change. They must take account of the inherent characteristics of the machines and the actions of the WTG or SG control systems and any relevant PPM control systems.

**DCC11.6.3 Computer Environment**

The dynamic models must run on the PSS/E software for the Irish network. They must not require a simulation time step of less than 5 ms. Details of the current PSS/E version, computer platform, compiler version etc., will be provided by the TSO upon request. The TSO may from time to time request that the models be updated to be compatible with changes in the TSO’s computing environment. Each PPM shall ensure that such updated models are provided without undue delay.

**DCC11.6.4 Features to be Represented in the Dynamic Model**

The dynamic model must represent the features and phenomena likely to be relevant to angular and voltage Stability. These features include but may not be limited to:

- a) The electrical characteristics of the Generator;
- b) The separate mechanical characteristics of the turbine and the Generator and the drive train between them;
- c) Variation of power co-efficient with pitch angle and tip speed ratio;
- d) Blade pitch control;
- e) Converter controls;
- f) Reactive compensation;
- g) Protection relays.

**DCC11.6.5 Model Aggregation**

For computational reasons, it is essential that the models of individual WTGs or SGs can be aggregated into a smaller number of models, each representing a number of WTGs or SGs at the same site. A representation of the Collector Network may be included in the aggregate model of the PPM.

**DCC11.6.6 Model Documentation**

\textsuperscript{12} PSS/E Power System Simulator for Engineering; the power system analysis software package used by the TSO.
The model should be fully documented. The documentation should describe in detail the model structure, inputs, outputs and how to set up and use the model and should be based on the documentation of standard PSS/E library models.

The TSO may, when necessary to ensure the proper running of its complete system representation or to facilitate its understanding of the results of a dynamic simulation, request additional information concerning the model, including the source code of one or more routines in the model. The PPM shall comply with any such request without delay. Where the PPM or any other party (acting reasonably) designates such information as confidential on the basis that it incorporates trade secrets, the DSO or TSO shall not disclose the information so designated to any third party.

DCC11.6.7 Time to Comply

Where a User requires reasonable time to develop the necessary model or models so as to comply fully with all the provisions in this section DCC11.6.2, the User may apply to the DSO to be deemed compliant with the provisions of DCC11.6.2 on the basis that the non-compliance will not unduly inhibit the assessment by the TSO of the Stability and reliability of the power system and that the User has a satisfactory programme to remedy the non-compliance. The DSO shall refer any such application to the TSO for consideration. If the TSO is satisfied as to the User’s programme for developing and testing the necessary dynamic model or models, the DSO and TSO may, for so long as the TSO is so satisfied, treat the User as being in compliance with the provisions of DCC10.6.2. If the TSO decides, acting reasonably, that it is not satisfied as to the User’s programme for developing and testing the necessary dynamic model and that the User cannot be deemed to be in compliance with DCC11.6.2, the User may apply for a derogation under the terms of DGC11.3.

DCC11.6.8 Validation of Model

All models provided to the DSO and TSO for use in dynamic simulations must be validated. The TSO must be satisfied that the behaviour shown by the model under simulated conditions is representative of the behaviour of the real Equipment under equivalent conditions.

For validation purposes the PPM shall ensure that appropriate tests are performed and measurements taken to assess the validity of the dynamic model. Where the validity of the model has not been confirmed prior to the Commissioning of the PPM, appropriate tests shall be carried out and measurements taken at the PPM to assess the validity of the dynamic model. The tests and measurements required shall be agreed with the DSO and the TSO.

The PPM shall provide to the DSO for onward transmission to the TSO all available information showing how the predicted behaviour of the dynamic model to be verified compares with the actual observed behaviour of a prototype or production WTG or SG under laboratory conditions and / or actual observed behaviour of the real WTG or SG as installed and connected to a transmission or distribution network.

If the on-site measurements or other information provided indicate that the dynamic model is not valid in one or more respects, the PPM shall provide a revised model whose behaviour corresponds to the observed on-site behaviour as soon as reasonably practicable. The conditions validated should as far as possible be similar to those of interest, e.g. low short circuit level at Connection Point, close up, severe faults, nearby moderate faults, remote faults, voltage excursions, Frequency excursions, large wind speed variations.

DCC11.6.9 Requirements for PPM of less than 5 MW

As an alternative to providing a dynamic model as specified in DCC11.6.2 to 11.6.8, a PPM of less than 5 MW may provide to the DSO for onward transmission communication to the TSO the following information:

For Wind Farm Power Stations only

– Wind Turbine Generator type
(fixed speed stall regulated, fixed speed pitch regulated, fixed speed pitch regulated with variable rotor resistance, variable speed with doubly-fed induction Generator, variable speed with synchronous Generator and fully-rated converter or other specified type.)

- Manufacturer of Wind Turbine Generator
- Model/type description
- Manufacturer of Generator
- Turbine Generator data as set out in DCC11.3.1
  - For Solar Farm Power Stations only
  - [to be completed]

DCC11.6.10 Power Park Module Data

In order to construct a valid dynamic model of each PPM the following Controllable PPM data is required by the TSO and DSO:

a) Generator (WTG or SG) Transformer
   This is the transformer that connects the WTG with the internal PPM network.
   - Rating of WTG or SG transformer (MVA or kVA)
   - WTG or SG transformer voltage ratio (kV)
   - WTG or SG transformer impedance (% on rated MVA or kVA)

b) Internal PPM Network and Corresponding Data
   Details of the PPM’s internal network (Collector Network) structure should be provided by means of a single-line diagram or other description of connections. The description should indicate how the individual WTG or SGs are connected together as well as how they are connected to the PPM substation. The different cable or overhead line types and the individual length of each section of circuit should be specified.

   Electrical parameters of the cables or overhead lines in the Collector Network should be provided as set out in the table below:

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Length (m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductor Cross Section Area per Core (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductor Type (Al, Cu, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Insulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charging Capacitance (µF/km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charging Current (Amp/km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Sequence Resistance (R1 Ohm/km)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Sequence Reactance (X1 Ohm/km)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   Extend table as appropriate

c) Connection Point Step-up Transformer
   If there is a step-up transformer connecting the PPM site with the Distribution System the following transformer data is required:

   - Rating of step-up transformer (MVA or kVA)
   - Transformer voltage ratio (kV)
- Transformer impedance (% on rated MVA or kVA)

d) Reactive Compensation Installed at Site

Number of inductive devices

For each device, the inductive kVAR or MVAr capability. If the device has more than one stage please indicate the number of stages and the kVAR or MVAr capability switched in each stage i.e. 0.5 MVAr in 5 steps etc.

Number of capacitive devices

For each device, the capacitive kVAR or MVAr capability. If the device has more than one stage please indicate the number of stages and the kVAR or MVAr capability switched in each stage i.e. 0.5 MVAr in 5 steps etc.

Method of voltage / Reactive Power control applied to each controllable reactive compensation device. This information should be provided in sufficient detail (e.g. transfer function block diagram, control system gain/droop, deadband and hysteresis characteristics, tap steps, etc.) to allow an appropriate dynamic model to be developed.
Distribution Operating Codes
DOC DISTRIBUTION OPERATING CODE 1

DOC1 DISTRIBUTION OPERATING CODE 1 – DEMAND FORECASTING

DOC1.1 INTRODUCTION

DOC1.1.1 In order for the DSO to operate the Distribution System efficiently and to ensure maximum system security and System Stability, there is a need for those Users specified in DOC1.3 to provide loading and generation output information to the DSO.

DOC1.1.2 The Grid Code specifies the TSO requirements for Demand forecasting for Users subject to Central Dispatch. Distribution Operating Code 1 (DOC1) specifies the information to be provided to the DSO by other Users of the Distribution System so that these requirements can be met.

DOC1.1.3 The information to be provided under DOC1 is required to enable the DSO to maintain the integrity of the Distribution System.

DOC1.1.4 Where Demand data is required from the User, this means the MW Demand of electricity at the Connection Point. The DSO may in certain cases specify that the Demand data shall include the MVAR Demand.

DOC1.1.5 The means of providing the information to the DSO and its confirmation includes any non-transitory written form, or any other suitable means of electronic transfer which enables the recipient to retain information.

DOC1.2 OBJECTIVE

The objectives of DOC1 are to:

a) Set out the Demand forecast and the Generating Plant output information to be provided by Users to enable the DSO to operate the Distribution System; and

b) Specify the information to be provided by Users to the DSO to enable it to comply with its obligations under the Grid Code.

DOC1.3 SCOPE

DOC1 applies to the following Users of the Distribution System:

a) Major Customers connected to the Distribution System and Medium Voltage Customers where the DSO considers it appropriate.

b) Generators with Generating Plant over 2MW.

DOC1.4 INFORMATION FLOW AND CO-ORDINATION

DOC1.4.1 The DSO shall co-ordinate Demand forecast information for each Bulk Supply Point to meet the requirements of the Grid Code (OC1). The DSO shall aggregate forecast information provided by Users, where appropriate, and provide forecast information to the TSO where Demand, or change in Demand, is greater than 4MW at any Connection Point.

DOC1.4.2 Generation information for Generating Plant in the Distribution System, which is not subject to Central Dispatch, shall be provided where specified to the DSO. Customers with CHP and Customers with Auto-production may also be required to supply information.

DOC1.4.3 Centrally Dispatched Users shall comply with the requirements of OC1 of the Grid Code. Information shall be provided directly to the DSO and TSO.
DOC1.5 DEMAND FORECAST DATA

DOC1.5.1 Generating Units greater than 2MW and not subject to Central Dispatch shall provide to the DSO information regarding output and planned shutdowns for specified future periods. This shall be provided on an annual basis when requested by the DSO. The information required is given in Schedule 2 of the Distribution Data Registration Code (DDRC).

DOC1.5.2 Major Customers shall provide to the DSO information regarding Demand and planned shutdowns for specified future periods. This shall be provided on an annual basis when requested by the DSO. The information required is given in Schedule 2 of the Distribution Data Registration Code (DDRC).

DOC1.5.3 Dispatchable Demand Customers shall provide to the DSO information regarding Demand and planned shutdowns for specified future periods. This shall be provided on an annual basis when requested by the DSO. The information required is given in Schedule 2 of the Distribution Data Registration Code (DDRC).

DOC2 DISTRIBUTION OPERATING CODE 2 – OPERATIONAL PLANNING

DOC2.1 INTRODUCTION

DOC2.1.1 Distribution Operating Code 2 (DOC2) is concerned with the co-ordination of Planned Outages of Plant and apparatus which affect the Operation of the Distribution System or require the commitment of DSO resources.

DOC2.1.2 DOC2 supplements the obligation of the DSO to provide certain information to the TSO under the Grid Code and establishes procedures to enable the collection of such data from Users specified in DOC2.3.

DOC2.1.3 The means of providing the information to the DSO and its confirmation includes any non-transitory written form, or any other suitable means of electronic transfer which enables the recipient to retain information.

DOC2.1.4 In order for the DSO to fulfil the requirements of this DOC2 it should be noted that the information set out in Grid Code (OC2), to be provided by the TSO will form the basis of operational planning under this DOC2.

DOC2.2 OBJECTIVE

DOC2.2.1 The objectives of DOC2 are to:

a) Set out the operational planning procedure and typical timetable for the co-ordination of outage requirements for Plant and apparatus to be provided by Users to enable the DSO to operate the Distribution System.

b) Specify the information to be provided by Users to the DSO to allow it to comply with the Grid Code.

DOC2.3 SCOPE

DOC2.3.1 DOC2 applies to the following Users of the Distribution System:

a) Major Customers connected to the Distribution System where the DSO considers it appropriate;

b) Generating Plant not subject to Central Dispatch;

c) Customers with CHP and Customers with Auto-production;

d) Centrally Dispatched Users
DOC2.4  PROVISION OF INFORMATION

DOC2.4.1 Information on Generating Plant not subject to Central Dispatch (including Customers with CHP and Customers with Auto-production) shall be provided, where specified, directly to the DSO. This information to be provided to the DSO is shown in Schedule 3(a) and Schedule 3(b) of the DDRC.

DOC2.4.2 Centrally Dispatched Users shall comply with the requirements of OC2 of the Grid Code. Information shall be provided directly to the TSO.

DOC2.5  TIMESCALES AND DATA

DOC2.5.1 For Users that are not subject to Central Dispatch detailed implementation of data gathering and timescales shall be determined by the DSO and each User. Due recognition shall be given by the DSO to voltage levels and capacities of Plant and apparatus when assessing information requirements.

DOC2.5.2 The information may be required for different timescales as may be determined by the TSO or the DSO planning needs.

DOC2.5.3 For Users that are subject to Central Dispatch, implementation of data gathering and timescales shall be determined by the User, DSO and TSO. Due recognition shall be given by the DSO to voltage levels and capacities of Plant and apparatus when assessing information requirements.

DOC2.6  INFORMATION FROM GENERATORS

DOC2.6.1 Information from Generating Plant greater than 2MW and not subject to Central Dispatch shall include details of Planned Outages for Maintenance or other purposes as well as the expected time of return to service.

DOC2.6.2 The Generator shall not synchronise without first obtaining permission from the DSO unless prior agreement has been reached with the DSO.

DOC2.7  INFORMATION TO USERS

DOC2.7.1 The DSO shall advise Major Customers, Dispatchable Demand Customers or Generators who may be significantly affected by particular outages of distribution Plant and apparatus, of the likely dates and duration of the outages. If there are objections from Users these shall be considered by the DSO and alternative arrangements proposed if possible.

DOC5  DISTRIBUTION OPERATING CODE 5 – DEMAND CONTROL

DOC5.1  INTRODUCTION

DOC5.1.1 Distribution Operating Code 5 (DOC5) is concerned with provisions to be made by the DSO or Users of the Distribution System, in certain circumstances, to permit reductions in Demand in the event of insufficient Generating Plant and transfers from external interconnections and Inter-jurisdictional Tie-lines being available to meet Demand or to avoid disconnection of Customers or in the event of breakdown and / or operating problems (such as in respect of system Frequency, system voltage levels or system thermal overloads) on any part of the Transmission or Distribution System.

DOC5.1.2 The Demand control procedures ensure that hardship to Users and Customers is minimised and that in so far as is practicable, all parties affected are treated equitably.
DOC5.3 SCOPE

DOC5 applies to the DSO and all Users of the Distribution System.

DOC5.4 METHODS OF DEMAND CONTROL

DOC5.4.1 Customer Demand may be disconnected automatically at selected locations in accordance with the requirements of the Grid Code, in the event of a sudden fall in Frequency. Such an arrangement shall be carefully co-ordinated as part of an overall scheme and may take into account any operational requirements or essential load.

DOC5.4.2 Automatic disconnection by under-voltage relay may be used to discriminately disconnect load at either 110kV, 38kV or MV in order to maintain voltage within acceptable limits, so as to avoid widespread load shedding.

DOC5.4.3 Deliberate reduction of voltage may be used to achieve a temporary reduction in load Demand.

DOC5.4.4 Deliberate reduction in system Frequency may also be used to achieve a temporary reduction in load Demand in accordance with the Grid Code.

DOC5.4.5 Emergency manual load shedding may be carried out on the Distribution or Transmission Systems for reasons of shortfall in supply or other reasons.

DOC5.4.6 In the event of a sustained period of shortfall then planned rota load shedding may be used to share the available power among affected Customers.

DOC5.5 IMPLEMENTATION OF DEMAND CONTROL
DOC5.5.1 Where Demand control is exercised by the DSO in order to safeguard the Distribution System, the DSO shall liaise with and inform Users accordingly as far as is practicable.

DOC5.5.2 Where Demand control is exercised by the DSO on instruction or request from the TSO in order to safeguard the Total System then the DSO is required to respond to these requests promptly but shall liaise with and inform other Users so far as is practical.

DOC5.5.3 Procedures for load shedding including exemption policies, load shedding rotas and Customer communications are contained in the distribution load shedding plan approved by the Commission for Regulation of Utilities.

DOC7 DISTRIBUTION OPERATING CODE 7 – OPERATIONAL COMMUNICATIONS AND LIAISON

DOC7.1 INTRODUCTION

Distribution Operating Code 7 (DOC7) sets out the requirements for the exchange of information in relation to Operations and / or Events on the Distribution System or the installation of any User connected to the Distribution System which have had or may have had, or will have or may have an Operational Effect on the Distribution System or the installation of any other User.

DOC7.2 OBJECTIVE

To provide for the exchange of information so that the implications of the Operation and / or Event 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 Total System and the User's installation. DOC7 does not seek to deal with any actions arising from the exchange of information, but merely with that exchange.

DOC7.3 SCOPE

DOC7 applies to the following Users of the Distribution System

a) Major Customers connected to the Distribution System where the DSO considers it appropriate;

b) Generating Plant with a Registered Capacity greater than 2MW;

c) Customers with CHP and Customers with Auto-production where the DSO reasonably considers it appropriate;

d) Dispatchable Demand Customers.

DOC7.4 PROCEDURE

DOC7.4.1 The DSO and Users connected to the Distribution System shall nominate persons and / or contact locations and agree communication channels for the necessary exchange of information to make effective the exchange of information required by DOC7.

DOC7.4.2 SCADA remote terminal Equipment shall be required at a User's site for the transmission of information and data to the TSO and to the DSO Control Facility. The requirement to provide this information shall normally be included in the relevant Connection Agreement.

DOC7.4.3 Information between the DSO and Users shall be exchanged on the reasonable request of either party. The request may follow a specific Operation, or be in accordance with a prior agreement to exchange information on particular types of Event.

This does not preclude the voluntary exchange of information which may be perceived as being relevant to the Operation of the distribution or User installation, in accordance with Good Industry Practice.

DOC7.4.4 In the case of an Operation on the Distribution System or on receipt of notification of an Operation on the Transmission System, which will have or may have, in the opinion of the DSO,
an Operational Effect on the installation of a User connected to the Distribution System, the
DSO shall notify the User.

DOC7.4.5 In the case of an Operation on the installation of a User connected to the Distribution System,
which will have or may have an Operational Effect on the Distribution System, the User shall
notify the DSO in accordance with DOC7.

DOC 7.4.6 In the case of an Operation on the installation of a Centrally Dispatched User connected to the
Distribution System, which will have or may have an Operational Effect on the Distribution
System, the User shall notify both the DSO and TSO in accordance with DOC7.

DOC7.4.7 A notification under DOC7 shall be of sufficient detail to describe the Operation, although it need
not state the cause, and to enable the recipient of the notification reasonably to consider and access
the implications and risks arising and shall include the name of the individual reporting the
Operation. The recipient may ask questions to clarify the notification.

DOC7.4.8 A notification under DOC7 shall be given as far in advance as possible to allow the recipient to
consider and assess the implications and risks arising.

DOC7.5 SIGNIFICANT INCIDENTS

DOC7.5.1 Where an Event on the Distribution System has had or may have had a significant effect on the
User’s installation or where an Event in the User’s installation has had or may have had a
significant effect on the Distribution System, the Event shall be deemed to be a Significant
Incident by the DSO in consultation with the User. Significant Incidents shall be reported in
writing to the affected party in accordance with the provisions of DOC8.

DOC7.5.2 A Significant Incident shall include Events which result in, or may result in, the following:

a) Voltage limits outside statutory limits;
b) System Frequency outside statutory limits; or
c) System Stability failure.

DOC8 DISTRIBUTION OPERATING CODE 8 – EVENT REPORTING

DOC8.1 INTRODUCTION

DOC8.1.1 Distribution Operating Code 8 (DOC8) sets out the requirements for reporting in writing those
Events deemed to be Significant Incidents under DOC7.

Information between the DSO and major Users shall be exchanged on the reasonable request of
both parties.

DOC8.1.2 DOC8 also provides for the joint investigation of Significant Incidents by the Users involved.

DOC8.2 OBJECTIVES

DOC8.2.1 The objective of DOC8 is to facilitate the provision of more detailed information in writing and where
agreed between the DSO and the Users involved, joint investigation of those Significant Incidents
reported verbally under DOC7.

DOC8.3 SCOPE

DOC8.3.1 DOC8 applies to the following Users of the Distribution System:

a) Major Customers connected to the Distribution System where the DSO considers it
appropriate;
b) Generating Plant with a capacity greater than 2MW;
c) Customers with CHP and Customers with Auto-production where the DSO reasonably
considers it appropriate;
d) Dispatchable Demand Customers.
DOC8.4 PROCEDURES

DOC8.4.1 The **DSO** and each **User** specified in DOC8.3.1 shall nominate officers and establish communication channels to ensure the effectiveness of this DOC8. Such officers and communication channels may be the same as those established under DOC7.

DOC8.4.2 Communication shall, as far as possible, be direct between the **User** and the operator of the **Distribution System**. However, this does not preclude communication with the **Users** nominated representative.

DOC8.4.3 In the case of an **Event** which has been reported to the **DSO** under DOC7 and subsequently has been determined by the **DSO** to be a **Significant Incident**, a written report shall be given to the **DSO** by the **User** in accordance with DOC8.

DOC8.4.4 In the case of an **Event** which has been reported to the **User** under DOC7 and subsequently has been determined by the **DSO** to be a **Significant Incident**, a written report shall be given to the **User** by the **DSO** in accordance with DOC8. In the case where the **User** is subject to **Central Dispatch**, the written report shall be shared with the **TSO**, where the **DSO** deems it to be appropriate.

DOC8.4.5 A report shall be in writing or in electronic form and shall be sent to the **DSO** or **User**, as the case may be. It shall contain confirmation of the notification given under DOC7 together with more details relating to the **Significant Incident** including information which has become known relating to the **Significant Incident** since the notification. The report shall, as a minimum, contain those matters specified in DOC8.6.

DOC8.4.6 A report under DOC8 shall be given as soon as reasonably practical after the notification under DOC7.

DOC8.5 JOINT INVESTIGATIONS

DOC8.5.1 Where a **Significant Incident** has been declared and a report submitted under DOC8 either party or parties may request in writing that a joint investigation be carried out.

DOC8.5.2 The composition of such an investigation panel shall be appropriate to the incident to be investigated and agreed by all parties involved.

DOC8.5.3 A joint investigation shall only take place where all parties affected by it agree to it. The form and rules of, and procedures for, and all matters relating to the joint investigation shall be agreed at the time of a joint investigation and in the absence of agreement the joint investigation shall not take place.

DOC8.6 MATTERS TO BE INCLUDED IN A WRITTEN REPORT OF A SIGNIFICANT INCIDENT

DOC8.6.1 Matters applicable to the **DSO**, **Generators** and **Dispatchable Demand Customers**:

a) Date and time of **Significant Incident**;

b) Location;

c) **Equipment** involved;

d) Brief description of **Significant Incident**;

e) Details of any **Demand** control undertaken;

f) Conclusions and recommendations if applicable.

DOC8.6.2 Matters applicable to the **DSO**:

Effect on **Users** where appropriate:

a) Duration of incident; and

b) Estimated date and time of return to normal service.

DOC8.6.3 Matters applicable to **Generator**:
Effect on generation including, where appropriate:

a) Generation interrupted;
b) **Frequency Response** achieved;
c) **MVAr** performance achieved; and
d) Estimated date and return to normal service.

DOC8.6.4 Matters applicable to **Dispatchable Demand Customers**:

Effect on **Demand** including, where appropriate:

a) **Demand Reduction** interrupted;
b) Duration of incident;
c) Estimated date and time of return to service.

DOC9 DISTRIBUTION OPERATING CODE 9 – SYSTEM TESTS

DOC9.1 INTRODUCTION

DOC9.1.1 Distribution Operating Code 9 (DOC9) sets out the responsibilities and procedures for arranging and carrying out **System Tests** which have or may have an effect on the systems of the **DSO** or **Users**. **System Tests** are those tests which involve either simulated or the controlled application of irregular, unusual or extreme conditions on the **Total System** or any part of the **Total System**, but which do not include **Commissioning** or recommissioning tests or any other tests of a minor nature.

DOC9.2 OBJECTIVES

DOC9.2.1 The objectives of DOC9 are to:

a) Ensure that the procedures for arranging and carrying out **System Tests** are such that, so far as practicable, **System Tests** do not threaten the safety of personnel or the general public and cause minimum threat to the security of supplies, the integrity of **Plant** or **Equipment** and are not detrimental to the **DSO** and **Users**; and

b) Set out procedures to be followed for establishing and reporting **System Tests**.

DOC9.3 SCOPE

DOC9.3.1 DOC9 applies to the following **Users** of the **Distribution System**:

a) **Major Customers** connected to the **Distribution System** where the **DSO** considers it appropriate;
b) **Generating Plant** with a capacity greater than 2MW;
c) **Customers with CHP** and **Customers with Auto-production** where the **DSO** reasonably considers it appropriate;
d) **Dispatchable Demand Customers**.

DOC9.4 PROCEDURES

DOC9.4.1 If the **System Test** is proposed by the **DSO** or the **User** connected to the **Distribution System** or the test will or may have an effect on the **Transmission System** then the provisions of DOC9 or the **Grid Code** shall apply.

DOC9.4.2 **System Tests** which have a minimal effect on the **Distribution System** or the systems of others will not be subject to this procedure; minimal effect shall be taken to mean variations in voltage, **Frequency** and waveform distortion of a value not greater than those figures which are defined in the **Distribution Planning Code**.
DOC9.4.3 When the DSO or a User intend to undertake a System Test which may have significant effect on the system of others normally twelve months’ notice, or as otherwise agreed by the DSO, shall be given by the person proposing the System Test (test proposer) to the DSO and to those Users who may be affected by such a System Test.

DOC9.4.4 The proposal shall be in writing and shall contain details of the nature and purpose of the proposed System Test and shall indicate the extent and situation of the Plant or apparatus involved.

DOC9.4.5 If the information set out in the proposal notice is considered insufficient by the recipient they shall contact the test proposer with a written request for further information which shall be supplied as soon as reasonably practicable. The DSO shall not be required to do anything under DOC9 until it is satisfied with the details supplied in the proposal or pursuant to a request for further information.

DOC9.4.6 If the DSO wishes to undertake a System Test, the DSO shall be deemed to have received a proposal of that System Test.

DOC9.4.7 The DSO shall have overall co-ordination of the System Test, using the information supplied to it under DOC9 and shall identify in its reasonable estimation, which Users other than the test proposer, may be affected by the proposed System Test.

DOC9.4.8 Following receipt of the System Test proposal the DSO shall evaluate the impact of the System Test and discuss the proposals with Users identified as being affected.

DOC9.4.9 Within one month of receiving the System Test proposal the DSO shall submit a report to the test proposer which shall contain:

   a) Proposals for carrying out the System Test (including the manner in which it is to be monitored);
   b) An allocation of costs between the affected parties, (the general principle being that the test proposer will bear the costs); and
   c) Such other matters that the DSO consider appropriate; outline the procedure to be followed and the proposed test schedule and advise of any costs.

DOC9.4.10 The proposal report shall be submitted to all those who received a notice under DOC9.4.3.

DOC9.4.11 If the proposal report (or a revised proposal report as agreed between the DSO and the test proposer) is approved by all recipients, the System Test can proceed.

DOC9.4.12 At least one month prior to the date of the proposed System Test, the DSO shall submit to all recipients of the proposal notice a programme which in this DOC9 shall be called a final test programme stating the switching sequence and proposed timings, a list of those staff involved in carrying out the System Test (including those responsible for site safety) and such other matters as the DSO deem appropriate.

DOC9.4.13 The final test programme shall bind all recipients to act in accordance with the provisions contained within the programme in relation to the proposed System Test.

DOC9.4.14 At the conclusion of the System Test, the test proposer shall be responsible for preparing a written report (the “final report”) of the System Test for submission to the DSO.

DOC9.4.15 The final report shall include a description of the Plant and / or apparatus, tested and of the System Test carried out, together with the results, conclusions and recommendation.

DOC9.4.16 Results of tests shall be reported to relevant parties, taking into account confidentiality issues.

DOC9.4.17 All System Test procedures shall comply with all applicable legislation.

DOC10 DISTRIBUTION OPERATING CODE – MONITORING, TESTING AND INVESTIGATION

DOC10.1 INTRODUCTION

DOC10.1.1 In order to properly discharge its responsibilities in respect of safe, secure and economic Operation of the Distribution System and in accordance with its Licence conditions the DSO shall organise
and carry out monitoring, testing and investigation on the effect of Users’ electrical apparatus or electrical installation on the Distribution System.

**DOC10.2 OBJECTIVE**

**DOC10.2.1** The objective is to specify the DSO requirements to test and / or monitor the Distribution System to ensure that Users are not operating outside the technical parameters required by the Distribution General Codes and Operating Codes.

**DOC10.3 SCOPE**

**DOC10.3.1** DOC10 applies to the following Users of the Distribution System:

a) All Generators;
b) All Customers who are connected to the Distribution System.

**DOC10.4 PROCEDURES**

**DOC10.4.1** The DSO shall, from time to time, determine the need to test or monitor the quality of supply at various points on the Distribution System.

**DOC10.4.2** In the case of a Centrally Dispatched User of the Distribution System, the TSO shall, from time to time, determine the need to test or monitor the functionality and operational response of the User. This testing and monitoring may be carried out at various points on the Distribution System, subject to the prior agreement between the DSO and TSO.

**DOC10.4.3** The requirement for specific testing and / or monitoring may be initiated by the receipt of specific complaints as to the quality of supply on the Distribution System.

**DOC10.4.4** Where testing or monitoring is required at the Connection Point with a User then the DSO shall advise the User involved and the DSO shall make available the results of such tests to the User. In the case of a Centrally Dispatched User, the DSO shall make available the results of such tests to the TSO on request.

**DOC10.4.5** Where a User is found to be operating outside the technical limits specified in the Distribution General Code then the User shall rectify the situation or disconnect the apparatus causing the problem from its electrical system connected to the Distribution System immediately or within such time as agreed with the DSO. In the case of a Centrally Dispatched User, the DSO shall inform the TSO of the issue on request.

**DOC10.4.6** Failure to rectify the situation shall result in the User being disconnected in accordance with the Connection Agreement.

**DOC10.4.7** The DSO shall, from time to time, monitor the effects of the User on the Distribution System.

**DOC10.4.8** The monitoring shall normally be related to the amount of Active Power and Reactive Power or Flicker or Harmonics transferred across the Connection Point.

**DOC10.4.9** Where the User is exporting or importing Active Power or Reactive Power in excess of those defined in the Connection Agreement or causing disturbances, the DSO shall inform the User and the User shall restrict the power transfer to within the specified parameters.

**DOC10.4.10** The DSO may check from time to time that Users are in compliance with agreed Protection requirements and Protection settings.

**DOC11 DISTRIBUTION OPERATING CODE – SAFETY CO-ORDINATION**

**DOC11.1 INTRODUCTION**

**DOC11.1.1** Distribution Operating Code 11 (DOC11) specifies the Safety Management system criteria to be applied by the DSO to meet statutory requirements and DSO Licence conditions and obligations.
Similar criteria and standards of Safety Management systems shall be provided by other Users of the Distribution System when carrying out work or tests at the operational interface with the DSO.

OBJECTIVES

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

SCOPE

DOC11 specifies the Safety Management criteria that applies to the DSO and the following Users of the Distribution System:

a) Generators;
b) Major Customers;
c) Any other party reasonably specified by the DSO including Users connected at Medium or Low Voltage for appropriate sections of DOC11 when necessary;
d) Agents of the DSO or Users working on the Distribution System or at or across operational boundaries;
e) Centrally Dispatched Users.

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 DSO and Users for work on their respective systems or Plant or apparatus connected to them.

The DSO shall specify the Safety Management system applicable at operational boundary points and proper documentation of the safety precautions to be taken shall be maintained.

• The DSO shall at all times have nominated ‘Authorised 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 Distribution System as per S.I. No.299 of 2007 Safety Health and Welfare at Work (General Application) Regulation 2007, SHAWW Act 2005 and relevant European Standards including EN50110 and ESB Networks Electrical Safety Rules.
• The User shall at all times have nominated ‘Authorised 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 Distribution System as per S.I. No.299 of 2007 Safety Health and Welfare at Work (General Application) Regulation 2007, SHAWW Act 2005 and relevant European Standards including EN50110, and Users Safety Management procedures.
• The User shall confirm nominated ‘Authorised Person(s)’ in writing to the DSO.

There shall be joint agreement between the DSO 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 DSO and each User shall at all times have nominated a person or persons responsible for the co-ordination of safety on the respective systems.

The DSO and each User shall maintain a suitable system of documentation which records all relevant operational Events that have taken place on the 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 DSO and User as required.
DOC11.5 SAFETY AT THE DSO / USER INTERFACE

DOC11.5.1 The following procedure set down the basic safety requirements at the operator and the DSO 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 DSO 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 S.I. No.299 of 2007.

DOC 11.5.2 Maintenance

The DSO shall ensure that it’s electrical installations and any Equipment within it:

i) are maintained in a safe condition; and
j) complies with S.I. No.299 of 2007 Safety Health and Welfare at Work (General Application) Regulation 2007, SHAWW Act 2005 and relevant European Standards as appropriate.

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

k) is maintained in a safe condition; and
l) complies with S.I. No.299 of 2007 Safety Health and Welfare at Work (General Application) Regulation 2007, SHAWW Act 2005 and relevant European Standards as appropriate.

DOC11.6 SAFETY PROCEDURES

DOC11.6.1 Operation and Maintenance of the Users’ Equipment shall only be carried out by Authorised Person(s). Before first Commissioning the Plant, operating procedures shall be agreed with the DSO.

DOC11.6.2 Instructions for operating and / or Earthing the Users’ electrical Equipment shall be clearly displayed in the Users’ Medium and High Voltage switch room.

DOC11.6.3 The ESB Networks Electrical Safety Rules detail the Safety Procedures to be observed for all personnel working on or in close proximity to Distribution System Plant or Equipment.

DOC11.6.4 The User’s Safety Procedures shall apply to the Users’ Authorised Persons’ at the User’s Plant or Equipment at the interface.
Distribution Data Registration Code
DDRC DISTRIBUTION DATA REGISTRATION CODE

DDRC1 INTRODUCTION

DDRC1.1 The various sections of the Distribution Code require Users to submit data to the DSO.

DDRC1.2 The Distribution Data Registration Code (DDRC) provides a series of schedule summarising all requirements for information of a particular type. Each User is then referred to the appropriate schedule for a statement of the total data requirements for that User.

DDRC1.3 The DDRC specifies procedures and timings for the supply of data and subsequent updating. Where the timings are covered by detailed timetables laid down in other sections of the Distribution Code they are not necessarily repeated in full in the DDRC.

DDRC1.4 In the case of a Generator seeking a connection to the DSO Distribution System then irrespective of the potential arrangements for Scheduling and Dispatch discussions on connection shall be with the DSO.

DDRC2 SCOPE

The Users to which the DDRC applies are:

a) Generators;
b) Major Customers;
c) Medium Voltage Customer where the DSO considers it appropriate;
d) Centrally Dispatched Users.

DDRC3 PROCEDURES AND RESPONSIBILITIES

DDRC3.1 Unless otherwise specified or agreed by the DSO each User shall submit data as defined in DDRC5 below and attached schedules.

DDRC3.2 Data changes are reviewed annually to ensure continued accuracy or relevance. The DSO shall initiate this review in writing and the User shall respond in writing.

DDRC3.3 Where possible data shall be submitted on standard forms forwarded to the User by the DSO.

DDRC3.4 If a User wishes to change any data item then this must first be discussed with the DSO in order for the implications to be considered and the change if agreed (such agreement not to be unreasonably withheld), be confirmed by the submission of a revised data form or by verbal means with confirmation in writing.

DDRC3.5 From time to time the DSO may change its data requirements, appropriate Users shall be advised of these changes as they occur and with a reasonable timescale by which to reply.

DDRC3.6 In the case of a Centrally Dispatched User, the same data shall be provided to both the DSO and TSO.
**DDRC4 DATA TO BE REGISTERED**

DDRC4.1 The schedule numbering matches the schedule numbering of the *Grid Code* and some schedules are not required within the *Distribution Code*.

DDRC4.2 Schedules 1(a), 1(b), and 1(c) – *Generator* Technical Information.

DDRC4.3 Schedules 1(d) and 1(e) – Wind Generation

DDRC4.4 Schedules 1(f) – Centrally Dispatched *Demand Customers*

DDRC4.5 Schedule 2 – *Demand* Forecasts – as described in DOC1, *Demand* and generation forecasts for the *Users* defined in the scope.

DDRC4.6 Schedule 3 (a) and (b) – Operational Planning – as described in DOC2, outage planning information.

DDRC4.7 Schedule 4 (a) and (b) – System Design Information – comprising system technical data.

DDRC4.8 Schedule 5 – Load Characteristics – comprising the forecast data for load points indicating for example, the maximum load, the *Equipment* that comprises the load and the *Harmonic* content of the load.

**DDRC5 DATA SCHEDULES**

The schedules applicable to each class of *User* are as follows:

<table>
<thead>
<tr>
<th>Schedule Number</th>
<th>Title</th>
<th>Applicable to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule 1(a)</td>
<td><em>Generating Unit</em> Data</td>
<td><em>Generators</em> including <em>Customers</em> with CHP and <em>Customers with Auto-production</em></td>
</tr>
<tr>
<td>Schedules 1(b)</td>
<td><em>Generating Unit</em> Data</td>
<td><em>Generators</em> (with Parallel <em>Operation</em>)</td>
</tr>
<tr>
<td>Schedule 1(c)</td>
<td><em>Generating Unit</em> Data</td>
<td><em>Generators</em> (greater than 2MW).</td>
</tr>
<tr>
<td>Schedule 2</td>
<td><em>Demand</em> Forecasts</td>
<td><em>Generators</em> (greater than 2MW), <em>Major Customers</em>, <em>Centrally Dispatched Users</em></td>
</tr>
<tr>
<td>Schedule 3(a)</td>
<td>Operational Planning (Outages)</td>
<td><em>Generators</em></td>
</tr>
<tr>
<td>Schedule 3(b)</td>
<td>Operational Planning (<em>Plant</em> and Apparatus)</td>
<td><em>Major Customers</em>, <em>Generators</em>, <em>Customers with CHP</em> and <em>Customers with Auto-production</em></td>
</tr>
<tr>
<td>Schedule 4(a)</td>
<td><em>System Design</em></td>
<td><em>Generators</em>, <em>Major Customers</em>, <em>MV Customers</em> if advised by DSO</td>
</tr>
<tr>
<td>Schedule 4(b)</td>
<td><em>System Design</em></td>
<td><em>Generator</em> (with Parallel <em>Operation</em>)</td>
</tr>
<tr>
<td>Schedule 5</td>
<td><em>Load Characteristics</em></td>
<td><em>Generator</em>, <em>Major Customers</em></td>
</tr>
</tbody>
</table>
SCHEDULE 1(a)

GENERATING UNIT DATA

For All Generators including Customers with CHP and Customers with Auto-production

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Details</td>
<td>Text</td>
</tr>
<tr>
<td>Contact Name</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Generator Make</strong></td>
<td>Text</td>
</tr>
<tr>
<td>Type of <strong>Generating Unit</strong></td>
<td>Text</td>
</tr>
<tr>
<td>Type of Prime Mover</td>
<td>Text</td>
</tr>
<tr>
<td>Anticipated Operating Regime</td>
<td>47.5</td>
</tr>
<tr>
<td>Terminal Volts</td>
<td>kV</td>
</tr>
<tr>
<td>Rated kVA</td>
<td>kVA</td>
</tr>
<tr>
<td>Rated kW</td>
<td>kW</td>
</tr>
<tr>
<td>Maximum <strong>Active Power</strong> sent out</td>
<td>kW</td>
</tr>
<tr>
<td><strong>Reactive Power</strong> required</td>
<td>kVar</td>
</tr>
<tr>
<td>Fault Level Contribution</td>
<td>MVA</td>
</tr>
<tr>
<td>Method of Voltage Control</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Generator</strong> Transformer Details</td>
<td>Text</td>
</tr>
</tbody>
</table>
## SCHEDULE 1(b)

### GENERATING UNIT DATA

For Generators with Parallel Operation

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Details to include:</td>
<td>Text / Schematic Diagram</td>
</tr>
<tr>
<td>Relevant Voltage Levels</td>
<td></td>
</tr>
<tr>
<td><strong>Generator</strong> Size and Winding Configuration</td>
<td></td>
</tr>
<tr>
<td>Transformer Size, Ratio, and Winding Configuration</td>
<td></td>
</tr>
<tr>
<td><strong>Circuit Breaker</strong> Location</td>
<td></td>
</tr>
<tr>
<td>Maximum Three Phase Short Circuit Level (amps)</td>
<td></td>
</tr>
<tr>
<td>Location of Alternate Electricity Supplies</td>
<td></td>
</tr>
<tr>
<td>CT/VT Ratios and Locations</td>
<td></td>
</tr>
<tr>
<td>Synchronising and Interlocking Arrangements</td>
<td></td>
</tr>
<tr>
<td>Relay Types and Location</td>
<td></td>
</tr>
<tr>
<td>Power Factor Correction Location</td>
<td></td>
</tr>
</tbody>
</table>

- Inertia Constant: **MW** **secs** / **MVA** (whole machine)
- Stator Resistance
- Direct Axis Reactance: Sub-transient, Transient, Synchronous
- Time Constants: Direct Axis: Sub-transient, Transient
- Zero Sequence: Resistance, Reactance
- Negative Sequence: Resistance, Reactance
- **Generator** Transformer: Resistance, Reactance
  - **MVA Rating**
  - Tap Arrangement
  - Vector Group
  - **Earthing**

- Impulse Levels (BIL) and power withstands at each voltage level: Schedule
- Fault current available due to metallic three phase short circuit at the main incoming **Circuit Breaker**: Calculation Sheet
- Interface arrangements: Text / Diagrams
- Details **Protection** circuit and trip circuit supervision: Text / Diagrams
- Details of relays to be used including measuring range, proposed settings and calculations used to determine relay settings: Text
- Details of power factor correction: Text / Diagrams
SCHEDULE 1(c)
GENERATING UNIT DATA
For Generators greater than 2MW

DATA DESCRIPTION

Type of prime mover
Rated MVA
Type of Excitation System

**Automatic Voltage Regulator (AVR)**
A block diagram for the model of the
AVR system including data on the
gains forward and feedback time
constants and voltage control limits.

Speed Governor and Prime Mover Data
A block diagram for the model of the
**Generator Plant** Governor detailing the
Governor Flyball and System Control
and Turbine Rating and Maximum
Power.

Capacity and Standby Requirements
Registered Capacity and Minimum
Generation of each **Generating Unit**
and **Power Station**.

**Generating Unit and Power Station**
Auxiliary Demand (Active and Reactive Power)
at Registered Capacity conditions.

**Generating Unit and Power Station** Auxiliary
Demand (Active and Reactive Power)
under Minimum Generation conditions.

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of prime mover</td>
<td>Text</td>
</tr>
<tr>
<td>Rated MVA</td>
<td>Text</td>
</tr>
<tr>
<td>Type of Excitation System</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Automatic Voltage Regulator (AVR)</strong></td>
<td>Diagram</td>
</tr>
<tr>
<td>A block diagram for the model of the AVR system including data on the gains forward and feedback time constants and voltage control limits.</td>
<td>Text</td>
</tr>
<tr>
<td>Speed Governor and Prime Mover Data</td>
<td>Diagram</td>
</tr>
<tr>
<td>A block diagram for the model of the <strong>Generator Plant</strong> Governor detailing the Governor Flyball and System Control and Turbine Rating and Maximum Power.</td>
<td>Text</td>
</tr>
<tr>
<td>Capacity and Standby Requirements</td>
<td>MW</td>
</tr>
<tr>
<td>Registered Capacity and Minimum Generation of each <strong>Generating Unit</strong> and <strong>Power Station</strong>.</td>
<td></td>
</tr>
<tr>
<td><strong>Generating Unit and Power Station</strong></td>
<td>MW</td>
</tr>
<tr>
<td>Auxiliary Demand (Active and Reactive Power) at Registered Capacity conditions.</td>
<td>MVAr</td>
</tr>
<tr>
<td><strong>Generating Unit and Power Station</strong> Auxiliary Demand (Active and Reactive Power) under Minimum Generation conditions.</td>
<td>MVAr</td>
</tr>
</tbody>
</table>
SCHEDULE 1(d)

GENERATING UNIT DATA – DYNAMIC MODELS FOR Power Park Modules

For all PPMs
(As an alternative, PPMs with a Registered Capacity of less than 5 MW may provide the data set out in Schedule 1(e)).

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Model</td>
<td>PSS/E format</td>
</tr>
<tr>
<td></td>
<td>(or other format agreed with TSO)</td>
</tr>
<tr>
<td>Dynamic Model Parameters</td>
<td>As required by dynamic model</td>
</tr>
</tbody>
</table>

OR

Dynamic Model previously provided to DSO or TSO:

<table>
<thead>
<tr>
<th>Title / version of dynamic model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Date sent to TSO/DSO</td>
<td></td>
</tr>
<tr>
<td>By whom sent</td>
<td></td>
</tr>
<tr>
<td>To whom addressed</td>
<td></td>
</tr>
<tr>
<td>Means of transmission</td>
<td></td>
</tr>
</tbody>
</table>
SCHEDULE 1(e)

GENERATING UNIT DATA – DYNAMIC MODELS FOR POWER PARK MODULES

For all PPMs with a Registered Capacity of less than 5 MW, where the data specified in Schedule 1(d) is not provided.

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTG Technology</td>
<td>Fixed speed stall regulated</td>
</tr>
<tr>
<td></td>
<td>Fixed speed pitch regulated</td>
</tr>
<tr>
<td></td>
<td>Fixed speed pitch regulated with variable rotor resistance</td>
</tr>
<tr>
<td></td>
<td>Variable speed with doubly-fed induction Generator</td>
</tr>
<tr>
<td></td>
<td>Variable speed with synchronous Generator and fully-rated converter</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td>SG Technology</td>
<td></td>
</tr>
<tr>
<td>WTG Manufacturer</td>
<td></td>
</tr>
<tr>
<td>WTG or SG Manufacturer’s Type Designation</td>
<td></td>
</tr>
<tr>
<td>Generator Manufacturer</td>
<td></td>
</tr>
<tr>
<td>Generator Parameters</td>
<td>As specified in Schedule 1(b)</td>
</tr>
</tbody>
</table>
SCHEDULE 1(f)

Centrally Dispatched Customers Excluding Dispatchable Demand Customers

For each centrally dispatched customer excluding Dispatchable Demand Customer, the following information shall be provided:

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Details</td>
<td>Text</td>
</tr>
<tr>
<td>Contact Name</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Generator</strong> Make</td>
<td>(if appropriate)</td>
</tr>
<tr>
<td>Type of <strong>Generating Unit</strong></td>
<td>(if appropriate)</td>
</tr>
<tr>
<td>Type of Prime Mover</td>
<td>(if appropriate)</td>
</tr>
<tr>
<td>Anticipated Operating Regime</td>
<td>Text</td>
</tr>
<tr>
<td>Terminal Volts</td>
<td>kV</td>
</tr>
<tr>
<td>Rated <strong>MVA</strong></td>
<td>MVA</td>
</tr>
<tr>
<td>Rated <strong>MW</strong></td>
<td>MW</td>
</tr>
<tr>
<td>Maximum <strong>Demand Reduction</strong></td>
<td>(if appropriate)</td>
</tr>
<tr>
<td><strong>Fault Level</strong> Contribution</td>
<td>MVA</td>
</tr>
<tr>
<td>Method of Voltage Control</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Generator</strong> Transformer Details</td>
<td>Text</td>
</tr>
<tr>
<td>Meter registration ID (MPRN)</td>
<td>Text</td>
</tr>
</tbody>
</table>

Dispatchable Demand Customers

For each **Dispatchable Demand Customer**, the following information shall be provided:

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of <strong>Demand Side Unit</strong></td>
<td>Text</td>
</tr>
<tr>
<td>Location of <strong>Demand Site(s)</strong></td>
<td>Text</td>
</tr>
<tr>
<td>The name of the distribution station(s) to which the <strong>Demand Site(s)</strong> is / are normally connected</td>
<td>Text</td>
</tr>
<tr>
<td><strong>Total Demand Reduction Capability</strong> (MW)</td>
<td>MW</td>
</tr>
<tr>
<td><strong>Demand Reduction Capability</strong> from on-site generation</td>
<td>MW</td>
</tr>
<tr>
<td><strong>Demand Reduction Capability</strong> from avoided Demand consumption</td>
<td>MW</td>
</tr>
<tr>
<td>Annual <strong>Demand Profile</strong></td>
<td>MW</td>
</tr>
<tr>
<td>Meter registration ID (MPRN)</td>
<td>Text</td>
</tr>
</tbody>
</table>

Dispatchable Demand Customer which represents an Aggregated Demand Site
For each Dispatchable Demand Customer which represents an Aggregated Demand Site, the following additional information shall be provided:

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Reduction Capability per Individual Demand Site</td>
<td>MW</td>
</tr>
<tr>
<td>Demand Reduction Capability from generation per Individual Demand Site</td>
<td>MW</td>
</tr>
<tr>
<td>Demand Reduction Capability from avoided Demand consumption per Individual Demand Site</td>
<td>MW</td>
</tr>
<tr>
<td>Annual Demand Profile per Individual Demand Site</td>
<td>MW</td>
</tr>
<tr>
<td>Meter registration ID (MPRN)</td>
<td>Text</td>
</tr>
</tbody>
</table>
SCHEDULE 2
DEMAND FORECASTS

a) Generating Units greater than 2MW, not subject to Central Dispatch:

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Output (Annual half-hour Maximum Active Power Output (MW))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecast Electricity Generation (MWh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: Start of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: End of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Year 0 is current year.

b) Major Customers and Medium Voltage Customers, where the DSO considers it appropriate:

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Demand (Annual half-hour Maximum Power Output (MW) and Power Factor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Energy Forecast requirement (MWh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: Start of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: End of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Year 0 is current year.

c) Centrally Dispatched Demand Customers:

<table>
<thead>
<tr>
<th>Data Description</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Demand (Annual half-hour Maximum Power in (MW)).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Energy Forecast requirement (MWh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: Start of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Shutdown Periods</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date: End of Shutdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SCHEDULE 3(a)

**OPERATIONAL PLANNING – SCHEDULED OUTAGES**

For Generators and Centrally Dispatched Users

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
<th>TIME PERIOD</th>
<th>TYPE OF DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>For individual Generating Units the Unit number and Generating Plant capacity. Preferred outage dates earliest start date latest finish date.</td>
<td><strong>MW</strong></td>
<td>0 to 52 weeks</td>
<td>Committed Outage Programme</td>
</tr>
<tr>
<td>For individual Generating Units the Unit number and Generating Plant capacity. Preferred outage dates earliest start date latest finish date.</td>
<td></td>
<td>Years 2 to 3</td>
<td>Provisional Outage Programme</td>
</tr>
<tr>
<td>For individual Generating Units the Unit number and Generating Plant capacity. Preferred outage dates earliest start date latest finish date.</td>
<td><strong>MW</strong></td>
<td>Years 4 to 7</td>
<td>Indicative Outage Programme</td>
</tr>
</tbody>
</table>
## SCHEDULE 3(b)

### OPERATIONAL PLANNING

**Plant and Equipment**

For **Generators** and **Major Customers, Customers with CHP** and **Customers with Auto-production** and **Centrally Dispatched Users.**

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
<th>Time Period Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Users</strong> provide the DSO and <strong>Centrally Dispatched Users</strong> provide the TSO with details of proposed outages which may affect the performance of the Distribution System with details of proposed outages which may affect the performance of the Distribution System, details of trip testing, risks of the trip and other information where known which may affect the security and Stability of the Distribution System</td>
<td>Dates</td>
<td>0 to 52 weeks</td>
</tr>
<tr>
<td><strong>Users</strong> provide the DSO and <strong>Centrally Dispatched Users</strong> provide the TSO with details of proposed outages which may affect the performance of the Distribution System, details of trip testing, risks of the trip and other information where known which may affect the security and Stability of the Distribution System</td>
<td>Dates</td>
<td>Years 1 to 2</td>
</tr>
</tbody>
</table>
SCHEDULE 4(a)

SYSTEM DESIGN INFORMATION

Generators and Major Customers, MV Customers and Centrally Dispatched Users if advised by DSO

DATA DESCRIPTION

Reactive Compensation
- Reactance of any capacity or banks and any series reactors
- Rating of individual shunt reactors (not associated with cables)

Rating of individual capacitor banks
- Details of any automatic control logic such that operating characteristics can be determined.

Point of connection to the system

Lumped Network Susceptance
- Details of the equivalent lumped network susceptance of the User installation referred back to the connection with the Distribution System.

Including:
- shunt reactors which are an integrated part of a cable system and which are not normally in or out of service independent of the cable.

Excluding:
- independently switched reactive compensation connected to the User installation and
- any susceptance of any User installation inherent in the active and reactive Demand.

Fault Infeeds
- Maximum and minimum short circuit infeeds into the system
  - X/R ratio under maximum and minimum short circuit conditions (contribution from rotating Plant)

Equivalent network information at the request of the DSO

Interconnection Impedance
SCHEDULE 4(b)

SYSTEM DESIGN INFORMATION

For Generators and Centrally Dispatched Users Operating in Parallel with the System

DATA DESCRIPTION

Interconnection Impedance:

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Sequence Resistance</td>
<td>%</td>
</tr>
<tr>
<td>Zero Sequence Resistance</td>
<td>%</td>
</tr>
<tr>
<td>Positive Sequence Resistance</td>
<td>%</td>
</tr>
<tr>
<td>Zero Sequence Resistance</td>
<td>%</td>
</tr>
<tr>
<td>Susceptance</td>
<td>%</td>
</tr>
</tbody>
</table>

If the DSO considers that the impedance is low, then more detailed information will be requested.

Circuit Parameters Text / Diagrams
Switchgear Text / Diagrams
Protection Arrangements Text / Diagrams
Protection Settings
Transient Over-voltage Effects
LOAD CHARACTERISTICS
For Generators, Major Customers and Centrally Dispatched Users

<table>
<thead>
<tr>
<th>DATA DESCRIPTION</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of Demand:</td>
<td></td>
</tr>
<tr>
<td>Maximum Active Power Demand</td>
<td>kW</td>
</tr>
<tr>
<td>Maximum and Minimum Reactive Power requirement</td>
<td>kVAr</td>
</tr>
<tr>
<td>Type of Load and Control Arrangements:</td>
<td>Text / Diagram</td>
</tr>
<tr>
<td>Type of starter employed;</td>
<td></td>
</tr>
<tr>
<td>Controlled Rectifiers;</td>
<td></td>
</tr>
<tr>
<td>Large motor drives;</td>
<td></td>
</tr>
<tr>
<td>Maximum load on each phase at the time of maximum Demand</td>
<td>Amp / Phase</td>
</tr>
<tr>
<td>Maximum Phase Unbalance</td>
<td>Amp / Phase</td>
</tr>
<tr>
<td>Maximum Harmonic content</td>
<td>% of Harmonic number</td>
</tr>
<tr>
<td>Fluctuating Loads:</td>
<td></td>
</tr>
<tr>
<td>Rate of change of Active and Reactive Power both increasing and decreasing</td>
<td>W / Sec</td>
</tr>
<tr>
<td>Shortest repetitive time interval between Fluctuation in Active and Reactive Power</td>
<td>Sec</td>
</tr>
<tr>
<td>Largest Step Change in Active and Reactive Power both increasing and decreasing</td>
<td>kW</td>
</tr>
<tr>
<td>Desturbing Loads</td>
<td>Text</td>
</tr>
</tbody>
</table>


SCHEDULE 6

**DSO** standard practice currently requires that, unless otherwise agreed with the **DSO**, the following standards shall apply:

a) **Generation Units**:  
   - For Hydro and Wind: G1, G2, etc.  
   - For thermal: U1, U2, etc.

b) **Generator Transformers**  
   (i.e. transformers for **Generation Unit** production)  
   - at 110kV; T101, T102, etc.

c) **Power Station Transformers**  
   (i.e. dedicated transformers supplying both the generation unit and the **Power Station** auxiliaries from the **HV busbar**)  
   - at 110kV: ST101, ST102, etc.

d) **Unit Transformers**  
   (i.e. transformers supplying auxiliaries of a **Generation Unit**)  
   - UT1, UT2, etc.

e) **Load Transformers**  
   - for 110/38kV: T141, T142, etc.  
   - for 110/20kV: T121, T122, etc.  
   - for 110/11kV and below: T101, T102, etc.

f) **Bus Sections, conventional busbars**  
   - Single Bus: A1, A2, etc.  
   - Double Bus: A1, A2, B1, B2, etc.

g) **Bus sections, ring busbars:**  
   - each section identified by designation of **Plant** and / or apparatus item connected to it.

h) **Bus Couplers**  
   - K1, K2, etc.

i) **Line and cables**  
   - each line or cable at a station identified name of station or stations at the remote end or ends of the line or cable in alphabetical order.

j) **Circuit Breakers**  
   - CB

k) **Main Earth Disconnects**  
   - DE

l) **Line Disconnects**  
   - DL

m) **Busbar Disconnects**  
   - DA, DB, etc.

n) **Coupler Disconnects**  
   - DA, DB, etc.
Glossary and Definitions
DEFINITIONS

In the Distribution Code the following words and expressions shall, unless the subject matter or context otherwise requires or is inconsistent therewith, bear the following meanings:

AC
Alternating Current.

Act
The Electricity Regulation Act 1999.

Active Power
The product of voltage and the in-phase component of alternating current (normally measured in kilowatts (kW) or megawatts (MW)).

Active Power Control
The automatic change in Active Power output from a PPM in a response to an Active Power Control Set-Point received from the TSO.

Active Power Control Mode
A mode of Operation of a Controllable PPM where the Controllable PPM has been instructed by the TSO or DSO as agreed between DSO and TSO, to maintain its Active Power output at the Active Power Control Set-Point.

Active Power Control Set-point
The maximum amount of Active Power in MW, set by the TSO, that the PPM is permitted to export.

Active Power Control Set-Point Ramp Rate
The rate of increase or decrease of Active Power output of a Controllable PPM in response to an Active Power Control Set-Point instruction.

Aggregated Demand Site
A group of Individual Demand Sites represented by a Dispatchable Demand Customer, which together are capable of a Demand Reduction Capability equal to or above 4 MW (and which is therefore subject to Central Dispatch from the TSO). Each Individual Demand Site comprising an Aggregated Demand Site shall be in one currency zone. Unless otherwise specified, information submitted in respect of an Aggregated Demand Site shall always be at an aggregated level.

Authorised Person
Authorised Person means a person who is:

(a) Competent in his/her
  a. knowledge of electricity;
  b. experience of electrical work;
  c. understanding of the installation to be worked on and practical experience of that work;
  d. understanding the hazards which can arise during the work and the precautions to be observed;
  e. ability to recognise at all times whether it is safe to continue working.
(b) Either an employer, a self-employed person, or an employee appointed or selected by the employer or self-employed person, and
(c) Engaged in work or duties incidental to the generation, transformation, conversion, switching, controlling, regulating, rectification, storage, transmission, distribution, provision, measurement or use of electrical energy.

**Automatic Mains Failure Mode**

The operation of Generation Unit(s) at a Customer’s premises where in the event of disconnection, the Generation Unit(s) is(are) enabled and supplies(y) the Customer’s load while not synchronised to the Transmission System or Distribution System. Upon sustained restoration of the connection to the Transmission System or Distribution System for a settable period of time, the Generation Unit(s) synchronise to the Transmission System or Distribution System for a short period of time not exceeding 180 seconds to facilitate the smooth transfer of power prior to shutdown of the Generation Unit(s).

**Available Active Power**

The amount of Active Power that the PPM could produce based on current wind conditions. The Available Active Power shall only differ from the actual Active Power if the PPM has been curtailed, constrained or is operating in a restrictive Frequency Response mode.

**Availability Notice**

A notice to be submitted to the TSO pursuant to SDC1.4.1.1 of the Grid Code.

**AVR**

Automatic Voltage Regulation

**Back-up Protection**

That Protection system which will open a Circuit Breaker or other fault-current interrupting device in the absence of the current Protection Operation of another Protection system.

**Black Start Shutdown**

The procedure necessary for recovery from a total or partial system shutdown.

**Bulk Supply Point**

A point of connection between the Transmission System and the Distribution System or between the Transmission System and a directly connected Customer.

**CCGT Installation**

A collection of Generating Units comprising one or more Combustion Turbine Units and one or more Steam Units where, in normal Operation, the waste heat from the Combustion Turbine Unit is passed to the water/steam System of the associated Steam Units and where the component Generating Units within the CCGT Installation are directly connected by steam or hot gas lines which enable those units to contribute to the efficiency of the combined cycle Operation of the CCGT Installation

**CCGT Unit**

A Generating Unit within a CCGT Installation.

**CENELEC**

European Committee for Electro-technical Standardisation.

**Central Dispatch**

The Dispatch of Users by the TSO.

**Centrally Dispatched Generating Units**

Generating Units subject to Central Dispatch by the TSO.
Centrally Dispatched Users

Users subject to Central Dispatch by the TSO.

Circuit Breaker

A mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also of making, carrying for specified time and breaking currents under specified abnormal circuit conditions, such as those of short circuit.

CHP

The simultaneous production of utilisable heat and electricity from an integrated thermo-dynamic process.

Collector Network:

A geographical area containing a number of PPMs with signed DSO Connection Agreements, where any individual WTG or SG on a PPM site with a signed DSO Connection Agreement is within 1.5 kilometre of any individual WTG or SG on another separate PPM site with a signed DSO Connection Agreement.

A proposed PPM will be deemed to be considered part of a Contiguous Power Park Module Site where any individual WTG or SG on the proposed PPM site is within 1.5 kilometre of any individual WTG or SG on a second PPM site, where that second PPM has a signed DSO Connection Agreement.

Combustion Turbine Unit

A Generating Unit which compresses the inlet air and feeds fuel to the combustion chamber. The fuel and air burn to form hot gases which in turn forces these hot gases into the turbine, causing it to spin. The turbine can be fuelled by natural gas, by distillate or by other such fuels as technology may allow.

Commission for Regulation of Utilities

The Commission for Regulation of Utilities (CRU) previously known as the Commission for Energy Regulation (CER) as established by the Act.

Commissioning

The final process of testing part of a system prior to that part of the system being considered suitable for normal use.

Connection Agreement

An agreement between the DSO and each User setting out terms relating to a connection with the Distribution System.

Connection Point

The physical point at which a User’s Plant or apparatus is joined to the Distribution System.

Contiguous Power Park Module Site

A geographical area containing a number of PPMs with signed DSO Connection Agreements, where any individual WTG or SG n a PPM site with a signed DSO Connection Agreement is within 1.5 kilometre of any individual WTG or SG on another separate PPM site with a signed DSO Connection Agreement.
A proposed PPM will be deemed to be considered part of a Contiguous PPM Site where any individual WTG or SG on the proposed PPM site is within 1.5 kilometre of any individual WTG or SG on a second PPM site, where that second PPM has a signed DSO Connection Agreement.

Control Facility
A location used for the purpose of monitoring, control and Operation of the User's Plant and apparatus.

Controlled Active-Power
The amount of Active Power that a Controllable PPM is permitted to export based on the Active Power Control Set-Point signal sent by the TSO.

Controllable PPM
A site containing at least one WTG or SG can automatically act upon a remote signal from the TSO to change its Active Power output.

Controllable PPM Availability
The amount of MW the Controllable PPM can produce given favourable wind conditions.

Controllable PPM MW Availability Declaration
A measure of the maximum Active Power which can be produced by a Controllable PPM given favourable wind conditions. Account shall be taken of partial and/or full outages of individual WTG or SG within the Controllable PPM.

Customer
A User whose premises is connected to the Distribution System for the purpose of obtaining a supply of electricity at that premises.

Customers with Auto-production
A Customer generating electricity for his or her own use.

DAO Licence
The licence granted to the DAO by the Commission for Energy Regulation now known as the Commission for Regulation of Utilities pursuant to section 14(1)(k) of the Act authorising the DAO to discharge the functions of the Distribution System Asset Owner.

DC
Direct Current

Demand
Unless otherwise stated, the Demand expressed in MW or MVAr of Active Power and Reactive Power respectively.

Demand Profile
The estimated consumption of MW Demand for an Individual Demand Site or aggregated consumption for each individual site which form part of a Aggregated Demand Site for each trading period in the following Optimisation Time Horizon Period and which must be submitted to the TSO in the Availability Notice under SDC1.4.1.2 of the Grid Code.
Demand Reduction

The reduction in MW Demand which can be achieved in one currency zone by a Demand Side Unit or Aggregated Demand Side Unit for each Trading Period in the following Optimisation Time Horizon Period and which must be submitted to the TSO in an Availability Notice under SDC1.4.1.2 of the Grid Code.

Demand Reduction Capability

The reduction capability in MW Demand that can be achieved by the Demand Side Unit.

Demand Side Unit

An individual Demand Reduction site or Aggregated Demand Site with a Demand Reduction Capability of at least 4 MW. The Demand Side Unit shall be subject to Central Dispatch.

Demand Site

A premises owned by a Customer connected to the Distribution System with a Demand Reduction Capability. The Demand Site shall have a Maximum Import Capacity and shall not have a Maximum Export Capacity.

Design Minimum Operating Level (DMOL)

The minimum Active Power output of Controllable PPM where all WTG's are generating electricity and capable of ramping upwards at any of the specified ramp rates (given available wind), and shall not be greater than 12% of Registered Capacity.

Disconnector

A device which provides in the open position a means of disconnecting apparatus from the Distribution System in accordance with specified requirements.

Dispatch

The issue of instructions for Generating Units to achieve specific Active Power and Reactive Power outputs within Registered Data parameter and by stated times.

Dispatchable Demand Customer

A person who operates a Demand Side Unit, with a Demand Reduction Capability not less than 4MW, and is subject to the Distribution Code pursuant to any agreement with the DSO or otherwise.

Distribution Code

This document produced by the DSO pursuant to the DSO Licence.

Distribution Code Review Panel (DCRP) or ‘Panel’

The Panel with the functions set out in DGC7.

EUNC

European Union Network Code

Distribution Data Registration Code (DDRC)

That portion of the Distribution Code which is identified as the Distribution Data Registration Code.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Conditions (DGC)</td>
<td>That portion of the Distribution Code which is identified as the Distribution Operating Code (DOC).</td>
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<td>Distribution Planning Code (DPC)</td>
<td>That portion of the Distribution Code which is identified as the Distribution Planning Code.</td>
</tr>
<tr>
<td>Distribution Connection Code (DCC)</td>
<td>That portion of the Distribution Code which is identified as the Distribution Connection Code.</td>
</tr>
<tr>
<td>Distribution System</td>
<td>The system which consists of electric lines, electric Plant, transformers and switchgear and which is used for conveying electricity to final Customers.</td>
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<tr>
<td>Distribution System Asset Owner (DAO)</td>
<td>ESB Networks Ltd. in its capacity as the licensed owner of the Distribution System under its Distribution System Owner Licence.</td>
</tr>
<tr>
<td>Distribution System Operator (DSO)</td>
<td>ESB Networks Ltd. in its capacity as the licensed operator responsible for the ownership, Maintenance and development of the Distribution System under its DSO Licence.</td>
</tr>
<tr>
<td>Distribution Use of System (DUoS)</td>
<td>The agreement between the DSO and Suppliers for transport of electricity Agreement from the Transmission System or Generators and Centrally Dispatched Users through the Distribution System to Customers.</td>
</tr>
<tr>
<td>Disturbing Loads</td>
<td>Loads which have the potential to introduce Harmonics, Flicker or Unbalance into the system.</td>
</tr>
<tr>
<td>DSO Licence</td>
<td>The Licence granted to the DSO by the Commission for Energy Regulation now known as the Commission for Regulation of Utilities pursuant to section 14(1)(g) of the Act authorising the DSO to discharge the functions of the Distribution System Operator.</td>
</tr>
<tr>
<td>Earthing</td>
<td>A way of providing a connection between conductors and earth by an Earthing Device.</td>
</tr>
<tr>
<td>Earthing Device</td>
<td>A means of providing a connection between a conductor and earth of adequate strength and capability for the intended purpose.</td>
</tr>
<tr>
<td>Equipment</td>
<td>Plant and / or apparatus.</td>
</tr>
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</table>
ESB

Electricity Supply Board, a statutory corporation and licensed owner of the Transmission System and the Distribution System

ESB Networks Limited

The Distribution System Operator (DSO) and wholly owned subsidiary of ESB established in accordance with Statutory Instrument No. 280 of 2008 (European Communities (Internal Market in Electricity) (Electricity Supply Board) Regulations, 2008) to have responsibility for operating the Distribution System.

ESB Networks Electrical Safety Rules

A document prepared by ESB Networks Ltd. and entitled ‘ESB Networks Electrical Safety Rules’.

ESI

Electricity Supply Industry.

ETCI

Electro Technical Council of Ireland

Event

An unscheduled or unplanned occurrence on or relating to a system including, without limiting that general description, faults, incidents and breakdowns.

Fault level

Prospective current that would flow into a short circuit at a stated point on the system and which may be expressed in kA or, if referred to a particular voltage, in MVA.

Flicker

Impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.

Frequency

The number of alternating current cycles per second, expressed in Hertz at which the system normally operates, i.e. 50 Hertz.

Frequency Response

The automatic adjustment of Active Power output from a Generation Unit(s) in response to Frequency changes.

Frequency Response System

A facility providing the means to automatically adjust the Active Power output from a Generation Unit(s) in response to changes in Frequency.

Frequency Response Ramp Rate

The minimum rate of increase or decrease of Active Power output of a Controllable PPM when acting to control System Frequency

Generating Plant

A Power Station including any Generating Unit therein.

Generating Unit

Any apparatus which produces electricity.

Generator

A person who generates electricity under Licence or exemption under the Act.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td><strong>Good Industry Practice</strong></td>
<td>The standard of practice attained by exercising that degree of skill, diligence, prudence and foresight which would reasonably and ordinarily be expected from a skilled and experienced operator engaged in the same type of undertaking under the same or similar circumstances.</td>
</tr>
<tr>
<td><strong>Governor Droop</strong></td>
<td>The percentage drop in the <strong>Frequency</strong> that would cause the <strong>Generation Unit</strong> under free governor action to change its output from zero to its full <strong>Capacity</strong>. In the case of a <strong>Controllable PPM</strong>, it is the percentage drop in the <strong>Frequency</strong> that would cause the <strong>Controllable PPM</strong> to increase its output from zero to its full <strong>Registered Capacity</strong>.</td>
</tr>
<tr>
<td><strong>Grid Code</strong></td>
<td>The code produced by EirGrid pursuant to the <strong>Act</strong> and any amendments thereto.</td>
</tr>
<tr>
<td><strong>Grid Connected</strong></td>
<td>Any <strong>Plant</strong> or apparatus connected to the <strong>Transmission System</strong> is referred to as being <strong>Grid Connected</strong>.</td>
</tr>
<tr>
<td><strong>Harmonics</strong></td>
<td>Sinusoidal currents with a <strong>Frequency</strong> equal to an integer multiple of the fundamental <strong>Frequency</strong> of the connection voltage.</td>
</tr>
<tr>
<td><strong>High Voltage (HV)</strong></td>
<td>A voltage, used for the supply of electricity, whose lower limit of nominal RMS value is greater than 35kV.</td>
</tr>
<tr>
<td><strong>IEC</strong></td>
<td>International Electro-technical Commission.</td>
</tr>
<tr>
<td><strong>Individual Demand Site</strong></td>
<td>A single premises of a <strong>Demand Customer</strong> connected to the <strong>Distribution System</strong> with a <strong>Demand Reduction Capability</strong>. The <strong>Individual Demand Site</strong> shall have a Maximum Import Capacity and shall not have a Maximum Export Capacity.</td>
</tr>
<tr>
<td><strong>Initial Demand Reduction</strong></td>
<td>The <strong>Demand Reduction</strong> of a <strong>Demand Side Unit</strong> following a <strong>Dispatch Instruction</strong> from the <strong>TSO</strong> when the <strong>Demand Reduction</strong> is at 0 <strong>MW</strong> for a period greater than 24 Hours</td>
</tr>
<tr>
<td><strong>Initial Demand Reduction Time</strong></td>
<td>The time as specified by the <strong>Dispatchable Demand Customer</strong> in the Technical Parameters and is the time it takes for the <strong>Dispatchable Demand Customer</strong> to be able to implement the <strong>Initial Demand Reduction</strong> from receipt of the <strong>Dispatch Instruction</strong> from the <strong>TSO</strong>.</td>
</tr>
<tr>
<td><strong>Inter-jurisdictional Tie-lines</strong></td>
<td>The lines, facilities and <strong>Equipment</strong> that connect the <strong>Transmission System</strong> of the Republic of Ireland to the <strong>Transmission System</strong> of Northern Ireland.</td>
</tr>
<tr>
<td><strong>Isolated</strong></td>
<td>Disconnected from associated <strong>Equipment</strong> by a <strong>Disconnector</strong> or adequate physical separation.</td>
</tr>
<tr>
<td><strong>kVA</strong></td>
<td>Kilo Volt-Amp</td>
</tr>
</tbody>
</table>
Low Voltage (LV) A voltage, used for the supply of electricity, whose upper limit of nominal RMS value is 1kV.

Lopping Mode (Peak Lopping) The operation of Generation Unit(s) at a Customer’s premises where the Generation Unit(s) supplies the Customer’s demand while not synchronised to the Transmission System or Distribution System. The Generation Unit(s) is(are) synchronised to the Transmission System or Distribution System for short periods of time not exceeding 180 seconds at start-up and shutdown of the Generation Unit(s) to facilitate a smooth transfer of power.

Maintenance The inspection, testing, servicing and repair of electrical apparatus, plant and associated ancillary equipment as per S.I. No.299 of 2007 Safety Health and Welfare at Work (General Application) Regulation 2007.

Major Customer A Customer who is connected to the Distribution System at High Voltage (voltage greater than 35kV).

Maximum Down Time The maximum period of time during which Demand Reduction at a Demand Side Unit can be Dispatched.

Max Ramp Down Rate The Maximum Ramp Down Rate of a Demand Side Unit. In the case of a Demand Side Unit which consists of an Aggregated Demand Site this shall be the aggregated Maximum Ramp Down Rate of the Individual Demand Sites.

Max Ramp Up Rate The Maximum Ramp Up Rate of a Demand Side Unit. In the case of a Demand Side Unit which consists of an Aggregated Demand Site this shall be the aggregated Maximum Ramp Up Rate of the Individual Demand Sites.

Medium Voltage (MV) A voltage, used for the supply of electricity, whose nominal RMS value lies between 1kV and 35kV.

Meteorological Mast A device erected at the PPM site which has the capability measure representative wind speed, wind direction, air temperature and air pressure to a degree of accuracy corresponding to the appropriate prevailing European Standard at that time.

Metering Point Has the meaning given to that term in the Registration Agreement.

Minimum Down Time The minimum period of time during which Demand Reduction at a Demand Side Unit can be dispatched.

MVA Mega Volt-Amp

MVAr Mega Volt-Amp reactive (1,000,000 vars).
MW  Mega Watt (1,000,000 watts).

National Control Centre (NCC)  The TSO’s National Control Centre, as notified by the TSO to the Generator from time to time.

Operating Reserve  The additional MW output required from Generating Units (or Demand Reduction) which must be realisable in real time Operation to contain and correct any potential Total System Frequency deviation to an acceptable level. It will include Primary Operating Reserve, Secondary Operating Reserve and Tertiary Operating Reserve.

Operation  A scheduled or planned action carried out on a system.

Operational Effect  Any Operation which causes the Transmission System or the Distribution System, or the system of other Users, to operate (or be at a materially increased risk of operating) differently from the way in which they would or may have operated in the absence of such effect.

Ownership Boundary  The boundary between the Distribution System and Equipment owned by the User.

Point of Common Coupling (PCC)  The point on the Distribution System which is electrically nearest to the Connection Point and from which other Customers’ loads are, or may be, connected.

Planned Outage  An outage of Generating Plant or of part of the Transmission System or of part of the Distribution System other than a forced outage.

Plant  Fixed and movable items used in the generation and / or supply and / or transmission of electricity other than apparatus.

Power Park Module (PPM)  A unit or ensemble of units generating electricity, which is either non-synchronously connected to the network or connected through power electronics, and that also has a single connection point to the, distribution system. For avoidance of doubt, a Wind Farm Power Station (WFPS) or Solar Farm Power Station (SFPS), are considered to be a PPM. A PPM will comprise at least one WTG or SG.

Power Park Module Availability  The amount of MW the PPM can produce given favourable wind conditions. A measure of the maximum Active Power output which can be produced by a MW availability declaration PPM given favourable wind conditions. Account shall be taken of partial and / or full outages of individual Generating Unit within the PPM.
Power Park Module Operator  The operator of the PPM

Power Station  An installation consisting of Generating Unit(s)

Primary Operating Reserve (POR)  The additional MW output (and / or reduction in Demand) required at the Frequency nadir (minimum), compared to the pre-incident output (or Demand) where the nadir occurs between 5 and 15 seconds after an Event. If the actual Frequency nadir is before 5 seconds or after 15 seconds after the Event, then for the purpose of POR monitoring the nadir is deemed to be the lowest Frequency which occurred between 5 and 15 seconds after the Event.

Protection  The provisions for detecting abnormal conditions in a system and initiating fault clearance or actuating signals or indications.

Rate of Change of Frequency  The rate of increase or decrease of Frequency as measured at the User's Connection Point over the time period as set out in DCC10.10.1.1(d)

Reactive Power  The product of voltage, current and the sine of the phase angle between them which is normally measured in kilovars (kVAr) or megavars (MVAr).

Registered Capacity  The maximum capacity, expressed to the nearest 0.1 MW, that a Generating Unit is capable of delivering on a sustained operational basis at the Connection Point, or could deliver if not otherwise restricted by terms agreed with the Distribution System Operator, without accelerated loss of equipment life. This shall be the value at 10°C, 70 % relative humidity and 1013 hPa. For the avoidance of doubt, this applies to all Generating Units on the Distribution System, including Centrally Dispatched Generating Units and Controllable PPM under the dispatch or control of the TSO.

Registered Data  Data referred to in the schedules to the Data Distribution Registration Code.

Remote Terminal Unit (RTU)  A device that collects, codes and transmits data. An RTU collects information from a master device and implements processes that are directed by that master. RTU's are equipped with input channels for sensing or metering, output channels for control, indication or alarms and a communications port.

Resource Following Mode  A mode of Operation of a Controllable PPM where the system Frequency is within normal range and the Controllable PPM is not under Active Power Control by the TSO, allowing the Controllable PPM to produce up to 100% of its Available Active Power, depending on the power-frequency curve in Operation. When operating on power-frequency curve 2, the Controllable PPM is required
to maintain its **Active Power** output at a fixed percentage of its **Available Active Power** when **Transmission System Frequency** is within the range $F_B - F_C$.

**Resource Following**

**Ramp Rate**

The maximum rate of increase of **Active Power** output of a **Controllable PPM** in response to an increase in the resource of the **Generating Unit**.

**Rise Time**

In relation to reactive current response from **Controllable PPM**, it is the length of time from fault inception for reactive current to reach 90% of its steady-state value.

**Safety Management**

The procedure adopted by the **DSO** or a **User** to ensure the safe **Operation** of its system and the safety of personnel required to work on that system.

**Safety Procedures**

The procedures specified within a **Safety Management** system.

**SCADA**

Supervisory Control and Data Acquisition

**Scheduling**

The procedure for determining intended usage of **Generating Plant**.

**Secondary Frequency Regulation Systems (SFRS)**

A control system installed between the **NCC** and a **Power Station** whereby **MW** set points can be adjusted remotely by the **TSO** to reflect the **Dispatch Instruction**.

**Secondary Operating Reserve (SOR)**

The additional **MW** output (and/or reduction in **Demand**) required compared to the pre-incident output (or **Demand**), which is fully available by 15 seconds from the time of the start of the **Frequency** fall and sustainable up to 90 seconds following an **Event**.

**Settling Time:**

In relation to reactive current response from **Controllable PPM**, it is the length of time from Fault Inception for reactive current to settle within $\pm 10\%$ of its steady-state value.

**SFRS Control Range**

The range of loads over which **SFRS** may be applied.

**SFRS Maximum Load**

The upper limit of the **SFRS Control Range**

**SFRS Minimum Load**

The lower limit of the **SFRS Control Range**.

**Single Electricity Market (SEM)**

The wholesale all-island **Single Electricity Market** established and governed pursuant to the relevant legislation and the Trading and Settlement Code

**Significant Incident**

**Events** which have had or may have an **Operational Effect** on the **Transmission** or **Distribution System** or a **User’s** installation.
Solar Farm Power Station (SFPS)  A site containing at least one SG. For avoidance of doubt, a Solar Farm Power Station is considered to be a Power Park Module.

Solar Generator (SG)  A Generating Unit which generates electricity from photo-voltaic or other solar technology, which forms an indivisible unit for the purposes of implementation of control functions. It would typically comprise an Inverter Block, with which the Solar Farm Power Station controller would interact.

Steam Unit  A Generating Unit whose prime mover converts the heat-energy in steam to mechanical energy.

Step Change  A Step Change is defined as a single, rapid change of the RMS voltage. Distribution System voltage Step Changes can occur due to switching in and out of capacitors, lines, cables, transformers and other Plant.

Stable / Stability:  A Generation Unit is adjudged to be Stable if the various machine states and variables, including but not limited to rotor angle, Active Power output, and Reactive Power output, do not exhibit persistent or poorly damped oscillatory behaviour, when the Generation Unit is subjected to a fault disturbance or other transient Event on the Distribution System.

Superimposed Signals  Those electrical signals carried on a Distribution System for the purposes of information transfer.

Supplier  A person authorised by licence under section 14(1)(b), (c) or (d) or Section 14(2) of the Act to supply electricity to the Connection Point under a supply agreement.

System Stability  The state of the system whereby predicted changes in load and generation can be accommodated without any detrimental effect on the system.

System Tests  Those tests which involve simulating conditions or the controlled application of irregular, unusual or extreme conditions on the Total System or any part of it, but not including routine testing, Commissioning or recommissioning tests.

TAO Licence  The licence granted to the TAO by the Commission for Energy Regulation now known as the Commission for Regulation of Utilities pursuant to section 14(1)(f) of the Act authorising the TAO to discharge the functions of the Transmission System Owner.

Tertiary Operating Reserve Band 1 (TOR1)  The additional MW output (and / or reduction in Demand) required compared to the pre-incident output (or Demand), which is fully available and sustainable from 90 seconds to 5 minutes following an Event.
Tertiary Operating Reserve
Band 2 (TOR2) The additional MW output (and / or reduction in Demand) required compared to the pre-incident output (or Demand), which is fully available and sustainable from 5 minutes to 20 minutes following an Event

Total System The Transmission System, Distribution System and all User systems within the Republic of Ireland

TN-C-S A system of Earthing as described in the National Rules for Electrical Installations (RT101) published by the ETCI.

Transmission System The system which consists wholly or mainly of High Voltage lines and electric Plant and which is used for conveying electricity from a generating station to a substation, from one generating station to another, or to any interconnector or to a final Customer but shall not include any such lines which the board may, from time to time, with the approval of the Commission for Regulation of Utilities, specify as being part of the Distribution System.

Transmission System Asset Owner (TAO) ESB in its capacity as licensed owner of Transmission System under its TAO Licence.

Transmission System Operator (TSO) EirGrid in its capacity as licensed operator of the Transmission System under its TSO Licence.

Transmission System Disturbance Any type of fault including, but not limited to, single line to ground, line to line and three-phase short-circuits, in any single item of Plant anywhere in the Transmission System where the Operation of the TSO Protection will not disconnect the Generator Plant from the existing or planned Transmission System under normal or scheduled outages conditions. For the avoidance of doubt this fault disturbance can include bus zone Protection.

TSO Licence The licence granted to the TSO by the Commission for Energy Regulation now known as the Commission for Regulation of Utilities pursuant to section 14(1)(e) of the Act authorising the TSO to discharge the function of the Transmission System Operator.

TSO Telecommunication Interface Cabinet The physical interface point between the TSO's telecommunications Equipment and the PPM's control Equipment.

Unbalance (see Voltage Unbalance).
User

A term used in various sections of the Distribution Code to refer to the persons using the Distribution System, more particularly identified in each section of the Distribution Code.

Voltage Dip

This is a short-duration reduction in phase to phase voltage on any or all phases, resulting in voltages outside the ranges as specified in Table 6A, and more generally, bus voltages or terminal voltages of less than 90% of nominal voltage on any or all phases. Percentage Voltage Dip shall be calculated with respect to nominal voltage.

Voltage Fluctuations

A series of rapid voltage changes which may be regular or irregular.

Voltage Reduction

The method to temporarily control Demand by reduction of system voltage.

Voltage Regulation

The automatic adjustment of Reactive Power output from a Generation Unit(s) in response to voltage changes.

Voltage Regulation Set-Point

The voltage in kV that the Voltage Regulation System will act to regulate by continuous modulation of the PPM’s Reactive Power.

Voltage Regulation System

A facility providing the means to automatically adjust the Reactive Power output from a Generation Unit(s) in response to changes in voltage.

Voltage Regulation System Slope Setting

The percentage change in Distribution System voltage that would cause the Reactive Power output of the Controllable PPM to vary from maximum MVar production capability of Q/Pmax of 0.33 to maximum MVar absorption capability of Q/Pmax of -0.33 or vice-versa, as per Figure 13.

Voltage Unbalance

In three-phase networks condition in which the RMS values of the phase voltages or the phase angles between consecutive phases are not equal.

PPM Control System

The control system at the PPM which provides for Active Power Control, Frequency Response, ramp rate control and other WTG or SG control features.

Wind Farm Power Station (WFPS)

A site containing at least one WTG.

Wind Turbine Generator (WTG)

A Generation Unit(s) generating electricity from wind
**Supplementary Publications**

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### DISTRIBUTION CODE DEROGATION – APPLICATION FORM

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<td></td>
<td></td>
<td>(to be assigned by Distribution Code Review Panel (DCRP) Secretary)</td>
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</tbody>
</table>

#### Contact Details for Derogation Applicant

- **Name:**
- **Telephone Number:**
- **E-mail address:**

#### DISTRIBUTION CODE Clause for which derogation is sought:

#### PLANT / APPARATUS for which derogation is sought:

#### EXTENT OF NON-COMPLIANCE:

#### REASON FOR NON-COMPLIANCE:

#### LENGTH OF TIME FOR WHICH DEROGATION IS SOUGHT:

#### PROPOSAL FOR REMEDYING NON-COMPLIANCE:

(MILESTONES FOR REMEDYING NON-COMPLIANCE, COSTS, RISK FACTORS THAT MAY DELAY COMPLIANCE ETC.)

#### DETAILS OF SUPPORTING DOCUMENTATION FOR APPLICATION (IF ANY) ATTACHED

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Please return this form to the Review Panel Secretary by E-mail: DistCodePanel@mail.esb.ie