Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

الشركة العُمانية لنقل الكهرباء ش.م.ع.م
OMAN ELECTRICITY TRANSMISSION COMPANY S.A.O.C
إحدى شركات مجموعة نماء
Member of Nama Group

GCRP
GRID CODE REVIEW PANEL
مجلس مراجعة قواعد الشبكة

The Grid Code

.

Version-3.0 August 2020

The Grid Code Contents

Oman Electricity Transmission Company S.A.O.G.

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The Grid Code

Preface and General Conditions

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The Preface to the Grid Code for Oman

This preface is not a formal part of the **Grid Code**, but is solely intended to provide readers of the **Code** with the context and overview of the **Code** and to state its legal background. If there is conflict between any section of the **Grid Code** and this Preface, the words used in the **Grid Code** shall determine the meaning.

This document is the **Grid Code** referred to in the Sector Law [(Articles 22 & 23)] and the Transmission and Dispatch **Licence** granted by the **Regulatory Authority** to the Oman Electricity Transmission Company SAOC ("**OETC**") under that Law. It contains rules in relation to the planning, development, **Connection** to, **Operation** and maintenance of and changes to **OETC's Transmission System**.

The **Grid Code** applies to all entities that are **Connected** to and/or use the **Transmission System**. However, individual parts of the **Grid Code** may be applicable to only some parties who have acceded to the **Grid Code** as a whole. Each constituent part of the **Grid Code** specifies which **Person** it applies to.

The **Oman Electricity Market** is governed by the **Market Rules Document**. Consistency between the **Grid Code** and the **Market Rules Document** shall be maintained at all times

OETC has policies and procedures needed to develop and **Operate** the **System** which documents deal with a range of issues not primarily concerning the interface with **Users**. These are not part of, or controlled by, the **Grid Code** but should be drafted so as not to conflict with the intent of the **Grid Code**.

Terms and expressions used in the **Grid Code** are defined either in the relevant section of the **Grid Code** entitled "Abbreviations and Definitions" or, in some cases, in individual **Grid Code** sections.

The **Grid Code** contains the following constituent parts;

- **General Conditions;**
- **Data Transfer Code;**
- **Planning Code;**
- **Connection Conditions Code** including Schedules**;**
- **Operating Codes;**
  - **OC 1 Demand Forecasting;**
  - **OC 2 Operational Planning;**
  - **OC 3 Operating Margin;**
  - **OC 4 Demand Control;**
  - **OC 5 Notice of Operations & Incidents, & Significant Incident Reporting;**
  - **OC 6 Safety Coordination;**
  - **OC 7 Contingency Planning;**
  - **OC 8 Numbering and Nomenclature of HV Plant;**
  - **OC 9 Operational Tests & Site Investigations;**
  - **ASC Alerts Summary Code;**
- **Scheduling and Dispatch Codes;**
  - **SDC 1 Generation and Desalination Scheduling;**

- **SDC 2 Generation and Desalination Dispatch;**
- **SDC 3 Frequency Control;**

- **Ancillary Services Code;**
- **Metering and Data Exchange Code;**
- **Glossary**

This **Grid Code** shall not constitute a contract between any of the parties to it. All **Licensees** (including **OETC**, **Licensed Generators**, **Licensed Generators / Desalinators**, **Licensed Distribution System Operators** and **RAEC** when **Connected** to the **Transmission System**) will be party to it, as will other parties **Connected** to the **Transmission System**. Some of these parties may have contractual obligations, created by separate documents (including **Connection Agreements**), to each other to comply with the **Grid Code**.

Nothing in this **Grid Code** shall entitle any party to it or any other **Person** to any contractual or other general law right or remedy of whatsoever kind and howsoever arising in respect of this **Grid Code**. Each party's liability to each other party shall be limited to one (1) Omani Rial.

However, nothing in this **Grid Code** (including this paragraph) shall affect any legal right or remedy that may exist between any two parties to this **Grid Code** under any such separate agreement between or any duty arising under the terms of any **Licence** granted pursuant to the **Sector Law** being the law promulgated by Royal Decree (78/2004). In particular, nothing in this **Grid Code** shall preclude the **Regulatory Authority** from taking such enforcement action in relation to it, the **Sector Law** or any **Licence** granted thereunder as it sees fit.

Each party to this **Grid Code** shall at all times deal with all other parties in good faith. All parties to the **Grid Code** shall at all times perform all of their obligations in accordance with **Good Industry Practice**.

General Conditions

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General Conditions

GC 1 Introduction

The individual sections of the **Grid Code** contain the rules and provisions relating specifically to that individual section of the **Grid Code**. There are also provisions of a more general application, which need to be included in the **Grid Code** to allow the various sections of the **Grid Code** to work together. Such provisions are included in these **General Conditions**.

GC 2 Objective

The objectives of the **General Conditions** are as follows:

- To ensure, insofar as it is possible, that the various sections of the **Grid Code** work together for the benefit of **OETC** and all **Users**; and
- To provide a set of principles governing the status and development of the **Grid Code** and related issues as approved by the **Regulatory Authority**.

GC 3 Scope

The General Conditions apply to **OETC** and to all Parties to the **Grid Code**.

GC 4 Grid Code Review Panel

OETC shall establish and maintain the **Grid Code Review Panel**, which shall be a standing body, constituted;

- to generally review, discuss and develop the **Grid Code** and its implementation;
- to review and discuss suggestions for amendments to the **Grid Code** which **OETC**, the **Regulatory Authority** or any **User** may wish to submit to **OETC** for consideration from time to time;
- to discuss what changes are necessary to the **Grid Code** arising out of any unforeseen circumstances referred to it by **OETC** ;
- to review existing Oman Electrical Standards relevant to **OETC**'s **Transmission System** and make recommendations to the **Regulatory Authority** concerning modifications to existing **Oman Electrical Standards** or proposals for new **Oman Electrical Standards** relevant to **OETC**'s **Transmission System**;
- to publish recommendations and ensure that **User** consultation upon such recommendations has occurred through **Members**; and
- Issue guidance in relation to the **Grid Code** and its implementation, performance and interpretation when asked to by a **User**.

The **Grid Code Review Panel** shall be governed by a constitution (given as Appendix A) which defines its scope, membership, duties, and rules of conduct, operation and further development of the **Grid Code** as approved by the **Regulatory Authority**.

The **Panel** shall consist of

- a **Chairperson** and up to 2 persons representing **OETC**;
- 1 person representing the **Regulatory Authority**;
- 1 person representing **the Power Procurer**;
- 1 person representing the **Market Operator;**
- 1 person representing **PAW**;
- 4 persons representing **Power Producers**;
- 1 person representing each **Licensed Distributor**;
- 2 persons representing **Internally Interconnected Parties** and **Directly Connected Customers**;
- 1 person representing **RAEC**.

GC 5 Grid Code revisions

All revisions to the **Grid Code** must be reviewed by the **Grid Code Review Panel** prior to application to the **Regulatory Authority** by the **Chairperson**. All proposed revisions from **Users**, the **Regulatory Authority** or **OETC** shall be brought before the **Grid Code Review Panel** by the **Chairperson** for consideration. The **Chairperson** will advise the **Grid Code Review Panel**, all **Users**, and the **Regulatory Authority** of all proposed revisions to the **Grid Code** with notice of no less than 20 **Business Days** in advance of the next scheduled meeting of the **Grid Code Review Panel**.

Following review of a proposed revision by the **Grid Code Review Panel**, the **Chairperson** will apply to the **Regulatory Authority** for revision of the **Grid Code** based on the **Grid Code Review Panel**'s recommendation. The **Chairperson**, in applying to the **Regulatory Authority**, shall also notify each **User** of the proposed revision and other views expressed by the **Grid Code Review Panel** and **Users** so that each **User** may consider making representations directly to the **Regulatory Authority** regarding the proposed revision.

The **Regulatory Authority** shall consider the proposed revision, other views, and any further representations and shall determine whether the proposed revision should be made and, if so, whether in the form proposed or in an amended form.

Having been so directed by the **Regulatory Authority** that the revision shall be made, either as submitted or in amended form, the **Chairperson** shall notify each **User** of the revision at least 10 **Business Days** prior to the revision taking effect, and the revision shall take effect (and this **Grid Code** shall be deemed to be amended accordingly) from (and including) the date specified in such notification or other such date as directed by the **Regulatory Authority**.

GC 6 Derogations

If a **User** finds that it is, or will be, unable to comply with any provision of the **Grid Code**, then it shall, without delay, report such non-compliance to **OETC** and the **Regulatory Authority** and shall make such reasonable efforts as are required to remedy such non-compliance as soon as reasonably practicable. Non-compliance may result

- with reference to **Plant Connected** to the **Transmission System** and is caused solely or mainly as a result of a revision to the **Grid Code**; and
- with reference to **Plant** which is **Connected,** approved to **Connect** or for which approval to **Connect** to the **Transmission System** is being sought.

When a **User** believes either that it would be unreasonable (including on the grounds of 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 **Regulatory Authority** a request for derogation from such provision and shall provide **OETC** and in the case of **Users** holding a form of contract with **PWP** (for example a **PPA**), **PWP** with a copy of such application.

If **OETC** finds that it is, or will be, unable to comply with any provision of the **Grid Code** at any time, then it shall make such reasonable efforts as are required to remedy such non-compliance as soon as reasonably practicable.

In the case where **OETC** and / or a **User** requests derogation, the party or parties requesting derogation shall submit the information set out in paragraph **GC 6.**1 to the **Regulatory Authority**.

GC 6.1 Requests for Derogation

A request for derogation from any provision of the **Grid Code** shall contain:

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

b) the detail of the **Plant** in respect of which derogation is sought and, if relevant, the nature and extent of non-compliance;

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

d) the reason for the non-compliance;

e) the date by which compliance could be achieved (if remedy of the non-compliance is possible).

On receipt of any request for derogation, the **Regulatory Authority** shall promptly consider such a request. Provided that the **Regulatory Authority** considers that the grounds for the derogation are reasonable, the **Regulatory Authority** shall grant such derogation unless the derogation would, or is likely to:

- have a material adverse impact on the security and/or stability of the **Total System**; or
- impose unreasonable costs on the **Operation** of the **Total System** or on other **Users**.

In its consideration of a derogation request by a **User**, the **Regulatory Authority** may contact the relevant **User** and/or **OETC** to obtain clarification of the request or to discuss changes to the request.

Derogations from any provision of the **Grid Code** shall contain:

i) the reference number and the date of the **Grid Code** provision against which the derogation applies;

ii) the detail of the **Plant** in respect of which a derogation applies and, if relevant, the nature and extent to which the derogation applies including alternative compliance provisions;

iii) the identification of the provision to which the derogation applies;

iv) the reason for the non-compliance requiring derogation; and

v) the date by which the derogation shall expire

To the extent of any derogation granted in accordance with this paragraph **GC 6**.1, **OETC** and/or the **User** (as the case may be) shall be relieved from any obligation to comply with the applicable provision of the **Grid Code** and shall not be liable for failure to so comply but shall comply with any alternative provisions identified in the derogation.

OETC shall:

a) keep a register of all derogations which have been granted, identifying the name of OETC, person and User in respect of whom the derogation has been granted, the relevant provision of the Grid 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.

The **Regulatory Authority** may initiate, at the request of **OETC** or **Users,** a review of any existing derogations, and any derogations under consideration where a relevant and material change in circumstance has occurred.

GC 7 Unforeseen Circumstances

If circumstances arise which the provisions of the **Grid Code** have not foreseen, **OETC** shall to the extent reasonably practicable in the circumstances, consult all affected **Users** in an effort to reach agreement as to what should be done and submit a proposal to the **Grid Code Review Panel** for consideration.

If **OETC** and affected **Users** are not able to agree, **OETC** will take any action necessary to ensure that it meets its **Licence** conditions wherever practical taking into account the views expressed by the **Users**.

Thereafter, **OETC** shall refer the matter relating to the unforeseen circumstances and any such determinations to the **Grid Code Review Panel** with a proposal for consideration.

GC 8 Hierarchy

In the event of any irreconcilable conflict between the provisions of the **Grid Code** and any contract, agreement, or arrangement between **OETC** and a **User** the provisions of the **Grid Code** shall prevail unless the **Grid Code** expressly provides otherwise.

OETC and the **Market Operator** shall maintain consistency between the **Grid Code** and the **Market Rules** as mandated by their Licences, including any directions issued by the **Regulatory Authority**. However, In the event of any irreconcilable conflict between the provisions of the **Grid Code** and the

Market Rules, the provisions of the **Grid Code** shall prevail unless the **Grid Code** expressly provides otherwise.

GC 9 Illegality and Partial Invalidity

If any provision of the **Grid Code** should be found to be unlawful or wholly or partially invalid for any reason, the validity of all remaining provisions of the **Grid Code** shall not be affected.

If part of a provision of the **Grid Code** is found to be unlawful or invalid but the rest of such provision would remain valid if part of the wording were deleted, the provision shall apply with such minimum modification as may be:

a) necessary to make it valid and effective; and

b) most closely achieves the result of the original wording, but without affecting the meaning or validity of any other provision of the **Grid Code**. **OETC** shall prepare a proposal to correct the default for consideration by the **Grid Code Review Panel**.

GC 10 Time of Effectiveness

This **Grid Code** shall have effect, as regards a new **User**, at the time at which its **Connection Agreement** comes into effect.

GC 11 Code Notices

Any notice to be given under the **Grid Code** shall be in writing and shall be duly given if signed by or on behalf of a **Person** duly authorised to do so by the party giving the notice and delivered by hand at, or sent by post, or facsimile transmission or e-mail to the relevant address, facsimile number or e-mail address last established pursuant to these General Conditions.

OETC shall maintain a list of contact details for itself and all **Users** containing the telephone, facsimile, e-mail and postal addresses for all **Users**. **OETC** shall provide these details to any **User** in respect of any other **User** as soon as practicable after receiving a request.

Both **OETC** and all **Users** shall be entitled to amend in any respect their contact details previously supplied and **OETC** shall keep the list up to date accordingly.

Any notice required to be given by this **Grid Code** shall be deemed to have been given or received:

- if sent by hand, at the time of delivery;
- if sent by post, from and to any address within Oman, 4 **Business Days** after posting unless otherwise proven; or
- if sent by facsimile, subject to confirmation of uninterrupted transmission report, or by e-mail, one hour after being sent, provided that any transmission sent after 14:00 hours on any day shall be deemed to have been received at 8:00 hours on the following **Business Day** unless the contrary is shown to be the case.

GC 12 Code Disputes

If any dispute arises between **Users** or between **OETC** and any **User** in relation to this **Grid Code**, either party may by notice to the other seek to resolve the dispute by negotiation in good faith.

If the parties fail to resolve any dispute by such negotiations within 14 days of the giving of a notice under the previous paragraph then:

a) either party shall be entitled by written notice to the other to require the dispute to be referred to a meeting of members of the boards of directors of the parties or, if no such directors are present in Oman, the most senior executive of each party present in Oman;

b) if either party exercises its right under the sub-clause 12(a) each party shall procure that the relevant senior executives consider the matter in dispute and meet with senior executives of the other party within 14 days of receipt of the written notice of referral to attempt to reach agreement on the matter in question; or

c) if the parties fail to resolve any dispute which has been referred to directors/senior executives under the sub-clause 12(a), either party may refer the matter to the **Regulatory Authority** for determination as the **Regulatory Authority** sees fit. All parties shall be bound by any decision of the **Regulatory Authority**. If it sees fit the **Regulatory Authority** may:

- determine the dispute itself; or
- refer the dispute for determination by arbitration.

If the dispute is referred by the **Regulatory Authority** to arbitration, the **Regulatory Authority** shall serve a written notice on the parties to the dispute to that effect and the Rules of Conciliation and Arbitration of the International Chamber of Commerce (the "ICC Rules") shall govern such arbitration save to the extent that the same are inconsistent with the express provisions of the **Grid Code**.

Any arbitration conducted in accordance with the preceding paragraph shall be conducted;

a) in the city of Muscat in Oman;

b) in English; and

c) by a panel comprising an odd number of arbitrators provided that:

(i) there shall be not fewer than three arbitrators;

(ii) each of the parties to the dispute shall appoint an arbitrator; and

(iii) the Regulatory Authority shall appoint:

- one arbitrator if there is an even number of parties to the dispute (in which case, the Regulatory Authority's appointee shall act as Chairperson of the panel) or
- two arbitrators if there is an uneven number of parties to the dispute (in which case the Regulatory Authority shall nominate one of its appointees to act as Chairperson of the panel).

Where the **Grid Code** provides that any dispute or difference of the parties in relation to a particular matter should be referred to an expert for resolution, such difference or dispute may not be referred to arbitration unless and until such expert determination has been sought and obtained.

The **Regulatory Authority** shall have the right to require that all disputes which are referred to it in accordance with paragraph **GC** 12(c) above and are related, whether between the same parties or not, shall be consolidated and determined together either by the **Regulatory Authority** or by any arbitrator to which the **Regulatory Authority** has referred any dispute.

Any arbitral award shall be final and binding on the parties.

GC 13 Code Confidentiality

Several parts of the **Grid Code** specify the extent of confidentiality, which applies to data supplied by **Users** to **OETC**. Unless otherwise specifically stated in the **Grid Code**, **OETC** shall be at liberty to share all data with **Users** likely to be affected by the matters concerned. **OETC** is at liberty to share all data with the **Power Procurer** and the **Market Operator** when they are likely to be affected by the matters concerned and may be required to share such data under the **Market Rules**. In all cases, **OETC** is at liberty, and may be required, to share the data with the **Regulatory Authority**.

GC 14 Interim Transitional Provisions

(This clause has been removed but the title kept for future use)

GC 15 Interpretation

In this **Grid Code**, unless the context otherwise requires:

- references to "this **Grid Code**" or "the **Grid Code**" are reference to the whole of the **Grid Code**, including any schedules or other documents attached to any part of the **Grid Code**;
- the singular includes the plural and the other way around;
- any one gender includes the others;
- references to **Code** sections, paragraphs, clauses or schedules are to Code sections, paragraphs, clauses or schedules of this **Grid Code**;
- **Code**, paragraph and schedule headings are for convenience of reference only and do not form part of and shall neither affect nor be used in the construction of this **Grid Code**;
- reference to any law, regulation made under any law, standard, secondary legislation, contract, agreement or other legal document shall be to that item as amended, modified or replaced from time to time. In particular, any reference to any licence shall be to that licence as amended, modified or replaced from time to time and to any rule, document, decision or arrangement promulgated or established under that licence;

- references to the consent or approval of the **Regulatory Authority** shall be references to the approval or consent of the **Regulatory Authority** in writing, which may be given subject to such conditions as may be determined by the **Regulatory Authority**, as that consent or approval may be amended, modified, supplemented or replaced from time to time and to any proper order, instruction or requirement or decision of the **Regulatory Authority** given, made or issued under it;
- all references to specific dates or periods of time shall be calculated according to the Gregorian calendar and all references to specific dates shall be to the day commencing on such date at 00:00hours;
- where a word or expression is defined in this **Grid Code**, cognate words and expressions shall be construed accordingly;
- references to "person" or "persons" include individuals, firms, companies, government agencies, committees, departments, ministries and other incorporate and unincorporated bodies as well as to individuals with a separate legal personality or not;
- the words "include", "including" and "in particular" shall be construed as being by way of illustration or emphasis and shall not limit or prejudice the generality of any foregoing words; and
- terms and expressions defined in the **Sector Law** shall have the same meanings in this **Grid Code**. In particular, the following words and expressions shall have the meanings ascribed to them in that **Sector Law**.

Appendix-A: Constitution and Rules of the Grid Code Review Panel

1 Definitions and Interpretation

1.1 The following words and expressions shall have the following meanings in this Constitution:

"**Chairperson**" means the person appointed by **OETC** under Clause 6 of this Constitution to act as the Chairperson of the **Panel**;

"**Constitution**" means the constitution and rules of the Panel as set out herein and as may be amended from time to time with the approval of the **Regulatory Authority**;

"**Grid Code**" means the Grid Code drawn up pursuant to Condition 3 of **OETC**'s **Transmission Licence**;

"Licence" has the meaning given it in the **Sector Law**;

"Member" means a person on the **Panel** appointed to act as a representative of the persons or groups referred to in Clause 3 below;

"Panel" means the Grid Code Review Panel established by the **OETC** in accordance with the **Grid Code** (section GC.4) and governed by this Constitution;

"Secretary" means the person appointed by **OETC** pursuant to Clause 7 and named as such;

"Sector Law" means the law for the electricity sector in Oman promulgated by Royal Decree No. [78/2004] ;

"OETC" means the Oman Electricity Transmission Company in its capacity as holder of a **Transmission Licence**;

"Transmission Licence" means a Licence to transmit electricity granted pursuant to the **Sector Law**;

1.2 Except as otherwise provided herein and unless the context otherwise admits, words and expressions used herein shall have the meanings given to them in the **Grid Code**.

1.3 Words expressed in the singular only also include the plural and the other way around where the context requires. Words expressed in the masculine only also include the feminine.

1.4 Headings and titles shall not be taken into consideration in the interpretation or construction of the words and expressions used herein.

1.5 Unless otherwise stated, any reference to a Clause is a reference to a Clause of this **Constitution**.

2. Principal Objects

2.1 The **Panel** has been established by **OETC** to further the objectives set out below and such other objectives as the **Regulatory Authority** may stipulate from time to time:

(a) to generally review, discuss and develop the **Grid Code** and its implementation;

(b) to review and discuss suggestions for amendments to the **Grid Code** which **OETC**, the **Regulatory Authority** or any **User** may wish to submit to **OETC** for consideration from time to time;

(c) to discuss what changes are necessary to the **Grid Code** arising out of any unforeseen circumstances referred to it by **OETC**;

(d) to review existing Oman Electrical Standards relevant to **OETC**'s **Transmission System** and make recommendations to the **Regulatory Authority** concerning modifications to existing **Oman Electrical Standards** or proposals for new **Oman Electrical Standards** relevant to **OETC**'s **Transmission System**;

(e) to publish recommendations and ensure that **User** consultation upon such recommendations has occurred through **Members**; and

(f) Issue guidance in relation to the **Grid Code** and its implementation, performance and interpretation when asked to by a **User**.

3. Membership and Appointment

3.1 The Panel shall consist of:

- a **Chairperson** and up to 2 persons representing **OETC**;
- 1 person representing the **Regulatory Authority**;
- 1 person representing **the Power Procurer**;
- 1 person representing the **Market Operator;**
- 1 person representing **PAW**;
- 4 persons representing **Power Producers**;
- 1 person representing each **Licensed Distributor**;
- 2 persons representing **Internally Interconnected Parties** and **Directly Connected Customers**;
- 1 person representing **RAEC**.

3.2 Each person appointed as specified at Clause 3.1 shall be a **Member** of the **Panel**. If at any time any of the persons or groups identified in Clause 3.1 are unable to agree on a representative to act as their **Member**, the **Chairperson** shall contact (insofar as they are reasonably able) the person(s) or group(s) unable to agree and seek to encourage appointment or, as appropriate, unanimous agreement between relevant persons as to their prospective **Member**. If no such agreement is reached at least 21 **Business Days** prior to the next meeting of the **Panel** the **Chairperson** shall request the **Regulatory Authority** to make such appointment and the **Regulatory Authority** shall have the right, until the relevant person or group of persons has decided upon an appointment and notified the **Regulatory Authority** and the **Chairperson** accordingly, to appoint a **Member** or **Members** on behalf of that person or group of persons, and to remove (if appropriate) any person so appointed by it.

3.3 No person other than an individual shall be appointed a **Member** or their alternate.

3.4 Members shall serve according to the following arrangements:

(a) each **Member** who has served two years or more shall retire automatically at the beginning of the meeting of the **Panel** held on the first Monday in the month of February each year (or if no meeting is held on such day, at the meeting which is held on the date falling closest after that day) but shall be eligible for re-appointment;

(b) each person or group of persons entitled to appoint a **Member** (or a person within such group of persons) may, by notice in writing to the **Chairperson**, indicate their wish to re-appoint the retiring **Member** or to appoint a new person as a **Member** in their place;

(c) the relevant person(s) must deliver such notifications for re-appointment or appointment to the **Chairperson** at least 21 **Business Days** in advance of the relevant meeting of the **Panel** or group(s) entitled to appoint a **Member**. A notification for re-appointment in respect of an existing **Member** shall be deemed to be given if no notification is delivered to the **Chairperson** at least 21 **Business Days** in advance of the relevant meeting of the **Panel**;

(d) if only one notification is received for the re-appointment of a **Member** or appointment of a new person as a **Member** (or if all notifications received are unanimous), the person named in the notifications(s) will become the **Member** with effect from the beginning of the relevant meeting of the **Panel**. If the notifications are not unanimous, the provisions of Clause 3.2 of this Appendix A shall govern the appointment of the **Member**.

These provisions shall apply equally to persons or groups of persons entitled to appoint more than one **Member**, with any necessary changes to reflect that more than one **Member** is involved.

4. Alternates

4.1 Each **Member** (and the **Chairperson**) shall have the power to appoint any individual to act as their alternate and remove (at their discretion) any alternate **Member** or **Chairperson** (as the case may be) so appointed. Any appointment or removal of an alternate **Member** or **Chairperson** shall be effected by notice in writing executed by the appointor and delivered to the **Secretary** or tendered at a meeting of the **Panel**.

4.2 If their appointor so requests, an alternate **Member** or **Chairperson** (as the case may be) shall be entitled to receive notice of all meetings of the **Panel** or of sub-committees or working groups of which their appointor is a **Member**. They shall also be entitled to attend and vote as a **Member** or **Chairperson** (as the case may be) at any such meeting at which the **Member** or **Chairperson** (as the case may be) appointing them is not personally present and at any such meeting to exercise and discharge all the functions, powers and duties of their appointor as a **Member** or **Chairperson** (as the case may be) and for the purpose of the proceedings at the meeting the provisions of this **Constitution** shall apply as if they were a **Member** or **Chairperson** (as the case may be).

4.3 Every person acting as an alternate **Member** or **Chairperson** (as the case may be) shall have one vote for each **Member** or **Chairperson** (as the case may be) for whom they act as alternate, in addition to their own vote if they are also a **Member** or **Chairperson** (as the case may be). Execution by an alternate **Member** or **Chairperson** (as the case may be) of any resolution of the **Panel** shall, unless the notice of their appointment provides to the contrary, be as effective as execution by their appointor.

4.4 An alternate **Member** or **Chairperson** (as the case may be) shall cease to be an alternate **Member** or **Chairperson** (as the case may be) if their appointor ceases for any reason to be a **Member** or **Chairperson** (as the case may be).

4.5 References in this **Constitution** to a **Member** or **Chairperson** (as the case may be) shall, unless the context otherwise requires, include their duly appointed alternate.

5. Representation and Voting

5.1 The **Chairperson** and each other **Member** shall be entitled to attend and be heard at every meeting of the **Panel**. One adviser (or such greater number as the **Chairperson** shall permit) shall be entitled to attend any meeting of the **Panel** with each **Member** and shall be entitled to speak at any meeting but shall not be entitled to vote on any issue.

5.2 Each **Member** (including the **Chairperson**) shall be entitled to cast one vote. In the event of an equality of votes, the **Chairperson** shall have a second or casting vote.

6. The Chairperson

6.1 Upon retirement or removal by **OETC** of the first and each successive **Chairperson**, **OETC** shall appoint a person to act as **Chairperson**.

6.2 **OETC** may at any time remove the **Chairperson** from office.

6.3 The **Chairperson** shall preside at every meeting of the **Panel** at which they are present. If the **Chairperson** is unable to be present at a meeting, they may appoint an alternate pursuant to Clause 4.1 of this Appendix A to act as **Chairperson**. If neither the **Chairperson** nor any other person appointed to act as **Chairperson** is present within half an hour after the time appointed for holding the meeting, the **Members** present appointed by **OETC**, may appoint one of their number to be **Chairperson** of the meeting.

6.4 The **Chairperson**, or the person appointed to act as **Chairperson** by the **Chairperson** shall be entitled to cast one vote. Where a **Member** is acting in the capacity of both **Member** and **Chairperson**, they shall be entitled to cast one vote as **Chairperson**, in addition to their one vote as **Member**.

7. The Secretary

7.1 **OETC** shall have power to appoint and dismiss a **Secretary** and such other staff for the **Panel** as it may deem necessary. The **Secretary** may, but need not be, a **Member**, but shall not be a **Member** by virtue only of being **Secretary**. The **Secretary** shall have the right to speak at, but, unless a **Member**, no right to cast a vote at any meeting.

7.2 The **Secretary**'s duties shall be to attend to the day to day operation of the **Panel** and, in particular, to:

i) attend to the requisition of meetings and to serve all requisite notices;

ii) maintain a register of names and addresses of **Member**s and the **Chairperson** and such alternates as may be appointed from time to time;

iii) maintain a register of names and addresses of persons in each of the groups of persons described in sub-clauses 3.1 of this Appendix A; and

iv) keep minutes of all meetings.

7.3 The **Secretary** shall make available the register of names and addresses referred to in sub-clauses 7.2(ii) and (iii) above, to **Licensed Distributors**, **Distribution System** users and/or the **Regulatory Authority** for inspection within a reasonable period of being requested to do so.

7.4 If the office of a **Member** is vacated the **Secretary** shall notify (insofar as they are reasonably able) the group or person whom the **Member** represented and they shall appoint a new **Member** as provided in Clause 3 of this Appendix A.

8. Meetings

8.1 Subject always to the direction of **OETC** and the **Regulatory Authority**, the **Panel** meetings shall operate as follows:

(a) the **Panel** shall meet on the first Monday in the months of May, August, November and February and as necessary for the transaction of business whenever convened by the **Chairperson** at such times as may be determined by the **Regulatory Authority**, and in any event shall meet not less than 4 times each year; If the first Monday of that month happens to be a holiday, then an alternate date will be communicated by the **Chairperson** of the **Panel**;

(b) notwithstanding the right of the **Chairperson** to call a meeting of the **Panel** whenever appropriate, the **Chairperson** shall call a meeting when requested by a notice in writing to do so by two or more **Member**s;

(c) unless agreed by all **Member**s, not less than 14 **Business Days** prior written notice shall be given to all **Members** of all meetings of the **Panel**;

(d) the quorum of **Members** required for the **Panel** meetings shall not be less than 7 of the **Members**;

(e) if within an hour of the time appointed for a meeting of the **Panel** a quorum is not present, the meeting shall stand adjourned for at least 2 **Business Days**. The re-adjourned meeting shall be deemed quorate and its proceedings valid notwithstanding that there are fewer than seven **Members** present; and

(f) subject to sub-paragraphs (d) and (e) above the following circumstances shall not (of themselves) invalidate proceedings of the **Panel**:

i) vacancies amongst the **Panel**;

ii) any defects in the appointment of **Members**; or

iii) the accidental omission to give notice of a **Meeting** to, or the non-receipt of notice of a meeting by a person entitled to receive notice.

9. Grid Code Revisions

9.1 All proposed revisions to the **Grid Code** must be reviewed by the **Panel** prior to their implementation. All revisions proposed by **Users**, the **Regulatory Authority** or **OETC** should be brought before the **Panel** by the **Chairperson** for consideration. The **Chairperson** will advise the **Panel**, **Users**, and the **Regulatory Authority** of all proposed revisions to the **Grid Code** with notice of no less than 20 **Business Days** in advance of the next scheduled meeting of the **Panel**.

9.2 Following review of a proposed revision by the **Panel**, the **Chairperson** will, if appropriate, apply to the **Regulatory Authority** to approve the revision of the **Grid Code** based on the **Panel** recommendation. The **Chairperson**, in applying to the **Regulatory Authority**, shall also notify each **User** of the proposed revision and other views expressed by the **Panel** and **Users** so that each **User** may consider making representations directly to the **Regulatory Authority** regarding the proposed revision.

9.3 The **Regulatory Authority** shall consider the proposed revision, other views, and any further representations and shall determine whether the proposed revision should be made and, if so, whether in the form proposed or in an amended form.

9.4 If the **Panel** is directed by the **Regulatory Authority** that the revision shall be made, the **Chairperson** shall notify each **User** of the revision at least 10 **Business Days** prior to the revision taking effect, and the revision shall take effect (and the **Grid Code** shall be deemed to be amended accordingly) from (and including) the date specified in such notification or other such date as directed by the **Regulatory Authority**.

10. Resolutions

10.1 A resolution of the **Panel** shall be passed by a simple majority of votes cast.

10.2 A resolution in writing signed by all **Members** shall be as valid and effective as if it had been passed at a meeting of the **Panel** duly convened and held. One or more counterparts may produce written resolutions.

10.3 A meeting of the **Panel** may consist of a conference between **Members** who are not all in one place but who are able (directly or by telephonic communication) to speak to each of the others and to be heard by each of the others simultaneously. The word "meeting" shall be construed accordingly.

11. Minutes

11.1 The **Secretary** shall circulate copies of the minutes of each meeting of the **Panel** to each **Member** as soon as practicable (and in any event within 15 **Business Days**) after the relevant meeting has been held.

11.2 Each **Member** shall notify the **Secretary** of their approval or disapproval of the minutes of each meeting within 15 **Business Days** of receipt of the minutes. A **Member** who fails to do so will be deemed to have approved the minutes. The approval or disapproval of the minutes aforesaid will not affect the validity of decisions taken by the **Panel** at the meeting to which the minutes relate.

11.3 If the **Secretary** receives any comments on the minutes, the **Secretary** shall circulate revised minutes as soon as practicable following the expiry of the period referred to in Clause 11.2 of this Appendix A, incorporating those comments which are of a typographical nature and indicating, where necessary, that **Members** disagree with certain aspects of the minutes. The **Secretary** shall then incorporate those aspects of the minutes upon which there is disagreement, into the agenda for the next following meeting of the **Panel**, as the first substantive item for discussion, and, if possible, resolution.

12. Guidance from the Panel

12.1 The **Panel** may at any time, and from time to time, issue guidance in relation to the **Grid Code** and its implementation, performance and interpretation, and it may establish sub-committees and working groups to carry out such work.

13. Sub-committees and Working Groups

13.1 The **Panel** may establish such sub-committees from time to time consisting of such persons as it considers desirable. Each sub-committee shall be subject to such written terms of reference and shall be subject to such procedures as the **Panel** may determine. The meetings of sub-committees shall so far as possible be arranged so that the minutes of such meetings can be presented to the **Members** in sufficient time for consideration before the next following meeting of the **Panel**.

13.2 The **Panel** may further establish working groups to advise it on any matter from time to time. Such working groups may consist of **Members** and/or others as the **Panel** may determine for the purpose.

13.3 Resolutions of sub-committees and working groups shall not have binding effect unless approved by resolution of the **Panel**.

14. Removal of Members and Chairperson and Vacation of Office

14.1 The office of a **Member** shall be vacated if:

(a) they resign their office by notice delivered to the **Secretary**;

(b) they become bankrupt or compounds with their creditors generally;

(c) they become of unsound mind or a patient for any purpose of any statute relating to mental health; or

(d) they or their alternate fails to attend more than three consecutive meetings of the **Panel** without submitting an explanation to the **Chairperson** which is reasonably acceptable to the **Chairperson**.

14.2 Further, any person or persons entitled to appoint a **Member** or the **Chairperson**, as the case may be, pursuant to Clause 3 may at any time remove that **Member** or the **Chairperson**, as the case may be, from office and appoint another person to be a **Member** or the **Chairperson**, as the case may be, in their place. A person or persons will only have the right to remove from office the **Member** or the **Chairperson**, as the case may be, that they have appointed, and will have no right to remove from office any **Member** or the **Chairperson**, as the case may be, appointed by another person. Whenever any individual **Member** or the **Chairperson** changes, the person or group of persons entitled to appoint that **Member** or the **Chairperson** shall notify the **Secretary** in writing within seven days of the change taking effect.

15. Panel Members Responsibilities and Protections

15.1 In the exercise of its powers and the performance of its duties and responsibilities, the **Panel** shall have due regard for the need to promote the attainment of the principal objects of the **Panel** set out in Clause 2 of this Appendix A.

15.2 In the exercise of their powers and the performance of their duties and responsibilities as a **Member**, a **Member** shall represent the interests of that person or persons by whom they are, for the time being, appointed pursuant to Clause 3, provided that such obligation of representation shall at all times be subordinate to the obligations of the **Member** as a **Member** of the **Panel** set out in Clause 15.1 of this Appendix A.

15.3 The **Panel**, each **Member** and the **Secretary**;

i) shall be entitled to rely upon any communication or document reasonably believed by it or them to be genuine and correct and to have been communicated or signed by the person by whom it purports to be communicated or signed; and

ii) may in relation to any act, matter or thing contemplated by this **Constitution** act on the opinion or advice of, or any information from, any chartered engineer, lawyer, or expert in any other field, and shall not be liable for the consequences of so acting.

15.4 The **Panel** shall enjoy no status, immunity or privilege of the Sultanate of Oman. However, **Members** shall not be personally liable in respect of the performance of the functions of the **Grid Code Review Panel**.

16. Group Representatives' Addresses

16.1 Each **Member** shall from time to time communicate their address to the **Secretary** and all notices sent to such address shall be considered as having been duly given to such **Member**.

17. Confidentiality

17.1 Each **Member** shall keep confidential all information, which that **Member** might reasonably be expected to understand to be confidential.

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

الشركة العُمانية لنقل الكهرباء ش.م.ع.م
OMAN ELECTRICITY TRANSMISSION COMPANY S.A.O.C
إحدى شركات مجموعة نماء
Member of Nama Group

GCRP
GRID CODE REVIEW PANEL
مجلس مراجعة قواعد الشبكة

The Grid Code

Data Transfer Code

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Version-3.0 August 2020

Data Transfer Code

Table of Contents

Data Transfer Code

DTC 1 Introduction

The **Data Transfer Code** provides a unified listing of all data that:

- **Users** are required by the **Grid Code** to provide to **OETC**; and
- **OETC** is required to provide to **Users**.

In the event of inconsistencies between this **DTC** and other sections of the **Grid Code** the provisions in individual sections of the **Grid Code** shall prevail.

The relevant section of the **Grid Code**, under which any item of data is required, specifies the procedures, timing, and routing for the supply of that data and the updating and recording of temporary or permanent changes to that data.

DTC 2 Objective

The objectives of the **DTC** are as follows:

- to list and collate all requirements in respect of data to be provided by each category of **User** to **OETC** under the **Grid Code**;
- to list requirements in respect of all the data to be provided by **OETC** to each category of **User** under the **Grid Code**; and
- to provide an overview of the data requirements of certain sections of the **Grid Code**.

DTC 3 Scope

In addition to **OETC**, the **DTC** applies to;

- **Power Producers;**
- **Licensed Distributors;**
- **Licensed Suppliers;**
- **Directly Connected Consumers;**
- **International Interconnected Parties**
- **Internally Interconnected Parties;**
- **Power Procurer;**
- **Market Operator**; and
- **PAW**.

DTC 4 Data Categories

The **DTC** groups data into a number of categories:

- **Standard Planning Data**: is that data listed in Appendix B to the **Planning Code** required for the purpose of determining any requirements to reinforce the **Transmission System**;
- **Detailed Planning Data**: is that data listed in Appendix C to the **Planning Code** required of carry out detailed stability studies as necessary;
- **System data**: is that data listed in Appendix D to the **Planning Code** required to enable **Users** to conduct their own studies as necessary;
- **Operational data**: is data related to **Operating Code** (OC) and **Scheduling and Dispatch Code** (**SDC**) of the **Grid Code**. Within the **DTC**, **Operational Data** is sub-categorised according to the relevant **Operating Code**, for example **OC 1**, **OC 2** or **SDC**, and;
- **Metering and Data Exchange Code data**: is that data listed in Appendix E **Metering** data.

DTC 5 Procedures and Responsibilities

DTC 5.1 Responsibility for Submission and Updating of Data

Users shall exchange and record data listed in the **DTC** in accordance with the provisions of relevant sections of the **Grid Code**.

DTC.5.2 Methods of Submitting Data

The data schedules to the **DTC** are structured, where possible, to serve as standard formats for submission of data to **OETC** and from **OETC** to **Users**. Unless agreed with **OETC**, all data provided by **Users** to **OETC** and by **OETC** to **Users** shall be provided in accordance with the **DTC** schedule formats where such formats are given.

Data submitted to **OETC** must include the name of the **User** representative submitting each schedule of data. The data is preferred in electronic format and may be submitted via e-mail or a computer link, if such a data link exists between a **User** and **OETC,** or utilising a hardware data transfer media, such as CD ROM or USB flash drive after obtaining the prior consent from **OETC**. Subject to **OETC**'s prior agreement, data to be provided to **OETC** on a daily basis may be submitted by e-mail or other electronic means. Data submitted under the **Market Rules** are to be submitted as per the provisions of the **Market Rules Document**.

DTC.5.3 Changes to Users' Data

All **Users** must notify **OETC** promptly of any change to an item of data that is registered with **OETC** in accordance with the relevant section of the **Grid Code**.

DTC.5.4 Data Not Supplied

Users and **OETC** are obliged to provide data as set out in and in accordance with the individual sections of the **Grid Code**. If a **User** fails to supply **OETC** with data required by a section of the **Grid Code**, **OETC** shall use its best estimate of the required data and persistent failures to supply data to **OETC** will be dealt with as set out in the relevant section of the **Grid Code**. **OETC** will advise a **User** in writing of any estimated data it intends to use concerning a **User**'s **Plant** in the event that a **User** has not provided the required data.

If **OETC** fails to provide data required by a section of the **Grid Code**, the **User** to whom that data ought to have been supplied will use an estimate of the data not provided by **OETC** when, in that **User**'s view, it is necessary to do so. A **User** will advise **OETC** in writing of any estimated data it intends to use in the event of data not being supplied.

OETC and **User** estimates of data not supplied will, in each case, be based upon data supplied previously for the same **Plant** or upon corresponding data for similar **Plant** or upon such other information as **OETC** or a **User**, as the case may be, deems appropriate.

Corrections to estimates of data not supplied shall be made by **OETC** or the **User** post event, where the data affects **Operating Parameters**.

DTC 6 Grid Code Data Exchanged between OETC and Users

Table 6.1 provides details of Schedules A to M of the **DTC**. **OETC** is a party to each Schedule, **PWP** is the recipient of the data in Schedules A to E and G and I. Where data is required to be submitted to the **Market Operator** under the **Market Rules**, such data is to be submitted as per the provisions of the **Market Rules Document.**

Table 6.1: Details of Schedules A to M of the DTC

Schedule	Data Type	Comprising	User	Grid Code Section
A	**User System** data	Electrical parameters relating to **Plant** Connected to **OETC Transmission System**	PP, LD, DCC, OCP	**PC**
B	**Load** characteristics data	The estimated parameters of **Loads** in respect of harmonic content, sensitivity etc.	LD, DCC, OCP	**PC**
C	**User Demand** profiles & Active Energy data	**Data** related to **Demand** profiles.	LD, DCC, OCP	**PC** **OC 1**
D	**Connection Point** data	Data related to **Demand** and **Demand** transfer capability.	PP, LD, DCC, OCP	**PC** **OC** 1
E	**Demand Control** data	Data related **Demand Control**.	LD, LS, DCC, OCP	**OC** 1
F	Fault infeed data	Data related to short circuit contribution to **OETC Transmission System**.	LD, DCC, OCP	**PC**
G	**Generating Unit** and **Desalination Unit** technical data	**Generating Unit, Desalination Unit** and **Production Facility** fixed **Operating Parameters**.	PP	**PC** **SDC 1**
H	**Generation/Operational Planning** data.	**Generating Unit Operating Parameters** required for **Operational Planning**.	PP	**OC** 2 **SDC 1**
I	**Scheduling** and **Dispatch** data	**Operating Parameters** required for **Scheduling** and **Dispatch**.	PP	**SDC 1**
J	**Generation Schedule** data.	Data required for the preparation of the **Generation Schedule**.	PP	**OC** 1 & 2 **SDC 1** & 2
K	**Generating Unit** and **Desalination Unit Outage** data	**Generating Unit** and **Production Facility** equipment **Outage** planning data.	PP	**OC** 2
L	**OETC** data to **Users**	All relevant data	PP, LD, DCC, OCP	**PC** **OC 1**, 2 & 6
M	**Metering** data	All relevant data	PP, LD, DCC, OCP	**MDEC**

DTC 7 Abbreviations Used in the DTC

Key to Users

	User
PWP	Power and Water Procurer
PP	**Power Producers** with **Generating** and **Desalination Plant**
LD	**Licensed Distributors**
LS	**Licensed Suppliers**
DCC	**Directly Connected Consumers**
OCP	Other **Connected Parties**: **Users Connected** to the **Transmission System** excluding PP, LD, LS, and DCC

Abbreviations used in all schedules:

MDEC	Metering and Data Exchange Code
OC	Operating Codes
PC B	Planning Code - Appendix B Standard Planning Data
PC C	Planning Code - Appendix C Detailed Planning Data
PC D	Planning Code - Appendix D Transmission System Data
SDC	Scheduling and Dispatch Codes

Notes:

1 The data marked with "+" is required with an application for an **ECA** (to facilitate an early assessment by **OETC** of the need for more detailed studies).

DTC 8 Data Schedules

Schedule A: User System Data

The following current and forecast details that relate to the **Connection Site** containing the **Connection Point** are required from each **User** on its **User System**.

	Data Description	Units	Grid Code
1. Single line diagram:			
	Single line diagram showing all existing and proposed **HV** equipment and **Connections** together with equipment ratings and any third party embedded within its **User** System;	Drawing	**PC** B.1 **PC** C
2. Reactive compensation equipment:			
For all reactive compensation equipment **Connected** to the **User System** at 11 **kV** and above, other than **Power Factor** correction equipment associated directly with a **Consumer Plant**, the following details;			
2.1	Type of equipment (e.g. fixed or variable);	Text	**PC** B.1
2.2	Capacitive rating;	**MVA**r	**PC** B.1
2.3	Inductive rating;	**MVA**r	**PC** B.1
2.4	Operating range;	**MVA**r	**PC** B.1
2.5	Details of any automatic control logic to enable operating characteristics to be determined including dead bands or control intervals and set points ;	Text and/or Diagrams	**PC** B.1
2.6	Point of **Connection** to the **User System** in terms of electrical location and **System** voltage;	Text	**PC** B.1
2.7	Total harmonic distortion and harmonic penetration at specified frequencies at the **Connection Point** and details of de-tuning installed.	Table of % harmonic current at each frequency, text, diagram of de-tuning	**PC B**.1
3. Switchgear:			
For all switchgear (i.e. circuit breakers, switch disconnectors and isolators) on all circuits **Directly Connected** to the **Connection Point** including those at **Production Facilities**;			
3.1	Rated voltage;	kV	**PC** B
3.2	Operating voltage;	kV	**PC** B
3.3	Rated short-circuit breaking current; Single phase; Three phase;	 kA kA	 **PC** B **PC** B
3.4	Rated load breaking current; Single phase; Three phase;	 kA kA	 **PC** B **PC** B

3.5	Rated peak short-circuit making current (symmetrical and asymmetrical); Single phase; Three phase;	 kA kA	 **PC** B **PC** B
4. User HV Connecting System data: Circuit Parameters (for all circuits);			
For all **Systems** at 11 **kV** and above **Connecting** the **User System** to the **Transmission System**, the following details are required relating to that **HV Connection Point**;			
4.1	Rated voltage;	kV	**PC** B.1
4.2	Operating voltage;	kV	**PC** B.1
4.3	Positive phase sequence; Resistance; Reactance; Susceptance;	 % on 100 % on 100 % on 100	 **PC** B.1 **PC** B.1 **PC** B.1
4.4	Zero phase sequence; Resistance; Reactance; Susceptance;	 % on 100 % on 100 % on 100	 **PC** B.1 **PC** B.1 **PC** B.1
4.5	Circuit constructional detail regards: Number of cables or conductors per phase Cable or overhead conductor size Cable or conductor length	 No. mm m or km	**PC B**.1 **PC B**.1 **PC B**.1 **PC B**.1
5. Interconnecting transformers:			
	For transformers between **the Transmission System** and the **User System**, the following data is required;		
5.1	Rated **Power**;	**MVA**	**PC** B.1 **PC** C
5.2	Rated voltage ratio; (i.e. primary/secondary/tertiary);		**PC** B.1 **PC** C
5.3	Winding arrangement;		**PC** B.1 **PC** C
5.4	Vector group;		**PC** C
5.5	Earthing arrangements	text	**PC** B.1
5.6	Positive sequence resistance; @ maximum tap; @ minimum tap; @ nominal tap;	 % on **MVA** % on **MVA** % on **MVA**	 **PC** C **PC** C **PC** C
5.7	Positive sequence reactance; @ maximum tap; @ minimum tap; @ nominal tap;	 % on **MVA** % on **MVA** % on **MVA**	 **PC** C **PC** C **PC** C
5.8	Zero phase sequence reactance;	% on **MVA**	**PC** C
5.9	Tap changer type (e.g. on-load or off-load);	On/Off	**PC** B

			PC C
5.10	Tap changer range;		**PC** B **PC** C
5.11	Tap changer step size;		**PC** B **PC** C
5.12	Impedance value (if not directly earthed);		**PC** C
6. HV motor drives:			
Following details are required for each **HV** motor drive connected to the **User** System;			
6.1	Rated VA;	**MVA**	**PC** C
6.2	Rated Active Power;	**MW**	**PC** C
6.3	Full Load current;	kA	**PC** C
6.4	Means of starting;	Text	**PC** C
6.5	Starting current;	kA	**PC** C
6.6	Motor torque/speed characteristics;		**PC** C
6.7	Drive torque/speed characteristics;		**PC** C
6.8	Motor plus drive inertia constant;		**PC** C
7. User protection data:			
Following details relates only to protection equipment which can trip, inter-trip or close any **Connection Point** circuit breaker or any **OETC** circuit breaker;			
7.1	A full description including estimated settings, for all relays and **Protection** systems installed or to be installed on the **User System**;	Text	**PC** C
7.2	A full description of any auto-reclose facilities installed or to be installed on the **User System**, including type and time delays;	Text	**PC** C
7.3	A full description including estimated settings, for all relays and **Protection** systems installed or to be installed on the **Generating Unit**, **Generating Unit** transformer, **Production Facility** transformer and their associated connections;	Text	**PC** C
7.4	For **Generating Unit** having or intended to have a circuit breaker at the **Generating Unit** terminal voltage, clearance times for electrical faults within the **Generating Unit** zone;	ms	**PC** C
7.5	The most probable fault clearance time for electrical faults on any part of the **User System Directly Connected** to the **Transmission System**;	ms	**PC** C
8. Transient over-voltage assessment data:			
When requested by **OETC**, each **User** is required to submit data with respect to the **Connection Site** as follows (for undertaking insulation co-ordination studies);			
8.1	Busbar layout, including dimensions and geometry together with electrical parameters of any associated current transformers, voltage transformers, wall bushings, and support insulators;	Diagram	**PC** C
8.2	Physical and electrical parameters of lines, cables, transformers, reactors and shunt compensator equipment **Connected** at that	Text	**PC** C

	busbar or by lines or cables to that busbar (for the purpose of calculating surge impedances);		
8.3	Specification details of equipment connected directly or by lines and cables to the busbar including basic insulation levels;	Text	**PC** C
8.4	Characteristics of over-voltage protection at the busbar and at the termination of lines and cables connected at the busbar;	Text	**PC** C
8.5	The following **Generating Unit or Production Facility** transformer data is required; three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage;	Text	**PC** C

Schedule B: Load Characteristics Data

The following information is required from each **User** regarding existing and future **Connections** for each **Connection Point**;

	Data Description	Units	Data for Future Years						Grid Code
			FY 0	FY 1	FY 2	FY 3	FY 4	FY 5	
1	Equipment type to be **Connected** i. number and size of motors; ii. types of drive and control arrangements; and iii. other large items of equipment e.g. induction funaces.	Text & **MW** No and **MW** Text and diagrams Text, diagrams and tables incl. **MW**							PC B.**2**
2	Details of individual loads which have fluctuating, pulsing or other abnormal characteristics: Fluctuating Loads greater than 10MW i. details of the cyclic variation of **Demand** (**Active Power** and **Reactive Power**); ii. the rates of change of **Demand** (**Active Power** and **Reactive Power**) both increasing and decreasing; iii. the shortest repetitive time interval between fluctuations in **Demand** (**Active Power** and **Reactive Power**); iv. the magnitude of the largest step changes in **Demand** (**Active Power** and **Reactive Power**), both increasing and decreasing; v. maximum energy **Demanded** per half hour by the fluctuating load cycle; and vi. steady state residual **Demand** (**Active Power**) occurring between **Demand** fluctuations. Pulsing (**Power** electronic) **Loads** The size of the **Load**, the number of pulses, maximum voltage notch, and	Diagrams Diagrams, tables or text s **MW** & **MVAr** **MWh** **MW** & **MVAr**							**PC** B

	harmonic distortion potential (up to the 50th Harmonic) for a range of realistic conditions;	**MW** No. **kV** Table showing % against **Hz**							
3	Sensitivity of **Demand** to variations in voltage and frequency on the **Transmission System** at the peak **Connection Point Demand** (Active Power); Voltage sensitivity; Frequency sensitivity;	**MW/kV** **MVAr/kV** **MW/Hz** **MVAr/Hz**							**PC** B
4	Phase unbalance imposed on the **Transmission System**; Maximum; Average;	% %							**PC** B
5	Maximum harmonic content and specific harmonic frequency levels imposed on the **Transmission System**;	%							**PC** B
6	Details of loads which may cause **Demand** fluctuations greater than 10 **MW** at a **Connection Point /** Point of Common Coupling;	Text							**PC** B

Schedule C: User Active Energy Data and Demand Profiles

The following information is required from each **User** with **Demand** whose **System** is **Directly Connected** to the **Transmission System**.

Annual **Energy** forecast by type of

Type of Demand Consumer	**FY0**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**Update Time**	**Grid Code**
	MWh	**MW**h	**MW**h	**MW**h	**MW**h	**MW**h	End of January	**PC B**2
Residential								
Commercial								
Industrial								
Agriculture and Fisheries								
Hotels and Tourism								
Government								
any other identifiable categories of **Consumers**								
User System losses								
TOTAL all **Users**								

Demand Profiles.

Data Description	**FY0**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**Update Time**	**Grid Code**
Forecast daily **Demand** profiles in respect of each **User System** (summated over all **Connection Points** for a **Licensed Distributor** and at the **Connection Point** for non embedded **Consumers**);	1. Day of **User** maximum **Demand** (**MW**) at annual maximum **Demand** conditions; 2. Day of peak **OETC Demand** (**MW**) at annual maximum **Demand** conditions; 3. Day of minimum **OETC Demand** (**MW**) at **Average Conditions**;						End of January	**PC** B.2 (all **Users** with **Demand**) & **OC 1** (on request of **OETC**)
00:00 – 01:00 01:00 – 02:00 02:00 – 03:00 03:00 – 04:00 04:00 – 05:00 05:00 – 06:00 06:00 – 07:00 07:00 – 08:00								

08:00 – 09:00 09:00 – 10:00 10:00 – 11:00 11:00 – 12:00 12:00 – 13:00 13:00 – 14:00 14:00 – 15:00 15:00 – 16:00 16:00 – 17:00 17:00 – 18:00 18:00 – 19:00 19:00 – 20:00 20:00 – 21:00: 21:00 – 22:00 22:00 – 23:00 23:00 – 24:00								

Schedule D: Connection Point Data

The following information is required from each **User** with **Demand** whose **System** is **Directly Connected** to the **Transmission System**. Last year's actual measured values shall also be supplied, where possible.

	Data Description	Units	FY0	FY1	FY2	FY3	FY4	FY5	Update Time	Grid Code
1. Forecast Demand and Power Factor related to each Connection Point:										
1.1	Annual peak hour **User Demand** at annual maximum **Demand** conditions;	**MW** **Power Factor**							End of Jan	**PC** B.2 (all **Users** with **Demand**) **OC 1** (on **request of OETC**)
1.2	**User Demand** at **OETC** peak hour **Demand** at annual maximum **Demand** conditions;	**MW** **Power Factor**							End of Jan	**PC** B.2 (all **Users** with **Demand**) **OC 1** (on request of **OETC**)
1.3	**User Demand** at minimum hour **OETC Demand** at average conditions agreed with **OETC**;	**MW** **Power Factor**							End of Jan	**PC** B.2 (all **Users** with **Demand**) **OC 1** (on request of **OETC**)
2. Demand Transfer Capability:										
Where a **User Demand** or group of **Demands** may be fed by alternative **Connection Point(s),** the following details should be provided;										
2.1	Name of the alternative **Connection Point(s)**;									**PC** B
2.2	**Demand** transferred;	**MW** MVAr								**PC** B
2.3	Transfer arrangement (e.g. manual or automatic);									**PC** B
2.4	Time to effect transfer;	hours								**PC** B

Schedule E: Demand Control Data

The following information is required from each **User**;

	Data Description	Units	Time covered	Update Time	Grid Code
1.Programming Phase: (applicable to **Licensed Distributors** & **Directly Connected Consumers**)					
Demand Control which may result in a **Demand** change of 10% or more on an hourly and **Connection Point** basis;					
1.1	**Demand** profile **MW** if requested by **OETC**;	Weeks 1 to 8		10:00 Saturday	**OC 1**
1.2	Duration of proposed **Demand Control** hrs as requested by **OETC**;	Weeks 1 to 8		10:00 Saturday	**OC 1**
2. Control Phase: (applicable to **Licensed Distributors** & **Directly Connected Consumers**)					
2.1	**Demand Control** which may result in a **Demand** change of 10% or more averaged over any hour on any **Connection Point** which is planned after 10:00 hours (unless notified otherwise by **OETC)**;	**MW**	Now to 7 Days	Immediate	**OC 1**
2.2	Any changes to planned **Demand Control** notified to **OETC** prior to 10:00 hours;	hours	Now to 7 Days	Immediate	**OC 1**
3. Post Control Phase:					
Demand reduction achieved on previous calendar day of 10% or more averaged over any **Connection Point**, on an hourly and **Connection Point** basis (unless notified otherwise by **OETC**);					
3.1	**Active Power** profiles;	**MW**	Previous Day	06:00 Daily	**OC 1**
3.2	Duration;	hours	Previous Day	06:00 Daily	**OC 1**

Schedule F: Fault Infeed Data

The following information is required from each **User** whose **System** is **Connected** to the **Transmission System** via a **Connection Point** and the **User System** contains **Centrally Dispatched Generating Unit**(s) and/or motor loads.

Short circuit Infeed to **OETC** Transmission System from a **User** System at a Connection Point

Name of Connection Point:.....

	Data Description	**Units**	**FY0**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**Grid Code**
1	Symmetrical three-phase short circuit current infeed; At instant of fault; After sub-transient fault current contribution has substantially decayed;	 kA kA							**PC** B
2	Zero sequence source impedance values as seen from the Connection Point consistent with the maximum infeed above; Resistance (R); Reactance (X);	 % on 100 % on 100							**PC** B
3	Positive sequence X/R ratio at instance of fault;								**PC** B

Schedule G: Embedded Genset, Generating Unit and Desalination Unit Technical Data

The following data are required from each **User** with existing or proposed **Embedded Gensets:**

Name / contact details of **Person** supplying data **……**

Ref.	Data Description	Units	Grid Code	**Embedded Genset** data					
				FY0	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**
1	Location and **Registered Capacity**;	Text & **MW**	PC B.3						
2	**Available Capacity** on a monthly basis	**MW**							
3	Name plate data for all equipment	Text							

The following details are required from each **User** with existing or proposed **Generating Units, Directly Connected**, or to be **Directly Connected**, to the **Transmission System** and/or with existing, or proposed **Embedded Centrally Dispatched Generating Units**.

Production Facility name:……..

Ref.	Data Description	Units	Grid Code	**Generating Unit/ Desalination Unit/ Production Facility (PF) data**					
				FY0	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**
1. Production Facility Demand:									
Demand associated with the **Production Facility** supplied through **Transmission System** or in addition to **Demand** supplied through unit transformer for the **Generating Unit**;									
1.1	**Maximum Demand** that could occur;	**MW** **MVAr**	PC C+						
1.2	**Demand** at the time of peak **OETC Demand;**	**MW** **MVAr**	PC C						
1.3	**Demand** at the time of minimum **OETC Demand**;	**MW** **MVAr**	PC C						
2.	**Centrally Dispatched Generating Unit Demand**	Units	**Grid Code**	**U1**	**U2**	**U3**	**U4**	**U5**	**PF**
Demand supplied through unit transformer for the **Generating Unit** when **Centrally Dispatched Generating Unit** is at rated **MW Output**		**MW** **MVAr**	PC C+						

Provide details of point of **Connection** to the **Transmission System** of each **Centrally Dispatched Generating Unit** (in terms of geographical and electrical location and **System** voltage) (**PC** B+)

Unit 1

Unit 2

Etc

		Units	**Grid Code**	**U1**	**U2**	**U3**	**U4**	**U5**	**PF**
3.	**Centrally Dispatched Generating Unit performance and parameters:**								
General									
3.1	Type of **Centrally Dispatched Generating Unit** (e.g. **Steam Turbine Generating Unit**, **Gas Turbine Generating Unit**, **Wind Turbine Generating Unit, Solar Generating Unit** cogeneration~~, etc~~);	Text & diagram e.g arrangement of **CCGT**	**PC** B.3						
3.2	Rated terminal voltage;	**kV**	**PC** B						
3.3	**Registered Capacity**;	**MW**	**PC** B **SDC** 1						
3.4	Rated **Active Power**;	**MW**	**PC** B/C+						
3.5	Rated **VA**;	**MVA**	**PC** B/ C +						
3.6	**System** constrained **Capacity** (for **Embedded Centrally Dispatched Generating Units** only);	**MW**	**PC** B						
3.7	Minimum **Generation**;	**MW**	PC B/C						
3.8	**Active Power** obtained in excess of **Registered Capacity**;	**MW**	**PC** B						
3.9	Expected running regime(s);		**PC** B						
3.10	For **Synchronous Generating Units, Generator Performance Chart** at stator terminals;	**Chart**							
3.11	Short circuit ratio;		**PC** B/C+						
3.12	**Generating Unit** inertia constant; (for **Synchronous Generating Units** alternator plus prime mover, for **Asynchonous Generating Units** as stated by the manufacturer for the **Generating System** as seen from the **Transmission** or **Distribution System**);	**MW**s/ **MVA**	**PC** B +						
3.13	For **Synchronous Generating Units**, rated field current at rated	**A**	**PC** C						

		Units	Grid Code	U1	U2	U3	U4	U5	PF
	MW and **MVAr** output and at rated terminal voltage;								
3.14	For **Synchronous Generating Units**, field current open circuit saturation curve test certificate); 120% rated terminal voltage; 110% rated terminal voltage; 100% rated terminal voltage; 90% rated terminal voltage; 80% rated terminal voltage; 70% rated terminal voltage; 60% rated terminal voltage; 50% rated terminal voltage;	**A** **A** **A** **A** **A** **A** **A** **A** **A** **A**	**PC** C						
4.	**Impedances** for generators being part of **Generating Units**								
4.1	Minimum **Connected** impedance of **Generator** and **Generator Transformer;** **Earthing** arrangements for **Generating Unit** and **Generator Transformer.**	% on **MVA** Diagram and text							
4.2	For **Synchronous Generating Units** -.direct axis **Synchronous** reactance;	% on **MVA**	**PC** C						
4.3	For **Synchronous Generating Units** -.direct axis transient reactance;	% on **MVA**	**PC** B +						
4.4	For **Synchronous Generating Units** -.direct axis sub-transient; reactance;	% on **MVA**	**PC** C						
4.5	For **Synchronous Generating Units** -.quadrature axis **Synchronous** reactance;	% on **MVA**	**PC** C						
4.6	For **Synchronous Generating Units** -.quadrature axis sub-transient reactance;	% on **MVA**	**PC** C						
4.7	S For **Synchronous Generating Units** -.stator leakage reactance;	% on **MVA**	**PC** C						
4.8	For **Synchronous Generating Units** -.armature winding direct-current resistance;	% on **MVA**	**PC** C						
5.	**Time constants** for **Synchronous Generating Units:**								
5.1	Direct axis short-circuit transient time constant;	s	**PC** C						
5.2	Direct axis short-circuit sub-transient time constant;	s	**PC** C						

		Units	Grid Code	U1	U2	U3	U4	U5	PF
5.3	Quadrature axis short-circuit sub-transient time constant;	s	**PC** C						
5.4	Stator time constant;	s	**PC** C						
6.	**Generator transformer:**								
6.1	Rated **VA**;	**MVA**	**PC** B +						
6.2	Rated voltage ratio;		**PC** C+						
6.3	Winding arrangement;		**PC** C						
6.4	Vector group;		**PC** C						
6.5	Positive sequence resistance; - @ maximum tap; - @ minimum tap; - @ nominal tap;	 % on **MVA** % on **MVA** % on **MVA**	 **PC** B/C **PC** C **PC** B/C						
6.6	Positive sequence reactance; - @ maximum tap; - @ minimum tap; - @ nominal tap;	 % on **MVA** % on **MVA** % on **MVA**	 **PC** B/C+ **PC** C + **PC** B/C+						
6.7	Zero phase sequence reactance at: Max, min and nominal tap;	% on **MVA**	**PC** C						
6.8	Tap changer range;	±%	**PC** C						
6.9	Tap changer step size;	±%	**PC** C						
6.10	Tap changer type; (i.e. on-load or off-circuit);	On/ Off	**PC** C						
6.11	Impulse withstand level	**kV**	**PC** C.2.3						
7.	**For Synchronous Generating Units -Excitation control system parameters:**								
7.1	Exciter category (e.g. rotating or static);	Text	**PC** C +						
7.2	Details of excitation system described in block diagram showing transfer functions of individual elements (including **PSS** if fitted);	Diagram	**PC** C						
7.3	Rated field voltage;	V	**PC** C						
7.4	Generator no-load field voltage;	V	**PC** C						
7.5	Excitation system on-load; positive ceiling voltage;	V	**PC** C						
7.6	Excitation system no-load negative ceiling voltage;	V	**PC** C						
7.7	Power system stabiliser fitted?	Yes /No	**PC** C +						

		Units	Grid Code	U1	U2	U3	U4	U5	PF
7.8	AGC whether fitted or not and model details and settings	YES/NO Model settings							
7.9	Details of over excitation limiter described in block diagram; showing transfer functions of individual elements;	Diagram	**PC** C						
7.10	Details of under excitation limiter described in block diagram showing transfer functions of individual elements;	Diagram	**PC** C						
8.	**Governor parameters and Load Management System (All Synchronous Generating Units):**								
8.1	For **Synchronous Generating Units** governor system block diagram showing transfer function of individual elements and settings range, interval and **Dead Bands**;	Diagram	**PC** C						
8.2	For **Synchronous Generating Units**, standard deviation Load error at steady-state **Load** over a 60 minute period	%							
9.	**Interface Arrangements – Synchronous Generating Units:**								
Arrangements for **Synchronising** a **Synchronous Generating Unit**;		Text	**PC** C.2.5						
10.	**Arrangement and Prime mover parameters (Steam Turbines Generating Unit):**								
CCGT Installation Matrix		Table and diagram	**PC B**.3						
Prime mover system block diagram showing transfer function of individual elements and controllers;		Diagram	**PC** C						
11.	**Prime mover parameters (Gas Turbines Generating Unit):**								
Prime mover system block diagram showing transfer function of individual elements and controllers;		Diagram	**PC** C						
12.	**Desalination Unit parameters:**								
Registered Capacity;		MIgpd	**PC B**.3						
Desalination Unit auxiliary Power;		**MW**	**PC B**.3						
Relationship between **Power** production and **Desalinated** water production;		Table **MW** v MIgpd	**PC B**.3+						
13.	**Asynchronous Generators**								
13.1	Capability curve showing **Reactive Power Output** range against **Active Power**	Table or diagram	PC B3						
13.2	Low Voltage ride through capability	Diagram of minimum	**PC B**.3						

		Units	Grid Code	U1	U2	U3	U4	U5	PF
		voltage v time							
13.3	Harmonic content imposed by each **Generating Unit** and the **Wind Farm Power Production Facility**	Tables of % harmonic at each HZ	**PC B**.3						
13.4	Details of power conditioning equipment	Text & diagram	**PC B**.3						
13.5	Details of islanding protection	Text	**PC B**.3						
13.6	Parameters similar to 3, 4 and 5 above, sufficient to populate manufacturers' models	Tables	**PC C**3.1						
13.7	An extended period dynamics model showing timed response to system voltage	Block diagram or assembled model	**PC C**.3.3						
14.	**Wind Turbine Generating Units**								
14.1	Turbine /energy convertor types No of turbines Layout of turbines	Text No. Map diagram	**PC B**.3						
14.2	**Power Output** / wind speed for **WFPPF**	**MW**/kmh^{-1}	**PC B**.3						
14.3	Maximum **Output** for each wind turbine generator and **Power Output** /wind speed	**MW**/kmh^{-1}	**PC B**.3						
14.4	For **Asynchronous Generating Units** system model or block diagram showing the transfer functions activated in **Frequency Sensitive Mode** including: wind turbine torque/speed controller(s) wind turbine blade angle controller(s) wind turbine power limitation function(s)	Model or block diagram	**PC C**3.5+						
15.	**Solar Generating Units**								
15.1	**Energy** conversion process: Thermal or PV	Text	**PC B**.3						
15.2	Further details of the process	Text	**PC B**.3.9(b)						
15.3	the arrangement and **Capacity** of **Solar Generating Units** within the **Solar Power Production Facility**	No. **MW** Map diagram	**PC B**.3						

		Units	Grid Code	U1	U2	U3	U4	U5	PF
15.4	rate of increase in **SPPF Output** for frequency deviations under a range of percentage of maximum incident light conditions;	**MW**/s or **MW**/min	**PC C**.3.3						
15.5	**Solar Generating Units** and **Solar Power Production Facility** model	Block diagram and assembled model	**PC C**.3.5						
16.	**Generating Unit flexibility performance**								
Details required with respect to **Generating Unit**;									
16.1	Rate of loading following a weekend (72 hour) shut- down (**Centrally Dispatched Generating Unit** and **Production Facility**);	**MW**/ Min	**PC** C						
16.2	Rate of loading following an overnight (8 hour) shut- down (**Centrally Dispatched Generating Unit** and **Production Facility**);	**MW**/ Min	**PC** C						
16.3	**Block Load** following **Synchronising**;	**MW**	**PC** C						
16.4	Rate of **De-loading** from Rated **MW**;	**MW**/ Min	**PC** C						
16.5	Regulating range;	**MW**	**PC** C						
16.6	**Load** rejection capability while still **Synchronised** and able to supply **Load**;	**MW**	**PC** C						
16.7	Heat rate versus ambient temperature and ambient pressure	Correction factor v temp and v pressure	**PC B**.3						
17.	**For Synchronous Production Facilities - Black Start** capability								
17.1	Whether **Black Start** capability exists Details of arrangements	YES/NO Text & diagram	**PC B**.3						

Note: The data marked with "+" is required with an application for an **ECA** (to facilitate an early assessment by **OETC** of the need for more detailed studies).

Schedule H: Generation/Operational Planning Data

Production Facility name:……..

The following details are required from each **User** in respect of each **Centrally Dispatched Generating Unit** and **Desalination Unit**.

	Data Description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
1.	**Steam Turbine Generating Units:**									
1.1	Minimum notice required to **Synchronise** under following conditions; **Hot** start; **Warm** start; **Cold** start;	 Min Min Min	 **OC 2** **SDC 1**							
1.2	Minimum time between **Synchronising** different **Centrally Dispatched Generating Units** at a **Production Facility**;	Min	**OC 2** **SDC 1**							
1.3	Minimum **Block Load** requirement on **Synchronising**;	**MW**	**OC 2** **SDC 1**							
1.4	Maximum **Centrally Dispatched Generating Units** loading **Ramp Rates** from **Synchronising** under following conditions; **Hot** start; **Warm** start; **Cold** start;	 Min **/MW**	 **OC 2** **SDC 1**							
1.5	Maximum **Centrally Dispatched Generating Unit Deloading Ramp Rate**;	**MW/** Min	**OC 2** **SDC 1**							
1.6	Minimum interval between **Desynchronising** and **synchronising** a **Centally Dispatched Generating Unit** (off-load time);	Min	**OC 2** **SDC 1**							
1.7	Maximum allowable starts per **Operational Year** from; **Hot**; **Warm**; **Cold**;	 No. No. No.	 **OC 2** **SDC 1**							

	Data Description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
2.	**Gas Turbine Generating Units:**									
2.1	Minimum notice required to **Synchronise**;	Min	**OC 2** **SDC 1**							
2.2	Minimum time between **Synchronising** different **Centrally Dispatched Generating Units** at a **Production Facility**;	Min	**OC 2** **SDC 1**							
2.3	Minimum **Block Load** requirement on **Synchronising**;	Min	**OC 2** **SDC 1**							
2.4	Maximum **Generating Unit Ramp Rates** for loading (from **Synchronising)** for; Fast start; Slow start;	 Min /**MW**	 **OC 2** **SDC 1**							
2.5	Maximum **Generating Unit Deloading Ramp Rate**;	Min /**MW**	**OC 2** **SDC 1**							
2.6	Minimum interval between **Desynchronising** and **Synchronising** a**Generating Unit**;	Min	**OC 2** **SDC 1**							
2.7	Maximum allowable starts per **Operational Year** from; **Hot**; **Warm**; **Cold**;	 No. No. No.	 **OC 2** **SDC 1**							

	Data description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
3.	**Asynchronous Generating Units:**									
3.1	Minimum notice required to commence operation or change mode of operation following an instruction from **OETC**;	Sec or min	**OC 2** **SDC 1**							
3.2	Minimum time to cease operation following an instruction from **OETC;**	Sec or min	**OC 2** **SDC 1**							

Schedule I: Scheduling and Dispatch Data

Production Facility name:.....

The following details are required from each **User** in respect of each **Centrally Dispatched Generating Unit**.

	Data Description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
1. Synchronous Generating Unit Declaration Availability Notice;										
1.1	**Centrally Dispatched Generating Unit** and/or **Desalination Unit Availability Notice**; **Registered Capacity**; Start time; Available water capacity; Start Time;	**MW** **MW** date/ time m3/h date/ time	**SDC** 1 **SDC** 1 **SDC** 1 **SDC** 1							
1.2	**Centrally Dispatched Generating Unit** unavailability; Start time; End time;	date/ time date/ time	**SDC** 1 **SDC** 1							
1.3	**Desalination Unit** unavailability; Start time; End time;	date/ time date/ time	**SDC** 1 **SDC** 1							
1.4	**Centrally Dispatched Generating Unit** and/or **Desalination Unit** initial conditions; Time required for **Notice to Synchronise**; Time required for start-up;	hrs hrs	**SDC** 1 **SDC** 1							
1.5	Maximum **Generation** and/or **Desalination** increase in **Output** above declared **Availability**;		**SDC** 1							
1.6	Any changes to **Primary Response** and **Secondary Response** characteristics;		**SDC** 1							

	Data Description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
2. Asynchronous Generating Unit Declaration Availability Notice (shows only **Plant** not **Available**)**;**										
2.1	**Asynchronous Centrally Dispatched Generating Unit** **Registered Capacity** not available; Start time; (a similar notice issued when **Plant** is returned to service)	 **MW** **MW** date/ time	 **SDC** 1 **SDC** 1 **SDC** 1 **SDC** 1							
3. Scheduling And Dispatch parameters:										
3.1	**Centrally Dispatched Generating Unit** inflexibility description; Start date; End date; **Active Power**;	 Text date/ time date/ time **MW**	 **SDC** 1 **SDC** 1 **SDC** 1							
3.2	**Centrally Dispatched Generating Unit Synchronising** intervals; **Hot** time interval; Off-load time interval;	 hrs hrs	 **SDC** 1 **SDC** 1							
3.3	**Desalination Unit** start-up intervals; **Hot** time interval; Off-load time interval;	 hrs hrs	 **SDC** 1 **SDC** 1							
3.4	**Generating Unit Desynchronising** intervals;	hrs	**SDC** 1							
3.5	**Desalination Unit** shutdown intervals;	hrs	**SDC** 1							
3.6	**Centrally Dispatched Generating Unit** basic data; **Minimum Generation**; Minimum shutdown;	 **MW** hrs	 **SDC** 1 **SDC** 1							

	Data Description	Units	Grid Code	Centrally Dispatched Generating Unit, Desalination Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
3.7	**Desalination Unit** basic data; Minimum production; Maximum production;	 m3/h m3/h	 **SDC** 1 **SDC** 1							
3.8	**Generating Unit** two shifting limitation;		**SDC** 1							
3.9	**Generating Unit** minimum on time;	hrs	**SDC** 1							
3.10	**Generating Unit Synchronising Generation**;	**MW**	**SDC** 1							
3.11	**Generating Unit Synchronising** groups;		**SDC** 1							
3.12	**Generating Unit** loading **Ramp Rates** with breakpoints;	**MW**/ min	**SDC** 1							
3.13	**Generating Unit Deloading Ramp Rates** with breakpoints;	**MW**/ min	**SDC** 1							
3.14	**Generating Unit** loading **Ramp Rates** covering the range from Minimum Generation to Available Capacity;	**MW**/ min	**SDC** 1							
3.15	**Generating Unit Deloading Ramp Rates** covering the range from **Available Capacity** to **Minimum Generation**;	**MW**/ min	**SDC** 1							

Schedule J: Generation Schedule Data

Production Facility name:…….

The following details are required from each **User** in respect of each **Synchronous Centrally Dispatched Generating Unit**.

	Data Description	Units	Grid Code	Synchronous Centrally Dispatched Generating Unit and Production Facility (PF) data						
				U1	U2	U3	U4	U5	U6	PF
1.	**Programming phase:**									
	Generation Schedule and **Desalination Schedule** for **Operation** of **Production Facility** on an hourly and **Connection Point** basis for the period of 1 to 8 weeks ahead by 10:00 hours each Saturday;	**MW**	**OC 2**							
2.	**Control Phase:**									
	Details of any differences to **Generation Schedule** submitted under **Programming Phase** for the unexpired part of the period;	**MW**	**SDC** 1 **SDC** 2							
3. Post Control Phase:										
	Details of hourly **Active Power** and **Reactive Power Output** sent out to the **Transmission System** by its **Centrally Dispatched Generating Unit**s;	**MW** **MVAr**	**OC 1**							
	Details of hourly **Active Power** and **Reactive Power** output sent out to the **Transmission System** by its **Centrally Dispatched Generating Units** during the previous day;	**MW** **MVAr**	**OC 1**							

Schedule K: Generating Unit Outage Data

Production Facility name:.....

The following details are required from each **User** in respect of each **Synchronous Centrally Dispatched Generating Unit**.

	Data Description	Units	Time Covered	Update Time	Grid Code
1. Provisional Outage Program:					
1.1	**Centrally Dispatched Generating Unit**s concerned;	ID	Year 2 to 3	End of January	**OC 2**
1.2	**Active Power** not **Available** as a result of **Outage**;	**MW**	Year 2 to 3	End of January	**OC 2**
1.3	Remaining **Active Power** of the **Generating Unit**;	**MW**	Year 2 to 3	End of January	**OC 2**
1.4	Duration of **Outage**;	Weeks	Year 2 to 3	End of January	**OC 2**
1.5	Start date and time or a range of start dates and times;	Date hrs	Year 2 to 3	End of January	**OC 2**
1.6	**Flexible Outage** or **Inflexible Outage**;	**Flexible/ Inflexible**	Year 2 to 3	End of January	**OC 2**
1.7	Flexible **Outage**; Period for which the **Outage** could be deferred (not less than 30 days in length); Period for which the **Outage** could be advanced (not less than 10 days in length);	Days Days	Year 2 to 3 Year 2 to 3	End of January End of January	**OC 2** **OC 2**
1.8	**Proposed System Outage Schedule:**				
	OETC issues **Proposed System Outage Schedule** to **Users**;		Year 2 to 3	End of July	**OC 2**
	Agreement on **Proposed System Outage Schedule**;	Text	Year 2 to 3	End of September	**OC 2**

2. Final System Outage Schedule:					
2.1	**Synchronous Generating Units** concerned;		Year 2 to 3	End of January	**OC 2**
2.2	**Active Power** not **Available** as a result of **Outage**;	**MW**	Year 1 to 2	End of January	**OC 2**
2.3	Remaining **Active Power** of the **Synchronous Generating Unit**;	**MW**	Year 1 to 2	End of January	**OC 2**
2.4	Duration of **Outage**;	Weeks	Year 1 to 2	End of January	**OC 2**
2.5	Start date and time or a range of start dates and times;	Date hrs	Year 1 to 2	End of January	**OC 2**
2.6	Flexible **Outage** or Inflexible **Outage**;	**Flexible/ Inflexible**	Year 1 to 2	End of January	**OC 2**
2.7	Flexible **Outage**; Period for which the **Outage** could be deferred (not less than 30 days in length); Period for which the **Outage** could be advanced (not less than 10 days in length);	 Days Days	 Year 1 to 2 Year 1 to 2	 End of January End of January	 **OC 2** **OC 2**
2.8	**OETC** issues draft **Final System Outage Schedule** to **Users**;	Text	Year 1 to 2	End of June	**OC 2**
2.9	**OETC** issue **Final System Outage Schedule** to **Users**;	Text	Year 1 to 2	End of Sept	**OC 2**
3. Short Term Planned Outage:					
3.1	**Synchronous Generating Units** concerned;	ID	Year 0	7 Days before	**OC 2**
3.2	**Active Power** not **Available** as a result of **Outage**;	**MW**	Year 0	7 Days before	**OC 2**
3.3	Remaining **Active Power** of the **Synchronous Generating Unit**;	**MW**	Year 0	7 Days before	**OC 2**
3.4	Duration of **Outage**;	Weeks	Year 0	7 Days before	**OC 2**
3.5	Start date and time or a range of start dates and times;	Date hrs	Year 0	7 Days before	**OC 2**

Schedule L: Data Supplied by OETC to Users

OETC will provide **Users** and potential **Users** the following data related to **OETC Transmission System**.

Name of Connection Point:.....

	Data Description	Grid Code
1. Operation Diagram:		**OC**B
1.1	**OETC** will notify each **User** no later than the end of October, for the current calendar year and for each of the following 5 calendar years; The date and time of annual peak of **OETC Demand** at annual maximum **Demand** conditions;	**OC 1**
1.2	The date and time of annual minimum **OETC Demand** at average conditions;	**OC 1**
2. Network Data:		
2.1	**Transmission System** data; including Network topology and ratings of principal items of equipment; Positive, negative and zero sequence data of lines, cables, transformers, etc; **Centrally Dispatched Generating Unit** electrical and mechanical parameters Relay and protection data;	**PC** D
2.2	Following network data as an equivalent 400kV, 220kV and 132kV source at the **HV Connection Point** to the **User System**;	
2.2.1	Symmetrical three-phase short circuit current infeed at the instant of fault from the **Transmission System**;	**PC** D
2.2.2	Symmetrical three-phase short circuit current from the Transmission System after the sub-transient fault current contribution has substantially decayed;	**PC** D
2.2.3	Zero sequence source resistance and reactance values at the **Connection Point**, consistent with the maximum infeed below;	**PC** D
2.2.4	Pre-fault voltage magnitude at which the maximum fault currents were calculated;	**PC** D
2.2.5	Positive sequence X/R ratio at the instant of fault **PC**;	**PC** D
2.2.6	Appropriate interconnection transformer data;	**PC** D
3	Names of **Safety Coordinators**;	**OC**6
3.1	Provisional **Outage** program showing the **Centrally Dispatched Generating Unit**s expected to be withdrawn from service during each week of Years 2 and 3 for Planned **Outages**;	**OC 2**
3.2	Draft **Final System Outage Schedule** showing the **Centrally Dispatched Generating Unit**s expected to be withdrawn from service during each week of year 1 for **Planned Outages**;	**OC 2**

Schedule M: Metering Data

The Metering Registration System forms the Metering database and holds Metering data relating to Metering Systems defined by the Metering and Data Exchange Code.

Timing: All data shall be submitted promptly after Connection or any other event that causes a change to the data.

Abbreviations:

MO **Meter Owner**

PO **Plant Owner**

	Data	Responsible Party	Data Category
1	**Connection and Metering Point reference details for both Delivery Point and Actual Metering Point:**		
1.1	Location and reference details;	PO	MDEC
1.2	Participant details at the Connection Point;	PO	MDEC
1.3	Site identification nomenclature;	PO	MDEC
1.4	Meter Owner;	PO	MDEC
1.5	Loss compensation calculation details where Actual Metering Point and Delivery Point differ;	PO	MDEC
2	**Main and Check Meter installation details;**		
2.1	Meter serial numbers;	MO	MDEC
2.2	Metering installation identification name;	MO	MDEC
2.3	Meter types and models;	MO	MDEC
2.4	Instrument transformer serial numbers;	PO	MDEC
2.5	Instrument transformer ratios;	PO	MDEC
2.6	Test and calibration programme details; test results and reference test certificates for Meters and Measurement Transformers;	MO	MDEC
2.7	Asset management plan and testing schedule;	MO	MDEC
2.8	Calibration tables, where applied to achieve Meter installation accuracy;	MO	MDEC
2.9	Meter summation scheme values and multipliers;	MO	MDEC
2.10	Data register coding details;	PO MO	MDEC
3	**Data communication details (when communication systems are used):**		
3.1	Telephone number for access to data;	PO MO	MDEC
3.2	Communication equipment type and serial numbers;	MO	MDEC
3.3	Communication protocol details or references;	MO	MDEC

3.4	Data conversion details;	MO	MDEC
3.5	**User** identifications and access rights;	MO	MDEC
4	**Data validation and substitution processes agreed between affected parties, including:**		
4.1	Algorithm;	MO	MDEC
4.2	Data comparison technique;	MO	MDEC
4.3	Processing and alarms (i.e. voltage source limits, phase-angle limits);	MO	MDEC
4.4	Check Metering compensation details;	MO	MDEC

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

الشركة العُمانية لنقل الكهرباء ش.م.ع.م
OMAN ELECTRICITY TRANSMISSION COMPANY S.A.O.C
إحدى شركات مجموعة نماء
Member of Nama Group

GCRP
GRID CODE REVIEW PANEL
مجلس مراجعة قواعد الشبكة

The Grid Code

The Planning Code

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Version-3.0 August 2020

Planning Code

Table of Contents

Planning Code

PC 1 Introduction

This code sets out the roles and responsibilities of **OETC**, **PWP** and **Users** regarding the data to be exchanged and the procedures to be followed, between parties, to enable the development of the **Transmission System**, the preparation of the **Five Year Statement** and to facilitate **Users** in the planning and development of their own **Systems**. The development of the **Total System** includes reinforcements / extensions to the **Transmission System** and **Connections** to **User's** equipment. **OETC** is required to carry out the planning process annually, covering the succeeding five **Operational Years** in order to provide sufficient lead times to facilitate:

- any necessary planning or consent work; and
- detailed engineering design / construction work to be completed by **OETC** and existing or potential **Users** of the **Total System**.

Operational Planning to optimise **Plant** and equipment **Outages** in order to ensure a secure and efficient **System** is covered in the **Operating Code OC** 2, **Operational Planning**.

Security and reliability issues are covered in the **Connection Conditions** and in the **Operating Code OC** 2 and **OC** 3.

PC 2 Objective

The objectives of the **Planning Code** are to define the roles and responsibilities of **OETC**, **PWP** and **Users** to enable:

- the exchange of information and interaction between **OETC, PWP** and **Users** concerning any proposed development of **User Systems** that are to be **Directly Connected** to the **Transmission System,** or that may impact on the performance of the **Transmission System**;
- any proposed development by a **User** that may impact on the performance of the **Transmission System** to be carried out in a manner that will allow **OETC** to meet its obligations as defined in the **Transmission Licence**;
- the supply of information to allow **PWP** and **OETC** to undertake their planning duties as set down in their **Licences** and the **Sector Law**; and the supply of information to allow **PWP** to meet its **Licence** requirements to plan adequate **Capacity** to meet forecast **Demand** and the **Generation Security Planning Standard**.

In addition, the **Planning Code** briefly reflects the process relating to the entering into, and modification of **Connection** and **Use of System Agreements**.

PC 3 Scope

PC 3.1 Connected Parties

In addition to **OETC** and **PWP**, the **Planning Code** applies to the following **Users**:

- Power Producers;
- Licensed Distributors;
- Licensed Suppliers;
- Directly Connected Consumers;
- International Interconnected Parties;
- Internally Interconnected Parties; and
- **RAEC** if Connected to the Total System.

PC 3.2 Parties Not Yet Connected

Persons whose prospective activities would place them in any of the categories of **User** listed in **PC** 3.1 will, either:

- pursuant to an approval granted by **OETC** to be **Connected**; or
- as a result of the application procedure for a **Electricity Connection Agreement** or other agreement, become bound by the **PC.**

PC 4 Planning Procedures

Development of the **Transmission System**, involving its reinforcement or extension, may arise for a number of reasons including, but not limited to:

a) a development on a **User System** already **Connected** to the **Transmission System**;

b) the introduction of a new **Connection** site or the modification of an existing **Connection** site between a **User System** and the **Transmission System**;

c) changing requirements for electricity **Transmission** facilities due to changes in factors such as **Demand**, **Generation**, technology, reliability requirements and/or environmental requirements;

d) transient or steady-state stability or fault-level considerations and other power system studies to ensure efficient, safe, reliable, and economic operation of the **Total System**;

e) the aggregate effect of **Customer** developments;

f) a development affecting, or a modification to, **Interconnection** with other systems; and/or

g) the cumulative effect of any combination of the above.

Accordingly, the reinforcement or extension of the Transmission System may involve work:

i) at a substation as a **Connection Site** where one or more **User's Plant** is **Connected** to the **Transmission System**;

ii) on transmission lines or other facilities which join that **Connection Site** to the remainder of the **Transmission System**; and

iii) on transmission lines or other plant at locations remote from that **Connection Site**.

OETC's **Licence** requires it to produce an annual statement (**The Five Year Statement** referred to in **PC** 5 below) setting out for each of the five succeeding **Operational Years**, guidance to **PWP** and other **Users** to assess the opportunities for **Connecting** to and using the **Transmission System**.

Appendix A shows an information flow chart and timetable for the planning process.

PC 5 The Five Year Statement

OETC shall, in accordance with the **Transmission and Despatch Licence**, prepare a statement, on an annual basis, in a form approved by the **Regulatory Authority**, showing, in respect of each of the five succeeding **Operational Years**, circuit **Capacity**, forecast power flows and **Loading** on each part of the **Transmission System** and fault levels for each transmission node, together with;

a) information on the status of transmission **Capacity** and the anticipated future requirements of transmission **Capacity**, including (i) new load and (ii) new **Capacity**;

b) a commentary prepared by **OETC** indicating its views as to those parts of the **Transmission System** most suited to new **Connections** including **Connection** of new **Capacity**;

c) information on what constraints are foreseen; information related to progress made with current investments; information contained in Appendix D; and

d) such other matters as may be specified in directions issued by the **Regulatory Authority**.

The **Five Year Statement** shall be produced and issued by the end of March in each year.

PC 6 Planning Data Requirements from Users

PC 6.1 Requirement to Provide Planning Data

PC 6.1.1 **Users** or prospective **Users** or **Users** planning a change to their **Systems** must provide sufficient planning data and update that data annually as set out below, or as reasonably requested by **OETC** from time to time, to enable **OETC** to perform the functions set down in **PC** 2 above. In the case of prospective **Users** or **Users** planning a change, the submission must include the relevant dates at which the change became or is expected to become effective.

PC 6.1.2 Planning data submissions must be in respect of each of the five succeeding calendar years (other than in the case of **Connected Project Planning Data** which will reflect the current position).

PC 6.1.3 Planning data submissions where the **User** reasonably believes that there is no change to the data from the last submission may be effected by submitting a written statement to **OETC** stating that there has been no change from the data (or the relevant data) submitted the previous time.

PC 6.1.4 In the case of unplanned changes to a **User's System** or operating regime the **User** shall notify **OETC** as soon as practically possible to ensure that any contingency measures which **OETC** considers necessary, can be implemented by **OETC**.

PC 6.2 Manner of Provision by Users

PC 6.2.1 All data to be supplied by **Users** to **OETC** pursuant to this **PC** shall reflect the best possible estimate or measurement available to the **User** in the circumstances. The data shall be supplied in writing (or such other means of permanent record as is acceptable to **OETC** by the date specified for the purpose of the **PC** or, where no date is so specified, in a prompt and timely manner.

PC 6.3 Data Requirements and Timing

PC 6.3.1 The **Planning Data** required under the **PC** from **Users** is allocated to one of two categories:

a) **Standard Planning Data** covers basic **Demand** data form **Licensed Suppliers**, **Licensed Distributors**, **Power Producers**, and **Interconnector Operators** to allow **OETC** to carry out load flow and short-circuit studies to determine any requirements to reinforce the **Transmission System** and allow preliminary assessment of the need for stability studies. These data requirements are set down in Appendix B. The data must be supplied in the format set out in the **Data Transfer Code**.

b) **Detailed Planning Data** covers additional data to allow detailed stability studies to be carried out as necessary. These data requirements are set down in Appendix C. The data must be supplied in the format set out in the **Data Registration Code**.

PC 6.3.2 To enable **The Five Year Statement** to be prepared, each **User** is required to submit to **OETC** the **Standard Planning Data** and **Detailed Planning Data** as listed in Appendices B and C. These data should be submitted before the end of September each year and should cover each of the five succeeding **Operational Years** (and in certain circumstances, the current **Operational Year**). The timetable is shown in Appendix A.

Where, from the date of one submission to another, there is no change in the data (or in some of the data) to be submitted, a **User** may submit a written statement stating that there has been no change from the data (or in some of the data) submitted previously and only detail any data which has changed.

By end October of each **Operational Year**, **PWP** shall provide **OETC** with a forecast **Demand** for **Total System** for the five succeeding **Operational Years**.

PC 6.3.3 **PC** 7 deals with what is required pursuant to the **Grid Code** for applications for new or modified arrangements for **Connection** to the **Transmission System**.

PC 6.3.4 To enable **Users** to assess their **Systems** in relation to short-circuit currents, **OETC** will provide short-circuit in-feeds under maximum **Capacity** conditions for each **Connection** point. **OETC** will make available to any **User** on request, the **System** that is listed in Appendix D. The data will be available at the end of December each year and will cover the 2 succeeding years.

PC 6.4 Status of Planning Data during the Connections Process

PC 6.4.1 Data Status Levels

As explained in **PC** 6.4.1 to **PC** 6.4.5, for **Planning Code** purposes, **Planning Data** supplied by **Users** applying for a **Connection Agreement** or other form of agreement or for a change to the current **Connection Agreement** is allocated to one of three status levels which provide a progression related to degrees of confidentiality, commitment and validation, as follows:-

- **Preliminary Project Planning Data**;
- **Committed Project Planning Data**;
- **Connected Planning Data**.

PC 6.4.2 Preliminary Project Planning Data

(a) **From** the time a **User** applies for an **Electricity Connection Agreement** or other form of agreement until an offer is made and accepted by the applicant **User**, the data relating to the proposed User development will be considered as **Preliminary Project Planning Data**.

(b) **Preliminary Project Planning Data** will normally contain only **Standard Planning Data**, unless elements of **Detailed Planning Data** are required in advance of the normal timescale, to enable **OETC** to carry out additional detailed **System** studies.

PC 6.4.3 Committed Project Planning Data

Once the offer for a **Connection Agreement** is accepted, the data relating to the **User** development already submitted **as Preliminary Project Planning Data**, and the subsequent data required by **OETC** which may be all or part of the data contained in Appendices B & C, will become **Committed Project Planning Data**. These data, together with the other data held by **OETC** relating to the **Transmission System** will form the background against which new applications by any **User** will be considered and against which planning of the **Transmission System** will be undertaken.

Committed Project Planning Data may contain both **Standard Planning Data** and **Detailed Planning Data**.

PC 6.4.4 Connected Planning Data

When any estimated values assumed for planning purposes are confirmed or replaced by validated actual values, these data are then termed **Connected Planning Data.** Accordingly, **Connected Planning Data** may be used and disclosed by **OETC** in the same manner and to the same extent as **Committed Planning Data**.

Connected Planning Data may contain both **Standard Planning** and **Detailed Planning Data**.

PC 6.4.5 Data Confidentiality

Committed Project Planning Data and **Connected Planning Data**, together with the other data held by **OETC** relating to the **Transmission System**, will form the background against which new applications by any **User** will be considered and against which planning of the **Transmission System** will be undertaken. Accordingly, data will not be treated as confidential to the extent that **OETC**;

- is obliged to use it in the preparation of the **Five Year Statement**;
- is obliged to use it when considering and/or advising on applications by other **Users** if the data is relevant to that other application; and
- is obliged to use it for **OETC** operational planning purposes.

All other data will be treated as confidential.

Where **Connected Planning Data** includes detailed models related to the operation and control of equipment and a **User** considers the data contained therein to be commercially sensitive and thus proprietary information, the **User** or their servant or agent in this matter may request **OETC** to sign an agreement related to the confidentiality of that information, but such agreement shall not prevent **OETC** from using the information for any reasonable purposes of **OETC** in discharge of its duties.

OETC may share **System** and **User** data with consultants or with **GCCIA**, for the purpose of studies or reports, provided arrangements are in place to ensure that those organisations apply this **Grid Code**'s data confidentiality requirements.

PC 7 Procedures for Applications for Connection

PC 7.1 Applicability

This **Planning Code** and in particular the procedures set down in **PC** 7 apply to all proposed developments on **User Systems**.

PC 7.2 Information from OETC

OETC will provide to **PWP**, by the end of March each year, details of suitable locations for the **Connection** of new **Capacity** together with estimate costs of **Connection** (including **System** reinforcement) for each **Connection** option.

Users and prospective **Users** of the **Transmission System** will be able to assess opportunities for **Connecting** to, and using, the **Transmission System**, through:

- OETC's Five Year Statement;
- **OETC's** annual report;
- OETC's published Connection Charging Statement; and
- OETC's published Transmission Use of System charges.

PC 7.3 Application Procedure for New Connection /Modification

Users wishing to establish a new **Connection** to the **Transmission System** or modify an existing **Connection** site must make application to **OETC**. The application shall include:-

a) a description of the **Plant** and/or **Apparatus** to be **Connected** to the **Transmission System** or, as the case may be, of the modification relating to the **User's Plant** and/or apparatus already **Connected** to the **Transmission System**) each of which shall be termed a development in this **PC** (which shall be deemed to be **Standard Planning Data**);

b) the relevant **Standard Planning Data** as listed in Appendix B (PC B); and

c) the desired completion date of the proposed development.

Appendix A (PC A.3) summarises the time scales for the actions relating to an application for a Connection. OETC will make an offer of a **Connection Agreement** within 9 weeks of receiving an adequately completed application by a User.

Any offer of a **Connection Agreement** made by OETC will state that the applicant User must accept within the period stated in the offer that will be at least 14 weeks of receiving an adequately completed application by a User, after which the offer automatically lapses. Acceptance of the offer commits the OETC works relating to that User development and binds both parties to the terms of the offer.

Within 4 weeks of acceptance of the offer, or such longer period that OETC may agree, the User shall supply the Detailed Planning Data pertaining to the **User** development as listed in Appendix C.

PC 7.4 Complex Connections

The magnitude and complexity of any **Transmission System** extension or reinforcement will vary according to the nature, location and timing of the proposed **User** development and it may be necessary for **OETC** to carry out additional, more extensive **System** studies (than are normally required) to evaluate more fully the impact of the proposed **User** development on the **Transmission System**.

Where **OETC** judges that such additional more detailed analysis is required, **OETC** will indicate to the **User** the areas that require more detailed analysis and the cost of additional studies necessary. The **User** shall state whether or not it wishes **OETC** to undertake the work necessary to proceed and confirm that the **User** is prepared to pay for this additional work. The Regulatory Authority may consent to a timescale longer than the 14 weeks normally allowed on application from either **OETC** or the **User**.

PC 7.5 Electricity Connection Agreement and Preliminary Project Planning Data

An **ECA** (or the offer for an **ECA**) will include, as appropriate, within its terms and conditions:-

a) a condition requiring both parties to comply with the **Grid Code**;

b) details of **Connection** and/or **Transmission Use of System charges**;

c) details of any capital related payments arising from necessary reinforcement or extension of the **Transmission System**;

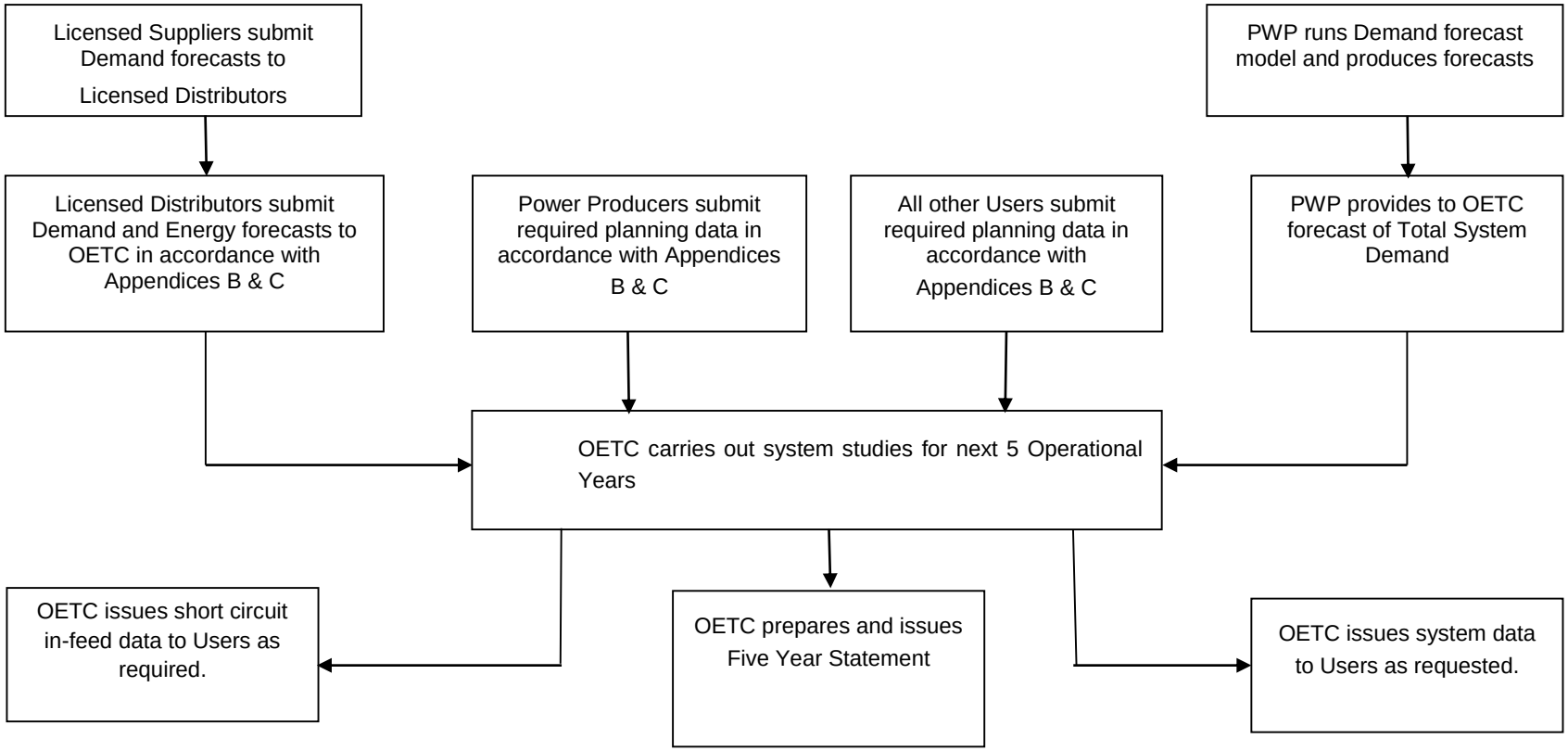
d) a **Site Responsibility Schedule**, detailing the divisions of responsibility at **Connection Sites** in relation to ownership, control, operation and maintenance of **Plant** and apparatus and to safety of **Persons** and shall also deal with the need to fulfil the requirements of **Operating Code OC** 6 – Safety Coordination; and

e) a condition requiring the **User** to supply **Detailed Planning Data** pertaining to the **User Development** as listed in Appendix C within 30 days of acceptance of the offer (or such longer period as **OETC** may agree in a particular case). If, after a period which in the **Regulatory Authority's** opinion is a reasonable period for the purpose, **OETC** has failed to enter into an **ECA** pursuant to a request, either party may apply to the **Regulatory Authority** to settle any terms of the agreement which are in dispute.

Appendix A: Transmission Planning Procedures

PC A.1 Transmission Planning Flow Chart

Note: The flow chart is a summary only and reference should be made to the Planning Code for full details. Data will be submitted for each of the next five Operational Years



PC A.2 Timetable for Main Actions for Transmission Planning & Five Year Statement

(Note that following data are summaries only and reference should be made to Planning Code for full details.)

Year 0	**Data to be provided for Operational Years 1, 2, 3, 4 & 5**
By end September	Each User to provide data to OETC as listed in Appendices B & C of the Planning Code.
By end October	PWP provide to OETC forecast of Total System demand for each of the five Operational Years.
By end December	OETC provides to Users short circuit infeeds at each Connection Point under maximum Capacity conditions to enable them to assess their networks in relation to short circuit currents.
	OETC will make available to any User, on request, the System data as listed in Appendix D.
By end March	OETC provides the Five Year Statement to PWP, Power Producers and makes available to potential Power Producers
	OETC to provide to PWP details of suitable locations for Connection of new Capacity together with estimate costs of Connection (including System reinforcement) for each Connection option
	OETC to provide to PWP a statement on the adequacy of the OETC network to meet the System Demand and Capacity requirements from considerations of power flows and voltage control. The statement will detail any needs for reinforcement of the network.

PC A.3 Timescale Chart for Applications for Connection

Time intervals		Action
Start	T = 0	User applies for new Connection or modification to an existing Connection
Offer	T + 9 weeks	OETC to make an offer of a Connection Agreement
Accept	T + 14 weeks (minimum)	User must accept offer or offer lapses
Data	Accept time + 4 weeks	User shall supply the Detailed Planning Data pertaining to the User development as listed in Appendix C

Appendix B: Standard Planning Data

PC B.1 Connection Site and User System Data

PC B.1.1 General

All **Users** shall provide **OETC** with details specified in sub sections **PC** B.1.2, **PC** B.1.3, **PC** B.1.4, **PC** B.1.5, **PC** B.1.6, **PC** B.1.7, and **PC** B.1.8, relating to their **User System**. The data shall relate to each **Connection** site. **Users** shall inform **OETC** of any matter which may have **Operational Effect** on the **Transmission System**.

Generators and other **Users** who may significantly contribute to fault-level on the **Total System** shall provide **OETC** with the details as specified in **PC** B.1.9.

PC B.1.2 User System Layout

Single line diagrams of existing and proposed arrangements of main **Connections** and primary **Distribution Systems** showing equipment ratings and if available, numbering and nomenclature.

PC B.1.3 Circuit Parameters (for all User circuits)

All **Users** shall provide the following details, in relation to any overhead lines and/or underground cables under the **User's** ownership and control from the **User System** substation to the **Connection Point** on **OETC System**:

a) rated and operating voltage;

b) positive sequence resistance, reactance and positive sequence shunt susceptance;

c) zero sequence resistance and reactance and zero sequence susceptance; and

d) rated current carrying capacity under Oman climatic conditions.

For underground cables or overhead lines

i) cable size(mm) type and length;

ii) conductor size (MM) type and length; and

iii) number of cables / conductors per phase.

PC B.1.4 Reactive Compensation Equipment

Users Directly Connected to the **Transmission System** shall provide details of all **Reactive Power** or voltage control equipment **Connected** to the **User System** at 11**kV**

and above, other than **Power Factor** correction equipment associated directly with **Consumer Plant**.

a) type of equipment (e.g. fixed or variable, capacitive or inductive);

b) rating or operating range in **MVAr**;

c) operating characteristics or details of any automatic control logic that enable operating characteristics to be determined;

d) dead bands and time / voltage based performance charts for each device;

e) the **Connection** point to the **User System** in terms of electrical location and System voltage; and

f) total harmonic distortion and harmonic penetration at specified frequencies at the **Connection Point** and details of de-tuning installed.

PC B.1.5 Switchgear

The following information must be provided for all switchgear (including circuit breakers, switch disconnectors and isolators) on all circuits **Connected** to the **Connection Point** including those at **Production Facilities**:

a) rated voltage (**kV**);

b) operating voltage (**kV**);

c) rated current (**A**);

d) rated short-circuit breaking current, 3-phase (**kA**) and 1-phase (**kA**) [symmetrical and asymmetrical];

e) rated load breaking current, 3-phase (**kA**) and 1-phase (**kA**); and

f) rated peak short circuit making current, 3-phase (**kA**) and 1-phase (**kA**)

PC B.1.6 Interconnecting Transformers

The following data shall be provided for each transformer between the **Transmission System** and the **User System**;

a) transformer rating, and impedance voltage;

b) winding arrangement and vector group;

c) tap-changing facilities and tapping range; and

d) earthing arrangements.

PC B.1.7 Nameplate Data

Nameplate data for all equipment.

PC B.1.8 Demand Transfer Capability

Where the **Demand** from one **User** could be supplied from more than one **Connection Point**, the **User** may request **OETC** to take this into account in designing the **Connection Site**. In these cases the following information must be supplied:

a) the alternative Connection Point(s);

b) the Demand which may be transferred under the loss of the most critical circuit from or to each alternative Connection Point (to the nearest 1MW/1MVAr); and

c) the arrangements for transfer (e.g. manual or automatic) together with the time required to effect transfer.

PC B.1.9 Short-circuit Infeed

All **Users**, other than **Power Producers**, that have **Generating Units** and/or motor **Loads Connected** to their **Systems** shall provide to **OETC** sufficient data for **OETC** to model the short-circuit infeed to the **Transmission System**. The **User** is required to provide data in accordance with **Good Industry Practice**.

The data should be provided for the condition of maximum infeed from that **User System** with all **Generating Units Synchronised** and all **HV** motors **Connected** to that **User System**. The **User** should ensure that the **System Connections** reflect credible **System** operating arrangements.

The following data shall be provided;

a) symmetrical three-phase short circuit current infeed at the instant of fault;

b) symmetrical three-phase short-circuit current after the sub-transient fault current contribution has substantially decayed;

c) the zero sequence source resistance and reactance values of the user system as seen from the **Connection Point**, consistent with the maximum infeed above; and

d) the positive sequence X/R ratio at an instant of fault.

PC B.2 Demand Users

PC B.2.1 User Total System Demand (Active Power) and Active Energy

PC B.2.1.1 Introduction

Each **User** that is directly **Connected** to the **Transmission System** and has **Demand** shall provide **OETC** with **Demand** data. Forecast **Data** shall be supplied for each of the next five **Operational Years** and in the case of existing **Users** recorded data shall be supplied for the immediate past year. For the avoidance of doubt, data is required from:

a) each Licensed Distributor / Licensed Supplier in relation to Demand and Active Energy requirements on its Distribution System;

b) each **Directly Connected Consumer** in relation to its **Demand and Active Energy** requirements; and

c) each Power Producer in relation to the demand of each Production Facility Directly Connected to the Transmission System.

The data provided should be that remaining after any deductions considered appropriate by the **User** to take account of the **Output** profile of all embedded non-**Centrally Dispatched Generating Unit**s.

PC B.2.1.2 System Demand (Active Power)

Forecast hourly **Demand** (**Active Power**) (**MW**) profiles for each **User System** (summated over all **Connection Points** from the **Transmission System** for each **User System**) shall be provided for:

a) the day of maximum **Demand** on each **User System** giving the values of **Demand** (**Active Power**) that could be imposed on the **Transmission System**;

b) the day, that will be specified by **OETC**, of the forecast maximum **Demand** (**Active Power**) on the **Transmission System**; and

c) the day, that will be specified by **OETC**, of the forecast minimum Demand (**Active Power**) on the **Transmission System.**

All forecast maximum **Demand** levels submitted to **OETC** by **Users** shall be on an average conditions basis agreed with **OETC** regards temperature and humidity.

PC B.2.1.3 System Active Energy

Forecast annual Active Energy (**MWh**) for each User System shall be provided and be subdivided into the following categories of consumer:

- Residential;
- Commercial
- Industrial;
- Agriculture and Fisheries;
- Hotels and Tourism;
- Government;
- any other identifiable categories of **Consumers**; and
- User System losses.

PC B.2.2 Connection Point Demand (Active and Reactive Power)

Forecast **Demand** (**Active Power**) and **Power Factor** (or **Reactive Power**) at each **Connection Point** shall be provided for:

a) the day that in the **User's** opinion, maximum **Demand** at the **Connection Point** could be imposed on the **Transmission System**;

b) the day, that will be specified by **OETC**, of the forecast maximum **Demand** on the **Transmission System**; and

c) the day, that will be specified by **OETC**, of the forecast minimum **Demand** (**Active Power**) on the **Transmission System**.

The above **Demand** data shall be in the form of:

- one set of **Demand** data where the **User System** is **Connected** to the **Transmission System** via a busbar arrangement which is not normally operated in separate sections; and
- separate sets of **Demand** data where the **User System** is **Connected** to the **Transmission System** via busbar arrangements which are, or expected to be, operated in separate sections.

The above **Demand** data shall:

- be that remaining after any deductions considered appropriate by the **User**, on a basis agreed with **OETC**, to take account of the **Output** of all embedded non **CD Generating Units**;
- include the net **User System** reactive **Demand** but exclude any reactive compensation equipment; and
- be on an average conditions basis agreed with **OETC** regards temperature and humidity.

PC B.2.3 General Demand Data

The following information will be required only infrequently and shall be provided when requested by **OETC** regarding:

a) equipment type to be **Connected** and the electrical **Loading** details of any individual **Loads** which have characteristics significantly different from the typical range of domestic, commercial or normal industrial **Loads**, including **Loads** which may cause flicker in the **System**;

i) number and size of motors;

ii) types of drive and control arrangements; and

iii) other large items of equipment e.g. induction furnaces.

b) power electronic **Loads**, including the size of the **Load**, the number of pulses, maximum voltage notch, and harmonic distortion potential (up to the 50th Harmonic);

c) the sensitivity of the **Demand** (**Active** and **Reactive Power**) to variation in voltage and **Frequency** at the **Connection Point** at the time of the peak **Demand**;

d) the average and maximum phase unbalance which the **User** would expect its **Demand** to impose on the **Transmission System**;

e) the maximum harmonic content and specific harmonic frequency levels which the **User** would expect its **Demand** to impose on the **Transmission System;**

f) details of all **Loads** which may cause **Demand** fluctuations greater than 10**MW** at the **Connection Point** as follows:

i) details of the cyclic variation of **Demand** (**Active Power** and **Reactive Power**);

ii) the rates of change of **Demand** (**Active Power** and **Reactive Power**) both increasing and decreasing;

iii) the shortest repetitive time interval between fluctuations in **Demand** (**Active Power** and **Reactive Power**);

iv) the magnitude of the largest step changes in **Demand** (**Active Power** and **Reactive Power**), both increasing and decreasing;

v) steady state residual **Demand** (**Active Power**) occurring between **Demand** fluctuations.

PC B.3 Generating Unit and Production Facility Data

PC B.3.1 Applicability of Requirements

Each **Power Producer**, or potential **Power Producer** with **Centrally Dispatched Generating Units Directly Connected**, or to be **Directly Connected**, to the **Transmission System** and/or with existing, or proposed large **Embedded Centrally Dispatched Generating Units** shall provide **OETC** and **PWP** with data relating to each **Centrally Dispatched Generating Unit** as specified in **PC** B.3.

PC B.3.2 Power Producers with Embedded Gensets

Each **Power Producer** or potential **Power Producer** with small **Embedded Gensets** shall provide the following information for each Gensets**:**

a) Location and Registered Capacity (MW);

b) Available Capacity (MW) on a monthly basis;

c) Nameplate data for all equipment; and

Forecast data shall be supplied for each of the next five **Operational Years** and recorded data, if available, shall be supplied for the immediate past year.

PC B.3.3 Data Requirements for Power Producers with all Types of Generating Units Connected or Seeking Connection to the Transmission System

Production Facility Data

a) The **Connection Point** to the **Transmission System** in terms of geographical and electrical location and **System** voltage, supported by diagrams / maps.

b) expected running regime(s) at each **Production Facility**;

c) maximum auxiliary **Demand** (**Active Power** and **Reactive Power**) of the **Production Facility**; and

d) The minimum **Connected** impedance of the **Generator** and **Generator Transformer** and the **Earthing** arrangements for both **Generating Units** and **Generator Transformers.**

PC B.3.4 General Information and Rated Parameters Data for all Centrally Dispatched Generating Units

i) **Generating Unit** type;

ii) **Generating Unit** rating and terminal voltage (**MVA** & **kV);**

iii) **Maximum Generation,** rated generation and **Minimum Generation** capability (**MW** sent out);

iv) **Registered Capacity** (**MW** sent out) under reference conditions;

v) **System** constrained **Capacity** (**MW**) i.e. any known constraint placed on the **Capacity** of an **Embedded Centrally Dispatched Generating Unit** due to the **Distribution System** to which it is **Connected**;

vi) **Available Capacity** (**MW**) on a monthly basis;

vii) **Active Power** capable of being obtained from **Centrally Dispatched Generating Units** in excess of their **Registered Capacity**;

viii) Maximum auxiliary **Demand** in **MW** and **MVAr**;

ix) Inertia constant (**MW** sec/**MVA**);

x) Short-circuit ratio; and

xi) **Generating Unit** rated **Power Factor**.

PC B.3.5 Additional Data Requirements for Power Producers with Synchronous Generating Units

For the avoidance of doubt, the data requirements in **PC** B 3.5 are **Standard Data.** This data is to be provided by **Users** or **Developers** with **Synchronous Generating Units** in addition to the data to be provided in **PC** B.3.3 and **PC** B.3.4.

The additional data items are required with respect to each **Centrally Dispatched Generating Unit** at each **Production Facility**;

a) Details of changes in **Registered Capacity** (**MW**) measured from reference conditions supported by correction curves showing **Output** versus heat rate;

b) heat rate versus ambient air temperature;

c) heat rate versus ambient air pressure;

d) **Generator Performance Chart** at the **CD Generating Unit** stator terminals;

e) minimum time that **Generating Unit** must be **Synhcronised** to the **Transmission System**;

f) minimum shutdown time;

g) time between start-up of different **Centrally Dispatched Generating Units** at each **Production Facility;**

h) Where the **Generating Units** form part of a combined electricity **Production Facility** and water **Desalination** facility, the **Capacity** of the desalination units and their relationship to the electricity produced by **Generating Units**;

i) direct axis transient reactance;

j) direct axis sub-transient time constant;

k) sustained load diagram; and

l) **Reactive Power** capability curves (both leading and lagging) at the lower voltage terminals of the **Generator Transformers** for **Maximum Generation**, normal full **Load** and normal minimum **Load**.

m) exciter category, for example whether rotating exciter or static exciter;

n) power system stabiliser (**PSS**) fitted or not;

o) automatic generation control (**AGC**) whether fitted or not and where fitted details of the control model and performance; and

p) In relation to CCGT installations:

i) **Power Producers** must supply a list and details of the **CCGT Modules** in the **CCGT** installation.

ii) **Power Producers** must supply a **CCGT Installation Matrix** in respect of its **CCGT** installations. . It must show the combination of **CCGT Modules** which would be running in relation to any given **Output**, in the format indicated in Appendix E. In the case of a **CCGT** installation which is under a contract it must reflect the requirements of the relevant agreement.

iii) Any changes must be notified to **OETC** promptly.

iv) The **CCGT Installation Matrix** submitted under the **PC** will be used by **OETC** for planning purposes and will also be used by **OETC** in connection with **Scheduling and Dispatch**.

v) Notwithstanding any other provision of this **PC**, the **CCGT Modules** within a **CCGT** installation, details of a **CCGT Installation Matrix** can only be amended if **OETC** gives its prior consent in writing.

vi) Details of **Black Start** arrangements associated with the **Generating Unit** or **Power Production Facility**.

PC B.3.6 Additional Data Requirements and Obligations for all Power Producers with Asynchronous Generating Units

For the avoidance of doubt, the data requirements in **PC** B 3.6 are **Standard Data.** This data is to be provided by **Users** or developers with **Asynchronous Generating Units** in addition to the data to be provided in **PC** B.3.3, and **PC** B.3.4.

The additional data items are required with respect to each **Generating Unit** at each **Production Facility**:

(a) graphs or tables showing the **Reactive Power Output** of the **Generating Unit** for a range of **Active Power Output** levels from 0**MW** to **Registered Capacity Output** when in voltage control, **Reactive Power** control and **Power Factor** control modes;

(b) a “Low Voltage Ride Through or LVRT” characteristic ;

(c) the harmonic emissions which the **Developer** or **User** would expect from each of its **Asynchronous Generating Units** and the maximum harmonic emissions which the **Developer** or **User** would expect all **Asynchronous Generating Units (**together with any additional equipment) to impose on the **Transmission System**;

(d) whether any power conditioning or other ancillary equipment is installed, how arranged and in all cases the control principle; and

(e) details of arrangements which show how the **Generating Unit** is prevented from supplying **Consumers** in the absence of that part of the network being energised from the **System**.

PC B.3.7 Additional Data Requirements and Obligations for Power Producers with Asynchronous Generating Units – Wind Farm Generating Units

For the avoidance of doubt, the data requirements in **PC** B 3.7 are **Standard Data.** This data is to be provided by **Users** or developers with **Wind Farm Generating Units** in addition to the data to be provided in **PC** B.3.3, **PC** B.3.4 and **PC** B 3.6.

The data is required for each **Wind Power Generating Unit** within a **Wind Farm Production Facility** or mixed **Production Facility** whether the equipment is **Embedded**, **Directly Connected**, **Centrally Dispatched** or not:

a) details and data for proposed or installed turbine types and the number, type and layout of energy convertors to be employed or installed;

b) data regarding the maximum **Output** of each of the wind turbine generators and its power generation to wind speed table or curve.

PC B.3.8 Additional Data Requirements and Obligations for Power Producers with Asynchronous Generating Units – Solar Generating Units

For the avoidance of doubt, the data requirements in **PC** B 3.8 are **Standard Data.** This data is to be provided by **Users** or developers with **Solar Generating Units** in addition to the data to be provided in **PC** B.3.3 and **PC** B 3.6.

The data is required for each **Solar Generating Unit** within a **Solar Power Production Facility** or mixed **Production Facility** whether the equipment is embedded, **Directly Connected**, **Centrally Dispatched** or not:

a) details and data of the fundamental principles of the energy conversion process employed and the spread and grouping of arrays;

b) the arrangement and **Capacity** of **Solar Generating Units** within the **Solar Power Production Facility.**

PC B.4 Generator Transformer Data

Users or **Developers** with **Generating Units Connected** (or to be **Connected)** to the **System** with **Generating Transformers** are required to supply the following data:

a) **Generator Transformer** rated **MVA**;

b) Positive sequence (reactance at maximum and nominal tap);

c) Type of tap changer;

d) Tap range and tap step; and

e) Details of the earthing arrangements.

Appendix C: Detailed Planning Data

Some of the data items below will have been provided previously under Appendix B to facilitate an preliminary assessment by **OETC** to determine whether detailed stability studies will be required (before an offer of terms for **ECA** can be made). Some of those data items have been repeated here but the data need not be resubmitted unless the values, known or estimated, have changed. Data provided under this Appendix must be copied to **PWP** in any circumstances where a **User** holds or will hold any form of agreement with **PWP**.

PC C.1 Connection Site and User System Data

Each **User**, whether **Connected Directly** to the **Transmission System** through an existing **Connection Point** or seeking such a **Direct Connection**, shall provide **OETC** with data on its **User System** associated with the **Connection Site** containing the existing and proposed **Connection Points**.

PC C.1.1 User System Layout

Each **User** shall provide a single line diagram showing both the existing and proposed arrangement(s) of all **Load** current carrying **Plant** relating to existing and proposed **Connection Points**.

The single line diagram shall include:

- busbar layout(s);
- electrical circuitry (ie overhead lines, underground cables, power transformers and similar equipment);
- phasing arrangements;
- Earthing arrangements;
- switching facilities;
- CTs and VTs;
- operating voltages; and
- numbering and nomenclature.

PC C.1.2 HV Motor Drives

For those **Users' Systems** that contain **HV** motors, the **User** shall provide the following data for each **HV** motor:

- rated voltage **kV**;
- rated **MVA**;
- rated **MW**;

- full Load current **A**;
- means of starting and magnitude of starting current;
- motor torque/speed characteristic;
- drive torque/speed characteristic; and
- motor plus drive inertia constant.

PC C.1.3 Interconnection Transformers

The following data shall be provided for each transformer **Connecting** the **User System** to the **Transmission System**:

- rated **MVA**;
- rated voltage ratio;
- winding arrangement and vector group;
- positive sequence resistance and reactance (max, min and nominal tap);
- zero sequence reactance;
- tap changer range and step size;
- tap changer type: on-load or off-load;
- earthing method: direct, resistance or reactance; and
- transformer cooling arrangements.

PC C.1.4 User's Protection Data

The following information is required for all **Protection** equipment that can trip, inter-trip or close any circuit breaker at a **Connection Point** or any of **OETC**'s circuit breakers:

- a full description, including estimated or actual settings, for all **Protection** systems and relays installed or to be installed on the **User System**;
- a full description of any auto-reclose facility installed or to be installed on the **User System**, including type, time delays and initiating functions;
- a full description, including actual or estimated settings, for all relays and **Protection** systems installed, or to be installed on **Generating Units**, **Generating Unit Transformers**, **Production Facility** transformers and their associated **Connections**;
- for those **Centrally Dispatched Generating Units** having (or intended to have) a circuit breaker at the **Generating Unit** terminal voltage, the clearance times for electrical faults within the **Centrally Dispatched Generating Unit Protection** zone; and
- the most probable fault clearance times for electrical faults on each part of the **User System Directly Connected** to the **Transmission System**.

PC C.1.5 Transient Over-voltage Assessment Data

OETC will need to undertake insulation co-ordination studies and may need to conduct transient overvoltage assessments. **OETC** may request additional data from **Users** for this purpose. When requested by **OETC**, each **User** shall provide the following data for specified **Connection Sites**:

- busbar layout including dimensions and geometry together with electrical parameters of any associated current transformers, voltage transformers, wall bushings, and support insulators;
- physical and electrical parameters of lines, cables, transformers, reactors and shunt compensator equipment **Connected** at that busbar or by lines or cables to that busbar; this information is required for the purpose of calculating surge impedances;
- specification details of all **Plant Connected Directly** or by lines and cables to the busbar including insulation levels;
- characteristics of overvoltage **Protection** at the busbar and at the termination of lines and cables connected at the busbar;
- for each **Generating Unit** or **Production Facility** transformer, data concerning transformer construction, i.e., three or five limb cores or single phase units, and operating peak flux density at nominal voltage; and
- any other information that **OETC** may reasonably request for the purposes of **System** analysis.

PC C.2 Synchronous Generating Unit Data

Each **Power Producer** or potential **Power Producer** with **Synchronous Centrally Dispatched Generating Units Directly Connected**, or to be **Directly Connected**, to the **Transmission System** and/or with existing, or proposed, large **Embedded Gensets**, shall provide **OETC** and **PWP** with data relating to each **Generating Unit**

All **Generating Unit** data shall be provided at reference site conditions.

PC C.2.1 Power Producer Demand

For each **Centrally Dispatched Generating Unit** which has an associated **Generator Transformer**, the value of the **Demand** supplied through this transformer when the **Generating Unit** is at **Registered Capacity Output** shall be provided.

Where the **Production Facility** has **Demand** in addition to that supplied through the **Generator Transformer** and which is supplied from either the **Transmission System** or the **Power Producer User System**, the **Power Producer** shall supply forecasts for each **Production Facility** of;

- the maximum **Demand** that could be imposed on the **Transmission System**;
- the **Demand** at the time of the peak **Demand** on the **Transmission System**; and

- the **Demand** at the time of minimum **Demand** on the **Transmission System**.

PC C.2.2 Synchronous Machine and Associated Control System Data

The following **Centrally Disppatched Generating Unit** and **Production Facility** data should be supplied for each **Centrally Dispatched Generating Unit**:

PC C.2.2.1 Generating Unit Parameters

1. rated terminal volts (kV);
2. rated **MVA**;
3. rated **MW**;
4. **Maximum Generation MW**;
5. **Minimum Generation MW**;
6. short circuit ratio;
7. direct axis **Synchronous** reactance;
8. direct axis transient reactance;
9. direct axis sub-transient reactance;
10. direct axis transient time constant;
11. direct axis sub-transient time constant;
12. quadrature axis synchronous reactance;
13. quadrature axis sub-transient reactance;
14. quadrature axis sub-transient time constant;
15. stator time constant;
16. stator leakage reactance;
17. armature winding direct-current resistance;
18. **Generating Unit** inertia constant (MWsec/**MVA**);
19. rated field current (amps) at rated **MW** and **MVAr Output** and at rated terminal voltage;
20. field current (amps) open circuit stator curve for **Generating Unit** terminal voltages ranging from 50% to 120% of rated value in 10% steps as derived from the manufacturer's test certificates; and
21. **Generator Performance Chart** showing **Active Power** plotted against **Reactive Power Output** and any limiting parameters.

PC C.2.2.2 Excitation Control System Parameters

Excitation system (including power system stabiliser if fitted) transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements including details of:

- rated field voltage;

- **Generating Unit** no-load field voltage;
- excitation system positive ceiling voltage;
- excitation system negative ceiling voltage;
- over-excitation limiter; and
- under-excitation limiter.

PC C.2.2.3 Governor, Load Management System and Associated Prime Mover Parameters

a) Governor Parameters – All Generating Units

Governor system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements including details of:

- filters;
- converters; and
- overall average gain **(MW**/**Hz**)
- settings range and interval and **Dead Band** settings and range above and below 50 **Hz**.

b) Load Management Systems

The standard deviation of **Load** error at steady-state **Load** over a 60 minute period.

c) Prime Movers Parameters – Steam Turbines Generating Units

Prime mover system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements and controllers with parameters expressed in terms of the electrical **Centrally Dispatched Generating Unit** rated **MW** including details of:

- boilers;
- HP turbine;
- HP turbine power fraction;
- HP steam extraction range (expressed in terms of the boiler rated output);
- HP steam extraction valves;
- LP turbine;and
- LP turbine power fraction.

d) Prime Mover Parameters – Gas Turbines Generating Units

Prime mover system transfer function block diagram showing gains, time constants, limits, rates of change etc of individual elements and controllers including details of:

- inlet guide vanes:
- compressor;
- fuel valve;
- combustion chamber; and

- power turbine.

PC C.2.3 Generating Unit Transformer Parameters

- rated **MVA**;
- rated voltage ratio;
- winding arrangement and vector group;
- positive sequence resistance and reactance (at max, min and nominal tap);
- zero phase sequence reactance (at max, min and nominal tap);
- tap changer range and step size;
- tap changer type: on-load or off-circuit;
- basic lightning impulse insulation level;
- Power frequency withstand voltage, required for **HV** transformers with a 220**kV** or higher voltage winding;
- chopped impulse withstand voltage, required for all transformers; and
- switching impulse withstand voltage, required for all transformers.

PC C.2.4 Production Facility Flexibility Performance

The following data shall be provided for each **Centrally Disppatched Generating Unit** and **Production Facility**:

- rate of Loading from cold shutdown (Centrally Disppatched Generating Unit and Production Facility);
- rate of Loading from warm shutdown (Centrally Disppatched Generating Unit and Production Facility);
- block Load following Synchronising;
- rate of **Deloading** from normal rated **MW**;
- regulating range;
- **Load** rejection capability while still **Synchronised** and able to supply **Load**;
- minimum time that Generating Unit must be Synhcronised to the Transmission System; and
- Minimum Shut Down Time.

PC C.2.5 Interface Arrangements

Details of the location and arrangements for **Synchronising** the **Generating Unit** and arrangements for switching the **Generating Unit** unto a dead busbar during **Black Start** conditions.

PC C.3 Asynchronous Generating Unit and Production Facility Data

PC C.3.1 Rotating Machines

For rotating machines (e.g. **Wind Turbine Generating Units),** such of the parameters listed in **PC C**.2.2 and such other parameters as are needed to model the steady state, dynamic and transient performance of the **Generating Unit**.

PC C.3.2 Convertor Technology

For partially converted, fully converted or DC based systems, a convertor based model is required. This could be supplied either as a manufacturer's propriety model for the **Plant** or parameters for an industry standard which can be implemented within Digsilent software.

PC C.3.3 Governor Parameters (for Wind Farm Power Production Facilities (WFPPFs)) and individual Wind Power Generating Units

Modelling details and parameters are required as follows:

- wind turbine torque/speed controller(s) (if any);
- wind turbine blade angle controller(s) (if any); and/or
- wind turbine power limitation function(s) (if any); and
- **Wind Farm Power Production Facility** model in block diagram and in Digsilent format as agreed with **OETC** or such other formats as **OETC** may require more detail regarding models is set down in **PC** C.3.5.

PC C.4 Governor Parameters (for Solar Power Production Facilities (SPPFs))

- Details of the rate of increase or decrease in **SPPF Output** (under a range of incident light conditions and for levels of reserved **Capacity** agreed with **OETC)** for various **System Frequency** deviations, while the **SPPF** is operating in **Frequency Sensitive Mode**;
- **Solar Generating Units** and **Solar Power Production Facility** model in block diagram format and in Digsilent format as agreed with **OETC** or such other formats as **OETC** may require as further described in **PC** C 3.5.

PC C.4.1 Wind Farm Power Production Facilities and Solar Power Production Facility - Voltage, Reactive Power and Control

a) Details of the settings, **Dead Bands** and switching interface for **Voltage Control** mode, **Power Factor** control mode and **Reactive Power Dispatch** mode; and

b) An extended period dynamics model which indicates the behaviour of the control system when switched into voltage control **/ Reactive Power** or **Power**

Factor mode taken together with the **Generating Unit** or **Power Production Facility** (where **Generating Units** are managed together or managed together with other equipment)**.** This extended period model may be used to assess the combined performance and interaction of **OETC**'s and **User's Plant** in achieving stable **Reactive Power / Voltage Control** for the **Total System**.

PC C.4.2 Wind Farm Power Production Facilities, Solar Power Production Facility – Dynamic Models

Notwithstanding the **Standard Planning Data** and **Detailed Planning Data** set out in these Appendices B and C to the Oman **Planning Code**, **OETC** may reasonably require a prospective **Generator** of a **Wind Farm Power Production Facility** or **Solar Power Production Facility** (either of **Capacity** 10**MW** or greater) **Connected** to the **System** at 132kV or above, to provide a manufacturer's dynamic model to agreed time-step accuracy as a transfer function block diagram and in the current version of [Digsilent] or other format agreeable to **OETC**. The model shall be suitable to indicate the stability and response of the **Wind Farm Power Production Facility** or **Solar Power Production Facility** under slow or rapid changes of state of the **Transmission System Frequency** and/or voltage. The model shall enable **OETC** to study, amongst other things, whether the **Wind Farm Power Production Facility** or **Solar Power Production Facility** will continue to operate during and after a set of **System** disturbances selected by **OETC** and how the proposed **Plant** and its control systems in any of these **Production Facilities** will respond to the changing **System** conditions at the **Connection Point**. The **Power Producer** must warrant that the **Production Facility** will perform in reasonable agreement with the model results and if the **Production Facility** is accepted for **Connection** by **OETC**, with or without agreed derogations, it shall be on the basis that the **Plant**, when installed and tested, performs in like agreement with the model supplied to **OETC**.

PC C.5 Interconnector Data

Interconnector owners or operators shall submit to **OETC Planning Data** of the nature required from other **Users** under the **Planning Code**. This obligation shall be satisfied as at [insert Date] by the **Planning Data** already submitted as at that date by the **Interconnector** owners or operators.

Appendix D: Transmission System Data

PC D.1 System Model

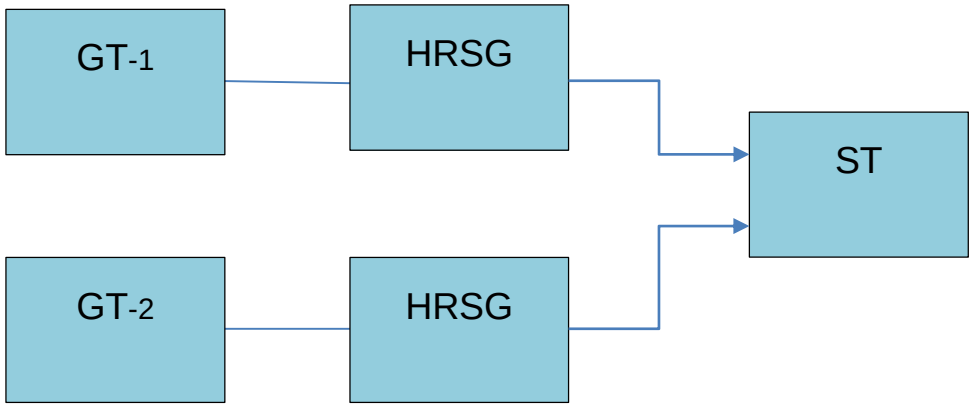
For modelling purposes, **OETC**, on request, will provide **Users** and potential **Users**, with a full listing of submitted and registered data relating to the **Transmission System**.

PC D.2 Short Circuit Calculations

For those **Users** who need to model the **Transmission System** for the purpose of short-circuit calculations, **OETC** will provide the following **System** data. It will be calculated in accordance with **Good Industry Practice**, as an equivalent 220 kV or 132 kV source at the **HV Connection Point** to the **User System**.

- symmetrical three-phase short-circuit current infeed from the **Transmission System** at the instant of fault based on sub-transient impedance of **Generating Units**;
- symmetrical three-phase short-circuit current infeed from the **Transmission System** based on transient impedance of **Generating Units**, i.e., after the sub-transient fault current contribution has substantially decayed;
- the zero sequence source resistance and reactance values at the **Connection Point**, consistent with the maximum infeed;
- the pre-fault voltage magnitude at which the maximum fault currents were calculated;
- the positive sequence X/R ratio at the instant of fault;
- appropriate **Interconnection** transformer data, as requested; and
- any other data requested as considered reasonable.

Appendix E: Example of CCGT Module and Matrix Data



Plant	Capacity in MW
Gas Turbine-1	165 MW
Gas Turbine-2	165 MW
Steam Turbine	170 MW

Configuration	MW output
GT 1	68 MW to 165 MW
GT 1 + ST	166 to 250 MW
GT 1 + GT 2 + ST	251 MW to 500 MW

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

The Grid Code

Connection Conditions Code

Version-3.0 August 2020

Connection Conditions Code & Schedule 1 & Schedule 2

Table of Contents

Connection Conditions Code

CC 1 Introduction

a) The **Connection Conditions** (**CC**) code specifies the minimum technical, design and certain operational criteria which must be complied with by **Users** whose **Plant** and apparatus is **Connected** to, or who are seeking a **Connection** to, the **Transmission System**.

b) The **CC** also set out the minimum technical, design and operational criteria, which must be complied with by **OETC**. These criteria are required for the protection of the **Transmission System** and **Users' Plant Directly Connected** to the **Transmission System**, and to enable **OETC** to comply with its **Licence**.

c) If a **User** considers that it is unable to meet any of the conditions, they should seek derogation from the **Regulatory Authority** in accordance with the provisions of GC 6.

d) Each **User** will have an **Electricity Connection Agreement** (**ECA**), and/or "**Electricity User System Charging Agreement**" with **OETC** that is specific to that **User**'s **Connection** to the **Transmission System**. On occasion, site specific conditions could require alternative provisions to the more general provisions in the **Connection Conditions**.

CC 2 Objectives

The objectives of the **Connection Conditions** code are to ensure that:

a) no new or modified **Connection** will impose unacceptable effects on the **Transmission System**;

b) by specifying minimum technical, design and operational criteria the basic rules for **Connection** to the **Transmission System** and to a **User**'s **System** are similar for all **Users** of an equivalent category and will enable **OETC** to comply with the **Sector Law** and its **Licence** obligations in a non-discriminatory way.

CC 3 Scope

The **Connection Conditions** code applies to **OETC** and **Users**, including:

- **Power Producers Directly Connected** to the **Transmission System**;
- potential **Power Producers** seeking to be **Directly Connected** to the **Transmission System**;
- **Power Producers** with **Embedded Centrally Dispatched Generating Units** (including **Wind Power Generating Units** or **Solar Power Generating Units)**;
- **Licensed Distributors**;
- **Licensed Suppliers**;
- **Directly Connected Consumers**;
- **PWP** (in its role in procuring New **Capacity**);

- **Internally Interconnected Parties**;
- **International Interconnected Parties**; and
- **RAEC** if **Connected** to the **Total System**.

CC 4 Procedure

All applicants seeking a **Demand Connection** should in the first instance seek connection from a **Licensed Supplier.**

The **ECA** contain provisions relating to the procedure for **Connection** to the **Transmission System** or, in the case of **Embedded Centrally Dispatched Generating Units**, include provisions relating to certain conditions to be complied with by **Users** prior to **OETC** notifying the **User** that it has the right to become operational and to be complied with thereafter.

CC 5 Connection

CC 5.1 Other Documents

The provisions relating to **Connecting** to the **Transmission System** are contained in each **Connection Agreement** (**ECA**) with a **User** and include provisions relating to the submission of information and reports relating to compliance with the relevant **Connection Conditions** for that **User**, **Safety Rules**, commissioning programs, **Operation Diagrams** and approval to **Connect**.

CC 5.2 Information to be Exchanged Prior to Completion

Prior to the completion date agreed under the ECA, the following information is to be submitted by the **User**;

a) A statement that the **User**'s installation complies with the requirements of **Grid Code**;

b) updated **Planning Code** data with any estimated values assumed for planning purposes confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for items such as **Demand**;

c) details of the **Protection**, arrangements and settings;

d) copies of all **Safety Rules** and **Local Safety Instructions** applicable at **Users'** sites which shall be used at **OETC/User** interface;

e) information to enable **OETC** to prepare **Site Responsibility Schedules** on the basis of the provisions set out in Appendix A;

f) an **Operation Diagram** for all **HV Plant** on the **User** side of the **Connection Point**;

g) the proposed name of the **User** site (which shall not be the same as, or confusingly similar to, the name of any **OETC** site or of any other **User** site);

h) a list of **Safety Coordinators**;

i) a list of the telephone numbers for joint **System Incidents** at which senior management representatives nominated for the purpose can be contacted and confirmation that they are fully authorized to make binding decisions on behalf of the **User**;

j) a list of managers who have been duly authorized to sign **Site Responsibility Schedules** on behalf of the **User**;

k) information to enable **OETC** to prepare **Site Common Drawings**;

l) confirmation of the **SCADA** interface arrangements for instruction, confirmation of instruction and information including the list of signals, and that these signals are formatted as required by **OETC**; and

m) **Metering System Registration Data**.

CC 6 Technical, Design and Operational Criteria

CC 6.1 Transmission System Performance Characteristics

OETC shall ensure that the **Transmission System** complies with the following technical, design and operational criteria in relation to the part of the **Transmission System** at the **Connection Site** with a **User**.

CC 6.1.1 Frequency deviations

During normal operating conditions, the nominal **System Frequency** of the **Transmission System** shall be 50.00 **Hz** and will be controlled normally between 49.95**Hz** and 50.05**Hz**.

During exceptional steady state conditions;

when there has been a significant shortfall in infeed or loss of **Demand** which cannot immediately be corrected, or where it would be unwise to do so (e.g. because it is anticipated that the **Demand** will shortly be restored) and which conditions could exist for a sustained period, the **System Frequency** deviations will not exceed:

- 49.70 **Hz** to 50.30 **Hz** when not interconnected to **GCCIA**;
- 49.90 **Hz**- 50.10**Hz** when interconnected to **GCCIA**;

unless **Disturbed** circumstances prevail.

Under Disturbed conditions,

being a transient **Event**, on the Oman **System** alone or on the **Interconnected** System, **System Frequency** could rise transiently to 51.50 **Hz** or fall to 47.50 **Hz**.

Users' Plant is required to have a tolerance for sustained operation between 49.50 **Hz** and 50.50 **Hz**.

OETC load shedding scheme **Frequency** range will be advised to **Users** from time to time.

CC 6.1.2 Voltage variations

a) The voltage variation on the **Transmission System** nominally operated at 400**kV** and above shall normally remain within the limits ± 5% of the nominal value but may reach - 10% for a maximum period of 30 minutes.

b) The voltage on the 220**kV** and 132**kV** parts of the **Transmission System** at each **Connection Site** with a **User** will remain within the limits of a minimum voltage of -10.0% and a maximum voltage of +10.0%.

c) The voltage on the 66**kV**, 33**kV** and 11**kV** sides of **Transmission** transformers at **Connection Sites** with **Users** will normally remain within the limits +/-6.0% of the nominal value unless abnormal conditions prevail.

d) Transient Voltage Conditions:

Over-voltage during faults

Under fault conditions the rated **Frequency** component of voltage could fall transiently to zero at the point of fault until the fault is cleared on one or more phases or rise to 140.0% phase-to-earth voltage. The voltage rise would last only for the time that the fault conditions exist. The fault conditions referred to here are those existing when the type of fault is single or two phase-to-earth.

Basic Insulation Level

The Basic Insulation Level (BIL) for **User** apparatus shall be as per relevant IEC standard IEC 60071-1.

CC 6.1.3 Voltage waveform quality

All **Plant Connected** to the **Transmission System**, and that part of the **Transmission System** at each **Connection Site**, should be capable of withstanding the following distortions of the voltage waveform in respect of harmonic content and phase unbalance.

Harmonic distortion

The maximum total levels of harmonic distortion on the **Transmission System** which **Users** may expect are:

- at 400**kV** Total Harmonic Distortion of 1.5% with no individual harmonic greater than 1%;
- at 220kV and 132kV, from all sources under both normal, **Planned Outage** and **Forced Outage** conditions, (unless abnormal conditions prevail) shall not exceed a total harmonic distortion of 2.0% with no individual harmonic greater than 1.5%.

Phase unbalance

Under normal operation, the maximum negative phase sequence component of the phase voltage on the **Transmission System** should remain below 1.0% unless abnormal conditions prevail.

Under **Planned Outage** conditions infrequent short duration peaks with a maximum value of 2.0% are permitted for phase unbalance, subject to the prior agreement of **OETC** under the **ECA**.

Voltage fluctuations

Voltage fluctuations arising from a fluctuating **Load Directly Connected** to the **Transmission System** at the **Connection Point** to the **Transmission System** shall not exceed 1.0% of the voltage level for step changes that may occur repetitively. Any large voltage excursions other than step changes may be allowed up to a level of 3.0% provided that this does not constitute a risk to the **Transmission System** or to the **System** of any **User**.

Flicker Severity

The level of voltage fluctuation at a **Connection Point** shall be within the limits defined in IEC 61000-3-7, with a **Flicker Severity (short term)** of 0.8 Unit and **Flicker Severity (Long Term)** of 0.6 Unit.

CC 6.2 Plant Relating to User/OETC Connection Site

The following requirements apply to **Plant** and equipment at **User/OETC Connection Points**. Each **User** must ensure that its **Plant** complies with these conditions.

CC 6.2.1 Licence Compliance

The design of **Connections** between any **Centrally Dispatched Generating Unit** and the **System** of a **Licensed Transmission System Operator** or **Licensed Distribution System Operator** shall be consistent with the **Licence** requirements of the **Licensed Transmission System Operator** or **Licensed Distribution System Operator**.

CC 6.2.2 Equipment Standards

All **User Plant** and equipment associated with **Connection** to the **Transmission System** shall comply with the following standards, as applicable. (in the following order of precedence):

(a) **OETC Safety Rules**;

(b) **Oman Electrical Standards**, which are such national standards as may be approved by and amended by the **Grid Code Review Panel** from time to time or which are imposed under the **Sector Law**;

(c) the standards and recommendations of the International Standards Organisation

(d) In the event that any standard or specification with which a **User**'s **Plant** is required to comply under **CC** 6 is amended, **OETC**, after having consulted with the affected **Users** will bring the issue to the **Grid Code Review Panel** for consideration.

Where **OETC** determines that in order to ensure safe and co-ordinated **Operation** of a **User**'s **Plant** with the **Transmission System**, there is a requirement for supplemental specifications and/or standards to apply to the design of a **User**'s **Plant**, **OETC** shall notify the **User** and the **User** shall comply with the additional requirements. On request from the **User**, **OETC** shall provide reasonable evidence as necessary to demonstrate the need for the supplemental specifications and/or standards. If a **User** is still not satisfied, the **User** may refer the issue to the **Grid Code Review Panel** for review.

CC 6.2.3 Equipment design and location

Rating of Equipment

OETC and the **User** shall agree the design fault level and insulation level of equipment at the time of the Offer of Terms for **Connection** and those values shall then appear in the **ECA**.

The short-circuit rating and insulation level of a **User**'s **Plant** and apparatus at the relevant **Connection Point** shall not be less than that specified in the relevant **ECA**.

Circuit breakers and arrangement

OETC shall ensure, in respect of its **Plant** and apparatus at the **Connection Point**, and a **User** shall ensure in respect of its **Plant** and apparatus at the **Connection Point**, that the specifications shall be such as to permit operation within the applicable **Local Safety Instructions** as described in **OC** 6.

Where an **OETC** circuit breaker is not provided at the **User Connection** voltage, or adjacent to a **User**'s facility, the **User** must provide **OETC** with the means of tripping all the **User** circuit breakers necessary to isolate faults or **System** abnormalities on the **Transmission System**. In these circumstances, the **User Protection** shall also provide signals to trip the appropriate **OETC** circuit breakers for faults on the **User System**. These tripping facilities shall be in accordance with the requirements specified in the **ECA**.

Each **Connection** between a **Generating Unit** and the **Transmission System** must be controlled by a circuit breaker capable of interrupting the maximum short circuit current at the **Connection Point** as determined by **OETC**.

Transformers and Tap-changers

Power Producers shall provide on-load tap-changing (OLTC) facilities for all **Generating Unit** transformers if required by **OETC** and such requirement shall be set down in the **ECA**. Where required, such **OLTC** facilities shall be capable of operation at voltages and currents which support the full range of generator operation as set down in the **Generator Performance Chart**.

All **Users** shall liaise with **OETC** on the design specification for the performance of the tap-changing facility.

Neutral earthing

The higher voltage windings of each **Generator Transformer Connected** to the **Transmission System** shall be star connected with the star point earthed in accordance with IEEE Standard C37.101: *IEEE Guide for Generator Ground Protection* unless otherwise specified in the **ECA**.

The earthing of **OETC**'s transformers at the interface with **Users** shall be as set down in the **Connection Agreement** or other form of agreement.

The **Earthing** of a **User**'s apparatus at the **Connection Point** must be in accordance with current **OETC** practice which will be notified to the **User**, initially, during the course of an application for **Connection** to the **Transmission System**.

In the event that **OETC** wishes to change its current practice, **OETC** will notify the **User** as soon as reasonably practicable in advance of the change.

Users shall take all reasonable precautions in relation to a particular **Connection Point** to limit the occurrence and effects of circulatory currents in respect of neutral points of any interconnected system (e.g. where there is more than one source of **Energy**).

Automatic switching equipment

Where, in the case of **Licensed Distributors** and **Directly Connected Users**, automatic re-closure of **OETC** circuit breakers is required following faults on the **User System**, automatic switching equipment shall be provided in accordance with the requirements specified in the **ECA**.

CC 6.2.4 Protection and fault clearance times

Protection Review

If in the opinion of **OETC** following an overall review of **Transmission System Protection** requirements improvements to any **User Protection** scheme are necessary, the relevant provisions of the **Connection Agreement** shall be followed.

Protection and Relay Settings

Protection and relay settings shall be coordinated across the **Connection Point** in accordance with the **ECA** to ensure effective disconnection of faulty **Plant**. The settings and operating values will only be changed if both **OETC** and the **User** agree, provided that neither **OETC** nor the **User** shall unreasonably withhold their consent. Any changes to protection arrangements, settings and operating values must be confirmed in accordance with the requirements of **DTC 5**.

The fault clearance times for faults cleared by **Main Protection** on the **Users'** equipment **Directly Connected** to the **Transmission System** and for faults on the **Transmission System** as measured from fault inception to the circuit breaker arc extinction, shall not be longer than 100 mS:

Slower fault clearance times may be specified for faults on the **Transmission System**, subject to written agreement by **OETC**. Slower fault clearance times for faults on **User**'s **Plant** or equipment may be agreed in accordance with the terms of the **ECA** but only if **System** requirements, in **OETC**'s sole view, permit. Faster fault clearance times than the above are permitted on **User**'s equipment provided that discrimination is achieved between faults on **User**'s equipment and **OETC** equipment.

Each **User**'s **Protection** must co-ordinate with any auto-reclose policy specified by **OETC**.

The probability that the fault clearance times declared in accordance with the **ECA** shall be exceeded by any given fault must be less than 2.0%.

Protection of interconnecting connections

The requirements for the provision of **Protection** equipment for interconnecting connections (i.e. the primary conductors from the current transformer accommodation on the circuit side of the circuit breaker to the **Connection Point**) shall be specified in the **ECA**.

Back-up Protection

Power Producers and other **Users** shall provide **Back-Up Protection** to cover the possible failure of the **Main Protection** systems at the **Connection Point**. **OETC** shall also provide **Back-Up Protection** and these **Back-Up Protections** shall be coordinated so as to provide discrimination with other protections fitted on the **Transmission System** and shall be so designed as to protect equipment from damage. Relevant details will be made available to a **Power Producer** upon request.

OETC's **Back-Up Protection**, shall result in a fault clearance time slower than that specified for the **Licensed Distributors'** or **Directly Connected Consumers' Back-Up Protection** so as to provide discrimination. The **Back-Up Protection** to be provided by the **Licensed Distributors** or **Directly Connected Consumers** shall have fault clearance times not slower than:

- 500mS (100 main protection +400 Back up protection) for faults on the Licensed Distributors' or Directly Connected Consumers' Plant Connected with the Transmission System at 400kV, 220kV or 132kV; and
- 800ms (100 main protection +700 Back up protection) for faults on the Licensed Distributors' plant Connected with the Transmission System at 33 kV Level.

Protection of Users' Plant and equipment

Users may consult **OETC** with respect to **Protection** adequacy.

It is recommended that **Users** take precautions against **Disturbances** on the **Transmission System** including, where appropriate, **Protection** against:

a) load unbalance (negative sequence) protection; also fitted with a restraint to prevent nuisance operation during energisation of any nearby transformer;

b) over/under voltage

c) over/under **Frequency**

d) any combination of (b) and (c) that may result in overfluxing

e) automatic reclosing (either single or three phase)

Power Producers shall be responsible for protecting all their **Generating Units** against damage should **Frequency** excursions outside the range 51.5 **Hz** to 47.5 **Hz** ever occur. Should such excursions occur, it is up to the **Power Producers** to decide whether to disconnect their **Plant** for reasons of safety of **Plant** and/or **Persons**.

Users are responsible for protecting **Generating Units** and other **User Plant** against any form of interaction between:

- the **Frequency** and wave form of the **Supply** voltage, including any harmonics present; and
- any mechanical resonance frequencies of the **Generating Unit**.

Generating Unit Protection must co-ordinate with any auto re-close policy specified by **OETC**.

Power producers with **Synchronous Generation** shall additionally provide protection to detect loss of **Generating Unit** excitation and initiate a trip of the associated **Generating Unit**.

Where, **System** requirements so dictate, **OETC** will specify in the **ECA** and/or **Use of System Agreement** a requirement for **Power Producers** to fit pole-slip **Protection** on their **Synchronous Generating Units**.

Circuit-breaker fail Protection

When a **User** is **Connected** to the **Transmission System** at 400kV, 220kV or 132kV and a circuit breaker is provided by the **User** or **OETC**, circuit breaker fail **Protection** shall be provided by the **User** or **OETC** on this circuit breaker unless otherwise agreed with **OETC**.

Following operation of a **Protection** system, in the event,of a failure to interrupt fault current by the appropriate circuit-breakers within the fault current interruption time, the circuit breaker fail **Protection** is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within a total time from the inception of the fault of 300ms.

No busbar **Protection**, circuit-breaker fail **Protection** relays, AC or DC wiring (other than power supplies or DC tripping associated with a **Centrally Dispatched Generating Unit** or other **Plant** operated by a **User** may be worked upon or altered by **User** personnel in the absence of a representative of **OETC**.

Work on Protection equipment

Where **OETC** owns the busbar at the **Connection Point**, no busbar **Protection**, AC or DC wiring (other than power supplies or DC tripping associated with the **Users' Plant** or equipment) may be worked upon or altered by the **User**'s personnel in the absence of a representative of **OETC** or by **OETC**'s personnel in the absence of the **User**'s representative.

CC 6.2.5 Under-frequency relays

As required under the **Operating Code**, each **Licensed Distributor** and **Directly Connected Users** as specified in the respective **ECA** or other agreement shall make arrangements that shall facilitate automatic under-frequency de-energisation of **Demand**. **Grid Code OC**4 specifies the manner in which **Demand** subject to under-frequency de-energisation shall be split into discrete **MW** blocks with associated under-frequency relay settings. Technical requirements relating to under-frequency relays are listed in Appendix E. All **Users** with **Demand** should have in mind their obligations under **OC**4 when designing the arrangement for controlling their **Systems**.

CC 6.2.6 Under voltage relays

On occasion, **OETC** may require a **User** to fit **Protection** to all or part of the **User**'s installation which initiates a **Demand** cessation or reduction on the occurrence of abnormal voltage conditions. Each **ECA** with a **Demand Consumer** shall contain a **Schedule** which may be updated by **OETC** from time to time to provide details of the requirements and settings for such **Protection**. As required in **OC** 4, **OETC** shall maintain an operational record indicating the occasions and duration of such operations.

CC 6.3 Power Quality of Users Facility at the Connection Point

CC 6.3.1. Power factor

All **Users** with **Demand** shall ensure that the **Power Factor** of **Demand** at the **Connection Point** never falls outside the limits of 0.95 lagging and 0.95 leading. If the **Demand Power Factor** falls outside these limits then **Users** shall take all necessary steps to add reactive compensation capability to rectify the situation.

CC 6.3.2. Power quality

The following power quality requirement shall be met at the **Connection Point**:

- harmonic distortion shall be not more than permitted in the most recent approved version of IEC.61000-3-6;
- voltage fluctuations shall be within the limits defined in the most recent approved version of IEC 61000-3-7;
- phase unbalance of currents shall not exceed 1%.

Power Quality meters shall be installed at any **User** interface location with the **Transmission System** when **OETC** so requires.

CC 6.4 Operational Metering and Telephony

CC 6.4.1 Communications equipment

In order to ensure control of the **Transmission System**, telecommunications between **Users** and **OETC** must, if required by **OETC**, be established in accordance with the requirements set down below.

Where a **User** proposes to use mains borne signalling equipment to superimpose signals on the **Transmission System**, the prior written agreement of **OETC** is required (which agreement will not be unreasonably withheld).

Users shall obey any requirements or instructions issued from time to time by **OETC** relating to controlling threats to the security of its operational capability, which threats may arise from **Users** interfacing with **OETC**'s communication and control systems.

Any **User** who has concerns relating to cyber threats to its installation arising from its connection with **OETC**'s communication network should identify the specifics of the concern to **OETC** who should investigate the matter promptly, and in any case report initially to the **User** within 4 weeks. Where the matter is complex, the initial report should identify by when a final report will be issued.

CC 6.4.2 Control telephony

Control telephony is the method by which a **User** operator and **OETC** control engineers speak to one another for the purposes of control of the **Total System** in both normal and emergency operating conditions (all communications being confirmed either by e-mail or by other electronic means). Control telephony provides secure point-to-point telephony for routine control calls, priority control calls and emergency control calls.

OETC shall install control telephony at the **User** location where the **User** telephony equipment is not capable of providing the required facilities or is otherwise incompatible with the **OETC** control telephony. Details relating to the control telephony required are contained in the **ECA**.

CC 6.4.3 Operational metering

OETC shall provide supervisory control and data acquisition (**SCADA**) **Outstation** interface equipment at each **Connection Site**. The **User** shall provide such voltage, current, frequency, **Active Power** and **Reactive Power** measurement outputs and **Plant** status indications and alarms to **OETC**'s **SCADA Outstation** interface equipment as required by **OETC** in accordance with the terms of the **ECA**.

Active Power and **Reactive Power** measurements, circuit breaker and disconnector status indications from **Generating Units** and **Generating Unit** transformer tap positions must each be provided to **OETC** on an individual **Generating Unit** basis. In addition, measured or derived **Active Power** output on each fuel, from **Generating Units** that can continuously fire on more than one fuel simultaneously must be provided.

The general requirements for connection of such signals to **OETC** SCADA system are set out in Appendix D.

Metering **System** requirements shall be provided in accordance with **MDEC**.

CC 6.4.4 Communication facility

Each **User** and **OETC** shall provide telephone(s) and e-mail facilities or any other agreed means of communication of reliable quality and redundancy (e.g., from different network operators where possible) at their working locations to facilitate reliable communication between **User** and **OETC**.

a) in the case of **Power Producer**s, at each **Production Facility**;

b) in the case of **OETC** and **Licensed Distributors**, at the respective control centre(s); and

c) in the case of **Directly Connected Consumers** at the **Control Centre**.

Each **User** shall, prior to **Connection** of the **User Plant** to the **System,** notify **OETC** of its telephone number or numbers, and shall notify **OETC** of any changes.

CC 6.4.5 Busbar voltage

OETC shall provide each **Power Producer** with voltage signals at a **Connection Point** to enable the **Power Producers** to synchronise the **Generating Units** to the **Transmission System**.

CC 6.4.6 System monitoring

Some monitoring equipment is installed on the **Transmission System** to enable **OETC** to monitor the **System** dynamic performance. Further such equipment will be installed in future. To allow the monitoring of individual **Generating Units**, **OETC** requires voltage and current signals from the secondary windings of **Generating Unit** circuit current transformers and voltage transformers. They shall be provided by the **User** with the installation of the monitoring equipment being dealt with in the **PPA**/**PWPA**.

CC 7 Technical Criteria - Schedules

CC 7.1 Purpose of Schedules

The schedules to these **Connection Conditions** contain certain **Plant** performance requirements for **Users**, divided into type of **Plant**:

a) Schedule 1 sets out technical performance criteria that **Power Producers** must comply with in respect of their **Synchronous Generating Units** whether functioning alone or as part of a combined electricity and desalination of water facility.

b) Schedule 2 sets out technical performance criteria that **Power Producers** must comply with in respect of their **Asynchronous Generating Units**.

CC 8 Site Related Conditions

In the absence of agreement between the parties to the contrary, construction, commissioning, control, **Operation** and maintenance responsibilities follow ownership.

CC 8.1 Responsibilities for Safety

Any **User** entering and working on its **Plant** on an **OETC** site will work to **OETC**'s **Safety Rules**, (and any future revisions of these rules) unless otherwise agreed in writing.

OETC entering and working on its **Plant** on a **User** site shall work to the **User Safety Rules**. Until receipt of such notice, **OETC**'s **Safety Rules** will apply.

A **User** may apply to **OETC** for permission to work according to that **Users** own **Safety Rules** when working on its **Plant** on **OETC** sites. If **OETC** is of the opinion that the **User Safety Rules** provide for a level of safety commensurate with that of **OETC Safety Rules**, it shall notify the **User**, in writing, that the **User** may use its own **Safety Rules**.

OETC may apply to a **User** for permission to work according to **OETC's** **Safety Rules** when working on its **Plant** on that **User** sites. If the **User** is of the opinion that **OETC**'s **Safety Rules** provide for a level of safety commensurate with that of that **User Safety Rules**, it shall notify **OETC**, in writing, that **OETC** may use its own **Safety Rules**. Until receipt of such notice, **OETC Safety Rules** will apply.

CC 8.2 Connection Site Schedules

A set of **Connection Site** schedules shall be prepared identifying the equipment and ownerships at the **Connection Site**, the **Connection Points** and the responsibilities for safety, control and maintenance.

The responsibilities for safety, control and maintenance shall be included in a **Site Responsibility Schedule** to inform site staff and **OETC** of agreed responsibilities for **Plant** at the operational interface.

Appendix A sets down the requirements for **Connection Site** Schedules. The attachment to Appendix A provides a format to be used in the preparation of **Site Responsibility Schedules**.

CC 8.3 Operation and Gas (SF6) Zone Diagrams

CC 8.3.1 Operation Diagrams

An **Operation Diagram** shall be prepared for each **Connection Site** at which a **Connection Point** exists using, where appropriate, the graphical symbols shown in Appendix B. The **Operation Diagram** shall include all **HV Plant** and the **Connections** to all external circuits and incorporate numbering, nomenclature and labelling, as set out in the **Operating Code OC** 8. At those **Connection Sites** where SF_6 gas-insulated metal enclosed switchgear and/or other SF_6 gas-insulated **HV Plant** is installed, those items must be depicted within an area delineated by a chain dotted line which intersects SF_6 gas-zone boundaries. The nomenclature used shall conform to that used on the relevant **Connection Site** and circuit. The **Operation Diagram** (and the list of technical details) is intended to provide an accurate record of the layout and circuit interconnections, ratings and numbering and nomenclature of **HV Plant** and related **Plant**.

CC 8.3.2 Gas (SF_6) Zone Diagrams

An SF_6 **Gas Zone Diagram** shall be prepared for each **Connection Site** at which a **Connection Point** exists where SF_6 gas-insulated switchgear and/or other SF_6 gas-insulated **HV Plant** is

utilized. They shall use, where appropriate, the graphical symbols shown in Appendix B. The nomenclature used shall conform to that used in the relevant **Connection Site** and circuit.

CC 8.3.3 Preparation of Operation and Gas (SF6] Zone Diagrams for User Sites

In the case of a **User** site, the **User** shall prepare and submit to **OETC**, an **Operation Diagram** for all **HV Plant** on the **User** side of the **Connection Point** and **OETC** shall provide the **User** with an **Operation Diagram** for all **HV Plant** on **OETC** side of the **Connection Point**.

The **User** shall then prepare, produce and distribute, using the information submitted on the **User Operation Diagram** and the **OETC Operation Diagram**, a composite **Operation Diagram** for the complete **Connection Site**.

CC 8.3.4 Preparation of Operation and Gas (SF6] Zone Diagrams for OETC Sites

In the case of a**n OETC** site, the **User** shall prepare and submit to **OETC** an **Operation Diagram** for all **HV Plant** on the **User** side of the **Connection Point**. **OETC** shall then prepare, produce and distribute, using the information submitted on the **User Operation Diagram**, a composite **Operation Diagram** for the complete **Connection Site**.

Changes to Operation and Gas (SF_6] Zone Diagrams

When **OETC** has decided that it wishes to install new **HV Plant** or it wishes to change the existing numbering or nomenclature of its **HV Plant** at an **OETC** site, **OETC** shall one month prior to the installation or change, send to each such **User** a revised **Operation Diagram** of that **OETC** site, incorporating the new **OETC HV Plant** to be installed and its numbering and nomenclature or the changes, as the case may be.

When a **User** has decided that it wishes to install new **HV Plant**, or it wishes to change the existing numbering or nomenclature of its **HV Plant** at its **User** site, the **User** shall one month prior to the installation or change, send to **OETC** a revised **Operation Diagram** of that **User** site incorporating the new **User HV Plant** to be installed and its numbering and nomenclature or the changes as the case may be.

CC 8.3.5 Validity

The composite **Operation Diagram** prepared by **OETC** or the **User** shall be the definitive **Operation Diagram** for all operational and planning activities associated with the **Connection Site**. If a dispute arises as to the accuracy of the composite **Operation Diagram**, a meeting shall be held at the **Connection Site**, as soon as reasonably practicable, between **OETC** and the **User**, to endeavor to resolve the matters in dispute.

CC 8.4 Site Common Drawings

Site Common Drawings shall be prepared for each **Connection Site** and shall include **Connection Site** layout drawings and electrical layout drawings and they will identify the responsibilities for common services drawings. These items will form part of the **ECA** that will also require common **Protection**/control drawings to be available to all relevant parties.

CC 8.4.1 Preparation of Site Common Drawings for a User Site

In the case of a **User** site, **OETC** shall prepare and submit to the **User**, **Site Common Drawings** for **OETC** side of the **Connection Point**.

The **User** shall then prepare, produce and distribute, using the information submitted by **OETC**, **Site Common Drawings** for the complete **Connection Site**.

CC 8.4.2 Preparation of Site Common Drawings for an OETC Site

In the case of an **OETC** site, the **User** shall prepare and submit to **OETC Site Common Drawings** for the **User** side of the **Connection Point**.

OETC shall then prepare, produce and distribute, using the information submitted by the **User**, **Site Common Drawings** for the complete **Connection Site**.

CC 8.4.3 User changes to Site Common Drawings

When a **User** becomes aware that it is necessary to change any aspect of the **Site Common Drawings** at a **Connection Site** it shall;

a) if it is a **User** site prepare, produce and distribute revised **Site Common Drawings** for the complete **Connection Site**; and

b) if it is an **OETC** site prepare and submit to **OETC** revised **Site Common Drawings** for the **User** side of the **Connection Point** and **OETC** shall then prepare, produce and distribute, using the information submitted by the **User**, revised **Site Common Drawings** for the complete **Connection Site**.

If the **User** change can be dealt with by it notifying **OETC** in writing of the change and for each party to amend its copy of the **Site Common Drawings** then the **User** shall so notify and each party shall so amend.

CC 8.4.4 OETC changes to Site Common Drawings

When **OETC** becomes aware that it is necessary to change any aspect of the **Site Common Drawings** at a **Connection Site** it shall:

a) if it is a **OETC** site, prepare, produce and distribute revised **Site Common Drawings** for the complete **Connection Site**; and

b) if it is a **User** site, prepare and submit to the **User** revised **Site Common Drawings** for **OETC** side of the **Connection Point** and the **User** shall then prepare, produce and distribute, using the information submitted by **OETC**, revised **Site Common Drawings** for the complete **Connection Site**.

If **OETC** change can be dealt with by it notifying the **User** in writing of the change and for each party to amend its copy of the **Site Common Drawings** then **OETC** shall so notify and each party shall so amend.

CC 8.4.5 Validity

The **Site Common Drawings** for the complete **Connection Site** prepared by the **User** or **OETC**, as the case may be, shall be the definitive **Site Common Drawings** for all operational and planning activities associated with the **Connection Site**. If a dispute arises as to the accuracy of the **Site Common Drawings**, a meeting shall be held at the site, as soon as reasonably practicable, between **OETC** and the User, to endeavor to resolve the matters in dispute.

CC 8.5 Access

The provisions relating to access to **OETC** sites by **Users**, and to **User** sites by **OETC**, are set out in each **ECA** between **OETC** and each **User**. In addition to those provisions, where an **OETC** site contains exposed **HV** conductors, unaccompanied access shall only be granted to individuals holding appropriate authorisation.

CC 8.6 Maintenance Standards

It is a requirement that all **User Plant** on **OETC** sites is maintained adequately for the purpose for which it is intended and to ensure that it does not pose a threat to the safety of any of **OETC Plant** or personnel on the **OETC** site.

OETC shall have the right to inspect the test results and maintenance records relating to such **Plant** at any time.

It is a requirement that all **OETC Plant** on **User** sites is maintained adequately for the purposes for which it is intended and to ensure that it does not pose a threat to the safety of any of the **User Plant** or personnel on the **User** site. **Users** shall have the right to inspect the test results and maintenance records relating to such **Plant**, at any time.

CC 8.7 Site Operational Procedures

OETC and **Users** with an interface with **OETC**, must make available staff to take necessary **Safety Precautions** and carry out operational duties as may be required to enable work/testing to be carried out and for the **Operation** of **Plant Connected to the Total System.**

Appendix A: Proforma for Site Responsibility Schedule for Connection Point

(next page)

Attachment to Appendix A Proforma for Site Responsibility Schedule for Connection Point

Connection Site:. ……

Company: ……

Item of Equipment	Equipment Owner	Safety Rules	Safety Co-ordinator[1]	Operational Procedures	Control Responsibility	Party Responsible for Statutory Inspections, Maintenance and Fault Investigations	Security Responsibility	Access[2] [3]	Comments
		.						.	

Signed on behalf of the OETC **Date**

Signed on behalf of each User involved

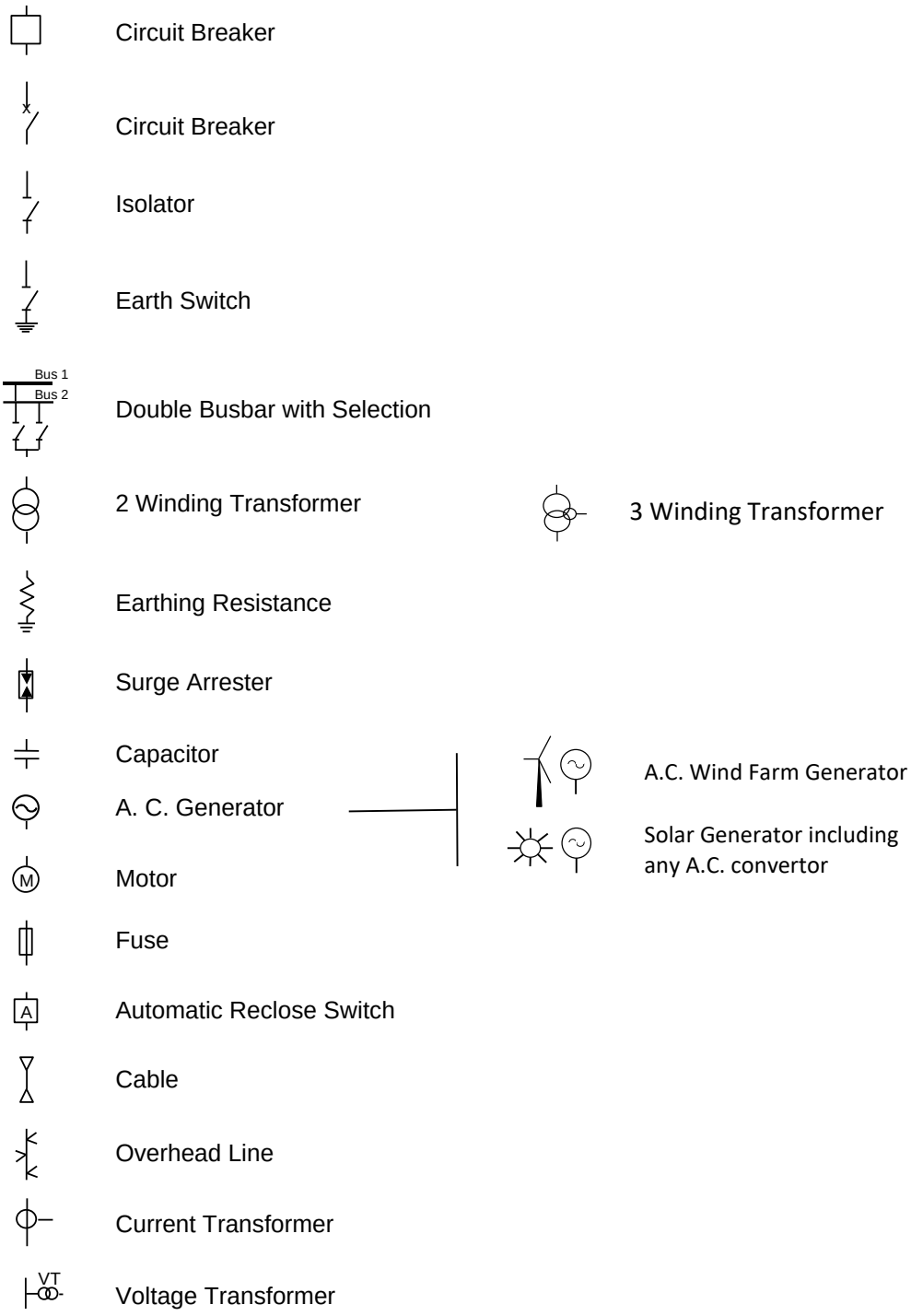
by way of written confirmation of its accuracy.

[1] At all interfaces OETC and the User must co-ordinate activities but the OETC authorized Person has overall responsibility.

[2] Access applies to authorised subcontractors of the OETC and the User also.

[3] Access to the OETC compound is with the OETC's approval, exercised by the site security officer.

Appendix B: Symbols for Operation Diagrams



Appendix C: Plant to be Included on Operation Diagrams

CC C.1 Basic principles

i) Where practicable, all the HV Plant on any Connection Site shall be shown on one Operation Diagram. Provided the clarity of the diagram is not impaired, the layout shall represent as closely as possible the geographical arrangement on the Connection Site.

ii) Where more than one Operation Diagram is unavoidable, duplication of identical information on more than one Operation Diagram must be avoided.

iii) The Operation Diagram must show accurately the current status of the Plant e.g. whether commissioned or decommissioned. Where decommissioned, the associated switching bay shall be labelled "spare bay".

iv) Provision shall be made on the Operation Diagram for signifying approvals, together with provision for details of revisions and dates.

v) Operation Diagrams shall be prepared in A4 format or such other format as may be agreed with OETC.

vi) The Operation Diagram should normally be drawn single line. However, where appropriate, detail that applies to individual phases shall be shown. For example, some HV Plant is numbered individually per phase.

CC C.2 Plant to be Shown on Operation Diagram

1) Busbars;
2) Circuit breakers;
3) Disconnectors (isolators);
4) Switch disconnectors (Switching isolators);
5) Bypass facilities;
6) Earthing switches;
7) Maintenance earths;
8) Overhead line entries;
9) Overhead line traps;
10) Cable and cable sealing ends;
11) Capacitor voltage transformers (CVTs);
12) Power line carrier line matching units (LMUs);
13) Generating unit;
14) Generator transformers;
15) Generating unit transformers;
16) Station transformers;

17) Static VAr compensators;

18) Series or shunt capacitors;

19) Series or shunt reactors;

20) System transformers including tertiary windings;

21) Earthing and auxiliary transformers;

22) Voltage transformers (VTs) and current transformers (CTs);

23) Surge arrestors/diverters;

24) Neutral earthing arrangements on HV Plant;

25) Fault throwing devices;

26) Phase shifting transformers (quadrature boosters);

27) Arc suppression coils;

28) Wall bushings;

29) Shorting and discharge switches; and

30) SF_6 gas zones.

Appendix D: SCADA Outstation Interfacing

CC D.1 Introduction

This Appendix sets out the technical requirements for connections to the OETC SCADA system Outstation in terms of electrical characteristics.

CC D.2 General Requirements

In all cases signals shall be arranged such that the level of electrical interference does not exceed those defined in IEC 870-2-1: "Telecontrol Equipment and Systems - Operating Conditions Power Supply and Electromagnetic Compatibility" and IEC870-3: "Telecontrol Equipment and Systems - Specification for Interfaces (Electrical Characteristics)".

CC D.2.1 Generation Connection Requirement

The connection requirement for the Generation shall include as following:

- Interfacing facilities for sending data to & from generation to OETC communication equipment will be in the scope of Generation.
- The plant has to be connected to the nearest Grid Station via a redundant single-mode fiber Optic cable enabling data communication.
- A redundant multiplexer shall be provided at the plant to be linked with OETC multiplexer through fiber optic cable and configured to work in MPLS-TP 1Gb. The proposed Multiplexer shall be compatible with gird station Multiplexer.
- The multiplexer shall facilitate all the required interfaces required in the plants which are:
    - Optical Interfaces MPLS-TP 1Gb (Outbound link)
    - Ethernet Interface for (for IEC104 SCADA links)
    - Ethernet Interface for (for VoIP service)

  The system architecture is showed in figure-1
- The Generation shall provide communication protocol for LDC and BCC over IEC 870-5-104 with all configurations.
- The generation shall provide direct interface facility from Distributed Control system (DCS system) to LDC & BCC through IEC 870-5-104 protocols via redundant channels
- The cabling required from Distributed Control System to Communication equipment (Multiplexers) will be in the scope of the Generation.
- The Two IEC 870-5-104 channels shall work in redundancy and ensure any single point of failure shall not affect communication with LDC & BCC.
- The signals required at LDC are outlined in Annexur-1 which is preliminary signals only for tendering purpose.

- The signal list outlined in Annexure-1 is preliminary signal list the final list will be decided and agreed during detail design and Engineering.

CC D.2.2 Directly Connected Customers Connection Requirements

- The DCC shall configure the required signals as outlined under signals requirement for DCC.
- The Signals shall be configured as part of Main-1 Relay located at DCC Grid Station.
- The Data from Main-1 Relay configured at DCC end shall be transferred to OETC end Main-1 relay through directly connected Fiber over C37.94 Protocol.
- It will be under the responsibility of DCC to configure Main-1 Relay via IEC 61850 protocol into the existing SCS or RTU system available in the existing OETC Grid station.
- It will be under the responsibility of DCC to configure the newly added signals from DCC end to configure into the SCS Gateway/ RTU over existing IEC 870-5-104 channels.
- The vendor appointed for modification in OETC Grid shall be approved by LDC department before commencement of work.

CC D.2.3 Critical Infrastructure Cyber Security Requirements

The Cyber security of Operational Technology(OT) is increasingly recognized as a high priority in OETC. A rapidly increasing number of incidents in the OT domain, many of which are confirmed or believed to result from cyber-attacks. Cyber security is vital. OT systems must be operated in a secure and reliable way. Today, especially the secure operation of systems that are part of critical infrastructures is of key importance. Security needs to be planned and implemented for a full system as secure operation is only guaranteed when secure products are combined as part of an overall secure system design.

- An industrial firewall shall be deployed between OETC – OT Critical infrastructure and Third-Party System/Other OETC departments network or systems for shared signals, if applicable.
- Following the complete implementation of OT Cybersecurity requirements, the OT Cybersecurity team shall perform final verification and of OT cybersecurity implementation
- Prior to ‘Go-Live’, the OETC OT Cybersecurity team shall conduct vulnerability assessment exercise to ensure that no vulnerabilities exist.
- The contractor has to perform the system hardening to ensure that networking devices are complying with OETC OT Cyber Security Management System Framework.
- All the Cyber Security witnessing part shall be done by the OETC OT Cyber Security team to verify that all hardening is enforced fully as per OETC Telecom Minimum Security Baseline
- For use of telecommunication services by other interfacing OETC departments suppliers / vendors shall mandatorily comply with ‘Telecom Minimum Security Baselines’ stipulated by the OETC OT Cybersecurity Team as per industry best practices.

CC D.3 Signals Requirement for Generation

The Following Signals shall be considered from Generation to OETC as follows,

Status Signals

1) Generator Breaker Status Open/Close
2) Generator Line Isolator Status Open/Close
3) Line Earth Switch Status Open/Close
4) Generator Earth Switch Status Open/Close
5) GAS Supply Valve Status
6) AGC Status IPP/LDC
7) Generating Unit Operation Status

Measurement Signals

8) Gross/Net MW, MVAR, MVA, PF, Frequency, Voltage
9) Turbine Speed
10) Tap Position
11) Gas Fuel Supply Pressure
12) Gas Fuel Supply Flow
13) Liquid Fuel Supply Flow
14) Exhaust Temperature of turbine Unit
15) Gas Fuel Temperature of turbine unit

Alarm Signals

16) Trip Relay 1 & 2 Generator Operated
17) Trip Relay Transformer Operated
18) Generator Protection Signals Status
19) Generator Transformer Protection Signals Status

Commands

20) Unit Operation Mode Selection (Gas/Liquid Fuel Mode)
21) AGC MW Station Set point available
22) Station Net MW set point value for AGC function
23) Generator MW Step Control Raise/Lower pulse
24) Generator MVAR Step Control Raise/Lower pulse
25) Generator Active Power Set Point
26) Generator Reactive Power Set Point
27) Unit Operation Mode Selection (Gas/Liquid Fuel Mode)

CC D.4 Signals Requirement for Directly Connected Customers

The Following Signals shall be considered for directly connected customers with OETC as follows,

Status Signals

1) Breaker Status Open/Close
2) Bus Bar Dis-connector Status Open/Close
3) Line Isolator Status Open/Close

Measurement Signals

4) Current AMP
5) Voltage kV

CC D.5 Connection Design for Communication

The connecting party shall consult OETC and finalize the technical criteria and method of connection to OETC SCADA system.

APPENDIX E: Automatic Under Frequency Load-shedding Relays

Technical requirements for under-frequency relays for the automatic de-energisation of Supplies at low Frequency

CC E.1 Under-frequency Relays

The under-frequency relays to be used shall be in accordance with the requirements of the ECA/ECUOSA. Though this will be determined on a case-by-case basis to align with Grid Code requirements, the set points are expected to be between 47.00Hz and 49.90Hz and be suitable for operation from a nominal AC input of 63.5, 110 or 240V. The following general parameters on the requirements of approved Frequency Relays for automatic installations is given as an indication to the provisions that may be included in a ECA/ECUOSA;

i) Numerical relay with IEC 61850 protocol

ii) Frequency settings: 46.00 – 52.00Hz in steps of 0.01Hz;

iii) Minimum 4 stages for frequency function setting

iv) Df/dt, f+df/dt setting facility

v) Front USB / Serial or Ethernet communication port

vi) Power supply voltage 60-150 Volt DC

vii) Output contacts two contacts per stage

viii) secure for a failure of potential supply.

ix) Time delay may be incorporated in to the scheme but must be in accordance with load dispatch requirement.

x) Under frequency relay should have phase to phase voltage measurement.

xi) Measurement period: Within a minimum settings selectable settings range of 3 to 7 cycles;

xii) Operating time: Between 20 and 160ms dependent on measurement period setting;

xiii) Voltage lock-out: 20 to 90% of nominal voltage;

xiv) Output contacts : 12 Nos

The relay shall be compatible with IRIG-B/SNTP protocol for Time Synchronization (for new relays).

CC E.2 Under-frequency Relay Voltage Supplies

The voltage supply to the under-frequency relays shall be derived from the System at the supply point concerned so that the Frequency of the under-frequency relays input voltage is the same as that of the primary System. This requires either;

i) the use of a secure supply obtained from voltage transformers directly associated with the Transmission System interconnection transformer(s) concerned, the supply being obtained where necessary via a suitable automatic voltage selection scheme; or

ii) the use of the substation 240V phase-to-neutral selected auxiliary supply, provided that this supply is always derived at the supply point concerned and is never derived from a standby supply **CD Generating Unit** or from another part of the Distribution System.

CC E.3 Scheme Requirements

The tripping facility should be engineered in accordance with the following reliability considerations;

i) Dependability: Failure to trip at any one particular Demand shedding point shall not harm the overall operation of the scheme. However, many failures would have the effect of reducing the amount of Demand under low frequency control. An overall reasonable minimum requirement for the dependability of the Demand shedding scheme is 96%, i.e., the average probability of failure of each Demand shedding point should be less than 4%. Thus the Demand under low Frequency control shall not be reduced by more than 4% due to relay failure; and

ii) Outages: Under-frequency Demand shedding schemes shall be engineered such that the amount of Demand under control is as specified by OETC and is not reduced unacceptably during equipment outage or maintenance conditions.

Connection Conditions Schedule-1: Performance Criteria for Synchronous Generating Units Connected to the Transmission System

CC S1.1 Applicability of Technical Design and Operational Criteria

a) In this Schedule 1, all references to **Generating Units** shall be read and construed as references only to **Synchronous Generating Units Connected** to the **Transmission System**.

b) **Power Producers** shall, in addition to the requirements of **CC** 6 at the **Connection Point**, meet the following technical design and operational performance criteria for each **Synchronous Generating Unit**.

CC S1.2 Generating Plant Performance Requirements

CC S1.2.1 For **Centrally Dispatched Generating Units** the **Reactive Power** capability shall as a minimum be:

(i) **Power Factor** (lagging) at rated **Active Power**= 0.80;

(ii) **Power Factor** (leading) at rated **Active Power**= 0.95; and

(iii) short-circuit ratio not less than 0.5.

These parameters are assessed at the terminals of the generator. The **Centrally Dispatched Generating Unit** must be capable of fully delivering **Reactive Power** according to the **Generator Performance Chart** supplied as part of planning data within the range of the minimum stable generation limit and the **Registered Capacity** and the **Generating Unit** will be expected to do so.

CC S1.2.2 For **Centrally Dispatched Generating Units** the minimum **Connected** impedance applicable to the generator and **Generator Transformer** may be specified by **OETC** in the "Offer of Connection" to the **System**. **OETC**'s requirements for the impedances will reflect the fault level and stability needs of the **Transmission System**.

CC S1.2.3 A **Generating Unit** must be capable of continuously supplying its **Registered Capacity** within the **System Frequency** range 49.5 **Hz** to 50.5 **Hz**. Within the **Frequency** range 49.50 **Hz** to 50.50 **Hz** there must be no reduction in **Output** whilst **Frequency** is falling. Any decrease in **Output** to a level below **Registered Capacity** occurring whilst **Frequency** is falling in the **Frequency** range 49.5 **Hz** to 47.5 **Hz** must not be more than pro rata with any decrease below nominal **Frequency**. **Centrally Dispatched Generating Units** must remain **Synchronised** to the **Transmission System** at **Total System Frequencies** within the range.47.50 – 51.50 **Hz**.

CC S1.2.4 The **Active Power Output** of a **Centrally Dispatched Generating Unit Directly Connected** to the **Transmission System** should not be affected by voltage changes in the normal operating range specified in **CC** 6.1.2. The **Reactive Power Output** under steady state conditions should be fully **Available** within the range of **Transmission System** voltages within the ranges specified in **CC** 6.

For Network faults on the **Transmission System or connected parties** (including faults which are not cleared by the intended circuit breaker) which might cause the

voltage drop at the **Connection Point** in any one phase or combination of phases in between 0% and 80% of the nominal voltage for a period of up to:

- 300 ms in the case of faults on all levels of the **Transmission System** followed by a period of 1 second where voltage may vary (with respect to nominal voltage) in the range:
- 80-110% for voltages up to 220**kV**; and
- 90-105% for the 400**kV** System,

and a subsequent return of the voltage within the range:

- 90-110% of the nominal voltage for **Systems** up to 220**kV**;
- and 95-105% for the 400**kV** System,

the **Generating Unit** must be capable of continuous uninterrupted operation and perform in accordance with the **Protection** philosophy during the fault clearance period, and the immediate post fault recovery period.

CC S1.2.5 Each **Generating Unit** must be capable of contributing to **Primary Response** by supplying **Active Power** according to its **Primary Response** capabilities as set out in the **PPA** or **PWPA** or the **ECA**.

The capability for contributing to **Secondary Response** shall be as set out in the **PPA** or **PWPA** or the **ECA**. **OETC** shall determine the required participation.

Each **Generating Unit** must be capable of supporting voltage regulation at the **Connection Point** by continuous modulation of **Reactive Power** supplied.

CC S1.3 Generating Unit Control Arrangements

CC S1.3.1 Each **Generating Unit** must be controlled, in accordance with **CC** S1.2, so as to contribute appropriately, as reasonably specified by **OETC**, to **Frequency** and **Voltage Control** by continuous modulation of **Active Power** and **Reactive Power** supplied to the **Transmission System**.

CC S1.3.2 Each **Generating Unit** with a **Registered Capacity** must be fitted with a fast acting proportional turbine speed governor to provide **Frequency** control. The turbine speed control principle shall be in such a way that the **Generating Unit Active Power Output** shall vary with rotational speed according to a proportional **Droop** characteristic.

Where a **Generating Unit** or **Power Production Facility** becomes isolated from the rest of the **Total System** but is still supplying **Consumers**, the **Turbine Speed Controller** must also be able to control **System Frequency** below 51.50**Hz** unless this causes the **Generating Unit** to operate below its designed minimum operating level when it is possible that it may trip after a time.

As stated in **CC** 6, the **OETC System Frequency** could rise to 51.50 **Hz** or fall to 47.50 **Hz**. Both the **Generating Unit** and the **Turbine Speed Controller** must continue to operate within this **Frequency** range unless **OETC** has agreed, under the

ECA, to any frequency-level relays and/or rate-of-change-of-frequency relays which shall trip such **Generating Unit** within this **Frequency** range.

For all **Steam Turbine Generating Units**, the governor must be designed and operated to the relevant requirements of IEC 60045.

The **Turbine Speed Controller** shall be sufficiently damped for both isolated and interconnected **Operation** modes. Under all **Operational** conditions, the damping coefficient of the **Turbine Speed Controller** shall be above 0.25 for speed **Droop** settings above 3.0% for **Gas Turbine Generating Units** and 5.0% for **Steam Turbine Generating Units**.

Under all **System** operating conditions, the **Generating Unit** speed shall not be permitted to exceed any value of speed which may cause damage to **Plant** or pose a risk to personnel. For **Generating Unit** oscillations with frequencies below 2 **Hz**, the **Turbine Controller** shall have no negative effect on **Generating Unit** oscillation damping.

The **Turbine Speed Controller** and any other superimposed control loop (load control, gas turbine temperature limiting control, etc.) shall contribute to the **Primary Control** as set out in the **PPA /PWPA** or this **Connection Conditions Code**.

All **Gas Turbine Generating Units** must be fitted with a **Turbine Speed Controller** capable of a power related speed **Droop** characteristic of between 3.0% and 5.0%.

In respect of all types of turbine, **Power Producers** seeking **Connection** of new **Plant** to the **System** after 1st January 2018, or re-**Connection** after undergoing major modification or replacement of the **Plant** or **Turbine Speed Controller** system, must ensure that governor **Dead Bands** are settable separately above and below 50**Hz**.

CC S1.3.3 Each **Generating Unit** is required to have a continuous **Automatic Voltage Regulator (AVR)** acting on the excitation system, which must provide constant terminal voltage of the **Generating Unit** without instability over the entire operating range of the **Generating Unit**.

Control performance of the voltage control loop shall be such that under isolated operating conditions the damping coefficient shall be above 0.25 for the entire operating range.

The **AVR** shall have no negative impact on **Generating Unit** oscillation damping.

The specific requirements for **AVR** facilities shall be specified in the **PPA/PWPA** or the **ECA**. **Operation** of such control facilities shall be in accordance with the **Scheduling and Dispatch Code**.

CC S1.3.4 All **Generating Units** (other than **Generating Units** forming part of a **Demand User**'s installation**)**, first agreed for **Connection** to the **System** after 1st January 2016 must be fitted with the facility to allow **OETC** to implement an **OETC** managed **Automatic Generation Control System** (**AGC**) but the operation of such **AGC** facility shall be subject to agreement between the purchaser (either as the case may be **OPWP** as part of the **PPA** or **OETC** as part of the agreement for **Ancillary Services**) and the **Power Producer**).

CC S1.3.5 **All Generating Units** seeking **Connection** to the **System** after 1st January 2018, must have a **Power System Stabiliser** (**PSS**) control system capable of damping the

range of oscillations which may be present on the **System**. In the case of new **Generating Units** and existing **Generating Units** already equipped with **PSS**, **OETC** may from time to time engage with the **Power Producer** to activate the function, change the settings and prove the operation of the **PSS**.

CC S1.3.6 **All Generating Units** seeking **Connection** to the **System** after 1st January 2018, must be equipped with a control loop capable of initiating actions so as to act as a **Reactive Power** (**VAr**) limiter.

CC S1.3.7 The design of **Load** management systems must be such that it is possible to achieve as a maximum a standard deviation of **Load** error, at steady-state **Load**, over a 60-minute period which does not exceed 2.5 percent of the **Dispatch Instructions**.

CC S1.3.8 **Synchronizion** facility shall be provided by **Generators** at circuit breakers, identified by **OETC**, which depending on the **Plant** configuration, shall include:

i. the **Generating Unit** circuit breaker; and/or

ii. the **Generator Transformer HV** circuit breaker.

OETC will provide the **Generator** with signals (in formats agreed in the **ECA**) from **System Plant** and **Apparatus**, as required, to facilitate **Synchronizing** on the:

- the **Generating Unit** circuit-breaker (which circuit-breaker and location are specified in the **ECA**); and/or
- **Generator Transformer HV** circuit breaker.

The **Synchronizing** facilities shall facilitate **Synchronizing** under the following conditions:

(a) **Transmission System** frequency within the limits specified in **CC** 6.

(b) **Transmission System** voltage within the limits as specified in **CC** 6.

CC S1.4 Negative Phase Sequence Loadings

Generating Units shall be capable of withstanding, without tripping, a negative-phase-sequence loading incurred by clearance of a close-up phase-to-phase fault by back-up **Protection on** the **Transmission System or Distribution System** which will be within the apparatus short-time rating in accordance with the IEEE Standard C37.102: - *IEEE Guide for AC Generator Protection*. In addition, **Generating Units** shall be required to withstand, without tripping, the negative-phase-sequence loading incurred by clearance of a close-up phase-to-phase fault by back-up **Protection** on the **User System** of which they are a part.

Relays designed to provide negative phase protection shall be fitted with a restraint to prevent nuisance operation during energisation of a nearby transformer.

OETC will inform the **Power Producer** of the expected negative-phase-sequence loadings.

CC S1.5 Isolation from Oman Supply and Black Start Capability

(a) It is an essential requirement that the **Transmission System** must incorporate a **Black Start Capability**. This shall be achieved by agreeing a **Black Start**

Capability at a number of strategically located **Production Facilities**. For each **Production Facility OETC** shall state in the **ECA** whether or not a **Black Start Capability** is required. **Black Start Units** approved for installation after 31st December 2020 must be fully capable of **Connecting** to a **System** which is either energized or unenergised. Unless otherwise specified in the **ECA**, **Connection** to the **System** will be at **Frequencies** within the range 47.50 **Hz**–51.50 **Hz**

Connection Conditions Schedule-2: Technical Performance Criteria for Asynchronous Generation Connected to the Transmission System

CC S2.1 Applicability of Technical Design and Operational Criteria

(a) In this Schedule 2, all references to **Generating Units** shall be read and construed as references only to **Generating Units Connected** to the **Transmission System** that form part of a **Wind Farm Power Production Facility** or a **Solar Power Production Facility**. A **Generating Unit** is a group of **Wind Turbines** or an assembly of solar arrays arranged and controlled to behave as a single generator.

(b) In this Schedule 2, unless otherwise specified, all references to measurements shall be deemed to be applicable at the **Connection Point** of the **Power Production Facility**.

(c) This Schedule 2 contains technical, design and operational performance requirements for **Wind Farm Production Facilities** and **Solar Power Production Facilities** in addition to the interface requirements set out in **CC** 6 and is intended to be complementary to **CC** 6.

(d) The requirements are not applicable to any **Wind Farm Power Production Facility** comprising a **Registered Capacity** of less than 10**MW**, but such windfarm shall as a minimum provide signals of its **Output** level to **OETC**. Where more than one **Asynchronous Generating Unit** is located at a single **Transmission** location, and the combined **Output** of the **Generating Units** at that location exceeds 10**MW, OETC** may require **Power Producers** who cause the **Output** to exceed 10**MW** to comply as if they were larger than 10**MW**.

(e) **Solar Power Production Facilities** based upon **Synchronous** generators and thermal cycles will be subject to Schedule 1 of these **Connection Conditions**, although some provisions of this Schedule 2 may apply. **OETC** will determine how Schedule 1 and Schedule 2 are to be applied to such **Users** and the **ECA** will so state.

CC S2.2 Solar or Wind Farm Power Production Facility Impedance

CC S2.2.1 For **Wind Farm Power Production Facilities or Solar Power Production Facilities Connected** to the **Transmission System** the minimum connected impedance applicable to the whole **Wind Farm Power Production Facility** or **Solar Power Production Facility** as a single unit will be specified in the **Connection Agreement**. **OETC**'s requirements for the impedance will reflect the needs of the **Transmission System** from the fault level and stability points of view.

CC S2.3 Power Production Facility Plant Performance Requirements

CC S2.3.1 Within:

(a) Wind Farm Power Production Facilities,

- given wind speeds equal to, or faster than, the manufacturer's cut-in point, and
- equal to, or slower than, the manufacturer's cut-out point,

(both as specified within the **Connection Agreement**) for operation of the **Wind Turbine Generating Units;** or

(b) Solar Power Production Facilities,

- given levels of incident solar energy above that required for stable operation of **Solar Generating Units** (as specified within the **Connection Agreement** for the particular site),

(i) each **Generating Unit** must be capable of continuously supplying **Output** in accordance with the power curve (as specified/set out in the **Connection Agreement)** within the **System Frequency** range 49.50 **Hz** to 50.50 **Hz**.

(ii) Within the **Frequency** range 49.50 **Hz** to 50.50 **Hz,** there must be no reduction in **Output** whilst **Frequency** is falling.

(iii) Within the **Frequency** range 49.5 **Hz** to 47.5 **Hz,** any decrease in **Output** to a level below the **Output** to be delivered in accordance with the power curve (as specified/set out in the **Connection Agreement)** must not be more than pro rata with any decrease below nominal **Frequency**.

(iv) Where **Wind Farm Production Facilities** or **Solar Power Production Facilities** are equipped with rate-of-change-of-frequency relays or other such devices **OETC** will advise the User of the arrangements for co-ordination of settings and **Users** must follow those procedures.

CC S2.3.2 A **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall continuously control voltage at the **Connection Point** within its **Reactive Power** capability limits. For **Wind Farm Production Facilities** or **Solar Power Production Facilities**, the minimum **Reactive Power** capability is defined by the characteristics in **CC** S2.3.2 Figure 1, within the voltage limits specified under **CC** 6.1.2.

There are three control modes required to control **Reactive Power** generation of the **Wind Farm Power Production Facility** or **Solar Power Production Facility**:

(i) **Voltage Control** mode

(ii) **Power Factor** control mode

(iii) **Reactive Power Dispatch**

For **Wind Farm Production Facilities** or **Solar Power Production Facilities Connected** to the **Transmission System**:

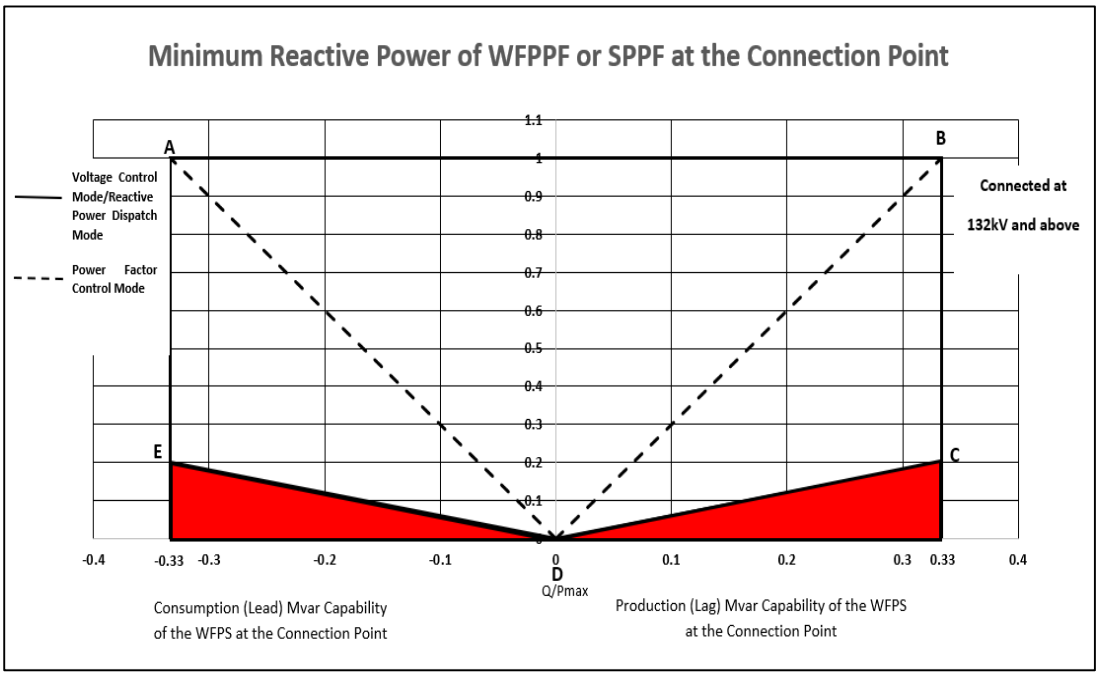
(a) Whilst the **Wind Farm Power Production Facility** or **Solar Power Production Facility** is operating in **Voltage Control** mode the minimum reactive capability is defined by the envelope ABCDE in the **Voltage Control** characteristic shown in **CC** S2.3.2 Figure 1.

(b) Whilst the **Wind Farm Power Production Facility** or **Solar Power Production Facility** is operating in **Power Factor** control mode the reactive capability is defined by the envelope ADB in **CC** S2.3.2 Figure 1.

(c) Whilst the **Wind Farm Power Production Facility** or **Solar Power Production Facility** is operating in **Reactive Power Dispatch** control mode, the **Wind Farm**

Power Production Facility or **Solar Power Production Facility**, as a minimum, must be capable of exporting or importing **MVArs** within the envelope ABCDE.

For the avoidance of doubt, all measurements refer to the Connection Point.



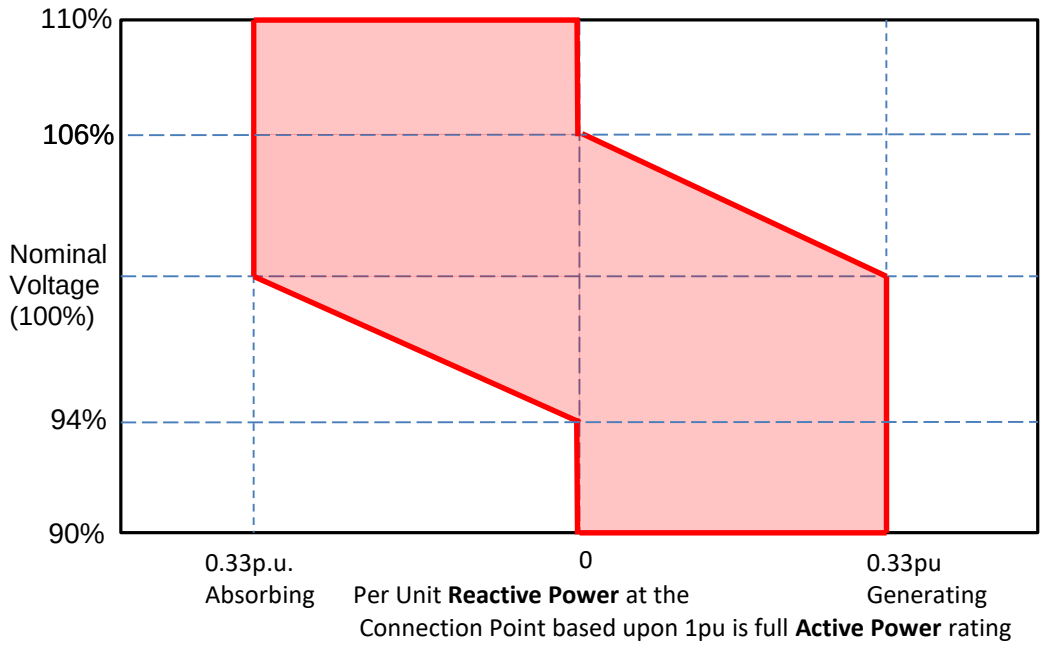
***CC** S2.3.2 Figure 1 - Minimum reactive capability of **Wind Farm Power Production Facility** or **Solar Power Production Facility** **Connected** to the **Transmission System** when operating in various modes and where the **System** voltage is nominal.*

Point A	**MVAr** consumption (lead) capability of the **Wind Farm Power Production Facility** at **Registered Capacity** at the **Connection Point**
Point B	**MVAr** production (lag) capability of the **Wind Farm Power Production Facility** at **Registered Capacity** at the **Connection Point**
Point C	**MVAr** consumption (lag) capability at 20% of **Active Power Output** of the **Wind Farm Power Production Facility** at the **Connection Point**
Point E	**MVAr** generation (lead) capability at 20% of **Active Power Output** of the **Wind Farm Power Production Facility** at the **Connection Point**

*Explanation of **CC** S2.3.2 Figure 1 - Minimum reactive capability of **Wind Farm Power Production Facility** or **Solar Power Production Facility** **Connected** to the **Transmission System** when operating in various modes.*

[For the avoidance of doubt, ***CC** S2.3.2 Figure 1* corresponds to a **Power Factor** range at full **Output** of 0.95 lead to 0.95 lag.]

The **WFPPF** or **SPPF** shall be fully capable of remaining **Connected** and operational for the voltage ranges in **CC** 6.1.2, however, the **Reactive Power Output** capability of the **WFPPF** or **SPPF** may be curtailed according to the following envelope for all levels of **Active Power Output** above 20%.

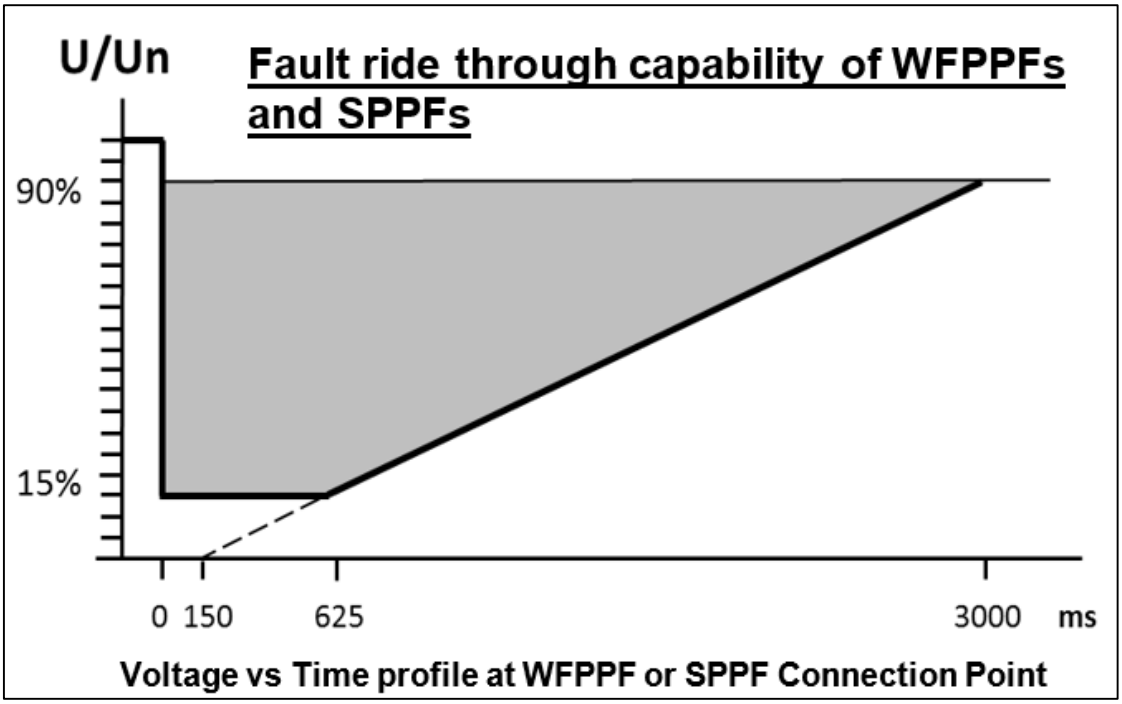


***CC S**2.3.2 Figure 2 – Shows how the requirement in **CC S**2.3.2 Figure 1 is modified for voltages within the range +10% to -10%.*

CC S2.3.3 For the avoidance of doubt, for voltages exceeding nominal, the upper half of the curve in **CC S**2.3.2 Figure 2 replaces the envelope ABCDE in **CC S**2.3.2 Figure 1 and for voltages below nominal, the lower half of the curve in **CC S**2.3.2 Figure 2 replaces the envelope ABCDE in **CC S**2.3.2 Figure 1.

CC S2.3.4

(a) In the event of a step change in voltage each **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall remain **Connected** to the **Transmission System** as specified in the following diagram and the remainder of this **CC** S2.3.4.



*CC S2.3.4 – Figure 1 Shows the time based requirement for a **Wind Farm Power Production Facility*** or **Solar Power Production Facility** *to remain **Connected** to the **Transmission System** during periods of reduced voltage on that **System.***

(b) The speed of response of the **Wind Farm Power Production Facility** control system should be such that, following a step change in voltage and recovery to the normal operating range, the **Wind Farm Power Production Facility** should achieve and maintain on average at least 90% of its steady-state **Active Power** response, measured by **Output**, at the **Connection Point** within 500ms of the voltage recovery to the normal range.

(c) **Wind Farm Production Facilities** shall not consume on average more **Reactive Power** in the 10 seconds following a disturbance on the **Transmission System** than they did on average in the 10 minutes before the occurrence of the disturbance. Where a **Wind Farm Power Production Facility** is supporting the **Transmission System** voltage through **Reactive Power** export, it shall not draw **Reactive Power** during or immediately following the disturbance.

(d) In order to ensure the continued performance of each **Wind Farm Power Production Facility** or **Solar Power Production Facility** the **Power Producer** shall meet the reasonable costs of **OETC** in providing and maintaining a monitoring, recording and transmitting device.

(e) Each **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall be capable of satisfactory operation at any voltage within the range 0% - 120% for the minimum time periods specified below. Other voltage thresholds may be possible but agreement between the **Power Producer** and **OETC** must be reached about their suitability at the application stage for **Connection** and shall be set out in the relevant **Connection Agreement**.

Minimum time periods:

Voltage Range (U/Un)	Time requirement, minimum
115% - 120%	2 seconds
110% - 115%	10 seconds
90% - 110%	Continuous operation
0% - 90%	As per fault-ride-through capability of **Wind Farm Production Facilities** chart (**CC** S2.3.4(a))

CC S2.4 Black Start Capability

A **Wind Farm Power Production Facility** or **Solar Power Production Facility** is not required to provide **Energy** to any part of the **Transmission System** during the process of restoration of power following a **Black Start** and therefore does not require a **Black Start Capability**. For the avoidance of doubt a **Wind Farm Power Production Facility** or **Solar Power Production Facility** will be disconnected from the **Transmission System** during **Black Start** conditions until the **Transmission System** is restored to a stable operating state, as determined by **OETC**.

CC S2.5 Wind Farm or Solar Power Production Facility Control Arrangements

CC S2.5.1 Each **Wind Farm Power Production Facility** or **Solar Power Production Facility** must be so controlled, in accordance with **CC** S2.5.2 and **CC** S2.5.3, as to contribute appropriately, to **Frequency** and voltage control by continuous modulation of **Active Power** and **Reactive Power** supplied to the **Transmission System**.

CC S2.5.2 **Frequency Control**

(a) Each **Wind Farm Power Production Facility** and **Solar Power Production Facility** must be fitted with a "Fast Acting" proportional wind power or solar power governor to provide **Frequency Control** under normal operational conditions.

"Fast Acting" means that the **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall be capable of ramping at the **Primary Response Ramp Rate** set down in the **Connection Agreement**.

(b) This **Fast Acting** governor should be equipped with controls which allow the **Droop** to be set independently in the range 2% to 10% above and below 50.0 **Hz**. A **Governor Dead Band** within which no control will be exercised must be capable of being set with a lower limit between 49.0 **Hz** and 50.0 **Hz** in steps of 0.05 Hz and an upper limit between 50.0 **Hz** and 51.0 **Hz** in steps of 0.05 Hz.

(c) Whilst responding to **Frequency** excursions on the **System** the change in **Output** of the **Wind Farm Power Production Facility** or **Solar Power**

Production Facility shall be at the **Primary Response Ramp Rate**. The governor **Droop**, governor **Dead Band** and high **Frequency** trip settings monitoring shall be as specified by **OETC** in the **Electricity Connection Agreement** and may be varied by **OETC**'s instruction from time to time.

(d) High frequency control / protection shall be provided as follows:

a **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall have a ramp **Frequency** controller, which on **Start-Up** and during normal operation of any **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall only allow an increase in **Output** when the **System Frequency** is below a set value. This set value in the ramp **Frequency** controller should be capable of being set in the range 50.00 **Hz** to 51.50 **Hz** in steps of 0.10 **Hz**. Unless notified otherwise by **OETC**, the **Power Producer** will initially set the controller to the setting as specified by **OETC** in the **Connection Agreement** and the **Power Producer** shall alter settings in line with instructions given by **OETC**.

(e) Under certain **System** conditions **OETC** may require a **Wind Farm Power Production Facility** or **Solar Power Production Facility** to operate below its maximum instantaneous **Output** on a **Droop** setting to be set in the range 2% to 10%. In this mode of operation the **Wind Farm Power Production Facility** or **Solar Power Production Facility** will be providing some of the **System** reserve. The **Wind Farm Power Production Facility** or **Solar Power Production Facility** controller must be capable of being set to operate in a constrained manner within the range of at least 50% to 100% of maximum instantaneous **Output**. This mode is known as **Frequency Sensitive Mode**.

(f) Where a **Wind Farm Power Production Facility** or **Solar Power Production Facility** becomes isolated from the rest of the **Transmission System** the **Wind Farm Power Production Facility** or **Solar Power Production Facility** must immediately detect the condition and shut itself down.

CC S2.5.3 Voltage Control

(a) Each **Wind Farm Power Production Facility** or **Solar Power Production Facility** must be fitted with a **Fast Acting** control system capable of being switched to control the **Wind Farm Power Production Facility** or **Solar Power Production Facility** voltage, **Power Factor** or the **Reactive Power Output** at the **Connection Point**.

These control modes must maintain the voltage at the **Connection Point** within a voltage band as specified within the **Connection Agreement** for the particular site, and in any case within the limits specified under CC 6.1.2.

A **Wind Farm Power Production Facility** or **Solar Power Production Facility** shall continuously control voltage at the **Connection Point** within its **Reactive Power** capability limits.

If, when set in **Power Factor** or **Reactive Power** control modes, the voltage exceeds the specified band, the **Power Factor** control or **Reactive Power** control must revert to **Voltage Control**.

The control of voltage, **Power Factor** and **Reactive Power Dispatch** must ensure stable operation over the entire operating range of the **Wind Farm Power Production Facility** or **Solar Power Production Facility**.

In the event that action by the **Wind Farm Power Production Facility** or **Solar Power Production Facility Active Power** and **Reactive Power** control functions is unable to achieve a sustained voltage within the limits specified in **CC** 6.1.2, the **Wind Farm Power Production Facility** or **Solar Power Production Facility** must detect this and immediately shut down.

(b) If **Voltage Control** is implemented for the **Wind Farm Power Production Facility** or **Solar Power Production Facility**, rather than on individual **Generating Units**, then the range of **Power Factor** available should not be less than that which would have been available if **Voltage Control** had been on individual **Generating Units**.

(c) In order to deal with **Wind Farm Production Facilities** inducing power fluctuations, an additional control loop must be provided by the **Power Producer** to ensure that:

- the **Generating Unit** control system,
- wind turbulence, or
- other factors ,

in the **Wind Farm Power Production Facility** cannot produce power oscillations between 0.25**Hz** and 2**Hz**. The control loop should be designed and operated to ensure that the total peak-to-peak **MW** oscillation within this **Frequency** range is less than 1% of the **Registered Capacity** of the **Controllable Wind Farm Power Production Facility**.

CC S2.5.4 **OETC** may specify the requirement for tap-changing facilities on the site transformer(s) for **Wind Farm Production Facilities** or **Solar Power Production Facilities**. Where a suitable site transformer does not exist, the requirement may be applied to individual wind turbine or solar array transformers. The tapping range and the step sizes will then be specified in the respective **Connection Agreement** or other agreements.

CC S2.6 Negative Phase Sequence Loadings

Wind Farm Production Facilities and **Solar Power Production Facilities** shall be capable of withstanding, without tripping, a negative-phase-sequence loading incurred by clearance of a close-up phase-to-phase fault by **System** back-up **Protection** (which will be within the **Apparatus** short time rating). **OETC** will inform the **Power Producer** of the expected negative-phase-sequence loadings during the course of an application for a **Connection** to the **Transmission System**. A **Power Producer** may obtain relevant details specific to its agreement.

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

The Grid Code

Operating Codes

Version-3.0 August 2020

List of Operating Codes

Operating Codes

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Operating Codes

OC 1 Demand Forecasting

OC 1.1 Introduction

OC 1 outlines the obligations placed on **OETC** and **Users** regarding the preparation of forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System**. **OC** 1 sets out the timescales within which **Users** shall provide forecasts of both **Active Power Demand** and **Reactive Power Demand** to **OETC**, and the timescales within which **OETC** shall provide forecasts to **Users**. The **Demand** forecasts referred to in **OC** 1 are required for certain operational purposes, specifically;

- the **Operational Planning Phase** requires annual forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** for each of the succeeding 5 years;
- for some **Users**, the **Programming Phase** requires weekly forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** for the period 1 to 8 weeks ahead; and
- for some **Users**, the **Control Phase** requires daily forecasts of **Demand Control** data on the **Transmission System** for the day ahead.
- **OC** 1 also deals with the provision of **Demand Control** data (as described in **OC** 4) in timescales consistent with the **Operational Planning Phase**, the **Programming Phase**, and the **Control Phase**.

OC 1.2 Objective

The objectives of **OC** 1 are as follows;

- to specify the requirement for **OETC** and **Users** to provide unbiased forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** within specified timescales. These forecasts are used by **OETC** for **Operational Planning** purposes, and in the **Programming Phase**, and the **Control Phase**;
- to describe information to be provided by **Users** to **OETC** in the post **Control Phase**, and
- to describe certain factors to be taken into account by **OETC** and **Users** when preparing forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System**.

OC 1.3 Scope

In addition to **OETC**, **OC**.1 applies to the following **Users**;

- **Licensed Distributors**;
- **Power Producers**;
- **Directly Connected Consumers**;
- **International Interconnected Parties**;
- **Internally Interconnected Parties**;
- **PWP**; and
- **RAEC if Connected** to the **Total System**.

OC 1.4 Data Required by OETC

OC 1.4.1 Operational Planning Phase

No later than the end of October each year, **OETC** shall notify each **User** in writing of the forecast information listed below for each of the following 5 **Operational Years** (**Five Year Capacity Statement**):

- the date and time of day of the forecast annual peak **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** at annual maximum **Demand** conditions;
- the date and time of day of the forecast annual minimum **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** at average minimum **Demand** conditions; and
- the basis to be assumed for **Average Conditions**.

By the end of January of each year, each **User** shall provide to **OETC** in writing, a statement that the most recent planning forecast remains accurate and contains the following information or alternatively supply the updated or more complete forecast information listed below for each of the succeeding two **Operational Years** on the following basis:

- each **Licensed Distributor** (summed over all **Bulk Supply Points)** and each **Directly Connected Consumer** (at the **Connection Point**), shall provide updated forecast profiles of hourly **Active Power Demand** for the day of that **User**'s maximum **Demand** and for the day specified by **OETC** as the day of forecast annual peak **Demand**. These forecasts to reflect annual maximum **Demand** conditions;
- each **Licensed Distributor** (summated over all **Bulk Supply Points**) and each **Directly Connected Consumer** (at the **Connection Point**), shall provide updated forecasts of their annual **Active Power Demand** requirements for **Average Conditions**.
- each **Licensed Distributor** (summed over all **Bulk Supply Points**) and **Directly Connected Consumer** (at the **Connection Point**), shall provide updated forecasts of

the profile of hourly **Active Power** for the day specified by **OETC** as the day of forecast minimum **Demand** at **Average Conditions**;

- each **Licensed Distributor** shall provide updated loadings relating to individual **Bulk Supply Point Demand** (**Active Power** and **Power Factor)** at annual maximum **Demand** conditions for the annual peak hour at the **Bulk Supply Point**; and individual **Bulk Supply Point Demand** (**Active Power**) and **Power Factor** at **Average Conditions** at the specified hour at the annual minimum **System Demand**.

User forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** provided to **OETC** in accordance with **OC** 1 must reflect the **User**'s best estimates of its forecast requirements.

In circumstances when the busbar arrangement at a **Bulk Supply Point** is expected to be operated in separate sections, separate sets of forecast information for each section shall be provided to **OETC**.

OETC will use updated information to prepare forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** for use in the **Operational Planning Phase**.

OC 1.4.2 Programming Phase

The **Users** identified in **OC** 1.4.2 shall, to the extent required in this **OC** 1.4.2, provide **OETC** in writing by 10:00 hours each Sunday with forecasts of **Demand** for **Active Power** and **Reactive Power** on the **Transmission System** for the period of 1 to 8 weeks ahead;

- **Licensed Distributors** shall supply information on an exception basis, where the **Demand** is expected to materially differ from the usual **Demand** profiles already supplied to **OETC**. Materiality shall be judged by reference to criteria published or advised by **OETC** and which may be updated from time to time.
- **Licensed Distributors** shall, in any case, provide the amount and duration of their proposed use of **Demand Control** which may result in a **Demand** change of 10**MW** or more on an hourly basis at each **Bulk Supply Point**; and
- each **Directly Connected Consumer**, unless excused from so doing by **OETC**, shall supply **Demand** for **Active Power** and **Reactive Power** at a **Connection Point**.

OETC will use the information supplied to it in preparing its forecasts of **Demand** for **Active Power** and **Reactive Power** on the **Transmission System** for the purposes of the **Programming Phase**.

OC 1.4.3 Control Phase

In accordance with **SDC** 1 each **Licensed Distributor**, **Directly Connected Consumer** or other **User** shall notify **OETC** by 10:00 hours each day of any **Demand Control** procedures that may result in a **Demand Change** of 10 MW or more averaged over any hour on any **Bulk Supply Point** for the following day, except where **OETC** requires the otherwise.

OETC will use the information supplied to it when preparing its forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** for use in **Control**

Phase studies. **OETC** shall issue to all **Users** the forecasts used in the **Control Phase** by 15:00 hours each day.

OC 1.5 OETC Forecasts

OETC is responsible for the forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** used for planning and operational purposes. However, **OETC** is required by the terms of its **Transmission and Dispatch Licence** to ensure that the forecasts of **Active Power Demand** used in the **Operational Planning Phase** are consistent with the forecasts of **Active Power Demand** prepared and published by the **PWP** (in its Statement of Future Capacity Requirements).

When preparing forecasts of both **Active Power Demand** and **Reactive Power Demand** on the **Transmission System** to be used in the **Planning Phase** and the **Control Phase**, **OETC** shall take account of the following:

- historic **Demand** data;
- **Transmission System** losses;
- weather forecasts and the current and historic weather conditions;
- the incidence of major events or activities which are known to **OETC** in advance;
- **Generation Schedule and Desalination Schedule**;
- **Demand Control** of, 10 MW or more, or such lower value as **OETC** shall determine for a particular instance, proposed to be exercised by **Licensed Distributors** and of which **OETC** has been informed; and
- other information supplied by **Users**.

Operating Codes

OC 2 Operational Planning

OC 2.1 Introduction

Operating Code OC 2, **Operational Planning**, is concerned with the:

- provision of data by **Users** to **OETC** for **Operational Planning** purposes; and
- procedures relating to the coordination of **Outages** for construction, repair and maintenance of **Plant** on the **Transmission System**.

Code **OC**2 covers planning procedures through various timescales for matching **Capacity** with forecast **Demand** plus **Operating Margin** on the **Total System**. The procedures coordinate **Outages** of **Generating Units** and **Outages** of and constraints on parts of the **Transmission System** and of the **Distribution System** to achieve, so far as possible, the **Transmission Security Standards**.

The code sets out the data required by **OETC** from **Power Producers** in order to conduct the **Operational Planning** process and the procedures to be adopted by **OETC** in the planning and coordination of **Outages** of **Generating Units** and of the **Transmission System**.

OC 2.2 Objective

The objective of this code is to ensure, as far as possible, that **OETC** coordinates and approves **Outages** of **Generating Units**, taking into account **Demand** forecasts, **Desalination** requirements, **Transmission System Outages** and **Distribution System Outages** in order to minimise the overall costs of **Total System Operation** and in order to ensure that forecast **Demand** plus the **Operating Margin** is met in accordance with the **Transmission Security Standards**.

OC 2.3 Scope

In addition to **OETC** and **PWP**, **OC** 2 applies to;

- **Power Producers**;
- **Licensed Distributors**;
- **Directly Connected Consumers**;
- **International Interconnected Parties**;
- **Internally Interconnected Parties**;
- **PAW**; and
- **RAEC** if **Connected** to the Total **System**.

OC 2.4 Procedures

The procedures in this code cover details of the data required and the time at which the data needs to be provided to **OETC** to allow co-ordination of **Outages**. An overall timetable for the **Operational Planning** process is presented in Appendix A.

OC 2.5 Planning of Generating Unit Outages

The procedure set out below is to be followed in each **Operational Year**.

OETC will indicate, to each **Production Facility**, criteria including that on which the **Proposed Station Outage Schedules** should be submitted. The format of the submission is shown in Appendix B.

OC 2.5.1 Planning for Operational Year 2

(i) By the end of January

Each **Power Producer** will provide to **OETC** and **PWP** a **Proposed Station Outage Schedule** for **Operational Year** 2 in writing, which will contain the following information in relation to each proposed **Planned Outage**:

a) identity of the **Generating Units** concerned;

b) **MW** concerned (i.e. **MW** which will not be **Available** as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be **Available**);

c) required duration of **Outage**;

d) preferred start date and start time or range of start dates and start times;

e) whether the **Outage** is a **Flexible Outage** or an **Inflexible Outage**, provided that the **Power Producer** must not declare an **Outage** to be an **Inflexible Outage** unless prudent operating practice would not permit the **Outage** to be declared as a **Flexible Outage**; and

f) if it is a **Flexible Outage**, if;

- the period for which the **Outage** could be deferred at the request of **OETC**, which period shall not be less than 30 days in length;
- the period for which the **Outage** could be advanced at the request of **OETC**, which period shall be not less than 10 days in length.

In relation to sub-paragraph (e) above, the **Power Producer** must provide **OETC** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Outage** and, if the **Power Producer** fails to establish to **OETC's** reasonable satisfaction that the **Outage** is required to be an **Inflexible Outage**, the **Outage** shall be deemed to have been submitted as a **Flexible Outage** with an attendant **Flexible Outage** period of 10 days for advancement and 30 days for deferral.

(ii) Between the end of January and the end of July

For each week of **Operational Year** 2, **OETC** will forecast the maximum **Capacity** that may be required from **Generating Units**, taking into account insofar as **OETC** may consider appropriate:

- **Demand** forecasts;
- **OETC** estimate of **Demand Control**;
- the **Operating Margin** as set by **OETC**;
- **Transmission System** and **Distribution System** constraints;
- **Transmission System** and **Distribution System Outages**; and
- **Transmission System** losses.

During this period **OETC** may, as appropriate, contact each **User** which has supplied information to seek clarification of information received, or such additional relevant information as is reasonable.

OETC will on the basis of (i) the maximum generating **Capacity** required each week (ii) the **Proposed Station Outage Schedule**s and (iii) the total **Available Capacity** develop a **Proposed System Outage Schedule**.

(iii) By the end of July

OETC will having taken into account the information notified to it and, having discussed it with **Users** and **PWP**, if appropriate, provide **PWP**, each **Power Producer** and other **User** in writing with the **Proposed System Outage Schedule**. The **Proposed System Outage Schedule** shall show the **Generating Units** that may be potentially withdrawn from service during each week of **Operational Year** 2 for a **Planned Outage**. It shall show the **Flexible Outage** periods, by way of amendment to, or confirmation of, the suggested **Proposed Station Outage Schedule** submitted by the **Power Producers**.

The **Proposed System Outage Schedule** may have deviations from the **Proposed Station Outage Schedules** as **Flexible Outages** and **Inflexible Outages** may have been moved. **Outages** are moved to coordinate all **Outage** proposals received by **OETC**, or for reasons relating to the proper **Operation** of the **Transmission System**. **OETC** will give priority to facilitate proposed **Inflexible Outages**.

In addition, where in the opinion of **OETC** the **Transmission Security Standards** could not otherwise be met, **OETC** may request **Users**;

a) to re-designate an **Inflexible Outage** proposed by the **Power Producer** to be a **Flexible Outage**; and/or

b) to exclude a **Flexible Outage** or an **Inflexible Outage** from the **Proposed System Outage Schedule**.

(iv) By the end of August

Where a **Power Producer**, a **User** or **PWP** objects to the **Proposed System Outage Schedule**, it may contact **OETC** to explain its concerns. **OETC**, **PWP**, and that **Power Producer** or **User** will then discuss the problem and seek to resolve it.

OETC may need to convene meetings with **PWP**, other **Power Producers** or **Users** and joint meetings of the parties to resolve the problem. **PWP**, **Power Producers** or other **Users** that notify **OETC** of objections may request that such a meeting be convened and **OETC** will give due and reasonable consideration to such request.

In the event of the above discussions not producing agreement, **OETC** will determine the **Proposed System Outage Schedule** by the end of September. However, the affected party, if dissatisfied, may raise the issue as a point of principle with the **Regulatory Authority**, without prejudice to **OETC** decision.

OC 2.5.2 Planning for Operational Year 1

The **Proposed System Outage Schedule** will form the basis for developing the **Final System Outage Schedule** when on the first of April; **Operational Year** 2 becomes **Operational Year** 1.

(i) By the end of January

Each **Power Producer** shall provide **OETC** and **PWP** with its suggested **Final Station Outage Schedule** in writing (showing any amendments to the **Proposed System Outage Schedule**).

The **Final Station Outage Schedule** provided by the **Power Producer** will reflect only changes to the **Proposed System Outage Schedule** if the **Power Producer** has had to respond to changed circumstances. The **Power Producer** will have to provide sufficient evidence of such changed circumstances.

The **Final Station Outage Schedule** will contain the following information in relation to each proposed **Planned Outage**;

a) identity of the **Generating Units** concerned

b) **MW** concerned (i.e. **MW** which will not be **Available** as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be **Available**,)

c) whether the **Outage** is a **Flexible Outage** or an **Inflexible Outage**

d) start date and start time

e) if it is a **Flexible Outage**;

- the period for which the **Outage** could be deferred at the request of **OETC**, which period shall be not less than 30 days in length
- the period for which the **Outage** could be advanced at the request of **OETC**, which period shall be not less than 10 days in length.

The **Power Producer** must provide **OETC** with such evidence as it may reasonably require in order to substantiate the declaration as an **Inflexible Outage** and, if the **Power Producer** fails to establish to **OETC**'s reasonable satisfaction that the **Outage** is required to be an **Inflexible Outage**, the **Outage** shall be deemed to have been submitted as a **Flexible Outage** with an attendant **Flexible Outage** period of 10 days for advancement and 30 days for deferment.

(ii) By the end of June

OETC will have considered the **Final Station Outage Schedule** taking into account the following factors insofar as **OETC** may consider appropriate:

- **Demand** forecasts;
- **OETC** estimate of **Demand Control**;
- the **Operating Margin** as set by **OETC**;
- **Transmission System** and **Distribution System** constraints;
- **Transmission System** and **Distribution System Outages**; and
- **Transmission System** losses.

OETC will provide **PWP**, each **Power Producer** and **User** with a draft **Final System Outage Schedule** in writing, showing the **Generating Units** which it is proposed to be withdrawn from service during each week of **Operational Year** 1 for a **Planned Outage** and showing **Flexible Outage** periods, by way of amendment to, or confirmation of, the **Final Station Outage Schedule** submitted by the **Power Producer**.

The draft **Final System Outage Schedule** may differ from the **Final Station Outage Schedule** as follows:

(i) **Flexible Outages** (and associated **Flexible Outage** periods) may have been moved to coordinate all **Outage** proposals received by **OETC** or generally for reasons relating to the **Operation** of the **Transmission System**; or

(ii) a **Flexible Outage** may have been re-designated as an **Inflexible Outage**.

In addition, where in the opinion of **OETC** the **Transmission Security Standards** could not otherwise be met, **OETC** may, by giving to the **Power Producer** and **PWP** a written notice request;

- that a **Flexible Outage** or an **Inflexible Outage** which was shown in the **Proposed System Outage Schedule** or is newly requested by the **Power Producer** be excluded from the **Final System Outage Schedule**; or
- that an **Inflexible Outage** which was shown in the **Proposed System Outage Schedule**, be re-designated as a **Flexible Outage**, or that its start date be moved.

(iii) By the end of July

Where a **Power Producer**, a **User** or **PWP** objects to the **Final System Outage Schedule**, it may contact **OETC** to explain its concerns. **OETC**, **PWP**, and that **Power Producer** or **User** will then discuss the problem and seek to resolve it.

OETC may need to convene meetings with **PWP**, other **Power Producers** or **Users** and joint meetings of the parties to resolve the problem. **PWP**, **Power Producers** or other **Users** that notify **OETC** of objections may request that such a meeting be convened and **OETC** will give due and reasonable consideration to such request.

In the event of the above discussions not producing agreement, **OETC** will determine the **Proposed System Outage Schedule** by the end of September. However, the affected party, if dissatisfied, may raise the issue as a point of principle with the **Regulatory Authority**, without prejudice to **OETC** decision.

(iv) By the end of September

OETC will have considered the **Final System Outage Schedule** in the light of the factors set out in subsection **OC** 2.5.2 (ii) (including the requirement for the **Operating Margin** to be met, and in particular during the period of minimum **Demand**) together with any issues agreed with **Power Producers** in subsection **OC** 2.5.2 (iii).

OETC shall issue to each **Power Producer**, other **Users** and **PWP** the **Final System Outage Schedule** showing

a) the **Generating Units** that will be withdrawn from service during each week of **Operational Year** 1 for a **Planned Outage**, and

b) the **Flexible Outage** periods.

OC 2.5.3 Planning for Operational Year 0

Throughout each **Operational Year** and from end of January of the preceding **Operational Year**, **OETC** will monitor the **Operating Margin** continuously in the light of any movement of **Planned Outages**, the incidence of **Outages** other than **Planned Outages** and the requirement for **Operating Margin** including at times of minimum **Demand** and taking into account the following factors insofar as **OETC** may consider appropriate the factors specified in subsection **OC** 2.5.1(ii), namely:

i) **Demand** forecasts;

ii) **OETC** estimate of **Demand Control**;

iii) the **Operating Margin** as set by **OETC**;

iv) **System** and **Distribution System** constraints;

v) **Transmission System** and **Distribution System Outages**; and

vi) **Transmission System** losses.

(i) Flexible Outage movements

In the case of a **Flexible Outage**, **OETC** may, upon giving a **Power Producer** and **PWP** written notice of not less than *7* days require the start date or start time of the **Flexible Outage** to be advanced or deferred within the **Flexible Outage** period the **Power Producer** will take that **Outage** in accordance with the revised timing set out in that notice.

(ii) Amendments to Planned Outages

In the cases of:

- a **Flexible Outage** which **OETC** would like to move outside the **Flexible Outage** period; or

- a **Flexible Outage** which **OETC** would like to move within the **Flexible Outage** Period at less than *7* days notice,

OETC may, upon giving a **Power Producer** and **PWP** written notice, request that the start date or start time of a **Planned Outage** be advanced or deferred.

If the **Power Producer** agrees to such advancement or deferral, or **OETC** and the **Power Producer** agree to some other advancement or deferral, the **Power Producer** will take the **Outage** in accordance with **OETC**'s requirements.

If there is no agreement, then the **Outage** will not be taken by the **Power Producer**.

(iii) Generating Unit substitution

A **Power Producer** may, on reasonable grounds, by notice submitted to **OETC** in writing and **PWP** at any time during **Operational Year** 0, request that a **Generating Unit** for which there is a **Flexible Outage**, as specified in the **Final System Outage Schedule**, remain in service and that one of the other **Generating Units** at the same **Production Facility** (having substantially the same **Capacity** and **Operating Parameters**) be permitted to be taken out of service during the period for which such **Flexible Outage** has been planned. **OETC** shall not unreasonably withhold its consent to such substitution and, if does consent, the **Final System Outage Schedule** shall be amended and the **Power Producer** shall be entitled to take the **Outage** accordingly.

(iv) Short Notice Outages

At any time in **Operational Year** 0, a **Power Producer** may request from **OETC**, a **Short Notice Outage**, by giving not less than 48 hours of notice before the earliest start date. The requested notice must contain the following information:

- identity of the **Generating Unit(s)**concerned;
- full details of the problem and the effect of the **Short Notice Outage** on the **Operating Parameters** and the equipment which is affected;
- the expected date and start time of the **Short Notice Outage**;
- the estimated date and time on which the **Generating Unit** and/or **Desalination Unit** and/or the **Plant** is expected to return to commercial **Operation**; and
- full details of any restrictions or risk of trip of a **Generating Unit** and/or the **Plant** caused by the problem associated with the **Short Notice Outage**.

On receipt of a request notice for a **Short Notice Outage**, **OETC** shall consider the request and shall, having discussed the position with the **Power Producer** (and **Users** in the case of an **Embedded Generating Unit**), reply in writing indicating;

- acceptance of the request, confirming the requested start time and duration of the **Short Notice Outage**;
- proposals for the advancement or deferment of the **Short Notice Outage** if taken, indicating alternative start time and duration; or
- rejection of the request.

If **OETC** has accepted the request, the **Short Notice Outage**, if taken, must be taken by the **Power Producer** in accordance with **OETC**'s requirements.

If **OETC** has indicated an alternative start time and/or duration, **OETC** and the **Power Producer** must discuss the alternative and any other options which may arise during the discussions. If agreement is reached, then the **Short Notice Outage**, if taken, must be taken by the **Power Producer** in accordance with **OETC's** requirements.

If **OETC** refuses the request or if agreement is not reached then the **Short Notice Outage** may not be taken by the **Power Producer**.

If in respect of a particular **Generating Unit**, **OETC** has rejected requests on two successive occasions, which were not less than 7 days apart, **OETC** shall not reject a third request and shall endeavour to accommodate the **Short Notice Outage** on the requested date and for the requested period. However, **OETC** may require that such **Outage**, if it is to be during the **Summer Period**, be deferred if, in **OETC's** reasonable opinion, were the **Short Notice Outage** not to be deferred;

- the **Transmission Security Standards** might not be met; or
- there would otherwise be insufficient generating **Capacity** to meet forecast **Demand** and the **Operating Margin**.

Any such deferral shall be for so long as the above circumstances exist, but shall not be beyond the end of the month following the end of the **Summer Period**.

OETC shall on any occasion on which a **Short Notice Outage** is refused, explain the reasons for the refusal and offer the first available date and the duration for which the **Short Notice Outage** could be accommodated.

In the event that a **Short Notice Outage** is scheduled pursuant to any part of **OC** 2.5.3 (iv), **OETC** shall by notice in writing and copy to **PWP** confirm the details thereof within one day after the details of the **Short Notice Outage** have been settled. Such notice shall contain the following information:

- the identity and **Capacity** of the **Generating Unit(s)** concerned;
- full details of the problem;
- maximum allowed duration of the **Outage**; and
- the start date and start time.

OC 2.5.4 Forced Outages

In the event that a **Generating Unit** suffers a **Forced Outage**, the relevant **Power Producer** shall immediately inform **OETC** (copied to **PWP**) by written notice and giving the **Power Producer's** best estimate of the date and time by which the **Generating Unit** is likely to have been repaired and restored to its full level of availability.

A **Power Producer** shall following a **Forced Outage** and within 24 hours of the commencement of the **Outage**, provide **OETC** with written notice of information and any updates to information as **OETC** may reasonably require, all copied to **PWP**. The **Power Producer** shall use all reasonable endeavours to ensure that the **Generating Unit** is repaired and restored to its full level of availability as soon as possible and in accordance with **Good Industry Practice**.

OC 2.5.5 Release of Generating Units

Power Producers may only undertake **Planned Outages** with **OETC's** agreement in accordance with **Outage** programmes produced pursuant to this code **OC 2 - Operational Planning**.

Generating Units must not be withdrawn for a **Planned Outage** or a **Short Notice Outage** without **OETC**'s formal permission for such release according to the procedures set out below.

OETC's formal permission shall specify:

- the identity of the **Generating Unit** and **Capacity** concerned (i.e. **Capacity** which will not be **Available** as a result of the **Outage** and that which will, notwithstanding the **Outage**, still be **Available**, if any);
- the duration of the **Outage**; and
- the start date and start time.

OETC may withhold its permission for the release of a **Generating Unit** for a **Planned Outage** or a **Short Notice Outage** where such **Outage** has previously been planned in accordance with this code **OC** 2 - **Operational Planning** where, in **OETC**'s reasonable opinion (were such **Outage** not to be deferred);

- the **Transmission Security Standards** could not be met; or
- there would be insufficient **Capacity** to meet forecast **Demand** and the **Operating Margin**.

OETC may require the **Power Producer** to continue to defer such **Outage** for so long as the above circumstances exist.

OETC shall on any occasion on which a **Planned Outage** is refused, explain the reasons for the refusal and offer the first available date at which the **Outage** could be accommodated or such other date as may be agreed with the **Power Producer**.

OC 2.5.6 Return to Service and Overruns

In relation to any **Outage** of duration more than 7 days, the **Power Producer** must notify **OETC** and **PWP** not later than 7 days before the expiry of the **Outage** whether its **Generating Unit** is returning to service:

a) earlier than expected;

b) at the time and date expected;

c) later than expected; and

d) upon return, if it is expected to be fully **Available**.

In all cases of return to service, the **Power Producer** must provide an **Availability Notice** in accordance with the **Scheduling and Dispatch Code 1** on the day prior to the **Schedule Day** on which the **Generating Unit** is to return to service.

A **Power Producer** must use all reasonable endeavours to ensure that, in respect of each **Planned Outage** of its **Generating Units**, the **Outage** timetable is followed, as

included in the **Final System Outage Schedule** (whether as originally agreed or as moved in accordance with this code).

In the case of a return to service earlier than expected, notice of return to service must be given as far as possible in advance of return, but in any event, not later than 7 days before the expiry of the **Planned Outage** period.

The notification is still required when the **Outage** will terminate at the time and date expected.

If at any time during an **Outage**, the **Power Producer** becomes aware that its **Generating Unit** will not be **Available** by the expiry of the period specified for the duration of the **Outage** in the **Final System Outage Schedule**, or as otherwise notified in the case of **Outages** other than **Planned Outages**, the **Power Producer** shall notify **OETC** and **PWP** immediately in writing. The notification shall state the reason for the delay and the **Power Producer**'s best estimate of the date and time by which the **Generating Unit** will actually have been maintained, repaired or restored to be **Available** in accordance with the **Scheduling and Dispatch Code**.

If unexpected issues emerge after the notification to return at the date and time expected, a further notification and a request for extension of the **Outage** may be made to **OETC**, and copied to **PWP**, by the **Power Producer** up to 2 days before the expiry of the **Planned Outage**. Such notification shall state the reason for the delay in the return of the **Generating Unit** to service and the **Power Producer**'s best estimate of the date and time at which the **Generating Unit** will return to service. If no such further notification is made, **OETC** will rely upon the first notification. If **OETC** cannot permit the extension and the **Power Producer** does not return the **Generating Unit** to service at the date and time agreed, the **Outage** will become a **Forced Outage** from the date and time agreed for the return to service.

If **OETC** can permit the **Outage**, in its sole discretion, it should do so. **OETC**'s decision is final. A permitted extension of a **Planned Outage** continues to be treated as a **Planned Outage** for the permitted period.

Where a **Generating Unit** is not expected to be fully **Available** upon its return to service, the **Power Producer** shall state the **Active Power** level at which the **Generating Unit** is expected to be **Available**. In the case of a **Generating Unit** that is capable of firing both on natural gas and on fuel oil, the **Availability** must be stated for each fuel.

OC 2.6 Planning of Transmission System Outages

The procedures set out below are to be followed in each **Operational Year**.

Transmission System Outages required in **Operational Year** 2 will be those resulting from construction or replacement works and will take due account of known requirements and the **Proposed System Outage Schedule**.

Transmission System Outages required in **Operational Years** 1 and 0 will, in addition, take into account **Transmission System Outages** required as a result of maintenance.

OC 2.6.1 Planning for Operational Year 2

OETC shall plan **Transmission System Outages** required in **Operational Year** 2 as a result of construction or replacement works taking due account of known requirements and the **Proposed System Outage Schedule**.

(i) By the end of July

OETC will have drawn up for **OETC** internal use, a draft **Transmission System Outage Plan** covering the period **Operational Year** 2. **OETC** will notify **PWP** in writing of the complete plan and will notify each **User** in writing of those aspects of the draft plan which may operationally affect such **User** including, in particular, proposed start dates and end dates of relevant **Outages** of the **Transmission System** will indicate to **PWP** and **Power Producers** where a need may exist to place restrictions on the **Scheduling** and **Dispatch** of **Generating Units** to allow the security of the **Transmission System** to be maintained within the **Transmission Security Standards**.

OC 2.6.2 Planning for Operational Year 1

The plan produced pursuant to subsection **OC** 2.6.1 will become the draft **Transmission System Outage Plan** for **Operational Year** 1 when on the first of April **Operational Year** 2 becomes **Operational Year** 1. **OETC** shall update the draft **Transmission System Outage Plan** and shall, in addition, take into account **Outages** required as a result of maintenance work.

(i) By the end of July

OETC will update the draft **Transmission System Outage Plan** for **Operational Year** 1 and will inform **PWP** in writing of the complete plan and will inform each **User** of any potential restrictions that may affect it and of any general implications for the **Transmission System**.

(ii) By the end of August

Where a **User** objects to the proposed restrictions or impact notified to it under subsection **OC** 2.6.2 (i) above, equivalent provisions to those set out in subsection **OC** 2.5.1 (iv) will apply, namely: the **User** shall contact **OETC** to explain its concerns. **OETC**, the **User** and any other affected party including **PWP** will then discuss the problem and seek to resolve it.

In the event of the above discussions not producing agreement, **OETC** will determine the requirements of the **Transmission System Outage Plan** by the end of September. However, the affected party, if dissatisfied, may raise the issue as a point of principle with the **Regulatory Authority** without prejudice to **OETC's** decision.

(iii) By the end of September

OETC will issue the final **Transmission System Outage Plan** for **Operational Year** 1.

OETC will notify **PWP** in writing of the complete plan and each **User** in writing of those aspects of the plan which may operationally affect such **User** including, in particular,

proposed start dates and end dates of relevant **Outages** of the **Transmission System**. **OETC** will also indicate where a need exists to use inter-tripping, emergency switching, emergency **Demand** management or other measures including restrictions on the **Scheduling** of **Generating Units** to allow the security of the **Transmission System** to be maintained within the **Transmission Security Standards**.

OC 2.6.3 Operational Year 0 through to the Programming Phase

The **Transmission System Outage Plan** for **Operational Year** 1 issued under subsection **OC** 2.6.2 (iii) shall become the final plan for **Operational Year** 0 when on the first of April **Operational Year** 1 becomes **Operational Year** 0.

OC 2.6.4 Programming Phase

(i) By 11:00 hours each Wednesday

OETC shall update the **Transmission System Outage Plan** for the following one-week period beginning on Sunday.

OETC will notify **PWP** in writing of the complete plan and each **User** in writing of those aspects of the plan that may operationally affect such **User** including in particular proposed start dates and end dates of relevant **Transmission System Outages**. **OETC** will also indicate where a need exists to use inter-tripping, emergency switching, emergency **Demand** management or other measures including restrictions on the **Dispatch** of **Generating Units** to allow the security of the **Transmission System** to be maintained within the **Transmission Security Standards**.

When during the **Programming Phase**, **OETC** becomes aware of the possible need for manual **Demand** shedding, advance warning shall be given to the potentially affected parties and preliminary manual **Demand** shedding programmes prepared in accordance with the procedures of **OC** 4.6.

(ii) During the Programming Phase

Each **User** and **OETC** will inform each other immediately and confirm in writing, copied to **PWP** if there is any unavoidable requirement to depart from the **Outages** and actions determined and notified under this subsection.

OC 2.7 Data Requirements

Each **Power Producer** shall submit in writing to **OETC** by the end of January for each **Operational Year** in respect of each **Generating Unit**;

- the **Generator Performance Chart**; and
- the **Operating Parameters** to be applied from the beginning of January onwards.

The submissions shall be in the format indicated in Appendix C and Appendix D (copied to **PWP**). The data shall be reconfirmed annually even where it has already been provided or specified under a **PPA**.

OETC shall use the **Operating Parameters** for **Operational Planning** purposes only and not for **Scheduling** and **Dispatch**. These data will, however, form the basis for **Operating Parameters** that **Power Producers** will submit/update within the **Scheduling and Dispatch Codes**.

In the case of a **Generating Unit** which is capable of firing on two different fuels, the **Power Producer** must submit to **OETC** (copied to **PWP**), by separate written notifications, the **Operating Parameters** in respect of each fuel, each clearly marked to indicate for which fuel it applies.

The **Generator Performance Charts** must be submitted for each **Generating Unit** separately showing **Output** at the **Generating Unit** terminals under reference conditions. They shall include the details shown in Appendix D.

The **Generator Performance Chart** shall be supported by correction curves or formulas to enable **OETC** to assess the variation in performance over expected ambient temperatures and for other parameters that could affect the **Output** of the **Generating Unit** from reference conditions.

For each **Production Facility** with both **Desalination Units** and **Generating Units**, **Power Producers** shall submit in writing to **OETC** and **PWP** the combination of **Desalination Units** and **Generating Units** that could be running for any given combination of **Capacity** and **Desalinated** water outputs.

Appendix A: Timetable for Main Actions of OC 2 Operational Planning

(Note: The following are summaries only and reference should be made to **OC** 2 for full details.)

(Months refer to month end)

In Operational Year 0	January	Feb	Mar	Apr	May	Jun	July	Aug	Sept
Planning for Operational Year 2									
Each **Power Producer** will provide **OETC** and **PWP** in writing with -	**Proposed Station Outage Schedule** for **Op Yr** 2 (1)								
OETC will provide -	Forecast of maximum **Capacity** required from each **Generating Unit** for each week of **Op Yr** 2 (2)								
OETC will prepare and send to **PWP** and affected Users draft **Transmission System Outage** plan									
OETC will provide **PWP**, each **Power Producer** and other **Users** in writing with -							**Proposed System Outage Schedule** for each week of **Op Yr** 2		
PWP, **Power Producers** and other **Users** will raise any objections to **Proposed System Outage Schedule**								Any objections to be raised and resolved with **OETC**	
OETC will determine -									**Proposed System Outage Schedule** No.1

In Operational Year 0	January	Feb	Mar	Apr	May	Jun	July	Aug	Sept
Planning for Operational Year 1 - **Proposed System Outage Schedule** No.1 forms basis for **Op Yr** 1 planning									
Each **Power Producer** will provide **OETC** & **PWP** in writing with -	**Final Station Outage Schedule** for **Op Yr** 1 (3)								
OETC will provide **PWP**, each **Power Producer** and other **Users** in writing with -						Draft **Final System Outage Schedule** for each week of **Op Yr** 1 (2) (4)			
PWP, **Power Producers** and other **Users** will raise any objections **to Draft Final System Outage Schedule**							Any objections to be raised and resolved with **OETC** (as in **OC**2.5.1)		
OETC, after consideration, will issue schedule -									Final **System Outage** Schedule
Planning for Operational Year 1 - **Transmission System Outage plan**									
OETC will update draft **Transmission System Outage** plan							Send to **PWP** and affected **Users**		
PWP and other **Users** will raise any objections to **Draft Transmission System Outage Plan**								Any objections to be raised and resolved with **OETC**	
OETC, after considerations, will issue plan									**Final Transmission System Outage Plan**

Abbreviations:

Op Yr 1 – **Operational Year** 1 **Op Yr** 2 – **Operational Year** 2

Notes: The following notes are summaries only of actions and reference should be made to **OC** 2 for full details

(1)	Data from **Power Producers** will include	Identity of **Generating Unit/Desalination Unit** **MW Available**/not **Available** Required duration of **Outage** Preferred start date/time or range **Flexible Outage/Inflexible Outage** If flexible, scope for change Proposed timing of Winter downtime
(2)	**OETC** forecast will be based on	**Demand**s forecasts **OETC** estimate of **Demand Management** **Operating Margin**s as set by **OETC** **Transmission System** & **Distribution System** constraints **Transmission System** & **Distribution System Outages** **Transmission System** losses Forecast imports/exports from **Internally Connected Parties** /**International Connected Parties**
(3)	The **Final Station Outage Schedule** produced by **Power Producers** will reflect changes to **Proposed Station Outage Schedule** only if the **Power Producer** has had to respond to changed circumstances for which sufficient evidence must be provided.	
(4)	Draft **Final System Outage** Schedule may differ from **Final Station Outage Schedule** due to;	**Flexible Outages** may have moved to coordinate all **Outage** proposals A **Flexible Outage** may have been re-designated as an **Inflexible Outage** Timing of a Winter **Outage** may have changed
	In addition, where in the opinion of **OETC**, the License requirements could not be met **OETC** may provide to **PWP** and the **Power Producer** a written request that;	A flexible or an **Inflexible Outage** originally shown may be excluded from the **Final System Outage Schedule**. An **Inflexible Outage** in the **Proposed System Outage Schedule** may be re-designated as flexible or its start date moved.

Appendix B: Format for Submission of Proposed Station Outage Schedules from Power Producers

To OETC CONTROL CENTRE		**e-mail**:		**Copy to PWP**	**e-mail**
FROM:	**PRODUCTION FACILITY**				
PROPOSED STATION OUTAGE SCHEDULE FOR		**YEAR**		**Date sent**:	

Generating Unit No	**Registered Capacity MW**	**Unavailable Capacity MW**	**Outage duration**	**Preferred start date or range of start dates**	**Flexible Outage or not**	**If Outage flexible. Period Outage could be**	
						deferred	**advanced**
1							
2							
3							
4							
5							
6							

Appendix C: Operating Parameters

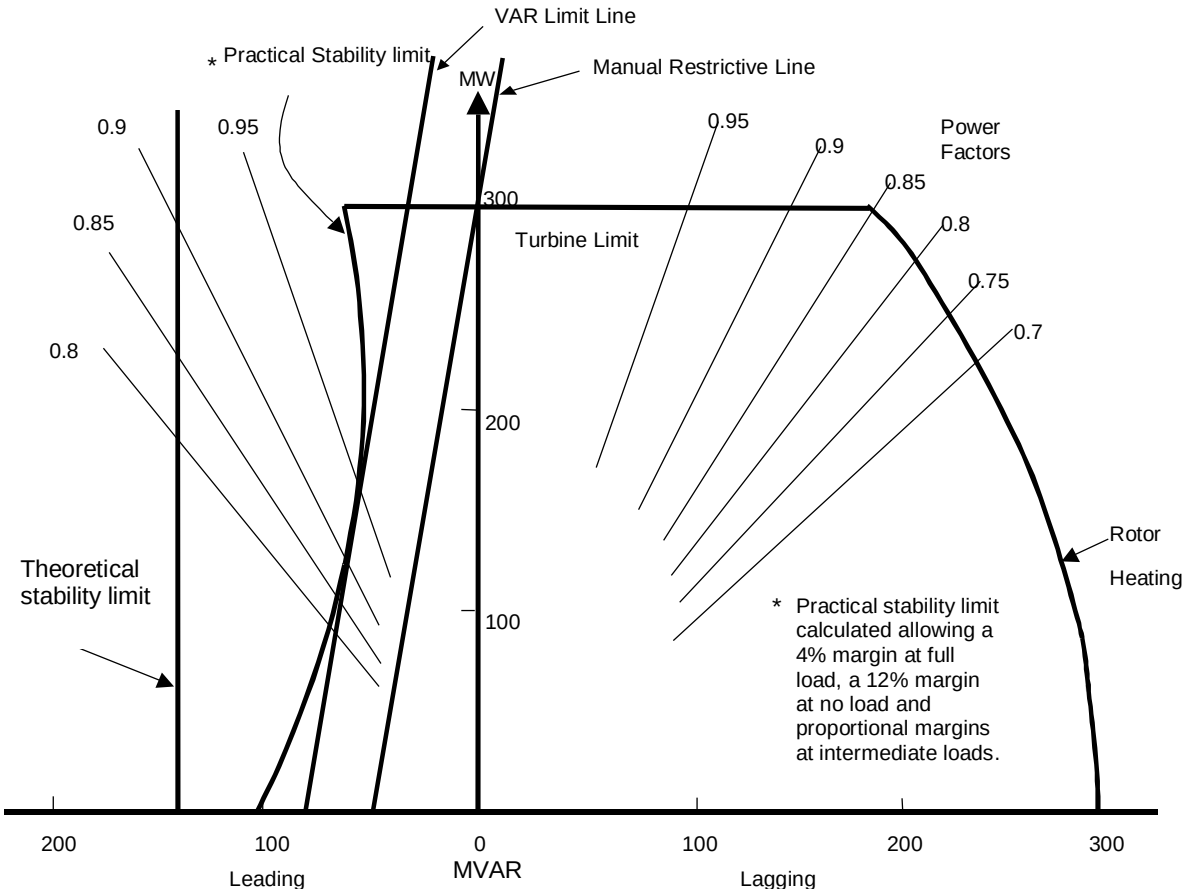
The following parameters are required for each **Generating Unit**

a) **Registered Capacity** under reference conditions supported by correction curves showing changes in;
b) **Output** versus heat rate;
c) **Output** and heat rate versus ambient air temperature; and
d) **Output** and heat rate versus ambient air pressure;

For each **Generating Unit**;

a) the minimum notice required to **Synchronise** the **Generating Unit** or a **CCGT Module** from a condition of de-synchronisation;
b) the minimum time between **Synchronising** different **Generating Units** or **CCGT Module** in a **Production Facility**;
c) the minimum **Generating Unit Active Power** requirements on synchronising, expressed as a **Block Load** in the case of a **Gas Turbine Generating Unit** or a **Steam Turbine Generating Unit**;
d) maximum **Generating Unit**, or **CCGT Module**, loading rates from synchronisation for the following conditions;
    - Hot;
    - Warm; and
    - Cold;
e) maximum **Generating Unit**, or in the case of a **CCGT Module**, de-loading rates;
f) minimum time offload;
g) maximum **Generating Unit**, or in the case of a **CCGT Module**, time to **Synchronise** for the following conditions;
    - Hot;
    - Warm;
    - Cold;
h) **Primary Response**, **MW** in 5 Seconds and sustainable until 30 Seconds;
i) **Secondary Response**, **MW** in 30 Seconds (measured from the **MW** available prior to the event) and sustainable for 30 minutes;
j) **Tertiary Reserve MW** available within 30 minutes to replace **Secondary Response**.

Appendix D: Typical Generator Performance Chart



Operating Codes

OC 3 Operating Margin

OC 3.1 Introduction

Operating Code OC 3, **Operating Margin,** sets out the types of reserves making up the **Operating Margin** that **OETC** may use in the **Control Phase**.

The **Operating Margin** is the amount of reserve (provided by **Production Facilities** or by **Demand Control**) available over and above that required to meet the expected **Demand**. It is required to limit and then correct **Frequency** deviations that may occur due to an imbalance between total **Generation Capacity Output** and **Demand**.

OC 3.2 Objective

The objectives are to state clearly the types of reserve provided over various timescales that make up the **Operating Margin**, and to describe the factors which will govern the issue of **Dispatch Instructions** for reserve.

OC 3.3 Scope

In addition to **OETC**, **OC** 3 applies to;

- **Power Producers**; and
- **Users** offering **Demand Control** as an **Ancillary Service**.

OC 3.4 Operating Margin Constituents

The **Operating Margin** comprises **Contingency Reserve** plus **Operating Reserve**.

Contingency Reserve and **Operating Reserve** provide regulation against uncertainties in **Availability** of **Generating Units** and in **Demand** forecasts.

Contingency Reserve

Contingency Reserve is the margin of **Generation Capacity** required in the period from 24 hours ahead down to real time, over and above the forecast **Demand**. It is provided by: **Generating Units** that are not required to be **Synchronised** in the case of **Synchronous Generating Units** but which must be held **Available** to **Synchronise (**in the case of **Synchronous Generating Units)** or be **Connected** and operational (in the case of non-**Synchronous Generating Units)** within a defined timescale.

Operating Reserve

Operating Reserve is to provide spare **Generation Capacity** for **Frequency** control in real time. The components of **Operating Reserve** are stated in **OC** 3.5.

OC 3.5 Operating Reserve Definitions

Operating Reserve is the additional **Generation Capacity** from **Generating Units** that are either:

- **Synchronised** in the case of **Synchronous Generating Units;**
- **Connected,** operational and governor enabled in the case of non-**synchronous Generating Units,**
- can be **Synchronised** within a maximum of 30 minutes in the case of **Synchronous Generating Units;** or
- from a reduction in **Demand**.

Operating Reserve must be able to respond in real time **Operation** to contribute to containing and correcting any change in the **Frequency** of the **Total System** to an acceptable level in the event of a loss of **Generation Capacity** or mismatch between **Generation Capacity** and **Demand**.

Operating Reserve also includes:

- **Synchronous Generating Units** that have been instructed to **Synchronise** and **Load** in the event of low **Frequency**;

The **Operating Reserve** must be capable of providing response in three phases;

(i) Primary Response

The automatic increase in **Active Power Output** of a **Generating Unit** or a decrease in the **Demand** for **Active Power** in response to a fall in the **Frequency** of the **Total System**.

The increase or decrease in **Active Power** must be in accordance with the provisions of the relevant **Power Purchase Agreement** or **Electrical Connection Agreement**. These will provide that the response will be fully **Available** within 5 seconds from the time of the **Frequency** change and must be sustainable until at least 30 seconds from the time of **Frequency** change.

The number of **MW** of increase in **Output** that can be achieved by the **Total System** in the **Primary Response** time is referred to as the **Primary Reserve**. When estimating the level of **System Primary Reserve** for any period, the maximum value of the **Primary Reserve Available** from any **Generating Unit** shall be limited to 5% of the **Registered Capacity** of that **Generating Unit**.

The number of **MW** of decrease in **Output** that can be achieved in the **Primary Response** time without any new **Dispatch Instructions** is referred to as the **Primary Negative Reserve**.

(ii) Secondary Response

The automatic increase or decrease in **Active Power Output** of a **Generating Unit** or increase or ~~a~~ decrease in the **Demand** for **Active Power** in response to a change in the **Frequency** of the **Total System**.

The increase or decrease in **Active Power** must be in accordance with the provisions of the relevant **PPA** or **Connection Agreement**. The response will be fully **Available** and sustainable over the period from 30 seconds to 30 minutes from the time of the **Frequency** change.

After 30 seconds, any additional **Active Power** should be made **Available** by **Operation** in **Frequency Sensitive Mode.**

The number of **MW** of increase in **Output** that can be achieved in the **Secondary Response** time is referred to as the **Secondary Reserve**.

The number of **MW** of decrease in **Output** that can be achieved in the **Secondary Response** time without altering the **Generation Schedule** is referred to as the **Secondary Negative Reserve**.

(iii) Tertiary Reserve

The component of the **Operating Reserve** that would be **Available** within 30 minutes to replace **Secondary Reserve** as a result of **Emergency** I**nstructions** to:

- **Synchronise** and/or **Dispatch** other **Synchronous Generating Units;** or
- make fully **Available** in the case of non-**Synchronous Generating Units**.

The provision of **Active Power** must be in accordance with the provisions of the relevant **PPA** or **Connection Agreement**.

Generating Units that are **Available** to **Synchronise** outside this time scale are considered not part of **Tertiary Reserve** and are subject to re-**Scheduling** by **OETC.**

OC 3.6 Operating Margin Determination

OC 3.6.1 Contingency Reserve

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

- historical or forecast **Availability** and reliability performance of individual **Generating Units** and the uncertainty of any forecast; and
- any notified **Risk** of **Trips** to the reliability of individual **Generating Units.**
- **Demand** forecasting uncertainties.

OC 3.6.2 Operating Reserve

OETC shall determine the total amount of **Primary Response**, **Secondary Response** and **Tertiary Reserve** that must be **Available** from **Generating Units** at any time to ensure **System** security. **OETC Operating Reserve** policy will take due consideration of relevant factors, including but not limited to the following;

- the magnitude and number of the largest **Active Power** infeeds from **Generating Units**, **International Interconnections, Internal Interconnections** and over single transmission feeders within the **Transmission System**;
- the predicted **Frequency** drop following loss of the largest infeed as may be determined through simulation using a dynamic model of the **Total System**;
- the extent to which **Demand Control** can be implemented;
- significant events that may justify provision of additional **Operating Reserve**;
- the cost of providing **Operating Reserve** at any point in time;
- ambient weather conditions, insofar as they may affect (directly or indirectly) **Generating Unit** and/or **Transmission System** reliability; and
- agreements in place with **International Interconnected Parties**.

OETC shall keep records of the **Operating Reserve** policy and of significant alterations to it as determined by the above and any other factors.

OETC shall also keep, and make available to **PWP** and the **Regulatory Authority**, records for 5 years of hourly reserve level figures.

OC 3.6.3 Spinning Reserve

Spinning Reserve is that portion of the **Operating Reserve** derived from **Generating Units** which are **Synchronised** to the **Total System** in the case of **Synchronous Units** or in operation and are energised and operating in **Frequency Sensitive Mode** in the case of **Asynchronous Generating Units**.

OC 3.7 Instruction of Operating Margin

As part of **Scheduling**, **OETC** will instruct **Power Producers** and other **Users** of the extent to which they are obliged to make their **Generating Units Available** to contribute towards **Contingency Reserve** and **Operating Reserve** with the required levels of response. **Power Producers** and **Users** shall make their **Generating Units** so **Available**.

OETC may issue **Dispatch Instructions**, or instruct **Users**, to require use of **Operating Reserve** in the case of each **Generating Unit** or **Users' Plant**, up to the levels reported under **OC** 3.7.

OC 3.8 Data Requirements

The requirements for **Operating Parameters** for **Operating Margin** are given in the **Connection Conditions** code (**CC** 5). This data shall be provided initially during application for a **Connection** and thereafter must be provided by **Power Producers** to **OETC** by 1 January each year. Any short-term changes to this data are required to be notified to **OETC** as part of the daily reporting under the **Scheduling and Dispatch Codes**.

Operating Codes

OC 4 Demand Control

OC 4.1 Introduction

Operating Code OC 4 is concerned with **Demand Control** measures and procedures for implementing such measures. The term "**Demand Control**" in **OC 4** refers to measures that allow the **OETC** to secure a reduction in **Demand** in situations of insufficient **Generation Capacity** or where severe operating difficulties pose a threat to the stability of the **Total System**.

OC 4 deals with the following aspects of **Demand Control**;

- **Consumer Demand** management initiated by **OETC**;
- Planned manual de-energisation or emergency manual de-energisation of **Demand** initiated by **OETC**;
- **Consumer Demand** management initiated by **Licensed Distributors**;
- De-energisation of **Demand** by automatic **Demand** shedding equipment and automatic relays to preserve **Total System** security;
- **Procedures** for issuing and complying with **Demand Control** instructions; and
- **Demand Control Imminent Warnings** and **Red warnings**.

OC 4.2 Scope

In addition to **OETC**, **OC 4** applies to;

- **Power Producers**;
- **Licensed Distributors**;
- **Licensed Suppliers**;
- **Directly Connected Consumers**;
- **International Interconnected Parties**;
- **Internally Interconnected Parties**;
- **PWP** (for information exchange); and
- **RAEC** if **Connected** to the **Total System**

OC 4.3 Objectives

The objectives of **OC 4** are as follows;

- to identify different methods of **Demand Control** and the procedures governing their implementation; and
- to clarify the obligations of **OETC**, **Users** including **Directly Connected Consumers** as regards the development of procedures, and exchange of information, required for the implementation of **Demand Control**.

OC 4 requires **OETC** to ensure that all parties affected by **Demand Control** are treated equitably and that **Demand Control** is used as a last resort and only after all other means of securing **System** security have been exhausted.

OC 4.4 Methods of Demand Control

Demand Control is implemented in a number of ways, including;

i) **Consumer Demand Side Management** agreements;

ii) **Emergency Manual Demand Shedding**;

iii) **Planned Rota Demand Shedding**; and

iv) De-energisation of **Demand** by automatic under-frequency relays.

The obligations of **OETC**, **Users** including **Directly Connected Consumers** in respect of these means of **Demand Control** are set out below. All plans and implementation of **Demand** de-energisation shall pay due attention to the need to protect certain classes of **Consumers**, e.g., hospitals, etc.

(i) Consumer Demand Side Management agreements

The terms of **DSM** agreements may provide for:

- **Directly Connected Consumers** reducing **Demand** at certain times of the day and at certain periods of the year; and / or
- **Directly Connected Consumers** reducing their **Demand** at **OETC**'s instruction for an agreed number of occasions in a year.

Directly Connected Consumers with **DSM** agreements with **OETC** may remain **Connected** to the **Transmission System** at times when other **Consumers** and **Users** have been manually de-energised.

Consumers who are not **Directly Connected** to the **Transmission System** may have **DSM** agreements with a **Licensed Supplier**. As **OETC** is not a party to **DSM** agreements between **Consumers** and **Licensed Suppliers** such agreements are not subject to the provisions of **OC 4**. However, **Licensed Suppliers** must notify **OETC** of all **DSM** agreements that provide for a reduction of **Demand** of 1**MW** or more.

(ii) Emergency Manual Demand Shedding

OETC may implement **Emergency Manual Demand Shedding** by issuing an instruction to manually de-energise to **Licensed Distributors**, other **Users**, and **Directly Connected Consumers**. **OETC** shall issue such instructions in accordance with plans prepared in paragraph **OC 4**.5 that establish the principles of the amounts and locations of **Demand** to be manually de-energised at a particular point in time or at specified **Frequency** levels.

In circumstances where thermal or stability considerations require it to do so, **OETC** may itself manually de-energise the equipment or **Systems** of **Licensed Distributors**, **Directly Connected Consumers** and other **Users**.

Each **Licensed Distributor** shall implement an instruction to manually de-energise, issued by **OETC**, in accordance with the following arrangements:

(a) each **Licensed Distributor** shall make arrangements that allow it to comply with an instruction from **OETC** to manually de-energise the equipment of **Consumers** on its **Distribution System** under **Emergency Conditions** irrespective of **Frequency** within 30 minutes. It must be possible to manually de-energise a proportion of **Demand** as determined by **OETC**;

(b) each **Licensed Distributor** shall implement the instructions of **OETC** regarding manual de-energisation without delay, and the manual de-energisation must be achieved as soon as possible after the instruction is given by **OETC**. The instruction may relate to an individual **Connection Point** and/or groups of **Connection Points**;

(c) once manual de-energisation has been applied by a **Licensed Distributor** in accordance with an instruction from **OETC**, that **Licensed Distributor** shall not re-energise the manually de-energised **Demand** until **OETC** instructs it to do so and the process of re-energisation must begin within 2 minutes of the instruction being given by **OETC**; and

(d) each **Licensed Distributor** shall provide **OETC** in writing by the end of October in each calendar year, in respect of the next following **Operational Year**, on a **Connection Point** basis, with the following information as set out in Appendix A:

- its total annual maximum **Demand**;
- the percentage value of the total annual maximum **Demand** that can be manually de-energised within timescales of 5, 10, 15, 20, 25, and 30 minutes; at least 40% of total **Demand** must be disconnectable; and
- confirm that a minimum of 20% of total **Demand** can be manually de-energised in the first 5 minutes following instruction from **OETC**.

OETC will notify a **Licensed Distributor** who was issued with an instruction requiring manual de-energisation of the events on the **Transmission System** that necessitated the instruction. In circumstances of protracted shortage of **Generation Capacity** or where a statutory instruction has been given and when a reduction in **Demand** is envisaged by **OETC** to be prolonged, **OETC** will notify the **Licensed Distributor** of the expected duration of the de-energisation.

If **OETC** determines that **Emergency Manual Demand Shedding** is inadequate, **OETC** may manually de-energise and re-energise all or part of a **Licensed Distributor's Demand** as part of a **Demand Control** requirement under **Emergency Conditions**.

To ensure **Directly Connected Consumers** and other **Users** can implement an instruction from **OETC** requiring manual de-energisation:

(a) each **Directly Connected Consumer** and other **User** shall make arrangements that allow it to comply with an instruction from **OETC** to manually de-energise under **Emergency Conditions** irrespective of **Frequency** within 30 minutes. It must be possible to apply the manual de-energisations to individual **Connection Points**, as determined by **OETC**;

(b) each **Directly Connected Consumer** and other **User** shall implement the instructions of **OETC** with regard to manual de-energisation without delay, and the manual de-energisation must be achieved as soon as possible after the instruction being given by **OETC**. The instruction may relate to an individual **Connection Point** and/or groups of **Connection Points**;

(c) once a manual de-energisation has been applied by a **Directly Connected Consumer** or other **User** at the instruction of **OETC**, the **Directly Connected Consumer** or other **User** shall not re-energise until **OETC** instructs it to do so and the process of re-energisation must begin within 2 minutes of the instruction being given by **OETC**; and

(d) each **Directly Connected Consumer** and **User** shall provide **OETC** in writing by the end of October in each calendar year, in respect of the next **Operational Year**, on a **Connection Point** basis, with the following information as set out in Appendix A:

- its total annual maximum **Demand**;
- the percentage value of the total annual maximum **Demand** that can be manually de-energised within timescales of 5, 15, and 30 minutes.

OETC will notify a **Directly Connected Consumer** or **User**, who has been issued with an instruction requiring manual de-energisation, of the events on the **Transmission System** that necessitated the instruction. In circumstances of protracted shortage of **Generation Capacity** or where a statutory instruction has been given and when a reduction in **Demand** is envisaged by **OETC** to be

prolonged, **OETC** will notify the **Directly Connected Consumer** or other **User** of the expected duration of the de-energisation.

If **OETC** determines that **Emergency Manual Demand Shedding** is inadequate, **OETC** may manually de-energise and re-energise **Directly Connected Consumers' Systems** and other **Users' Systems** as part of a **Demand Control** requirement under **Emergency Conditions**.

(iii) Planned Rota Demand Shedding

In the event of a sustained period of shortfall in the **Generation Capacity** and **Demand** balance, either for the **Transmission System** as a whole or for significant parts of the **System**, manual de-energisation of **Demand** will be implemented on a rota basis.

OETC shall develop **Demand** shedding rotas in consultation with **Licensed Distributors**, **Directly Connected Consumers** and other **Users**. **Planned Rota Demand Shedding** shall ensure that **Available** power is shared among affected parties on an equitable basis; groups of **Consumers** can have their equipment de-energised for periods of up to 1 hour, after which their supplies shall be re-energised and another group of **Consumers** can have their equipment de-energised.

OETC shall amend any **Planned Rota Demand Shedding** prior to implementation if, in **OETC**'s opinion, operational considerations require it to do so. **OETC** shall notify each **User** of the total amount of **Demand** that shall be de-energised at different times.

(iv) De-energisation of Demand by automatic under-frequency relays

Automatic **Demand** de-energisation through under-frequency relay **Demand** shedding is normally used to address short-term imbalances in the **Generation Capacity** and **Demand** situation, and generally following the tripping of an amount of **Generation Capacity** beyond the planned contingency value. It is a method of safeguarding the stability of the **Transmission System** when other actions, such as the use of the **Operating Margin**, have failed to stabilise or hold the **Frequency** within required **Operating Limits**.

Each **Licensed Distributor** shall make arrangements to allow approximately 40% of its annual maximum **Demand** to be de-energised by automatic under-frequency relays. These arrangements shall allow automatic de-energisation to occur in stages with specified proportions of **Demand** being de-energised at each level of **Frequency**. **OETC** shall determine the proportion of **Demand** that is required to be de-energised at each stage of falling **Frequency** and agree with **Licensed Distributors** those feeders that will be de-energised.

Each **Licensed Distributor** shall comply with the following:

(a) the **Demand** of each **Licensed Distributor** that is subject to automatic under-frequency de-energisation will be split into discrete **MW** blocks;

(b) the number, location, size and the associated under-frequency settings of these blocks, shall be specified by **OETC** by the end of October in each calendar year following discussion with **Licensed Distributors**. **OETC** will review the arrangements for each discrete **MW** block annually, and prepare a schedule of the agreed arrangements covering all **Licensed Distributors**;

(c) the arrangements covering all **Licensed Distributors** in respect of each discrete **MW** block will ensure a reasonably uniform de-energisation within each **Distribution System** across all **Connection Points**;

(d) where conditions are such that, following automatic under-frequency **Demand** de-energisation, and the subsequent **Frequency** recovery, it is not possible to restore a large proportion of the total **Demand** so de-energised within a reasonable period of time, **OETC** may instruct a **Licensed Distributor** to implement additional **Demand** de-energisation manually, and restore an equivalent amount of the **Demand** that had been de-energised automatically. The purpose of such action is to ensure that a subsequent fall in **Frequency** will again be contained by the **Operation** of automatic under-frequency **Demand** de-energisation;

(e) once an automatic under-frequency **Demand** de-energisation has taken place, the **Licensed Distributor** on whose **Distribution System** it has occurred, will not re-energise until **OETC** instructs that **Licensed Distributor** to do so and then only in the amounts of **Demand** so instructed; and

(f) following the recovery of **Frequency**, **OETC** will issue instructions for the re-energisation of **Demand**. Re-energisation of **Demand** by **Licensed Distributors** must be achieved as soon as possible and the process of re-energisation must begin within 2 minutes of the instruction being given by **OETC**.

Each **Directly Connected Consumer** and other **User** shall make arrangements to allow approximately 40% of its annual maximum **Demand** (subject to discussion with **OETC**) to be de-energised by automatic under-frequency relays. These arrangements shall allow automatic de-energisation to occur in a number of stages with specified proportions of **Demand** being de-energised at each level of **Frequency**. **OETC** shall determine the proportion of **Demand** that is required to be de-energised at each stage of falling Frequency and agree with **Directly Connected Consumers** and other **Users** those feeders that will be de-energised.

The **Demand** of each **Directly Connected Consumer** and other **User** that is subject to automatic under-frequency de-energisation will be split into discrete **MW** blocks. The number, location, size and the associated under-frequency settings of each block, will be specified by **OETC** by the end of October in each calendar year following discussion with **Directly Connected Consumers** and other **Users**. **OETC** will review the arrangements for each discrete **MW** block

annually and prepare a schedule of the agreed arrangements covering all **Directly Connected Consumers** and other **Users**.

Licensed Distributors, **Directly Connected Consumers** and other **Users** shall provide **OETC** with an estimate of the **Demand** reduction that occurred under automatic under-frequency **Demand** de-energisation as soon as practical. Usually verbal information is expected within 10 minutes and written confirmation within 1 day.

Licensed Distributors, **Directly Connected Consumers** and other **Users** shall provide **OETC** with an estimate of the time at which **Demand** was restored following an automatic under-frequency **Demand** de-energisation. The estimate shall be provided to **OETC** as soon as practical. Usually verbal information is expected within 10 minutes and written confirmation within 1 day.

OC 4.5 Procedures for Implementing Demand Control

OETC shall prepare procedures for the implementation of the **Demand Control** measures contained in **OC 4**. The **Grid Code Review Panel** shall review and approve the procedures proposed by **OETC**. In drawing up procedures for the implementation of **Demand Control** measures, **OETC** shall demonstrate that **Demand Control** will be used as the last option in **OETC**'s plans to maintain the stability of the **Transmission System**, and will be used in an equitable manner.

When drawing up its proposals for the implementation of **Demand Control** measures, **OETC** shall consult with all parties to the **Grid Code** including the **PWP**.

Where agreement cannot be achieved with a particular **Licensed Distributor**, **Directly Connected Consumer**, or **User** on the implementation of a **Demand Control** measure, **OETC** shall, after consulting with the **Regulatory Authority**, determine the least-worst case for the **Licensed Distributor**, **Directly Connected Consumer**, or **User** concerned taking into account the requirement to maintain the stability and security of the **Transmission System**.

OC 4.6 Warning System

OETC shall issue advance warnings as soon as it considers an **Alert** will require the implementation of **Demand Control** measures. A **Demand Control** warning issued by **OETC** will state whether **Emergency Manual Demand Shedding** or **Planned Rota Demand Shedding** is imminent. Recipients of **Demand Control** warnings shall take such preparatory action, as they deem necessary in view of the warning. All **Demand Control** warnings will be of a form determined by **OETC** and will remain in force from the stated time of commencement until **OETC** issues notification of their cancellation, amendment or re-issue. The exception is a **Demand Control Imminent Warning** that will automatically lapse after 2 hours unless renewed by **OETC**.

Following the issue of a **Demand Control** warning, no **Demand Control** measures shall be implemented unless **OETC** so issues an instruction.

If a **Licensed Distributor** or **Internally Interconnected Party** considers it necessary to apply **Demand Control** measures to preserve the integrity of its **System**, it may implement the necessary measures provided the impact upon the integrity of the **Total**

System has been properly assessed. In such situations a **Licensed Distributor** shall endeavor to discuss the situation with **OETC** prior to the implementation of **Demand Control** measures and shall notify **OETC** as soon as possible.

i) Demand Control Imminent Warning

OETC will issue a **Demand Control Imminent Warning** to **Licensed Distributors**, **Directly Connected Consumers** and other **Users** who may subsequently receive instruction requiring **Emergency Manual Demand Shedding**.

A **Demand Control Imminent Warning** need not be preceded by any other warning and will be issued when **OETC** expects to issue an instruction requiring **Emergency Manual Demand Shedding** within the following 30 minutes.

A **Demand Control Imminent Warning** will automatically lapse if not reissued by **OETC** within 2 hours of the time of issue.

ii) Red Warning

OETC will issue a **Demand Control Red Warning** by 16:00 hours on the day ahead to **Licensed Distributors**, **Directly Connected Consumers** and other **Users** who may receive instructions on the day ahead concerning **Emergency Manual Demand Shedding** or **Planned Rota Demand Shedding**. A **Demand Control Red Warning** will also be issued to **Power Producers** with **Centrally Dispatched Generating Units** that may be affected by such instructions.

A **Demand Control Red Warning** will specify the period during which **Demand** shedding may be required and the part of the **Transmission System** to which it may apply, the percentage of **Demand** reduction that **OETC** may require and any other matters.

Form of warnings

The form of warnings is given in Appendix B.

OC 4.7 Post Event Reporting

Demand Control instructions may be either to de-energise **Demand** or to restore **Demand**. Following the issue of a **Demand Control** instruction by **OETC**, recipients shall notify **OETC** in writing (or by electronic media as agreed in writing with **OETC**) that they complied with **OETC**'s instruction. Telephone communication, which has to be recorded in the log book, is sufficient in real time. This has to be confirmed in writing within 1 day. For de-energisations the notification shall include an estimate of the **Demand** reduction and the time at which the de-energisation occurred. For restorations the notification shall include an estimate of the amount of **Demand** restored and the time at which the restoration was achieved.

All **Users** shall provide further details to **OETC** of the timings, amount of **Demand** reduction and/or restoration actually achieved. This reporting shall be implemented for each **Demand Control** instruction and should be completed within 24 hours of the events.

OC 4.8 Scheduling and Dispatch during Demand Control

During **Demand Control**, **Scheduling and Dispatch** in accordance with the **Merit Order** may cease, and will not be re-implemented until **OETC** so decides.

Appendix A: Emergency Manual Demand Shedding / De-energisation Summary Sheet

Connection Point (Name)	Annual maximum MW	% of Group Demand De-energisation (Cumulative)						Remarks
		Minutes						
		5	10	15	20	25	30	

Notes: Data to be provided annually by the end of October to cover the following year.

Appendix B: Form of Warnings

Demand Control Imminent Warning

The form of a **Demand Control Imminent Warning** will be;

- This is **Demand Control Imminent Warning** timed at (*xx.xx)* hours;
- This warning applies to (include name of **Users** and area/ substations affected);
- Prepare for **Emergency Manual Demand Shedding** of (*XX*) MW within the next 30 minutes;
- Do not shed **Demand** until instructed;
- Standby for further instructions.

Demand Control Red Warning

The form of a **Demand Control Red Warning** will be;

- This is **Demand Control Red Warning** timed at (*xx.xx*) hours;
- This warning applies to (include name of **Users** and area/ substations affected) to implement ***(Emergency Manual Demand Shedding*** *or* ***Planned Rota Demand Shedding)*** tomorrow;
- The amount of **Demand** to be shed will be *(specify amount and duration of* ***Demand*** *to be shed)*;
- Do not shed **Demand** until instructed.

Operating Codes

OC 5 Notice of Operations, Incidents and Significant Incident Reporting

OC 5.1 Introduction

Operating Code OC 5, Notice of **Operations** and **Incidents**, and **Significant Incident** reporting, requires **OETC** and **Users** to issue notices of all **Operations** and **Incidents** on their respective **Systems** that have or may have implications for the **Transmission System** or a **User's System**.

OETC may determine that an **Incident** shall be classified as a **Significant Incident**. **OC** 5 sets out the procedures for reporting and subsequent assessment of **Significant Incidents**. **OC 5** requires **OETC** or a **User** to prepare;

- a preliminary written **Significant Incident** report within 1 day of **OETC** determining an **Incident** as a **Significant Incident**; and
- a full written **Significant Incident** report within 5 **Business Days** of **OETC** determining an **Incident** as a **Significant Incident**.

In addition, **OC** 5 contains requirements governing the content of **Significant Incident** reports, the circulation of **Significant Incident** reports, and their subsequent assessment and review by the **Grid Code Review Panel**.

OC 5.2 Objective

The objectives of **OC 5** are;

- to specify the obligations on **OETC** and **Users** regarding the issue of notices of **Operations** and **Incidents** on their respective Systems;
- to ensure notices of **Operations** and **Incidents** provide sufficient detail to allow recipients of such notices to fully assess the likely implications and risks and take the necessary actions required to maintain the security and stability of the **Transmission System** or a **User's System**;
- to specify the arrangements for reporting an **Incident** that **OETC** has determined to be a **Significant Incident**; and
- to provide for the review of all **Significant Incident** reports by the **Grid Code Review Panel** to assess the effectiveness of policies adopted in accordance with this **Grid Code**.

OC 5.3 Scope

In addition to **OETC**, **OC** 5 applies to;

- **Power and Water Producers;**
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **Internally Interconnected Parties;**
- **International Interconnected Parties;**
- **Power Procurer** (copy recipient of Significant Incident reports)**;**
- **Market Operator** (copy recipient of Significant Incident reports)**; and**
- **RAEC** if **Connected** to the **Total System**.

OC 5.4 Notice of Operations

OETC and **Users** shall issue notices concerning **Operations** on their respective **Systems** that have had or may have implications for the **Transmission System** or a **User's System**. Where information is requested in writing throughout this code, facsimile transmission or other electronic means as agreed with **OETC** in writing may be used. All writing shall be in the English language.

Without limiting the requirements of **OC 5**.4, notifications shall be issued for the following;

- where an **Operational Instruction** to be issued may have an effect on another **User's System**, or **Plant**;
- where **Plant** is expected to be operated in excess of its rated capability and may present a hazard to **Persons**;
- where there is an expectation of abnormal operating conditions;
- where there is increased risk of inadvertent **Operation** of **Protection**; and
- in relation to major testing, commissioning and maintenance.

OC 5.4.1 Operations on the Transmission System

In the case of an **Operation** on the **Transmission System** that will have or has had an **Operational Effect** on the **System** of another **User**, **OETC** will notify the **User** whose **System** will be, is, or has been, affected.

OC 5.4.2 Operations on a User System

In the case of an **Operation** on the **System** of a **User** that will have, or has had, an **Operational Effect** on the **Transmission System**, the **User** will notify **OETC**. Following notification by the **User**, **OETC** will notify any other **Users** whose **Systems** will be, are, or have been, affected.

OC 5.4.3 Form of Notice of Operations

All operational notifications must be made promptly. Notifications and responses to notifications may be made by telephone but must be confirmed in writing within 30 minutes where practical.

The appropriate party (as described in **OC 5**.4.1 and **OC 5**.4.2) will issue a notification (and respond to any questions asked) of any **Operation** that has arisen independently of any other **Incident** or **Operation**.

The notification will;

- describe the **Operation** (but is not required to state its cause);
- provide sufficient detail to enable the recipient of the notification to reasonably consider and assess the implications, and risks arising; and
- include the name of the **Person** reporting the O**peration** on behalf of **OETC** or the **User**.

The recipient of a notification may ask questions to clarify the notification and the provider of the notification will, insofar as it is able, answer any questions raised.

OC 5.4.4 Timing

A notification will be given as far in advance as possible. Notification of future **Operations** shall be given in sufficient time as will reasonably allow the recipient to consider and assess the implications and risks arising from the **Operation**.

OC 5.5 Notification of Incidents

OETC and **Users** shall issue notifications of **Incidents** on their respective **Systems** that have had or may have implications for the **Transmission System** or a **User's System**. Where information is requested in writing throughout this code, facsimile transmission or other electronic means as agreed with **OETC** in writing may be used. All writing shall be in the English language.

Without limiting the requirements of **OC 5**.5, **Incident** notifications shall be issued for the following:

- where **Plant** has been **Operated** in excess of its rated capability and presented a hazard to **Persons**;
- the activation of any alarm or indication of any abnormal operating condition;
- adverse weather conditions being experienced;
- breakdown of, faults on or temporary changes in the capabilities of **Plant**;
- breakdown of or faults on control, communication and **Metering** equipment; and

- increased risk of inadvertent **Operation** of **Protection**.

OC 5.5.1 Incidents on the Transmission System

In the case of an **Incident** on the **Transmission System**, which has had or may have an **Operational Effect** on the **System** of a **User**, **OETC** will notify the **User** whose **System** will be, is, or has been affected.

OC 5.5.2 Incidents on a User System

In the case of an **Incident** on the **System** of a **User**, which has had, or may have, an **Operational Effect** on the **Transmission System**, the **User** will notify **OETC**. Following notification by the **User**, **OETC** will notify any other **Users** whose **Systems** will be, are, or have been, affected.

OC 5.5.3 Form of Notification

Incident notifications must be issued promptly. Notifications and responses to notifications may be made by telephone but must be confirmed in writing within 30 minutes where practical.

The appropriate party (as described in **OC 5**.5.1 and **OC 5**.5.2) will issue a notification (and any response to questions asked) of any **Incident** that has arisen independently of any other **Incident** or **Operation**.

The notification will;

- describe the **Incident** (but is not required to state its cause);
- be of sufficient detail to enable the recipient of the notification to reasonably consider and assess the implications, and risks arising; and
- include the name of the individual reporting the Incident on behalf of **OETC** or the **User**.

The recipient of a notification may ask questions to clarify the notification and the provider of the notification will, insofar as it is able, answer any questions raised.

OC 5.5.4 Timing

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

OC 5.6 Significant Incident Reporting

OC 5.6.1 Requirement for a Significant Incident Report

OETC may determine that an **Incident** reported by it, or a **User,** shall be classified as a **Significant Incident**. **OETC** shall promptly notify all potentially affected **Users** by telephone that such a determination has been made and

that procedures governing **Significant Incident** reporting are to be followed. **OETC** shall confirm such notice within 2 hours by e-mail or other electronic means or by communication on recorded telephone. All affected **Users** shall acknowledge receipt of the notification in writing within 2 hours of receipt. Both the notifying party and the acknowledging party shall record the communication in their logbooks.

Without limiting this general description, **Significant Incidents** will include, as a minimum all of the following:

- manual or automatic tripping of **System** circuits, and **Plant** where such tripping has resulted in interruption of supply to **Consumers**;
- any multiple tripping or repeated tripping of **System** circuits, and **Plant** even where such tripping has not resulted in a loss of **Demand** or generation;
- voltage excursions outside normal operating limits;
- **Frequency** excursions outside normal operating limits;
- **System** instability;
- overloading (i.e., **Loading** in excess of the rated **Capacity**) of **System** circuits, and **Plant**; and
- breeches of **Safety Rules** or procedures that resulted in danger or injury to members of the public or to **OETC** or **User** employees or their representatives.

Notwithstanding the above, **OETC** may declare any incident to be a **Significant Incident** where, in its view, that **Incident** has had a significant impact on the normal **Operation** of the **System**.

OC 5.6.2 Timing of Significant Incident Reporting:

(i) Preliminary report

OETC and / or the notified **User** must produce a preliminary written **Significant Incident** report within 1 day of **OETC** or the **User** receiving notification that **OETC** has determined an **Incident** to be a **Significant Incident**.

The preliminary written **Significant Incident** report shall cover in outline terms the matters specified in Appendix A.

(ii) Full report

OETC and / or the notified **User** must produce a full written **Significant Incident** report within 5 **Business Days** of **OETC** or the **User** receiving notification that **OETC** determined an **Incident** to be a **Significant Incident.**

Explanation: The preliminary & final reports may have to be produced by more than one party. The following notes are provided as clarification:

- **OETC** shall decide which party (parties) shall produce **Preliminary Significant Incident Report** and notify accordingly. All parties shall send their preliminary reports to **OETC** within 1 **Day**;
- **OETC** shall consider all preliminary reports and, if necessary, issue a consolidated **Preliminary Significant Incident Report**;
- **OETC** shall decide which party (parties) shall produce **Final Significant Incident Report** and notify accordingly. All parties shall send their **Final Significant Incident Reports** to **OETC** within 5 **Business Days**;
- **OETC** shall consider all reports and, if necessary, issue a consolidated **Final Significant Incident Report;**
- However, a party which did not receive any notification may also send their report (preliminary or final) to **OETC**, if they wish to report anything which they consider significant.

OC 5.6.3 Written Reporting of Significant Incidents by OETC to Users

In the case of an **Incident** that has been reported by **OETC** to a **User**, and subsequently determined by **OETC** to be a **Significant Incident**, **OETC** will provide a full written **Significant Incident** report to the **User** and the **Regulatory Authority**. The **User** shall not pass the report to other affected **Users** but:

- if the **User** is a **Licensed Distributor**, it may use the information contained therein in preparing a written report to a **Power Producer** with a **Centrally Dispatched Generating Unit Connected** to its **System** or to a **Licensed Supplier** of **Consumers Connected** to its **Licensed Distribution System**. The **Significant Incident** report may be used in connection with the reporting of **Significant Incidents** under the **Distribution Code**; and
- if the **User** is a **Power Producer**, it may use the information contained therein in preparing a written report to **PWP** or to another **Power Producer** with a **Generating Unit Connected** to its **System** or to a **Licensed Distributor Connected** to its **System** in accordance with requirements for reporting **Significant Incidents** on its **System**.

OC 5.6.4 Written Reporting of Significant Incidents by Users to OETC

In the case of an **Incident** that has been reported by a **User** to **OETC**, and subsequently determined by **OETC** to be a **Significant Incident**, the **User** shall provide a full written **Significant Incident** report to **OETC**. **OETC** will not pass this report to other affected **Users** but may use the information contained therein in preparing a report to another **User** in relation to the **Significant Incident** and in the preparation of a report to the **Regulatory Authority**.

OC 5.6.5 Form of Full Significant Incident Report

A full **Significant Incident** report prepared by **OETC** or a **User** shall be sent

to the **User**, **OETC**, the **Power Procurer,** the **Market Operator** and the **Regulatory Authority**. For the avoidance of doubt, the party who prepares the full **Significant Incident** report shall ensure that all the above parties receive the report. The full **Significant Incident** report will contain confirmation of the **Significant Incident** notification together with full details relating to the **Significant Incident**. The **Significant Incident** report shall cover in the necessary detail those matters specified in Appendix A.

OC 5.7 Evaluation of Significant Incidents

OETC shall maintain an indexed record of all **Significant Incident** reports and shall review each report to determine whether there has been any lack of compliance with the **Grid Code**.

Each month or other period to be agreed with the **Grid Code Review Panel**, **OETC** shall produce a summary report of **Significant Incidents**. The report shall comprise additions to the index of **Significant Incident** reports since the last summary report together with commentary of the **Significant Incidents** added to the index. The summary shall draw specific attention to any lack of compliance with the **Grid Code** and to any areas where there may be a need to modify the **Grid Code**.

The **Grid Code Review Panel** shall make recommendations at any time, including proposed modifications to the **Grid Code** arising from its review of **Significant Incident** reports.

OC 5.8 Alerts

(i) Alert statement from OETC

Whenever **OETC** becomes aware of any factors likely to give rise to an **Emergency Condition** or to unusual **Operating** conditions, **OETC** shall send an **Alert** to all **Users** who may be adversely affected by such disturbances or unusual **Operating** conditions.

The **Alert** will indicate the likely reason for the disturbance, the severity and duration of the disturbance and duration of the **Alert** period. An **Alert** shall take the following form.

- This is an **Alert** timed at (*xx:xx)* hours.
- A disturbance caused by (……), is probable at (*yy:yy)* hours.
- The likely effect of the disturbance is (…….).
- The disturbance is likely to last (*zz:zz*) hours.
- This **Alert** shall be considered cancelled automatically in 2 hours time unless renewed before that time.

The following conditions are those that as a minimum should be considered to give rise to an **Alert**:

1. **Outage** of any **Transmission** components or **Generating Units** which cause either substantial reduction in **System** security or violate (n-1)

criteria to a **Supply** point.

2. Any condition where the **Operating Margin** is below the agreed standard.
3. The voltage or **Frequency** going outside operational limits.
4. Important events (e.g., National Day celebrations or localised celebrations).
5. Major testing.
6. Accidents.
7. Significant weather events.

The **Alert** may be delivered by telephone but must be confirmed in writing as soon as practical.

All parties receiving the **Alert** shall acknowledge receipt in writing and shall report any resulting events in accordance with the procedures set down in this code **OC** 5.

(ii) Alert statement from Users

Whenever a **User** becomes aware of any factors likely to give rise to an **Emergency Condition,** increased risk, or to unusual **Operating** conditions, the **User** shall send an **Alert** to **OETC**.

The **Alert** will indicate the likely reason for the disturbance or increased risk, the severity and duration of the disturbance or increased risk and duration of the period covered by the **Alert**. It shall also indicate whether a further **Alert** is expected and when. An **Alert** shall take the following form.

- This is an **Alert** timed at *(ww:ww)* hours*;*
- A disturbance/event caused by ……

  has taken place at …(*location)* at *(xx:xx)* hours;[*or*

  is probable at …(*location)* at *(xx:xx)* hours]*;*
- The likely effect of the disturbance is *(…….);*
- The disturbance is likely to last until *(yy:yy)* hrs*;*
- A further ***Alert*** *will/will not* be issued.
- Time of next ***Alert*** *(zz:zz)* hours.

The Alerts Code summarises **Alerts**.

OC 5.9 Operational Logs

Each **Control Centre** of each **User** shall maintain an **Operational Log** of each notice of **Operation** and/or **Incident** issued and received and all relevant aspects of **Significant Incident** reporting. The **Operational Log** shall record all acknowledgements of notices and any other matters relevant to the **Operation** of the **Transmission System**.

Each **Operational Log** shall record as a minimum the following information in the format described:

- each day shall commence on a new page that will be dated;
- each entry shall record the name of the **Person** giving the instruction, report, or any other information;
- each entry shall record the name of the **Person** receiving the instruction, report, or any other information;
- each entry shall record the time at which the instruction was given/received;
- each entry shall record the substation name and **Plant** label or number to which the instruction refers;
- every instruction, etc shall be entered on a new line;
- the **Isolation** of **Plant** and the connection and disconnections of main earths shall be separately recorded;
- the number and location of temporary earths and their removal shall be recorded either in the **Operational Log** or in a log under the control of the **Safety Coordinator**;
- the issuing of safety permits and their clearance shall each be separately recorded; and
- the numbers of individual safety permits shall be recorded.

Appendix A: Significant Incident Report

Information, if applicable to the **Significant Incident** and to the relevant **User** (or **OETC**, as the case may be) that shall be included in a written **Significant Incident** report prepared in accordance with **OC 5** is as follows:

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

Operating Codes

OC 6 Safety Coordination

OC 6.1 Introduction

OC 6 requires **OETC** (and its agents), **PWP** (and its agents) and **Users** (and their agents) to operate in accordance with approved **Safety Rules**, in order to ensure safe working conditions for personnel working on, or in close proximity to, **Transmission System** electrical **Plant** and for personnel who may have to work or use **Transmission System** electrical **Plant** at an interface.

In the event of a conflict between this **Operating Code OC** 6 – "Safety Coordination" and any other section of the **Grid Code**, **OC** 6 shall take precedence.

OC 6.2 Objective

The objective of **OC** 6 is to allow work and/or testing on the **Transmission System** or **HV Plant** that is **Directly Connected** to the **Transmission System** to be carried out safely.

OC 6.3 Scope

In addition to **OETC**, **OC** 6 applies to;

- **Power Producers;**
- **PAW;**
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **Internally Interconnected Parties;**
- **International Interconnected Parties;**
- **RAEC** if **Connected** to the **Total System**;
- all contractors/agents working on the **Transmission System**; and
- **PWP**.

OC 6.4 Terms

The following terms shall have the meaning ascribed to them below for the purposes of **OC** 6;

"Isolation" means the disconnection of **Plant** from the remainder of the **System** in which that **Plant** is situated by either of the following:

a) an **Isolating Device** maintained in an **Isolating** position. The isolating position must be maintained and/or secured by a method that accords with **Safety Rules** approved by **OETC**; or

b) an adequate physical separation which must be in accordance with, and maintained in accordance with **Safety Rules** approved by **OETC**. If it is required by the approved **Safety Rules,** a **Caution Notice** must be placed at the point of separation.

The words isolated and isolating shall have the meaning construed accordingly.

"Earthing" means a way of providing a connection between conductors and general mass of earth by an **Earthing Device** which is maintained and/or secured in position in accordance with **Safety Rules** approved by **OETC**.

OC 6.5 The Safety Rules

Safety procedures for personnel working on, or in close proximity to, **Transmission System Plant** are governed by **OETC**'s **Safety Rules** as detailed in the current version of **OETC**'s **Safety Rules** (Electrical and Mechanical).

Safety procedures will normally involve switching out and suitably **Isolating** and **Earthing** electrical **Plant** to ensure that it cannot be made live before and during work on that **Plant**.

OETC shall review the **Safety Rules** every twelve months. The review shall consider any implications arising from but not limited to:

- accidents at **OETC** or **User** sites at the interface;
- issues arising from differences between the **Safety Rules** of **OETC** and any interfacing **User**;
- reports from **OETC** personnel concerning the application of the **Safety Rules**; and
- any other relevant matter.

OETC shall prepare a report of each review and summarise in the report relevant events considered as part of the review. The report can make recommendations for changes to the **Safety Rules**, the implementation of the **Safety Rules**, or amendments to codes of practice to support the **Safety Rules**. The report shall be presented to the **Grid Code Review Panel** promptly for its consideration and review in so far as the changes may have impact on the **Operational** interface between **Users** and **OETC** or on any matter covered in **OC** 6. Any other reports of events shall be shared with the **GCRP** at an appropriate time.

OC 6.6 Safety at the Interface

All **Users** seeking **Connection** to the **Transmission System** must provide **OETC** with a copy of their **Safety Rules**. **OETC** shall ensure the **User Safety Rules** provide for at least the same degree of safety as **OETC Safety Rules**. If **OETC** is dissatisfied with any aspect of a **User's Safety Rules OETC** may require, following consultation with the **User**, all relevant work and procedures to be undertaken according to **OETC Safety Rules**.

All **Users** seeking **Connection** to the **Transmission System** must approve **Designated Operators** who are deemed by the relevant **User** to be competent to carry out the procedures in the agreed **Operational Instructions**. The approvals must be in writing and copies must be sent to **OETC**.

OETC, in consultation with **Users,** shall develop for each **User** site a **Site Responsibility Schedule** (referred to in **Connection Conditions**, clause **CC** 7.2). The **Site Responsibility Schedule** shall detail the demarcation of responsibility for the safety of **OETC** personnel and **Designated Operators** carrying out work or testing at the **User's Connection Site** and on circuits that cross the **User's** site at any point.

OETC shall issue operational procedures for each **User** site. The operational procedures shall include, but are not limited to;

- detailed switching sequences (which meet as a minimum, the requirements of **OETC**'s **Safety Rules**) to be followed for operational, fault and emergency switching;
- procedures for control and **Operations**;
- identification of operational boundaries; and
- the identity of **OETC** representatives (or its agents), **PWP** (or its agents) and **Users** (or their agents) who are authorised to attend the **Transmission** site and/or facility for operational purposes or during emergencies.

OETC and each **User** will cooperate in developing procedures and agreements on any matters that may be relevant for ensuring overall site safety and, in particular, safety during work or testing at or near to interface equipment.

In the event of a modification or change in operational practices, which has or may have an **Operational Effect** at a **User** site, **OETC** and the **User** shall review the adequacy of overall site safety.

Adequate means of **Isolation** shall be provided at the interface to allow work to be carried out safely at the interface or either side of the interface by **OETC** and each **User**.

Where necessary adequate facilities for earthing **Plant** shall be provided at either side of the interface to allow work to be carried out safely at the interface or on either side of the interface.

Operating Codes

OC 7 Contingency Planning

OC 7.1 Introduction

Operating Code OC 7, **Contingency Planning**, requires **OETC** to develop a strategy to be implemented in **Emergency Conditions** such as a **Total System Shutdown** or **Partial System Shutdown** and in response to other major **System Incidents**.

A **Total System Shutdown** or **Partial System Shutdown** can have widespread implications for electricity **Supply** and it is imperative that **OETC** has arrangements in place to deal with such situations. It is also important that **Users** are aware of the procedures, and cooperate fully in both practice and real **System Incidents** ~~the~~ implementation of the procedures, through which **OETC** can return the **Transmission System** to normal operating conditions.

OC 7.2 Objective

The objectives of **OC** 7 are:

- to require **OETC** to develop a general restoration strategy to adopt in the event of **Total System Shutdown** or **Partial System Shutdown**;
- to require **OETC** to produce and maintain comprehensive **System Normalisation Procedures** covering **Total System Shutdowns** and **Partial System Shutdowns**;
- to provide for the cooperation of **Users** with the formation, practice and execution of **System Normalisation Procedures**;
- to provide for the development and implementation of communications between **OETC** and **Users** when dealing with a **System Incident**;
- to ensure **OETC** and **User** personnel who will be involved with the implementation of **System Normalisation Procedures**, are adequately trained and familiar with the relevant details of the procedures;
- to require **OETC** to develop a general strategy and detailed plans and procedures for the loss of communications whether or not associated with a **System Incident** and to practice those procedures;
- to require **OETC** to develop a general strategy and detailed plans and procedures for the loss of the **System Control Centre** facility and to practice those procedures; and
- to require **Users** to cooperate to the extent required by **OETC** in both

practice and real circumstances involving loss of communications or the **System Control Centre** facility.

OC 7.3 Scope

In addition to **OETC**, **OC**7 applies to:

- **Power Producers;**
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **International Interconnected Parties;** and
- **Internally Interconnected Parties**.

OC 7.4 Terms

For the purposes of this section of the **Grid Code**, the term:

- **Incident Centre** means a centre established as determined by **OETC** following a **System Incident** to provide a focal point for communication and the dissemination of information between **OETC** and senior management representatives of relevant **Users**;
- **Power Island** means a group of **Production Facilities** together with complementary local **Demand**, disconnected from any other power source or the **Total System**. (A group may only contain a single **Production Facility**);
- **System Normalisation Strategy** means the strategy setting out the procedures for the restoration of the **System** following a **System Incident**;
- **System Incident Communications Procedures** are procedures agreed between **OETC** and **Users** to ensure secure communications during **System Incidents**.

OC 7.5 System Normalization Strategy

OETC shall develop a **System Normalisation Strategy** to be implemented in **Emergency Conditions** such as **Total System Shutdown** or a **Partial System Shutdown** and other major **System Incidents**. The overall objectives of the **System Normalisation Strategy** shall be as follows:

- restoration of the **Transmission System** and associated **Demand** in the shortest possible time, taking into account **Production Facilities'** capabilities, including **Embedded Gensets** and **Transmission System** operational constraints;
- re-**Synchronisation** of parts of the **Transmission System** which have become out of **Synchronism** with each other; and
- to provide for effective communication routes and arrangements to enable

senior management representatives of **OETC** and **Users**, who are authorised to make binding decisions on behalf of **OETC** or a **User** to communicate with each other during a **System Incident**.

The **System Normalisation Strategy** will provide for the detailed implementation of the following:

- notification by **OETC** to **Users** that a **Total System Shutdown** or a **Partial System Shutdown** exists and that **OETC** intends to implement **System Normalisation Procedures**;
- identification of separate groups of **Production Facilities** (a group may only contain a single **Production Facility**) together with complementary local **Demand**; and
- step by step integration of these **Power Islands** into larger sub-**Systems** to return the **Transmission System** to normal operating conditions.

The **System Normalisation Strategy** will also provide for the issue of any **Dispatch Instructions** necessitated by the **System** conditions prevailing at the time of the **System Incident**.

OETC will consult with I**nternational Interconnected Parties** and with **Internal Interconnected Parties** during the preparation of the **System Normalisation Procedures** and incorporate their services wherever practicable.

OC 7.6 System Normalization Procedures

OC 7.6.1 OETC Responsibilities

In the event of **Emergency Conditions** such as a **Total System Shutdown** or **Partial System Shutdown** of the **Transmission System, OETC** shall issue an **Alert** as set out in **OC 7.7.3** to notify **Users** that it intends to implement **System Normalisation Procedures**. **OETC** shall notify **Users** at the time of a **System Incident** of the particular **System Normalisation Procedure** to be implemented for that **System Incident**.

The **System Normalisation Procedures** will be developed and maintained by **OETC** in consultation with other **Users,** as appropriate, in accordance with **Good Industry Practice**.

The **System Normalisation Procedures** shall be subject to periodic review by the **Grid Code Review Panel**. The **Grid Code Review Panel** shall establish the frequency of its review and may at any time require **OETC** to consider the adequacy of the plan.

The **System Normalisation Procedures** shall provide for:

- procedures to establish an **Incident Centre** immediately following a **System Incident**;
- a decision on the location of an **Incident Centre**; and
- the operational responsibilities and requirements of an **Incident Centre**, noting that such an **Incident Centre** will not have any responsibility for the **Operation** of the **Transmission System** but will

be the focal point for communication and the dissemination of information between **OETC** and senior management representatives of relevant **Users**.

The complexities and uncertainties of recovery from a **Total System Shutdown** or **Partial System Shutdown** of the **Transmission System** require the **System Normalisation Procedures** to be sufficiently flexible so as to accommodate the full range of prevailing **Users'** and **Transmission System** operational possibilities.

OC 7.6.2 User Responsibilities

Each **User** shall follow **OETC**'s instructions during a **System Incident** and restoration process or a scheduled practice for such a **System Incident**, subject to safety of personnel, **OETC** and the **User's Plant**.

It shall be the responsibility of the **User** to ensure that any of its personnel who may reasonably be expected to be involved in **System Normalisation Procedures,** or any practice called for by **OETC**, are familiar with, and are adequately trained and experienced in their standing instructions.

OC 7.6.3 Black Start Procedure

The procedure for a **Black Start** situation will be that specified by **OETC** at the time of the **Black Start** situation. **Users** shall abide by **OETC** instructions during a **Black Start,** provided that the instructions do not require operation outside the limits of the **Operating Parameters** of each **Centrally Dispatched Generating Unit** or limitations imposed by any **Interconnector Agreement**.

OETC may issue instructions to:

- a **Production Facility** with **Black Start** capability, an external party in relation to the **Import** from any **Interconnector**, or to a **Licensed Distributor** with an **Embedded Generating Unit** with **Black Start** capability relating to the commencement of generation;
- a **Licensed Distributor** or to a **Directly Connected Consumer** relating to the restoration of **Demand**; and
- a **Production Facility** relating to commencement of generation when an external power supply is made available to it.

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

- a **Production Facility** with **Black Start** capability will **Start-up** as soon as possible, and in any case within two hours of an instruction from **OETC** to initiate **Start-up**. The **Production Facility** will confirm to **OETC** when start-up of a **Centrally Dispatched Generating Unit** has been completed;
- following such confirmation, **OETC** will endeavour to stabilise that **Centrally Dispatched Generating Unit** by instructing a **Licensed Distributor** to re-energise appropriate **Demand**, following which

OETC may instruct the **Start-up** and **Synchronisation** of the remaining **Available Centrally Dispatched Generating Units** at that **Production Facility** and their loading with appropriate **Demand** to create a **Power Island**;

- if during this **Demand** restoration process any **Centrally Dispatched Generating Unit** cannot keep within its safe **Operating Parameters** because of **Demand** conditions, the **Power Producer** shall inform **OETC** and **OETC** will, where possible, either instruct **Demand** to be altered or will re-configure the **Transmission System** or will instruct a **User** to re-configure its **System** in order to alleviate the problem being experienced by the **Power Producer**;
- **OETC** accepts that the decision to keep a **Centrally Dispatched Generating Unit** operating outside its safe **Operating Parameters** is one for the **Power Producer** concerned. **OETC** will accept and respond accordingly to a decision of **Power Producer** to change **Generation Output** on a **Centrally Dispatched Generating Unit** if it believes it is necessary to do so for safety reasons;
- as part of the **Black Start** strategy, **Licensed Distributors** with **Embedded Gensets** or **Generating Units** within their **Distribution System** which have become islanded, may in liaison with **OETC** sustain and expand these islands. **Licensed Distributors** will inform **OETC** of their actions and will not re-**Synchronise** to the **Transmission System** without **OETC** agreement; and
- **OETC** will instruct a relevant **User**, where possible, to interconnect **Power Islands** to achieve larger sub-**Systems**, and subsequently may instruct the interconnection of these sub-**Systems** to form an integrated **System**. This should eventually provide for the return of the **Transmission System** to normal operating conditions.

OETC shall inform **Users** of the end of a **Black Start** situation and the time at which the **Transmission System** resumed normal **Operation**.

All notifications must be made promptly. Notifications and responses may be made by telephone but must be confirmed in writing within 2 hours where practical. Where information is requested in writing throughout this code, e-mail or other electronic means as agreed with **OETC** may be used. All writing shall be in the English language.

OC 7.6.4 Re-Synchronisation Procedures

Where there is neither a **Total System Shutdown** nor a **Partial System Shutdown,** but parts of the **Transmission System** are out of **Synchronism** with each other, **OETC** will instruct **Users** to regulate **Generation Output** or **Demand** to enable the separate parts to be re-**Synchronised**. **OETC** will inform the relevant **Users** when re-**Synchronisation** has taken place.

OETC shall issue whatever revised **Dispatch Instructions** are required to enable re-**Synchronisation** and to return the **Transmission System** to

normal **Operation**.

OC 7.7 System Incident Procedures

OC 5 sets out the procedures for the exchange of information and follow-up reporting between **OETC** and **Users** in relation to events that have an impact on the **Transmission System**. An event may be either an **Operation** or an **Incident**. **OETC** will define certain **Incidents** as **Significant Incidents**; other more severe **Incidents** such as a **Partial System Shutdown** will be defined as **System Incidents**.

System Incidents are unpredictable, both with respect to timing and the resulting implications. **OETC** shall establish procedures for determining when an **Incident** on the **Transmission System** shall be considered a **System Incident** and also establish outline procedures for handling **System Incidents**.

OC 7.7.1 Incident Center

In certain circumstances, **OETC** may require an **Incident Centre** to be established to coordinate the response to a **System Incident** and to avoid placing further stress on existing **OETC** and **User** operational control arrangements.

OETC will inform **Users** promptly that an **Incident Centre** is to be established and request all relevant **Users** to implement **System Incident Communications Procedures**. **OETC** will specify the responsibilities and functions of the **Incident Centre** and the relationship with existing operational and control arrangements.

The **Incident Centre** established in accordance with **OETC**'s instructions will not have any responsibility for the **Operation** of the **Transmission System** but will be the focal point for communication and the dissemination of information between **OETC** and senior management representatives of relevant **Users**.

An **Incident Centre** does not imply a specially built centre for dealing with **System Incidents**; it is a focal point for communications related to the **System Incident**. During a **System Incident**, normal communication channels for operational control communication between **OETC** and **Users** will continue to be used.

OETC will decide when conditions no longer justify the need to use the **Incident Centre** and will inform all relevant **Users**.

In certain rare situations, **Licensed Distributors** may declare a **System Incident** on their **Distribution System**. The procedures for this are included in the **Distribution Code** and may not involve **OETC** directly. **OETC** shall however be kept informed promptly of such **Incidents**.

OC 7.7.2 System Incident Communications

OETC and all **Users** will maintain lists of telephone contact numbers at which, or through which, senior management representatives nominated for this

purpose and who are fully authorised to make binding decisions on behalf of **OETC** or the relevant **User** can be contacted day or night.

The lists of telephone contact numbers shall be provided in writing prior to the time that a **User Connects** to the **Transmission System** and must be updated and circulated to all relevant parties (in writing) whenever the information changes.

Notifications and responses will be made normally by telephone but must be confirmed in writing within 2 hours where practical.

All communications between the senior management representatives of the relevant parties with regard to **OETC**'s role in the **System Incident** shall be made via the **Incident Centre,** if such a centre has been established.

OC 7.7.3 System Alerts

In the event of **System Incidents**, such as **Total System Shutdown**, a **Partial System Shutdown** or a **System** separation, **OETC** will issue promptly an **Alert** to all **Users**. The form of the **Alert** is set out in the **Alerts Code.**

OC 7.8 Loss of Communication

Normal communications between operational sites shall be by telephone with confirmation by facsimile or other electronic means.

OC 7.8.1 Emergency Communications Plan

OETC shall prepare an emergency communications plan whereby in the event of failure of normal communication routes, a priority ranked order of alternative methods is agreed in consultation with all **Users**. The plan shall include the names of contacts and alternative contact details for each operational group of each **User**.

OETC shall update the emergency communications plan each year and circulate the new plan to all **Users**.

OETC shall arrange for practice and reporting on the effectiveness of the emergency communications plan and consider situations whereby loss of communications is also accompanied by a **System Incident** or loss of **System Control Centre** facility.

OETC, acting reasonably, may require input or practice from **Users** in order to develop and practice emergency communications plans, and **Users** shall so cooperate with **OETC**.

OC 7.8.2 Loss of Communication Alerts

In the event of total or partial loss of normal communications affecting the **System Control Centre**, **OETC** will issue promptly an **Alert** to all affected **Users**. The form of the **Alert** is set out in the **Alerts Code.**

All **Users** receiving the **Alert,** whether for a real event or a practice event, shall

endeavour to communicate with **OETC** using the arrangements indicated.

OC 7.9 Loss of System Control Facility

OC 7.9.1 Loss of System Control Centre Plan

For the temporary loss of the **System Control Centre** facility (with or without concurrent loss of communications), the following provisions apply:

- **OETC** shall review and update a plan for the loss of **System Control Centre** facility, practice the plan and report on the effectiveness of the plan;
- **OETC** shall endeavour to make known immediately to **Power Producers**, and other **Users** that it is dealing with the loss of its **System Control Centre** facility;
- each **Power Producer** shall continue to operate its **Centrally Dispatched Generating Units** in accordance with the last **Dispatch Instructions** except where the plan has identified certain **Power Producers** or **Generating Units** to be operated to maintain the Oman **System Frequency** at the target **Frequency** of 50**Hz** plus or minus 0.05**Hz** until such time as new **Dispatch Instructions** are received from **OETC**. Such **Generating Units** will be known as **Frequency Emergency Control Units**.
- as part of the plan, **OETC** may instruct **Power Stations** to adopt an order of frequency and voltage control action until such times as **OETC** has regained the ability to control generation **Outputs**;
- to the extent possible, **Wind Farm Power Production Facilities**, **Solar Power Production Facilities** and other **Users** shall avoid changing their **Output** during the **Event** unless otherwise agreed with **OETC.**

OETC will have arrangements in place whereby it may transfer the functions of the **System Control Centre** to an alternative control facility. **OETC** will then re-commence the issue of **Dispatch Instructions** in accordance with the **Scheduling and Dispatch Codes** and inform **Users** of the communications details for the new location. **OETC** will inform all **Power Producers** with **Centrally Dispatched Generating Units** as and when **Scheduling** and/or **Dispatch** in accordance with the principles in the **Scheduling and Dispatch Codes** can be re-implemented. Other **Users** will then be informed that control has been re-established.

OC 7.9.2 Alerts for Loss of System Control Centre

In the event of total or partial loss of the **System Control Centre** function, **OETC** will issue promptly an **Alert** to all affected **Users**. The form of the **Alert** is set out in the **Alerts Code.**

All **Users** receiving the **Alert** shall endeavour to perform the actions indicated

until **OETC** informs that the **System Control Centre** facility has been re-established and issues new instructions.

OC 7.10 Duty to Involve Users and Share Plans

OETC shall share plans and details necessary to ensure that **Users** are aware of their roles and responsibilities and can adequately prepare their staff and facilities for any of the events covered by – **OC** 7. **OETC** shall maintain a record of the recipient of the plans, the issue date and issue number of such plans.

Operating Codes

OC 8 Numbering and Nomenclature of High Voltage Plant

OC 8.1 Introduction

Operating Code OC 8 - Numbering and nomenclature of High Voltage (**HV**) **Plant** sets out the requirements for the numbering and nomenclature of:

- **OETC HV Plant** on **User's Sites**; and
- **User HV Plant** on **OETC Sites**.

OC8 requires the numbering and nomenclature of **Users' HV Plant** to be distinguishable and different from the numbering and nomenclature of **HV Plant** used by **OETC**.

OC 8.2 Objective

The objectives of **OC**8 are as follows:

- To provide for the application of consistent and distinct numbering and nomenclature of **HV Plant** to ensure that **User's Plant** at a **Connection Point** or a **Supply Point** cannot be confused with **OETC Plant**; and
- To reduce the risk of **Incidents** and events attributable to human error regarding the identification of **HV Plant**.

OC 8.3 Scope

In addition to **OETC**, **OC** 8 applies to the following **Users**:

- **Power Producers;**
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **Internally Interconnected Parties;**
- **International Interconnected Parties;** and
- **RAEC** if **Connected** to the **Total System**.

OC 8.4 Terms

For the purposes of this section of the **Grid Code**, the term:

- **User Site** means a site owned (or occupied pursuant to a lease, licence or other agreement) by a **User** in which there is a **Connection Point**; and
- **OETC Site** means a **Site** owned (or occupied pursuant to a lease, licence or other agreement) by **OETC** in which there may be a **Connection Point**.

OC 8.5 General Requirement

Where throughout this code information is requested in writing, facsimile transmission or other electronic means as agreed with **OETC** in writing may be used. All writing shall be in the English language.

All **User Plant** at a **Connection Point** or a **Supply Point** shall have numbering and nomenclature that is different and distinct from the numbering and nomenclature used by **OETC** for its **HV Plant** at that **Connection Point** or **Supply Point**.

To comply with the requirements of **OC**8, **Users** shall not install, nor permit the installation of any **Plant** with numbering or nomenclature that could reasonably be confused with the numbering and nomenclature of the **Plant** of **OETC** or any other **User** at a **Connection Point** or **Supply Point**.

OC 8.6 Procedure

The numbering and nomenclature of each item of **HV Plant** shall be included in the **Operation Diagram** prepared for each **OETC Site** or **User Site**. The requirements for an **Operation Diagram** are set down in the **Connection Conditions** and that code requires that the **Operation Diagram** shall be updated for every change to **Plant** or its labelling.

OC 8.7 OETC HV Plant on a User Site

OETC HV Plant on **User Sites** shall have numbering and nomenclature in accordance with **OETC**'s Numbering and Nomenclature Policy.

When **OETC** is to install **HV Plant** on a **User Site**, **OETC** shall notify the relevant **User** of the numbering and nomenclature to be adopted for that **HV Plant** at least six months prior to proposed installation.

The notification will be made in writing to the relevant **User** and will consist of:

- an **Operation Diagram** incorporating the new **OETC HV Plant** to be installed;
- **OETC**'s numbering and nomenclature to be adopted for that **HV Plant**; and
- the proposed date of installation of the **HV Plant**.

The relevant **User** will respond in writing to **OETC** within one month of the receipt of the notification, confirming:

- receipt of the notification;
- that none of the **Users HV Plant** at the relevant **User Site** has the same numbering and nomenclature proposed or as used by **OETC**; and
- that if any of the **User's HV Plant** at the relevant **User Site** has the same numbering and nomenclature as that proposed or used by **OETC**, the numbering and nomenclature of the **User's HV Plant** at the relevant site will be changed before installation of **OETC**'s **HV Plant** at the relevant site.

The relevant **User** shall not install, or permit the installation of, any **HV Plant** at a site that has numbering or nomenclature that could be confused with **OETC HV Plant** which is either already on that **User Site** or which **OETC** has notified to that **User** will be installed on that **User Site**.

OC 8.8 User HV Plant on OETC Sites

User HV Plant on **OETC Sites** shall have numbering and nomenclature in accordance with **OETC**'s Numbering and Nomenclature Policy.

When a **User** is to install **HV Plant** on an **OETC Site**, or wishes to replace existing **HV Plant** on an **OETC Site,** or adopt new numbering and nomenclature for such **HV Plant**, the **User** shall notify **OETC** in writing at least six months prior to proposed installation to provide:

- an **Operation Diagram** incorporating the new **User HV Plant** to be installed;
- the details of the **HV Plant**;
- the proposed numbering and nomenclature to be adopted for that **HV Plant**; and
- the proposed date of its installation.

OETC will respond in writing to the **User** within one month of the receipt of the notification and state:

- whether **OETC** accepts the **User**'s proposed numbering and nomenclature; and
- if the numbering and nomenclature proposed by the **User** are not acceptable, **OETC** shall give details of the numbering and nomenclature which the **User** shall adopt for the **User's HV Plant**.

Users will be provided upon request with details of **OETC**'s current Numbering and Nomenclature Policy in order to assist them in planning the numbering and nomenclature for their **HV Plant** on **OETC Sites**.

OC 8.9 User HV Plant within OETC Installation on a User Site

Where **User HV Plant**, such as circuit breakers, form part of an **OETC** installation on a **User Site**, the **User**'s **HV Plant** shall use numbering and nomenclature in accordance with **OETC**'s Numbering and Nomenclature Policy.

OC 8.10 Changes to Existing Numbering or Nomenclature

Where **OETC** has decided that it needs to change the existing numbering or nomenclature of **OETC HV Plant** on a **User Site** or of **User HV Plant** on an **OETC Site**:

- for **OETC HV Plant** on a **User Site**, the provisions of **OETC**'s Numbering and Nomenclature Policy shall apply to such changes of numbering or nomenclature with any necessary amendments to those provisions to reflect that a change is being made; and
- for **User HV Plant** on an **OETC Site**, **OETC** will notify the **User** of the numbering and nomenclature that the **User** shall adopt for that **HV Plant** at least six months prior to the change being needed and the **User** will respond in writing to **OETC** within one month of the receipt of the notification, confirming receipt and acceptance of the changes; and
- if the **User** objects to the changes proposed by **OETC, OETC** and the **User** shall consult promptly, to reach agreement. If agreement cannot be reached, **OETC**'s Numbering and Nomenclature Policy will be used and if the disagreement concerns a point of principle, the **User** may set out the arguments and present them to the **Grid Code Review Panel** for their consideration. **OETC**'s Numbering and Nomenclature Policy will apply until the disagreement is resolved.

In all cases **OETC**'s notification shall indicate the reason for the proposed change to the existing numbering or nomenclature.

OC 8.11 Labelling

All **HV Plant** shall be provided with clear and unambiguous labelling showing the numbering and nomenclature.

OETC and **Users** are each responsible for the provision and erection of labelling on their own **HV Plant**.

Where there is a requirement for the numbering and nomenclature of **HV Plant** to be changed, **OETC** and **Users** shall each be responsible for providing and erecting the labels on their own **Plant** by the required date.

Operating Codes

OC 9 Operational Tests and Site Investigations

OC 9.1 Introduction

Operating Code OC 9 sets out the authorization required and the procedures to be followed by **OETC**, **PWP** and **Users** wishing to conduct **Operational Tests** or **Site Investigations** involving **Plant** that is **Connected** to or a part of the **Transmission System**.

OC 9 stipulates that prior authorisation from **OETC** is required before conducting **Operational Tests** or **Site Investigations**.

OC 9.2 Objective

The objectives of **OC** 9 are to ensure that **Operational Tests** and **Site Investigations**:

- are authorized by **OETC** and are carried out in accordance with appropriate procedures;
- are carried out in a coordinated manner to avoid unnecessary risk or damage to **Plant** and to minimise costs to **OETC**, **PWP**, and affected **Users**;
- do not threaten the safety of personnel or the general public;
- do not threaten the security or stability of the **Transmission System**; and
- are properly evaluated on completion and, where appropriate, subject to certain reporting arrangements.

A further objective of **OC** 9 is to allow sufficient **Operational Tests** to be conducted to enable predictive fault finding.

OC 9.3 Scope

In addition to **OETC**, **OC** 9 applies to:

- **Power Producers**;
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **Internally Interconnected Parties;**

- **International Interconnected Parties**; and
- **PWP** (with regard to **Operational Tests** carried out under **PPAs**/**PWPAs**).

OC 9.4 Terms

For the purposes of this section of the **Grid Code**, the term:

- **Site Investigation Tests** are tests conducted in relation to **Plant** and operational procedures at **Production Facilities** and **User Sites** or to monitor and assess the characteristics of **Plant**;
- **Test Document** means the document prepared by the **Test Panel** setting out all aspects for the management and implementation of an **Operational Test**;
- **Test Panel** means a panel established to prepare a detailed programme for the conduct of an **Operational Test** or **Site Investigation** and to prepare a formal **Test Document**;
- **Test Request** means a document setting out the detailed proposal for an **Operational Test** or **Site Investigation**.

OC 9.5 Categories of Tests

OC 9 applies to the following categories of tests:

- Operational tests:
  - required by **OETC**;
  - requested by a **User**; and
  - requested by **PWP** or a **Power Producer** to commission or test the compliance of **Production Facilities** with the requirements of a **PPA** or **PWPA** or for other purposes specified in a **PPA**/**PWPA**.
- Site Investigation tests:
  - in relation to **Plant** and operational procedures at **Production Facilities** and **User Sites**; and
  - to monitor and assess the characteristics of **Plant** for which a **User** is required to provide, or has contracted to provide, certain **Ancillary Services**.
- Other tests:
  - required, in certain circumstances, (whether by means of a formal test or verification by inspection) to ascertain whether **Operating Parameters** and/or **Connection Conditions** are being complied with in respect of **Generating Units**, **Desalination Units** and **User's Plant**;

- required, in certain circumstances, to assess whether **Operating Margin** requirements can be met;
- required, in certain circumstances, at the request of a **User**; and
- other tests and measurements that may have an **Operational Effect** on the **System**.

OC 9.6 Authorization and Test Procedures

OC 9.6.1 Test Requests

Prior authorisation from **OETC** is required before conducting an **Operational Test**, **Site Investigation** or other test, which may have an **Operational Effect**.

PWP or **Users** seeking to conduct an **Operational Test** or **Site Investigation**. Shall submit a **Test Request** to **OETC** giving at least eight weeks minimum notice before the date of the proposed test. A **Test Request** shall include a detailed test proposal including:

- a brief description of the proposed test;
- the preferred time or times for the test and the potential duration;
- The reason for the proposed test indicating whether the test is required for compliance with licence conditions, statutory regulations, or **Safety Rules**. This will assist in determining the priority to be given to the test;
- an indication of any potential adverse effects if the test is cancelled at short notice or delayed (reasonable detail of such adverse effects to be provided);
- an indication of any **Dispatch Instructions** required to facilitate the test; and
- Details of any operational switching required to facilitate the test.

OETC shall evaluate all **Test Requests** submitted. On receipt of a **Test Request** **OETC** shall within 2 weeks:

- Approve the **Test Request**;
- Request any additional information from the test proposer required to evaluate the impact of the **Test Request**; or
- Reject the **Test Request** application.

OETC shall consider the following factors when evaluating a **Test Request**;

- the impact of the requested test on **Transmission System** stability and security;
- the impact of the requested test on **Transmission System** economics;
- the impact of the requested test on other **Users**; and

- the effect of the requested test on the continuity and quality of electricity **Supply**.

If **OETC** approves a **Test Request**, it will inform the test proposer accordingly.

If **OETC** requests additional information from the test proposer to evaluate the impact of a **Test Request OETC** shall stipulate the time within which the information shall be provided. If the information is not provided in the timescale indicated by **OETC** the **Test Request** shall automatically lapse.

If **OETC** does not approve a **Test Request**, it will set down its reasons for rejecting a **Test Request** application and consult with the test proposer (and the **PWP** if the proposed test is in relation to **Production Facilities** subject to a **PPA**/**PWPA**) on any changes to the test proposal required to secure approval for the test. The test proposer may update a test proposal in accordance with guidance provided by **OETC** and submit a revised **Test Request**.

OETC shall not withhold approval of a **Test Request** unless it considers it has reasonable grounds for doing so. If a **User** is not satisfied that a **Test Request** was rejected on reasonable grounds it can refer the matter to the **Regulatory Authority** for determination.

OETC shall not disclose any information received as part of a **Test Request** application without the consent of the **User** who submitted the **Test Request** if it reasonably believes the information to be commercially sensitive or otherwise potentially sensitive.

OC 9.6.2 Test Panel

If a **Test Request** is approved **OETC** shall decide if a **Test Panel** is required. If **OETC** decides that a **Test Panel** is required, the test proposer shall convene a **Test Panel**. The number of **Test Panel** members shall be kept to the minimum number of persons compatible with affected **User** representation.

The **Chairman** of a **Test Panel** shall be appointed by the test proposer. As regards other representation:

- **OETC** shall have a representative on all **Test Panels**;
- **PWP** shall have a representative on all **Test Panels** that are concerned with tests arising from a **PPA** or **PWPA**; and
- all directly affected **Users** shall be represented on the **Test Panel**.

The duties and responsibilities of the **Test Panel** are as follows:

- to prepare a detailed programme for the conduct of the test, including the start and end date of the test, and any **Dispatch** requirements and operational switching required to facilitate the test;
- to identify the detailed management requirements of the test including:
    - that the agreed pre-conditions are fulfilled,

- that the impact of the actions other Users are managed;

- to ensure that all affected parties are properly informed of, and have access to, all relevant information;
- to schedule the resources required to conduct the test; and
- to prepare a **Test Document** that shall include all the elements listed above.

The **Test Document** shall be copied to all members of the **Test Panel** at least 2 weeks before the start date of the test. Members of the **Test Panel** may provide comments on the **Test Document** to the **Chairman** of the **Test Panel** no later than 1 week before the scheduled start date of the test.

The test shall proceed only on the condition that the **Test Panel** has approved the **Test Document**. If a member of the **Test Panel** is not satisfied with the test proceeding and they have fully discussed the issues within the **Test Panel**, they may make representation to the **Regulatory Authority**.

Neither **OETC** nor the **PWP** shall disclose information provided to a **Test Panel** without the consent of the person who submitted the information if it reasonably believes the information to be commercially sensitive or otherwise potentially sensitive.

OC 9.6.3 Post-test Reporting Requirements

At the conclusion of an **Operational Test** or **Site Investigation** the test proposer shall prepare a written report on the test that shall be available within 4 weeks of the conclusion of the **Operational Test**. The report shall be copied to **OETC** and the **Regulatory Authority** in all cases and to the **PWP** whether a **Power Producer** conducted the test or a test arose from a **PPA**/**PWPA**.

The **Test Report** shall not be submitted to any other person who is not a representative of **OETC** or the test proposer unless **OETC** and the test proposer have reasonably considered the confidentiality issues arising, and shall have unanimously approved such submission.

The **Test Report** shall include a detailed description of the completed test, the **Plant** to which the test relates, together with the results, conclusions and recommendations as they relate to the test proposer, **OETC**, **PWP** where relevant, and operationally affected **Users**, where applicable.

The **Test Panel** shall be disbanded after the final test report has been approved.

OC 9.7 Operational Tests

OETC shall cooperate with the implementation of all **Operational Tests**.

Where **OETC** considers the potential impact or **Operational Effect** of an **Operational Test** to be significantly greater than originally estimated, **OETC** may at any time contact the test proposer (and **PWP** where the test is in relation to a **PPA**/**PWPA**) to discuss a revised test procedure or schedule. **OETC** shall, where it considers it necessary to do so, cancel, interrupt, or postpone an **Operational Test** at any time.

If the test proposer wishes to cancel an **Operational Test** before commencement of the test or during the test, the test proposer (and the **PWP** where the test is in relation to a **PPA**/**PWPA**) must notify **OETC** immediately and the notice must be confirmed in writing within 1 hour by facsimile or other electronic means. The form and any change to the form of confirmation must have been agreed in writing with **OETC**.

OC 9.7.1 Operational Tests Required by OETC

OETC may from time to time need to conduct **Operational Tests** in order to maintain and develop operational procedures, to train staff, and to acquire information in respect of **Transmission System** behaviour under abnormal **System** conditions.

OETC will endeavour to keep the frequency of occurrence, scope, and impact of **Operational Tests** to the minimum necessary to achieve the stated objectives of the test.

Where **OETC** intends to carry out an **Operational Test** and in **OETC**'s reasonable opinion, such a test will or may have an operational effect on a **User**'s **System**, **OETC** shall give eight weeks notice and provide sufficient information to the affected **Users** to enable the affected **Users** to assess any risks to their **Systems**. The information provided by **OETC** shall include;

- a brief description of the **Operational Test**;
- the probable effects of the **Operational Test**; and
- the scheduled time and duration of the **Operational Test**.

Affected **Users** may contact **OETC** to request additional time or information to consider the impact of the **Operational Test** on their **Systems** and shall respond to **OETC** within 2 weeks of receipt of **OETC**'s notice of the test.

OC 9.7.2 Operational Tests Required by Users

Operation of **Users**' **Plant** in accordance with **Good Industry Practice** requires testing to maintain and develop operational procedures, develop and measure **Plant** performance, comply with statutory or other industry obligations and contracts, and to train staff.

Each **User** shall endeavour to limit the frequency of occurrence of **Operational Tests** and to limit the effects of such **Operational Tests** on the **Transmission System**.

Users shall submit a **Test Request** to **OETC** in accordance with the requirements of **OC** 9.6.1.

OC 9.7.3 Operational Tests at Production Facilities

The **PWP** or a **User** shall submit a **Test Request** to **OETC** in accordance with the requirements of **OC** 9.6.1. **OETC** will incorporate any requirements identified in the **Operational Test** proposal within the programming phase of **Operational Planning** (**OC**2) and in accordance with the **Scheduling and Dispatch Codes SDC**1 and **SDC**2.

Where an **Operational Test** requires a **Dispatch Instruction** that is outside the currently declared **Operating Parameters**, then **OETC** may so **Dispatch** the **Generating Unit** for the period required for the **Operational Test**.

However, **OETC** shall contact the **Power Producer** and **PWP** 2 days before the test date and review the **Dispatch Instructions** contained in the formal **Operational Test** proposal. The **Power Producer** and **PWP** shall confirm their acceptance or rejection of the proposed **Dispatch Instructions** without undue delay.

On notification of rejection of the proposed **Dispatch Instructions**, the **Power Producer** and **PWP** may enter into discussions with **OETC** as to an alternative schedule for the **Operational Test**, or may request a different **Operational Test** or may request the **Operational Test** at an alternative time.

OETC shall inform other **Users** of the scheduled time and nature of the **Operational Test**, if in the opinion of **OETC** those **Users** will or may be affected by the test.

The **Operational Test** shall proceed in accordance with normal operational practices but with particularly close communication between the control engineer and the test manager. Where the **Operational Test** is complex or time consuming, **OETC** shall provide additional support at the **Control Centre**, if necessary.

OC 9.7.4 Other Operational Tests

Any **Operational Test** proposal accompanying a **Test Request** shall indicate whether **Dispatch Instructions** and operational switching instructions are required to facilitate the test. **OETC** will, subject to any amendments it may require to be made, incorporate the **Dispatch Instructions** and operational switching instructions required to facilitate the test within the programming phase of **Operational Planning** (**OC** 2) and in accordance with the codes **SDC** 1 and **SDC** 2. **OETC** shall issue **Dispatch Instructions** for **Operational Tests** in accordance with the procedures set out in code **SDC** 2.

Where an **Operational Test** requires a **Dispatch Instruction** that is outside the currently declared **Operating Parameters**, then **OETC** may so **Dispatch** the **Generating Unit** for the period required for the **Operational Test**.

OETC shall inform other **Users** of the scheduled time and nature of the **Operational Test**, if in the opinion of **OETC** those **Users** will or may be affected by the test.

The **Operational Test** shall proceed in accordance with normal operational practices but with particularly close communication between the control engineer and the test manager. Where the **Operational Test** is complex or time consuming, **OETC** shall provide additional support at the **Control Centre**, if necessary.

OC 9.8 Site Investigation Tests

OETC may, if it reasonably considers that there may be an issue of non-compliance with an agreement by the **User**, request **PWP** to carry out a **Site Investigation** to acquire or verify information relevant to **Users**' **Plant** and/or apparatus design, **Operation** or **Connection** requirements under the **PPA**, **PWPA**, **Grid Code**, **ECA** and other agreements between **Users** and **OETC** or **PWP**.

OETC or **PWP** may, having given reasonable notice, send a representative or agent to a **User**'s **Site** in order to investigate any equipment or operational procedure applicable to the **User** site insofar as the condition of that equipment or operational procedure is relevant to compliance with a **PPA**, **PWPA**, the **Grid Code**, an **ECA**, or other relevant agreements.

OC 9.9 Other Tests

OETC and/or **PWP** can, at any time, request a test. Where a **PWP**/ **PWPA** or other agreement exists (with appropriate test procedures) these will form the basis of the test.

Testing (including tests carried out under a **PWP**, **PWPA** or any other relevant agreement) may involve attendance by **PWP**, **OETC** or their representatives at **User Sites** in order to carry out or observe such tests.

Where required a test shall be carried out in accordance with **Dispatch Instructions** and operational switching instructions issued by **OETC** or by such alternative procedures as are required or permitted by the **Grid Code**.

Where a test is required at short notice, **OETC** shall use reasonable endeavours to accommodate the test in the requested timescale provided that in **OETC**'s reasonable opinion the test would not compromise the security and stability of the **Total System**, or pose a risk to the safe and secure operation of **Plant**, or compromise the safety of related personnel and the general public

Operating Codes

Alerts Summary Code

Alerts 1 Introduction

The Alerts Summary Code (**Alerts Code**) provides a unified reference of all **Alerts** and warnings contained in the **Grid Code**. The **Alerts Code** lists actions that **OETC** may take to warn or alert **Users** in abnormal or **Emergency Conditions** and describes instructions to **Users** concerning immediate action or preparation for possible future action.

This **Alerts Code** is a summary of the requirements of the **Grid Code**. Individual sections of the **Grid Code** should be consulted on the detailed requirements of each warning and **Alert**. In the event of inconsistencies between this **Alerts Code** and other sections of the **Grid Code** the provisions in individual sections of the **Grid Code** shall prevail.

The relevant section of the **Grid Code**, under which any warning or **Alert** may be required, specifies the procedures, timing, possible actions and form of instruction for the instruction of that warning or **Alert**.

Alerts 2 Objective

The objectives of the **Alerts Code** are as follows:

- to list the warnings and **Alerts** that may be issued by **OETC** to enable the safe **Operation** of the **Total System** in abnormal situations; and
- to identify the potential responses and actions that may need to be taken by **Users** on receipt of such warnings and **Alerts**.
- to list **Alerts** to be issued by **Users** to **OETC** to advise of occurrences or potential occurrences on their **Plant** and **Systems** likely to affect the operation or security of the **Total System**.
- to identify that **OETC** acknowledges and responds to such **Alerts**.

Alerts 3 Scope

In addition to **OETC**, the **Alerts Code** applies to:

- **Power Producers**;
- **Licensed Distributors**;
- **Licensed Suppliers**;

- **Directly Connected Consumers**;
- **International Interconnected Parties**;
- **Internally Interconnected Parties**;
- **Power Procurer** (for information); and
- **Market Operator** (for information)

Alerts 4 Alert Categories

This **Alerts Code** is concerned only with instructions associated with abnormal or **Emergency Conditions**. It does not refer to or include instructions given in the normal course of planning and operating the **Total System** or **Dispatch**. These are detailed in the individual sections of the **Grid Code**.

Table 1: General Alerts Issued by OETC

OETC shall issue an Alert whenever it becomes aware of any factors likely to give rise to Emergency Conditions, a significant disturbance or unusual operating conditions.			
Grid Code Reference OC 5			
	Circumstances of issue	**Recipients of Alert**	**Action to be taken by Users**
1	Whenever **OETC** becomes aware of any factors likely to give rise to an **Emergency Condition** or unusual operating conditions.	All **Users** who may be adversely affected by the **Emergency Condition** or unusual operating conditions.	Acknowledge receipt of **Alert** by agreed electronic means. Take any necessary preparatory steps consistent with overall **System** requirements to safeguard their **Systems** for the event. Report any resulting events in accordance with the procedures set down in code **OC** 5.
2	The following conditions are those that as a minimum may give rise to an **Alert**.		
	1. **Outage** of any **Transmission** components or **Generating Units** which cause either substantial reduction in **System** security or violate (n-1) criteria to a **Supply** point. 2. Any condition where the **Operating Margin** is below the agreed standard. 3. The voltage or **Frequency** going outside operational limits. 4. Important events (e.g., National Day celebrations or localised celebrations). 5. Severe or adverse weather patterns 6. Major testing. **7.** Accidents.		
3	An **Alert** shall take the following form;		
	• "This is an **Alert** timed at *(xx:xx)* hours; • A disturbance caused by …… is probable at *(yy:yy)* hours; • The likely effect of the disturbance is *(…….)*; • The disturbance is likely to last *(zz:zz)* hrs; • This **Alert** shall be considered to be automatically cancelled if the **Alert** is not renewed within 2 hours of the time of issue."		

Table 2: Alerts to be Issued by Users

A User shall issue an Alert whenever it becomes aware of any factors likely to give rise to an event an Emergency Condition, increased risk or unusual operating conditions.			
Grid Code Reference OC 5			
	Circumstances of issue	**Recipients of Alerts**	**Action to be taken by OETC**
1	Whenever a **User** becomes aware of any factors likely to give rise to an **Emergency Condition** or unusual operating conditions.	**OETC** shall acknowledge receipt of the **Alert**	Acknowledge receipt of **Alerts** by agreed electronic means. Take any necessary preparatory steps consistent with overall **System** requirements to safeguard their **Systems** for the event.
2	The following conditions are those that as a minimum may give rise to an **Alert**.		
	1. **Outages** or risks associated with 66**kV** or 33**kV** equipment, which may have substantial impact on **Total System Load** or **System Operations**. In such circumstances the relevant **Licensed Distributors** or **Power Producers** should send an **Alert** to **OETC** and other **Users** who are likely to be affected. 2. **Outages** or risks associated with **Generation Plant** or **Interconnector** flows, which may have substantial impact on the **Generation** capability of the **Plant** or **Import** or **Export** flows on any **Interconnector** or on **System** operations. In such circumstances the relevant **Licensed Distributors** or **Power Producers** or **Embedded Power Producers** should send an **Alert** to **OETC**, **PAW** Water Department (if applicable) and other **Users** who are likely to be affected. 3. Local celebration of civic events 4. Major testing of **Embedded Generating Units**. **5.** Accidents.		
3	An **Alert** shall take the following form;		
	• "This is an **Alert** timed at *(ww:ww)* hours; • A disturbance/event caused by …… has taken place at …(*location)* at *(xx:xx)* hours; [*or* is probable at …(*location)* at *(xx:xx)* hours]; • The likely effect of the disturbance is *(…….)*; • The disturbance is likely to last until *(yy:yy)* hrs; • A further ***Alert*** *will/will not* be issued. • Time of next ***Alert*** *(zz:zz)* hours.		

Table 3: Alerts for System Incidents

OETC will issue an Alert in the event of System Incidents, such as a Total System Shutdown, a Partial System Shutdown or a System Separation or any practice for such an event.			
Grid Code Reference OC 7			
	Circumstances of issue	**Recipients of Alert**	**Action to be taken by Users**
1	In the event of **System Incidents**, such as a **Total System Shutdown**, **a Partial System Shutdown** or a **System Separation** or a practice for such event.	All **Users**	Acknowledge receipt of **Alert** by agreed electronic means. Each **User** shall follow **OETC**'s instructions during an **Incident** and restoration process or in any agreed practice event. **Users** shall ensure that their personnel are familiar with, and adequately trained to be able to implement the **System Normalisation Procedures** prepared by **OETC**.
2	The form of the **Alert** will be;		
	• "This is an **Alert** timed at *(xx:xx)* hours; • There is a (Partial System Shutdown [or practice Partial System Shutdown]) at (aaaaa); • **A System Normalisation**; **Procedure** [or practice **System Normalisation Procedure**] is being implemented; • Standby for further instructions".		

Table 4: Demand Control Warnings

All Warnings in this table will be issued only by OETC			
Grid Code Reference OC 4			
	Circumstances of issue	**Recipients of Warning**	**Action to be taken by Users**
1	**Demand Control Imminent Warning**		
1.1	When **OETC** expects to issue an instruction requiring **Emergency Manual Demand Shedding** within the following 30 minutes.	**Licensed Distributors**, **Directly Connected Consumers**, and **Users**.	Acknowledge receipt of warning by agreed electronic means. Prepare to implement instruction requiring **Emergency Manual Demand Shedding** within the following 30 minutes.
1.2	A **Demand Control Imminent Warning** will automatically lapse if not reissued by **OETC** within 2 hours of the time of issue.		
1.3	The form of a **Demand Control Imminent Warning** will be;		
1.4	• "This is a **Demand Control Imminent Warning** timed at *(xx:xx) hours*; • This warning applies to (include name of **Users** and area/ substations affected); • Prepare for **Emergency Manual Demand Shedding** of *(XX)* **MW** within the next 30 minutes; • Do not shed **Demand** until instructed; • Standby for further instructions".		

Table 4 (continued)

	Circumstances of issue	Recipients of Warning	Action to be taken by Users
2	**Demand Control Red Warning**		
2.1	When **OETC** expects to instruct **Emergency Manual Demand Shedding** or **Planned Rota Demand Shedding** on the day ahead.	**Licensed Distributors**, **Directly Connected Consumers**, **Users**, and **Power Producers** with **Centrally Dispatched Generating Units** that may be affected by such instructions.	Acknowledge receipt of warning by agreed electronic means Prepare to implement a later instruction requiring **Emergency Manual Demand Shedding** during the day ahead.
2.2	A **Demand Control Red Warning** will be issued by 16:00 hours on the day ahead.		
2.3	A **Demand Control Red Warning** will specify the period during which **Demand Shedding** may be required, the part of the **Transmission System** to which it may apply, the percentage of **Demand** reduction that may be required and any other matters.		
2.4	The form of a **Demand Control Red Warning** will be;		
2.5	• "This is a **Demand Control Red Warning** timed at (*xx*:*xx*) hrs; • This warning applies to (include name of **Users** and area/ substations affected) to implement (**Emergency Manual Demand Shedding** or **Planned Rota Demand Shedding**) tomorrow; • The amount **of Demand** to be shed will be (specify amount and duration of demand to be shed); • Do not shed **Demand** until instructed ".		

Table 5: Special Instructions

OETC may issue special instructions in respect of a Schedule Day at any time during the period beginning immediately after the issue of the Generation Schedule and Desalination Schedule.			
Grid Code Reference SDC 2			
	Circumstances of issue	**Recipients of special instructions**	**Action to be taken by Users**
1	**OETC** may issue a list of special instructions in respect of a **Schedule Day** at any time during the period beginning immediately after the issue of the **Generation Schedule** and **Desalination Schedule**. **OETC** will issue special instructions directly to the **Users** at each **Control Centre** in relation to required actions and **Demand Control**.	**Licensed Distributors**; **Users**; **Directly Connected Consumers**; **Internally Interconnected Parties**.	Note and acknowledge receipt of special instructions by agreed electronic means. Prepare to implement as instructed.
2	Special instructions may include:		
	• requirements for **Demand** reduction, de-energisation or restoration; • instructions to effect a **Demand** transfer between **Connection Points**; and/or • instructions to switch in **a Demand Intertrip Scheme**.		

Table 6: Alerts – Communication Failure

OETC will issue an Alert in the event of a loss of normal communications from or to the Control Centre or in the case of any practice for such an event.			
Grid Code Reference OC 7			
	Circumstances of issue	**Recipients of Alert**	**Action to be taken by Users**
1	In the event of a partial or complete loss of communications affecting the **Control Centre** or its functions.	All **Users**	Acknowledge receipt of **Alert** by agreed means. Each **User** shall follow **OETC**'s instructions regarding communication methods during a partial or total loss of normal communications or in any agreed practice event. **Users** shall ensure that its personnel are familiar with, and adequately trained to be able to implement the emergency communications procedures prepared by **OETC**.
2	The form of the **Alert** will be;		
	• "This is an **Alert** timed at *(xx:xx)* hours; • There is a (*partial loss of normal communications **i**nvolving the **Control Centre** [or practice loss of normal communications **i**nvolving the **Transmission Control Centre**]*); • The following are instructions for communicating with the **Control Centre** • *(Use National mobile telephone systems and numbers as listed in the Emergency Communications Plan)* • This message was sent by • *(Name, Position, contact details)*. • Adopt this approach to communications until advised otherwise".		

Table 7: Alert Warnings – Control Centre Function Compromised

OETC **will issue an Alert warning in the event of a total or partial loss of Control Centre function or any practice for such an event**.			
Grid Code Reference OC 7			
	Circumstances of issue	**Recipients of Alert**	**Action to be taken by Users**
1	In the event of a total or partial loss of **Control Centre** function.	All **Users**	Acknowledge receipt of **Alert** by agreed electronic means. Each **User** shall follow **OETC**'s instructions during an **Incident** and restoration process or in any agreed practice event. **Users** shall ensure that their personnel are familiar with, and adequately trained to be able to implement the **System Normalisation Procedures** prepared by **OETC**.
2	The form of the **Alert** warning will be:		

	• "This is an **Alert** timed at *(xx:xx)* hours;
	• There is a (*total loss of **Control Centre** function [or practice total loss of **Transmission Control Centre** function]*)
	• Arrangements are being made to transfer control to another location;
	• The following actions are immediate and imperative:
	  ○ **All Centrally Dispatched Generating Units** except **Generating Units** defined as **Frequency Emergency Control Units** are to maintain present **Output**,
	  ○ **Frequency Emergency Control Units** are to hold the **System Frequency** to the range 49.95 **Hz** – 50.05**Hz**, and
	  ○ All other **Generating Units** and **Users** are to endeavour to maintain constant infeed or **Load**,
	  ○ **OETC** will advise when **Control Centre** functionality has been re-established.
	  ○ Message sent by / contact details"		

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

The Grid Code

Scheduling & Dispatch Codes

1. SDC 1 - Generation and Desalination Scheduling
2. SDC 2 - Generation and Desalination Dispatch
3. SDC 3 - Frequency Control

Version-3.0 August 2020

Scheduling and Dispatch Codes

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Scheduling and Dispatch Codes

SDC 1 Generation and Desalination Scheduling

SDC 1.1 Introduction

The scheduling of **Centrally Dispatched Generating Units** and **Desalination Units** depends on:

- the expected level and pattern of **Demand** on the **Total System**;
- the location of **Production Facilities Connected** to the **Total System** relative to the locations of **Demand** centres supplied from the **Total System**;
- the running cost of each **Centrally Dispatched Generating Unit**;
- the desalination requirements of **PAW;** and
- the flexibility of **Operation** of **Centrally Dispatched Generating Units** and **Desalination Units.**

SDC 1 sets out the following procedures to facilitate production of a **Generation Schedule** and **Desalination Schedule**;

- the submission of a **Daily Status Form** (and revisions) by **Power Producers** to **OETC** and copied to **PWP** for **Centrally Dispatched Generating Units** and **Desalination Units**;
- the submission of **System** data to **OETC** by **Users** with a **System Directly Connected** to the **Transmission System** to which **Centrally Dispatched Generating Units** are **Connected**;
- the exchange of information on relevant contracts and data between **PWP** and **OETC** to allow the production of a **Generation Schedule** and **Desalination Schedule** by **OETC**;
- the issue by **OETC** to **PWP,** on the day before the next **Schedule Day,** of a **Generation Schedule** and **Desalination Schedule**;
- the issue by **OETC** to **Power Producers**, on the day before the next **Schedule Day,** of statements of probable **Output** requirements from **Centrally Dispatched Generating Units** and **Desalination Units** throughout the **Schedule Day**;
- exchange of **Scheduling** data with **International Interconnected Parties**;
- submission of **Demand Control** data; and
- data exchange with **PAW** .

For the avoidance of doubt, **OETC** does not intend to **Schedule** or fully **Dispatch Wind Farm Power Production Facilities** or **Solar Power Production Facilities** but requires to be

informed on an exceptions basis if part or all of the **Plant** is not **Available** for reasons other than climatic conditions. Specific reporting forms for each installation will be agreed between **OETC** and the **Power Producer**. The timing will follow that set out in Appendix A.

SDC 1.2 Objective

The objectives of **SDC 1** are as follows;

- to specify the data to be provided by **Power Producers** to enable **OETC** to prepare the **Generation Schedule** and **Desalination Schedule**;
- to specify the data exchange between **OETC**, **PWP**, and other parties necessary for the preparation of the **Generation Schedule** and **Desalination Schedule**; and
- to specify the timetable for the preparation and issue of the **Generation Schedule** and **Desalination Schedule** and probable **Output** requirements from **Centrally Dispatched Generating Units** and **Desalination Units** throughout the **Schedule Day**.

SDC 1.3 Scope

In addition to **OETC** and **PWP**, **SDC** 1 applies to the following **Users**;

- **Power Producers;**
- **Licensed Distributors;**
- **Directly Connected Consumers;**
- **Internally Interconnected Parties;**
- **International Interconnected Parties**;
- **PAW**; and
- **RAEC** if **Connected** to the **Total System**.

SDC 1.4 Procedures

A timetable for the main actions stipulated in this code is provided in Appendix A.

Where information in this code is required to be provided in writing, subject to **OETC** giving its prior written approval, facsimile transmission or other electronic means may be used. All written communication shall be in the English language.

SDC 1.4.1 Data Provided to OETC and PWP by Power Producers

All declarations made to **OETC** should be made at site **Reference Conditions**.

(i) Availability Notice

By 10:00 hours each day, each **Power Producer** shall notify **OETC** in writing (copied to **PWP**) of the **Availability** of each of its **Centrally Dispatched Generating Units** and **Desalination Units** by means of an **Availability Notice** in the **Daily Status Form** set

out in Appendix B to this **SDC 1**. The **Availability Notice** shall state the **Availability** of the each **Centrally Dispatched Generating Unit** or **Desalination Unit** to be applied for the next **Schedule Day**.

Such **Availability Notice** will replace any previously submitted **Availability Notice**.

(ii) Operating Parameters

By 10:00 hours each day, each **Power Producer** shall notify **OETC** in writing (copied to **PWP**) of any revisions to the **Operating Parameters** of each of its **Centrally Dispatched Generating Units** and **Desalination Units** to those submitted under a previous declaration. The data shall be submitted in the **Daily Status Form** set out in Appendix B to this **SDC** 1.

The **Operating Parameters** shall reasonably reflect the operating characteristics expected on the **Schedule Day**. In so far as not revised, the previously submitted **Operating Parameters** will apply.

(iii) Other relevant Scheduling and Dispatch data

By 10:00 hours each day, each **Power Producer,** in respect of each of its **Centrally Dispatched Generating Units** and **Desalination Units** declared **Available,** shall notify **OETC** in writing (copied to **PWP**) of the following:

- details of any special factors which may have a material effect on the likely **Output** of such **Centrally Dispatched Generating Unit** and/or **Desalination Unit**; and
- any temporary changes and their possible duration, to the **Operating Parameters**;

The data to be provided in **SDC** 1.4.1 (i), (ii) and (iii) shall form the **Daily Status Form**.

In the case of **Wind Farm Power Production Facilities** and **Solar Power Production Facilities,** the expected **Output** for each **Wind Turbine Generating Unit** or **Solar Generating Unit** shall be provided by 10:00 hours each day for the next **Scheduled Day** and updated whenever there is a substantial change in the forecasted **Output**. The quantum of change deemed substantial will be agreed between the **User** and **OETC** but in the absence of such agreement 10**MW** of expected increase or decrease in the forecasted **Output** will be deemed notifiable to **OETC** as soon as such change is known by the **User**.

(iv) Redeclarations

If, at any time after the submission of the **Daily Status Form,** the **Power Producer** becomes aware of any change to any of the values in its **Availability Notice** or **Operating Parameters** that are to be applied to any **Operating Parameters** before the end of the relevant **Schedule Day**, it shall promptly notify **OETC** in writing (copied to **PWP**) by submitting a **Daily Status Form** showing the changed data only and the time submitted.

(v) Failure to submit

Failure to submit a **Daily Status Form** in accordance with **SDC** 1.4.1 shall result in the following:

- **OETC** shall endeavour to contact the **Power Producer** to see if a **Daily Status Form** was sent and not received. If this is the case, the **Daily Status Form** shall be resent immediately;
- if no **Daily Status Form** is received by 12:00 hours **OETC** shall, for the purposes of **Scheduling** and **Dispatch**, use the data provided in the previous day's **Daily Status Form** received from that **Power Producer**. **OETC** will send, in writing, the data so used to the **Power Producer** (copied to **PWP**) on a form entitled "**Daily Status Form** –**OETC** Assumed Data"; and
- if no **Daily Status Form** is received on two or more consecutive days, **OETC** shall alert **PWP** who shall notify the **Regulatory Authority** for persistent offences.

SDC 1.4.2 Distribution and User System Data Provided to OETC

(i) Data provided

By 10:00 hours each day, each **User** with a **System Directly Connected** to the **Transmission System** to which **Centrally Dispatched Generating Units** are **Connected**, will submit to **OETC,** in writing, confirmation of the following in respect of the next **Schedule Day**:

- any change to constraints on its **System**, which **OETC** may need to take into account for derivation of the **Generation Schedule** and **Desalination Schedule** or **Operation** of the **Total System**. In this context, constraints include any restrictions on the **Operation** of **Embedded Centrally Dispatched Generating Units**, as a result of the **User's System**; and
- any change in the requirements for maintaining voltage within prescribed limits and **Reactive Power** reserves, which **OETC** may take into account for **Total System** security reasons.

The form of the submission given in Appendix B, Table 1, will be;

- **Centrally Dispatched Generating Unit Output** (**Active Power** and **Reactive Power**), in each case a fixed value or an operating range, at the low voltage side of the **Generator Transformer** for identified **Centrally Dispatched Generating Units** for each hour of the **Schedule Day**; and
- adjusted in each case for **Active Power** by the correction factors applicable for those **Centrally Dispatched Generating Units** to provide **Output** at the **Connection Points**.

(ii) Failure to submit

Failure to submit the data listed in **SDC** 1.4.2(i) shall result in **OETC** considering that there is no change from data previously submitted or if no data has previously been submitted that there are no constraints and no voltage maintenance actions to be dealt with.

SDC 1.4.3 Directly Connected Consumer Data Provided to OETC

By 10:00 hours each day each **Directly Connected Consumer** with a maximum **Demand** greater than 20 **MW** will submit to **OETC** in writing the **Consumer's** best estimate of its hourly **Demand** profile by **Connection Point** for the next **Schedule Day**. The data should be submitted on the form given in Appendix C, Table 1.

Where the pattern of **Demand** is reliable and consistent, such that the pattern does not vary by more than 10**MW** in any similar period for each day (or working day), **OETC** may agree to accept a submission of a standard **Demand** pattern, and a further submission in the form above (Appendix C Table 1) for exceptional days (being days where the pattern of **Demand** in any period differs by more than 10**MW** from the pattern).

(i) Failure to submit

Failure to submit the data listed in **SDC 1**.4.3 shall result in the following:

- **OETC** shall endeavour to contact the **User** to see if the data was sent and not received. If this is the case the data shall be resent immediately; and
- if, in any event, the data is not received by 12:00 hours, **OETC** shall use the data provided for the corresponding day of the previous week.
- if no data as required in this **SDC** 1.4.3 is received for one week, **OETC** may advise **Directly Connected Customer** that **OETC** is required to notify the **Regulatory Authority** for persistent offences and **OETC** may so notify the **Regulatory Authority**.

(ii) Redeclarations

If at any time between the 10:00 hours and the expiry of the next **Schedule Day,** the **User** becomes aware of any change to the information submitted under **SDC** 1.4.3, or under a previous submission under this **SDC** 1.4.3, that is to be applied before the end of the relevant **Schedule Day**, it shall promptly notify **OETC** in writing.

SDC 1.4.4 Data Provided to OETC by Internally Interconnected Parties

(i) Data provided

By 10:00 hours each day, each **Internally Interconnected Party** with a **System Directly Connected** to the **Total System** to which **Centrally Dispatched Generating Units** that may be **Dispatched** by **OETC** are **Connected**, will submit to **OETC,** in writing, confirmation of the following in respect of the next **Schedule Day**:

- changes in constraints on its **System**, which **OETC** may need to take into account for derivation of the **Generation Schedule** and **Desalination Schedule** or **Operation** of the **Transmission System**. In this context, constraints include any restrictions on the **Operation** of **Embedded Centrally Dispatched Generating Units** as a result of the **User's System**; and
- changes in the requirements for maintaining voltage within prescribed limits and **Reactive Power** reserves, which **OETC** may take into account for **Transmission System** security reasons.

The form of the submission given in Appendix B, Table 2, will be:

- **Centrally Dispatched Generating Unit Output** (**Active Power** and **Reactive Power**), in each case a fixed value or an operating range, at the low voltage side of the **Generator Transformer** for identified **Centrally Dispatched Generating Units** for each hour of the **Schedule Day**; and
- adjusted in each case for **Active Power** by the conversion factors applicable for those **Centrally Dispatched Generating Units** to provide **Output** at the **Connection Points**.

Each **Internally Interconnected Party** with a **System Directly Connected** to the **Total System** to which **Generating Units** not dispatched by **OETC** are **Connected**, will as part of its annual assessment have provided net **Demand** data for its **User System.** In the event of materially changed conditions on its **User System** by 10:00 hours each day, each such **Internally Interconnected Party,** will submit to **OETC** in writing its best estimate of its hourly net **Demand** profile by the **Connection Point** of each **Interconnector** for the following **Schedule Day**.

(ii) Failure to submit

Failure to submit the data listed in **SDC** 1.4.4 (i) shall result in **OETC** considering that there is no change from data previously submitted;

SDC 1.4.5 Data Provided to OETC by International Interconnected Parties

By 10:00 hours each day, **OETC** and the **International Interconnected Parties** shall agree the **Active Power** and **Reactive Power** transfers and any required voltage limits for each hour of the next **Schedule Day** at the **Connection Point** and both confirm the data in writing.

In the event that agreement has not been obtained by the start of the next **Schedule Day**, the transfers shall be adjusted to 0 **MW** and 0 **MVAr, within technically possible margins and variations,** until agreements are reached,

SDC 1.4.6 Data Provided to OETC by PAW

By 10:00 hours each day the **PAW** will submit to **OETC** in writing the total requirement for **Desalinated** water production for the next **Schedule Day** from each **Production Facility** that has **Desalination Units**.

SDC 1.4.7 Data Provided to OETC by PWP

The **Power Procurer** shall submit to **OETC** in writing details relevant to the preparation of the **Generation Schedule** and **Desalination Schedule** from each **PWPA/ PPA** executed between **PWP** and a **Power Producer**.

The **Market Operator** shall submit in accordance with the **Market Rules** to **OETC** details relevant to the preparation of the **Generation Schedule** and **Desalination Schedule**.

The Power Procurer or the Market Operator (as applicable) shall provide such clarification and guidance that it considers will be required by OETC and that it would wish OETC to take into account when preparing the Generation Schedule and Desalination Schedule. OETC may

request, and the **Power Procurer** or the **Market Operator** (as applicable) shall provide, any additional information on a relevant agreement required by OETC to comply with the requirements of its statutory obligations, its **Transmission and Dispatch Licence**, and the **Grid Code**.

SDC 1.4.8 Compilation of the Generation Schedule and Desalination Schedule

For the next **Schedule Day**, **OETC** will compile two **Merit Order Schedules**. Each **Schedule** will list **Centrally Dispatched Generating Units** and **Desalination Units** in descending order of incremental cost using information from relevant agreements and guidance on such relevant agreements provided by the **PWP**, the **Operating Parameters** supplied by the **Power Producers**, the requirements of the **Grid Code** regarding **Operating Reserve**, **Frequency Control**, **Ancillary Services**, and other factors listed below. The two **Schedules** to be compiled by **OETC** are as follows:

- The first **Schedule** will be the '**Unconstrained Schedule**', which will be compiled assuming that there were no **Transmission System** constraints, either through inherent physical limitations on the **Total System** or because of **Outages** on the **Transmission System** ;
- The second **Schedule** will be the '**Constrained Schedule**' which will be compiled taking into account the inherent physical limitations of the **Transmission System** and all known **Outages** and constraints on the **Total System** and **Connected Production Facilities** for the **Schedule Day**.

OETC shall produce the **Generation Schedule** and **Desalination Schedules** taking due consideration of the following factors:

a) forecast **Demand** for electricity and the geographical distribution of forecast **Demand**;

b) forecast requirements for **Desalination** production;

c) declared **Centrally Dispatched Generating Unit Active Power** capabilities;

d) declared **Centrally Dispatched Generating Unit Ancillary Service** capabilities;

e) declared **Operating Parameters**;

f) declared **Centrally Dispatched Generating Unit** inflexibilities;

g) **Licensed Distributor System** constraints;

h) **Output** of **Embedded Centrally Dispatched Generating Units**;

i) **System Operating Reserve** requirements;

j) **Transmission System** stability issues;

k) **System Frequency** control;

l) **Operating Margin**;

m) **Transmission System** constraints together with relevant standards and other constraints;

n) **Transmission System** losses;

o) relevant information on **International Interconnections**;

p) relevant information on other **Users**;

q) **Ancillary Service** requirements; and

r) other factors as may be reasonably considered by **OETC** to be relevant.

OETC shall provide copies of the **Unconstrained Schedules** and **Constrained Schedules** to **PWP** by 15:00 hours each day. The **Schedules** will be made available to other **Users** following requests to **OETC**.

OETC shall issue "Provisional Running Orders" for each hour of the **Schedule Day** based upon the **Constrained Schedule** to each **Power Producer** for each of its **Centrally Dispatched Generating Units** and **Desalination Units** by 16:00 hours on the day preceding the relevant **Schedule Day**.

The "Provisional Running Orders" issued to each **Power Producer** by **OETC** shall contain information relating to the **Centrally Dispatched Generating Unit**(s) of that **Power Producer** only, and shall indicate, for each of its **Centrally Dispatched Generating Units**, the planned loading pattern for the **Schedule Day**.

"Provisional Running Orders" are indicative only, and are provided as a guide to the expected **Output** requirements from **Power Producers** and are not **Dispatch Instructions.**

Appendix A: Timescale Diagram for Main Actions from Scheduling and Dispatch Code 1

(Note that following are summaries only and reference should be made to **Scheduling and Dispatch Codes** for full details.)

	Operating day 1 **Data to be provided for Operating day 0**			
	By 10:00 hours	**By 12:00 hours**	**By 15:00 hours**	**By 16:00 hours**
All **Power Producers** notify **OETC** in writing (copied to **PWP**) (see note 1)				
	Availability Notice (**SDC** 1 Appendix B, Table 1 & 2)			
	Any revisions to **Operating Parameters** (**SDC** 1 Appendix B, Table 1 & 2)			
	Details of any special factors likely to affect **Output** of **Generating Units** (**SDC** 1 Appendix B, Table 3)			
	Any temporary changes and duration to registered data (**SDC** 1 Appendix B, Table 3)			
Users with **Systems Connected** to the **Transmission System** to which **Generating Units** are **Connected** notify **OETC** in writing (see note 1)				
	Constraints in **User's System** that **OETC** may need to consider in preparing schedule			
	Voltage & **MVAr** reserve requirements (**SDC 1** Appendix D, Table 1)			
	Any temporary changes to registered **Demand** management data			
Directly Connected Consumers with Max **Demand** > 1**MW** notify **OETC** in writing (see note 1)				
	Best estimate of hourly **Demand** profile (SDC 1 Appendix C, Table 1)			

	Operating day 1 Data to be provided for Operating day 0			
	By 10:00 hours	**By 12:00 hours**	**By 15:00 hours**	**By 16:00 hours**
Internally Interconnected Parties and **International Interconnected Parties** notify **OETC** in writing (see note 1)				
	Best estimate of hourly imports/exports to **OETC System** (SDC 1 Appendix C, Table 2 & 3)			
	Constraints on its **System** that **OETC** may need to consider			
	Requirements for **Voltage Control** and **MVAr** reserves (**SDC 1** Appendix D, Table 2 & 3)			
	Any other information agreed with **OETC**			
PAW notify **OETC** in writing (see note 1)				
	Total requirement for **Desalinated** water production from each **Production Facility**			
OETC actions				
		If any party does not submit data, **OETC** will use the latest data submitted.		

	Operating day 1 Data to be provided for Operating day 0			
	By 10:00 hours	**By 12:00 hours**	**By 15:00 hours**	**By 16:00 hours**
OETC produces the **Generation Schedule** and **Desalination Schedule** for operating day 0 by 15.00 hours after considering -			Forecast **Demand** and geographic **Demand** distribution	
			Declared **Generating Unit MW** capabilities	
			Declared water production capabilities	
			Declared **Generating Unit Ancillary Service** capabilities	
			Declared **Operating Parameters**	
			Other relevant data	
OETC issues" Provisional Running Orders" for each **Generating Unit** & **Desalination Unit** by 16.00 hours (see note 2)				
				Information only provided to relevant **Power Producer**s

Notes

1 If at any time after submission of the **Daily Status Form**, all parties shall promptly inform **OETC** of any changes to values submitted;

2 "Provisional Running Orders" are indicative only and are not **Dispatch Instructions**.

Appendix B: Daily Status Form

(See General Notes in the End of Appendix B)

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail :**
FROM:			**PRODUCTION FACILITY**
Date-Schedule day:			
Today's date:		**Time sent:**	

Table 1 Centrally Dispatched Generating Units

Temperature basis of Availability declaration			**^{0}C**	
Generating Unit No	**Registered Capacity MW**	**Availability Notice MW**	**Changes to Operating Parameters (Use code from sheet 4 followed by new value)**	
			Code	**Revised value**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Table 2: Desalination Units

Desal Unit No	Registered Capacity Cu mtr/hr	Availability Cu meters/hr	Changes to Operating Parameters (Use code from sheet 4 followed by new value)	
			Code	Revised value
1				
2				
3				
4				
5				

Table 3: Detail any Special Factors or Temporary Changes That May Affect Centrally Dispatched Generating Unit or Desalination Unit Outputs

Date-Schedule Day:		
Centrally Dispatched Generating Unit/ Desal Unit no.	Description of special factor/temporary change	Expected duration Hours/Mins

Table 4: Generating Unit Operating Parameter Codes

Item	Performance item	Units	Code
1	**Minimum Generation**	**MW**	MG
	At full load		
2	Maximum lagging **MVAr**	**MVAr**	Flvarlag
3	Maximum leading **MVAr**	**MVAr**	Flvarlead
	At minimum load		
4	Maximum lagging **MVAr**	**MVAr**	Mlvarlag
5	Maximum leading **MVAr**	**MVAr**	Mlvarlead
6	Maximum emergency **Generation**	**MW**	MEG
7	Minimum on-time	Hours/mins	Minon
8	Minimum off-time	Hours/mins	Minoff
9	Notice to **Synchronise/Start-up**	Hours/mins	NSS
10	**Synchronising Block Load**	**MW**	SBL
11	Time between starting/ **Synchronising Generating Unit**	Hours/mins	TbeSynch
12	Time between stopping/ **Desynchronising Generating Units**	Hours/mins	TbeStop
13	Maximum water production	Cu mtr/hr	Max Prod
14	Minimum water production	Cu mtr/hr	MinProd
15	Change to **Ancillary Service** capability		ASC
16	Governor not in **Frequency Sensitive Mode**		NFM
17	Change to **Primary Response** characteristics		PrimResp
18	Change to **Secondary Response** characteristics		SecResp
19	Change to **Tertiary Reserve** characteristics		TertResp
20	Abnormal loading rate		ALR
21	Special factor		SF
22	Temporary change		TC
23	**Risk of Trip**		RoT
24	Restriction of gas supplies		GasRes

Notes: These data should be entered in sheet 1 but detailed in sheet 2;
All other data should be entered and data given in sheet 1.

General notes: Power Producers when making the daily submissions of Availability to **OETC** and **PWP** will address the following factors. Most regular issues will be covered by responses in Table 1 using heading codes from Table 4. All other issues will be tabulated on a **Centrally Dispatched Generating Unit**/ **Desalination Unit** basis in Table 3.

1. **Centrally Dispatched Generating Unit** basic data;
2. Minimum **Generation**;
3. Maximum **Generation** and/or **Desalination Unit** increase in **Output** above declared **Availability**;
4. **Centrally Dispatched Generating Unit** minimum on time;
5. Minimum shutdown time;
6. **Centrally Dispatched Generating Unit** and/or **Desalinating Unit** inflexibility (inflexibility description, start date and time, end date and time, **MW**, m^3/h);
7. **Centrally Dispatched Generating Unit Synchronising** intervals (**Hot** time interval, off-load time interval);
8. **Centrally Dispatched Generating Unit Synchronising Output MW**;
9. **Desalination Unit Start-up** intervals (**Hot** time interval, off load time interval);
10. **Centrally Dispatched Generating Unit Desynchronising** intervals;
11. **Desalinat~~ing~~ion Unit Shut-down** intervals;
12. **Desalination Unit** basic data;
13. Minimum water production;
14. Maximum water production;
15. Constraints on **Centrally Dispatched Generating Unit Output** for range of associated **Desalination Unit Outputs**;
16. **Centrally Dispatched Generating Unit** two shifting limitation;
17. **Centrally Dispatched Generating Unit Synchronising** groups;
18. **Centrally Dispatched Generating Unit** run-up times with **MW** breakpoints;
19. For **Centrally Dispatched Generating Units, Generating Unit** run-down times with **MW** breakpoints;
20. For **Centrally Dispatched Generating Units, Generating Unit Loading rates** covering the range from **Minimum Generation** to declared **Registered Capacity**; and
21. For **Centrally Dispatched Generating Units, Generating Unit De-loading Rates** covering the range from declared **Registered Capacity** to **Minimum Generation**.

Appendix C: Pro-forma for Demand and Import/Export Profiles

Table 1: Data to be Completed by Users Including Directly Connected Consumers

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail :**
FROM:			**USER NAME**
Date-Schedule day:			
Today's date:		**Time sent:**	

Time Hours	**Demand MW** (1)
01:00	
02:00	
03:00	
04:00	
05:00	
06:00	
07:00	
08:00	
09:00	
10:00	
11:00	
12:00	

Time	**Demand MW** (1)
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	
24:00	

Note (1) Transfers from Oman **Transmission System** are +ve
Transfers to Oman **Transmission System** are -ve

Pro-Forma for Demand and Import/Export Profiles

Table 2: Data to be Completed by Internally Interconnected Parties

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail:**
FROM:			**NAME OF PARTY**
Date-Schedule day:			
Today's date:		**Time sent:**	

Time Hours	Transfer **MW** (1)
01:00	
02:00	
03:00	
04:00	
05:00	
06:00	
07:00	
08:00	
09:00	
10:00	
11:00	
12:00	

Time	Transfer **MW** (1)
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	
24:00	

Note (1) Transfers from Oman **Transmission System** are +ve

Transfers to Oman **Transmission System** are –ve

Pro-Forma for Demand and Import/Export Profiles

Table 3: Data to be Completed by International Interconnected Parties

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail:**
FROM:			**NAME OF PARTY**
Date-Schedule day:			
Today's date:		**Time sent:**	

Time Hours	Transfer **MW** (1)
01:00	
02:00	
03:00	
04:00	
05:00	
06:00	
07:00	
08:00	
09:00	
10:00	
11:00	
12:00	

Time	Transfer **MW** (1)
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	
19:00	
20:00	
21:00	
22:00	
23:00	
24:00	

Note (1) Transfers from Oman **Transmission System** are +ve

Transfers to Oman **Transmission System** are –ve

Appendix D: Requirements for Voltage Control & Reactive Power Reserves

Table 1: Data to be Completed by Users with Systems Connected to OETC

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail:**
FROM:			**USER NAME**
Date-Schedule day:			
Today's date:		**Time sent:**	

This table should only be completed where requirements are necessary, otherwise a nil return should be shown.

A separate form should be used for each **Connection Point**.

Connection Point	
Voltage limits	

Time Hours	**Voltage target**	**MVAr**
01:00		
02:00		
03:00		
04:00		
05:00		
06:00		
07:00		
08:00		
09:00		
10:00		
11:00		
12:00		

Time Hours	**Voltage target**	**MVAr**
13:00		
14:00		
15:00		
16:00		
17:00		
18:00		
19:00		
20:00		
21:00		
22:00		
23:00		
24:00		

Note: Mvar: **+ ve lagging;**
- ve leading

Requirements for voltage control & Reactive Power reserves

Table 2: Data to be Completed by Internally Interconnected Parties

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail:**
FROM:			**NAME OF PARTY**
Date-Schedule day:			
Today's date:		**Time sent:**	

This table should only be completed where requirements are necessary, otherwise a nil return should be shown. A separate form should be used for each **Connection Point**.

Connection point	
Voltage limits	

Time Hours	**Voltage target**	**Mvar**
01:00		
02:00		
03:00		
04:00		
05:00		
06:00		
07:00		
08:00		
09:00		
10:00		
11:00		
12:00		

Time Hours	**Voltage target**	**Mvar**
13:00		
14:00		
15:00		
16:00		
17:00		
18:00		
19:00		
20:00		
21:00		
22:00		
23:00		
24:00		

Note: Mvar: **+ ve lagging;**
- ve leading

Requirements for voltage control & Reactive Power reserves

Table 3: Data to be Completed by International Interconnected Parties

To OETC CONTROL CENTRE **Copy to PWP**			**e-mail:** **e-mail:**
FROM:			**NAME OF PARTY**
Date-Schedule day:			
Today's date:		**Time sent:**	

This table should only be completed where requirements are necessary, otherwise a nil return should be shown. A separate form should be used for each **Connection Point**.

Connection point	
Voltage limits	

Time Hours	**Voltage target**	**Mvar**
01:00		
02:00		
03:00		
04:00		
05:00		
06:00		
07:00		
08:00		
09:00		
10:00		
11:00		
12:00		

Time Hours	**Voltage target**	**Mvar**
13:00		
14:00		
15:00		
16:00		
17:00		
18:00		
19:00		
20:00		
21:00		
22:00		
23:00		
24:00		

Note: Mvar: **+ ve lagging;**
- ve leading

Scheduling and Dispatch Codes

SDC 2 Generation and Desalination Dispatch

SDC 2.1 Introduction

SDC 2 sets out the procedures for the issue of **Dispatch Instructions** by **OETC** in the order to meet **Demand** at minimum cost; and with an appropriate margin of reserve, whilst maintaining:

- the security and quality of electricity **Supply**;
- provision of desalinated water; and
- taking account of operational constraints,

OETC needs to:

- re-optimise **Generation Schedules** and **Desalination Schedules** as required;
- issue instructions to **Centrally Dispatched Generating Units** (including within **Wind Farm Power Production Facilities** and **Solar Power Production Facilities**), and **Desalination Units**;
- manage power flows with **International Interconnected Parties**;
- issue instructions to **Users** with respect to **Ancillary Services**; and
- exchange information with **PWP**.

SDC 2.2 Objective

The objective of **SDC 2** is to clarify procedures for the issue of **Dispatch Instructions** by **OETC** to:

- meet electricity **Demand** and **Desalinated** water requirements at minimum cost, taking account of operational constraints whilst maintaining the integrity of **Total System** security and the quality of electricity **Supply**; and
- enable **OETC** to comply with its statutory obligations, the requirements of its **Transmission and Dispatch Licence**, and the **Grid Code**.

SDC 2.3 Scope

In addition to **OETC**, **SDC 2** applies to:

- **Power Producers** with **Centrally Dispatched Generating Units** (including **Wind Farm Power Production Facilities and Solar Power Production Facilities)**;and **Desalination Units**;
- **Users**;
- **Directly Connected Consumers**;

- **International Interconnected Parties**;
- **Ancillary Service** providers;
- **Internally Interconnected Parties**;
- **RAEC** if **Connected** to the **Total System**; and
- **PWP** (for information).

SDC 2.4 Procedures

Where information in this code is required to be provided in writing, subject to **OETC** giving its prior written approval, facsimile transmission or other electronic means may be used. All written communication shall be in the English language. The format for issuing **Dispatch Instructions** is given in Appendix A.

SDC 2.4.1 Data

OETC shall, when assessing which **Centrally Dispatched Generating Units** and **Desalination Units** to **Dispatch**, review:

- the **Constrained Schedule**;
- the declared **Availability** (**Daily Status Form**) of each **Centrally Dispatched Generating Unit** and **Desalination Unit**; and
- other relevant data in respect of each **Centrally Dispatched Generating Unit** and **Desalination Unit**, as determined by **OETC**.

The **Operating Parameters** used in the **Dispatch** phase shall be those used by **OETC** to compile the **Generation Schedule** and **Desalination Schedule** as described in **SDC 1**.4.

In the event that two or more **Centrally Dispatched Generating Units** have equivalent costs, **OETC** will first **Dispatch** the **Centrally Dispatched Generating Unit** that will give the highest reduction in overall **Total System** costs.

SDC 2.4.2 Dispatch Instructions to Power Producers

Dispatch Instructions relating to the **Schedule Day** shall be issued at any time during the period beginning immediately after the issue of the **Generation Schedule** and **Desalination Schedule** in respect of that **Schedule Day**.

A **Dispatch Instruction** given by **OETC** may require:

- a change in:
  - the **Active Power** or **Reactive Power Output** of a **Synchronous Centrally Dispatched Generating Unit** including a **Desalination Unit**;
  - the **Reactive Power Output** of an **Wind Farm Power Production Facility** or **Solar Power Production Facility**;
  - the mode of **Operation** or an instruction to provide an **Ancillary Service** by a specific **Centrally Dispatched Generating Unit** or a **Wind Farm Power Production Facility** or **Solar Power Production Facility**; or

- an instructed reduction in, or cessation of, **Output** from a **Wind Turbine Generating Unit** or **Solar Generating Unit**.

A **Dispatch Instruction** given by **OETC** to a **Power Producer** shall be given by telephone. **OETC** will maintain a list of the type of **Dispatch Instructions** which are to be confirmed in writing within 5 minutes and **Users** shall so confirm. Each party shall enter all **Dispatch Instructions** into the respective logs.

Alternatively, User may send in his confirmation to the verbal request and the same shall be checked and accepted by OETC on the User's request.

In the case of **Generating Units** controlled by **AGC**, the **Dispatch Instructions** may also be given by direct signal from the **Control Centre** and are then electronically acknowledged by the **Plant**.

A **Dispatch Instruction** must be either formally acknowledged immediately by the **Power Producer** in respect of that **Centrally Dispatched Generating Unit** by telephone, or a reason given immediately for non-acceptance. The reason for non-acceptance may only be on safety grounds (relating to **Persons** or **Plant**) or because the **Dispatch Instruction** is not in accordance with the **Daily Status Form** relevant to the time and period to which the **Dispatch Instruction** relates.

A **Dispatch Instruction** given by **SCADA** direct signaling to the **Plant** must be acknowledged as received by a signal from the **Plant** and a confirmation signal returned indicating that the action is being taken and a further signal when the action is completed.

For a **Dispatch Instruction** to be valid, it must observe the limits of **Availability**, **Ancillary Service** capability and **Operational Parameters** as properly declared to **OETC** in accordance with **SDC 1**.

In the event that an unforeseen problem arises in carrying out the **Dispatch Instruction**, **OETC** must be notified without delay by telephone.

SDC 2.4.3 Generation Synchronising and De-synchronising Times

OETC shall determine the required timing of **Synchronising** and **Desynchronising** of each **Synchronous Centrally Dispatched Generating Unit**.

If the **Power Producer** is unable to meet the **Synchronising** time, it must inform **OETC** immediately. If the estimate of the **Synchronising** time is:

- later than the instructed time by more than 10 minutes, this will constitute a redeclaration of **Availability** by the **Centrally Dispatched Generating Unit** as defined in **SDC 1**.4.1.
- early by more than one minute, **OETC** shall keep a record and inform **PWP**.

When **OETC** issues a **Dispatch Instruction** to a **Power Producer**, for a **Centrally Dispatched Generating Unit**, which is not in accordance with the data submitted on **Daily Status Form**, the **Power Producer** must immediately contact **OETC** to indicate the error. **OETC** will take immediate steps to amend the **Dispatch Instruction**.

SDC 2.4.4 Additional instructions to Centrally Dispatched Generating Units

Additional instructions to **Centrally Dispatched Generating Units** may include the following:

Reserve

To ensure that an adequate **Operating Margin** is maintained, **Dispatch Instructions** may include details of the reserve (in the categories set out in **OC**3) to be carried on each **Centrally Dispatched Generating Unit (**including a **Wind Turbine Generating Unit** or **Solar Generating Unit)**, including notification of the timescale in which that reserve may be transferable into increased **Generating Unit Output**.

Reactive Power

To ensure that a satisfactory **System** voltage profile and sufficient **Reactive Power** reserves are maintained, **Dispatch Instructions** may include, in relation to **Reactive Power**:

a) **Reactive Power Output**.

The **Reactive Power Output** from the individual **Centrally Dispatched Generating Unit** (including a **Wind Turbine Generating Unit** or **Solar Generating Unit)** onto the **Transmission System** is the **Output** at the **Generating Unit's Connection Point** namely the **HV** side of the **Generator Transformer** (or at the **Distribution System Connection Point** in the case of **Embedded Centrally Dispatched Generating Units**). In relation to each **Centrally Dispatched Generating Unit**, where there is no **HV** indication, **OETC** and the **Power Producer** will discuss and agree equivalent **Reactive Power** levels for the corresponding LV indication.

Where a **Centrally Dispatched Generating Unit**, (including a **Wind Turbine Generating Unit** or **Solar Generating Unit)** is instructed to a specific **Reactive Power Output**, the **Power Producer** must achieve that **Output** within a tolerance of ± 5 **MVAr** (or such other figure as may be specified within the relevant **PPA/PWPA** or agreed with **OETC**) by either;

- on-load tap changing on the **Generator Transformer**; or
- adjusting the **Centrally Dispatched Generating Unit** stator terminal voltage, or by automatic adjustments made to power electronic convertor in the case of **Asynchronous Generating Units**.

Once this has been achieved, the **Power Producer** will not tap again or adjust terminal voltage again without prior consultation with and the agreement of **OETC**, on the basis that **Reactive Power Output** will be allowed to vary with **Transmission System** conditions.

b) **Target voltage levels.**

Target voltage levels are to be achieved by the **Centrally Dispatched Generating Unit** (including a **Wind Turbine Generating Unit** or **Solar Generating Unit)** on the **Transmission System** at the **Generating Unit's Connection Point**, namely the **High Voltage** side of the **Generator Transformer** (or on the **Distribution System** at the **Distribution Network Connection Point** in the case of **Embedded Centrally Dispatched Generating Units**). Where a **Centrally Dispatched Generating Unit** is instructed to a specific target voltage, the **Power Producer** must achieve that target within a tolerance of ± 0.5 kV (or such other figure as may be agreed with

OETC) by either;

- on load tap changing on the **Generator Transformer**; or
- adjusting the **Centrally Dispatched Generating Unit** stator terminal voltage or by automatic adjustments made to power electronic convertor in the case of **Asynchronous Generating Units**.

In relation to each **Centrally Dispatched Generating Unit** (including a **Wind Turbine Generating Unit** or **Solar Generating Unit)**, where there is no **HV** indication, **OETC** and the **Power Producer** will discuss and agree equivalent voltage levels for the corresponding LV indication.

Under normal operating conditions, once this target voltage level has been achieved the **Power Producer** will not tap again or adjust terminal voltage settings again without prior consultation with, and with the agreement of, **OETC**.

Under certain circumstances the **Power Producer** may be instructed to maintain a target voltage until otherwise instructed and this will be achieved by on-load tap changing on the **Generator Transformer** or adjusting **Centrally Dispatched Generating Unit** stator terminal voltage without reference to **OETC** or by automatic adjustments made to power electronic convertor in the case of **Asynchronous Generating Units**.

Voltages on the 220kV and 132kV parts of the **Transmission System** at each **Connection Point** with a **User** will normally remain within the limits ±10% of the nominal value unless abnormal conditions prevail. Voltages on the 400kV system will normally be within +5% and -5% unless abnormal conditions prevail (-10% for a short period). Under fault conditions, voltage may collapse transiently to zero at the point of fault until the fault is cleared or could rise transiently on some phases in the case of unbalanced faults.

c) Maximum Reactive Power Output ("maximum excitation")

Under certain conditions, such as low **System** voltage, an instruction to maximum **Reactive Power Output** at instructed **Active Power Output** ("maximum excitation") may be given, and a **Power Producer** should take appropriate actions to maximise **Reactive Power Generation** unless constrained by **Plant** operational limits or safety grounds (relating to **Persons** or **Plant**).

d) Maximum Reactive Power absorption ("minimum excitation")

Under certain conditions, such as high **System** voltage, an instruction to maximum **Reactive Power** absorption at instructed **Active Power Output** ("minimum excitation") may be given, and a **Power Producer** should take appropriate actions to maximise **Reactive Power** absorption unless constrained by **Operating Parameter** limits or safety grounds (relating to **Persons** or **Plant**).

In addition;

- **OETC** may issue **Dispatch Instructions** for **Active Power** (from **Synchronous Generators**) and **Reactive Power** at any point on or within boundaries of the **Generator Performance Chart** as modified by any temporary changes

submitted in the **Daily Status Form**. Any failure of a **Power Producer** to achieve these instructions within the agreed times shall be reported by **OETC** in writing to **PWP** as a failure to meet the terms of the **PPA**;

- the issue of **Dispatch Instructions** for **Active Power** at the **Connection Point** of any **Synchronous Centrally Dispatched Generating Unit**, will be made with due regard to any resulting change in **Reactive Power** capability and may in the case of a **Synchronous Generating Unit** include instruction for reduction in **Active Power Generation** to enable an increase in **Reactive Power** capability;
- the excitation system, unless otherwise agreed with **OETC**, must be operated only in its constant terminal voltage mode of **Operation** with (in the case of **Synchronous Generators) VAr** limiters in service. Any constant **Reactive Power Output** control mode or constant **Power Factor Output** control mode must always be disabled, unless agreed otherwise with **OETC**. In the event of any change in the **System** voltage, a **Power Producer** must not take any action to override automatic **Reactive Power** response that is produced as a result of constant terminal voltage mode of **Operation** unless instructed otherwise by **OETC** or unless immediate action is necessary to comply with stability limits or unless constrained by **Operating Parameter** limits or safety grounds (relating to **Persons** or **Plant**);
- a **Dispatch Instruction** relating to **Reactive Power** will be implemented without delay and shall be achieved not later than 2 minutes after the instruction time, or such longer period as **OETC** may instruct;
- on receiving a new **Dispatch Instruction** for **Active Power**, to a **Synchronous** generator, no tap changing or **Centrally Dispatched Generating Unit**, terminal voltage adjustment shall be carried out to change the **Reactive Power Output** unless there is a new **Dispatch Instruction** for **Reactive Power**;
- where a **Dispatch Instruction** to **Synchronise** is given, or where a S**ynchronous Centrally Dispatched Generating Unit** is **Synchronised** and a **Dispatch Instruction** for **Active Power** is given, a **Dispatch Instruction** for **Reactive Power** consistent with the **Centrally Dispatched Generating Unit** relevant **Operating Parameters** may be given. In the absence of a **Dispatch Instruction** for **Reactive Power** with a **Dispatch Instruction** to **Synchronise**, the **Reactive Power Output** shall be 0 **MVAr**; and
- where a **Dispatch Instruction** to **Desynchronise** is given, a **Dispatch Instruction** for **Reactive Power**, compatible with shutdown, may be given prior to **Desynchronisation** being achieved. In the absence of a separate **Dispatch Instruction** for **Reactive Power**, it is implicit in the instruction to **Desynchronise** that **Reactive Power Output** shall be reduced to 0 **MVAr** by the time of **Desynchronisation**.

SDC 2.4.5 Frequency Sensitive Mode

OETC may instruct a change to or from the **Frequency Sensitive Mode** for each **Centrally Dispatched Generating Unit**, (including a **Wind Turbine Generating Unit** or **Solar Generating Unit)**.

Ancillary Services

When an agreement exists between **OETC** or **PWP** and a **User** for provision of **Ancillary Services**, other than those covered in this **Grid Code**, **Dispatch Instructions** relating to the provision of these services may be issued.

Tests

An instruction may be issued to carry out tests as required under **OC** 9.

SDC 2.5 Actions Required from the Power Producer

Each **Power Producer** will comply with all **Dispatch Instructions** correctly given by **OETC** unless the **Power Producer** has given notice to **OETC** under the provisions of the **Scheduling and Dispatch Code** regarding non-acceptance of **Dispatch Instructions**.

Each **Power Producer** with **Synchronous Generating Units** must utilise the relevant run-up or run-down rate and loading or de-loading rate in accordance with the **Operating Parameters**.

To preserve **Transmission System** integrity under **Emergency Conditions OETC** may issue **Emergency Instructions**. Such **Emergency Instructions** will be issued by **OETC** direct to the **Power Producer** and may require an action or response that is outside **Operating Parameters**. The **Power Producer** will use reasonable endeavours to achieve these **Emergency Instructions** without prejudice to the safety of the **Plant** or **Persons**.

SDC 2.6 Synchronization / De-Synchronization

Power Producers will only **Synchronise** or **Desynchronise Synchronous Centrally Dispatched Generating Units** in response to a **Dispatch Instruction** from **OETC**. **Desynchronisation** may take place without **OETC**'s prior agreement if it occurs automatically as a result of **Centrally Dispatched Generating Unit** or **Transmission** protection operations or it is done purely on safety grounds.

SDC 2.7 Instruction following Operating Parameter Changes

If **OETC** fails to issue a new **Dispatch Instruction** within 15 minutes of being notified of an **Operating Parameter** change then the relevant **Power Producer** shall be entitled to change the **Operation** of such **Centrally Dispatched Generating Unit** (including any **Generating Unit** forming part of a **Wind Farm Power production Facility** or **Solar Power Production Facility**) and/or **Desalination Unit** to bring its **Operation** within the applicable **Availability** and/or **Operating Parameters** until **OETC** issues a new **Dispatch Instruction** within the applicable **Availability** and/or **Operating Parameters**. Prior to making such a change in **Operation**, the **Power Producer** will use reasonable endeavours to advise **OETC** (by telephone and then confirmed in writing) of its intended action and timing.

SDC 2.8 Requests for Operation under Risk of Trip

A **Power Producer** may request **OETC's** agreement for one of the **Synchronous Centrally Dispatched Generating Units** and/or **Desalination Units** at the **Production Facilities** to be operated under **Risk of Trip**. **OETC**'s agreement will be dependent on the evaluation by **OETC** of the risk to the **Total System** arising from the potential trip of the **Synchronous Centrally Dispatched Generating Unit**.

SDC 2.9 Instructions to Users with Demand

Dispatch Instructions to **Users** with **Demand** relating to the **Schedule Day** shall be issued as a list of special actions in respect of that **Schedule Day** at any time during the period beginning immediately after the issue of the **Generation Schedule** and **Desalination Schedule**. **OETC** will issue instructions directly to the **Users** with **Demand** at each **Control Centre** in relation to special actions and **Demand Control**. **Dispatch Instructions** may include;

- a requirement for **Demand** reduction, de-energisation or restoration;
- an instruction to effect a **Load** transfer between **Connection Points**; and
- an instruction to switch in a **Demand Intertrip Scheme**.

SDC 2.10 Communications with Demand Users

OETC shall issue **Dispatch Instructions** to **Users** with **Demand** by telephone. **OETC** shall maintain a list of types of instruction which require confirmation. **OETC** shall confirm **Dispatch Instructions**, as required by **OETC** list mentioned above, in writing within 5 minutes. All **Users** with **Demand** must acknowledge all **Dispatch Instructions** in writing within 2 minutes of receipt, as required by **OETC** list mentioned above.

Each **Demand User** must comply without delay with all **Dispatch Instructions** received by it. In the event of an unforeseen problem arising that prevents the carrying out of a **Dispatch Instruction**, **OETC** must be notified by telephone without delay and not later than 5 minutes after receipt of the **Dispatch Instruction**. **OETC** shall confirm the notification in writing within 5 minutes of receipt.

Each party shall enter all **Dispatch Instructions** sent and received and all events into the respective logs.

Appendix A: Dispatch Instructions

1. Format of Dispatch Instruction

OETC shall give **Dispatch Instructions** to **Users** by telephone.

OETC shall confirm the **Dispatch Instruction** in writing and shall be acknowledged by the recipient and confirmation sent to **OETC** in writing as in SDC 2.4.2. In all cases, all **Dispatch Instructions** and events shall be entered into the respective logs by the sender and by the receiver.

A **Dispatch Instruction** may also be issued as a **SCADA** command and the acknowledgment of receipt and action then is a **SCADA** function.

An oral /written **Dispatch Instruction** to **Power Producers** shall include the following information;

a) **an exchange of operator names;**

b) **the specific Centrally Dispatched Generating Unit and/or Desalination Unit to which the instruction applies;**

c) **the Output to which it is instructed;**

d) **if the start time is different from the time the instruction is issued, the start time will be included;**

e) **where specific Generating Unit run-up time / Generating Unit run-down time or Generating Unit loading rate / Generating Unit de-loading rate are concerned, a specific target time/rate;**

f) **the issue time of the instruction.**

All **Synchronous Generating Unit** run-up times / **Generating Unit** run-down times and **Synchronous Generating Unit** loading rates / **Generating Unit** de-loading rates will be assumed to be constant and in accordance with **Operating Parameters.** Each **Dispatch Instruction** will, wherever possible, be kept simple, drawing as necessary from the following formats.

2. A Dispatch Instruction to Increase or Decrease Output

Any e-mail, or telephone **Dispatch Instruction** or acknowledgement will follow the form;

“This is Operator A at **OETC Control Centre**. To whom am I speaking?”

“Operator Z at Production Facility X”

*If the time of the instruction is 14:00 hours, the **Centrally Dispatched Generating Unit** is **Generating Unit** number 1 and the **Output** to be achieved is 25**MW**, the relevant part of the instruction would be*.

"**Generating Unit** number I to 25**MW**, instruction timed at 14:00 hours"

If the start time is 1415 hours, the instruction will follow the form;

" **Generating Unit** number 1 to 25**MW**, start at 14:15, hours, instruction timed at 14:00 hours"

3. Centrally Dispatched Generating Unit Synchronising

When issuing instructions, **OETC** will always have due regard for the time of **Notice to Synchronise** declared to **OETC** by the **Power Producer**.

The instruction will follow the form:

"**Generating Unit** number 1 **Synchronise** at 16:00 hours, instruction timed at 13:00 hours."

Unless a loading program is also given at the same time it will be assumed that the **Centrally Dispatched Generating Units** are to be brought to **Minimum Generation** and 0 **MVAr Output**.

OETC will issue a further **Dispatch Instruction** when the **Power Producer** reports that the **Centrally Dispatched Generating Unit** has **Synchronised**.

If it should be necessary for a **Dispatch Instruction** for a **Centrally Dispatched Generating Unit** to **Synchronise** to be cancelled before the **Generating Unit** or **CCGT Module** is **Synchronised**, the instruction shall be given by telephone and will be confirmed in writing within 5 minutes and will follow the form;

"**Generating Unit** number I cancel **Synchronising** instruction, instruction timed at 14:00 hours."

4. Centrally Dispatched Generating Unit De-Synchronising

The instruction will follow the form;

"**Generating Unit** number 1 **Shutdown** instruction timed at 13:00 hours."

*If the instruction **Desynchronising** time is for 14:00 hours, it will follow the form*;

"**Generating Unit** number 1 **Shutdown** at 14:00 hours, instruction timed at 13:00 hours."

Both of the above instructions assume a run-down rate at declared **Operating Parameters**.

Unless a separate **Reactive Power Dispatch Instruction** is given, the **Centrally Dispatched Generating Unit** will be brought to 0 **MVAr** (at the point of **Synchronism**) prior to **Desynchronisation**.

5. Voltage Control Instruction

To ensure adequate **System** voltage profiles and **Reactive Power** reserves are maintained under normal and fault conditions a range of voltage control instructions will be utilized:

a) increase/decrease **Reactive Power** to (*XX*)**MVAr** export or import;

b) maximum **MVAr Output** (or "maximum excitation");

c) maximum **Reactive Power** absorption (or "minimum excitation");

d) increase **Generator Transformer** tap position by (*one)* tap or go to tap position (*x*])

e) achieve a target voltage of (*YYkV)* and then allow to vary with **System** conditions;

f) maintain a target voltage of (*YYkV*) until otherwise instructed. Tap change (or adjust **Centrally Dispatched Generating Unit** terminal voltage) as necessary.

6. Frequency Control

All **Dispatch Instructions** will be deemed to refer to target **Output** at the instructed **Target Frequency** when the **Centrally Dispatched Generating Unit** is in the **Frequency Sensitive Mode**.

Synchronous Centrally Dispatched Generating Units are required to operate in **Frequency Sensitive Mode** in the combinations set out in the relevant **PPA**/**PWPA**.

Frequency control instructions may be issued in conjunction with or separate from **Dispatch Instruction** for **Active Power Output** (for **Synchronous Generating Units**).

7. Tertiary Reserve

Tertiary Reserve will be specifically instructed as required and will normally be given with the **Dispatch Instruction** as an additional item in the form, for example:

"**Generating Unit** number I to 40**MW** and 5**MW Tertiary Reserve**; instruction timed at 14:00 hours."

8. Black Start

The instruction will normally follow the form:

"Initiate **Black Start** procedure; instruction timed at 19:00 hours."

9. Emergency instruction

All such instructions will be prefixed with the words:

"This is an **Emergency Instruction**".

It may be in a pre-arranged format and normally would follow the form:

"This is an **Emergency Instruction**. Reduce **Output** to (*X*) **MW** in (*Y*) minutes, instruction timed at 20:00 hours."

Scheduling and Dispatch Codes

SDC 3 Frequency Control

SDC 3.1 Introduction

To maintain the security and quality of electricity **Supply**, the **Frequency** of the **Total System** must be maintained within specified limits. **SDC** 3 describes **Frequency** control procedures to allow **OETC** to meet its **Licence** requirement to maintain the **Frequency** of the **Total System** and the **Electric Time** within specified limits.

These procedures include:

- **Generating Units** operating in a **Frequency Sensitive Mode**;
- **Demand Control**; and
- **Dispatch** of **Generating Units**.

SDC 3 is complementary to **SDC** 1 and **SDC** 2.

SDC 3.2 Objective

The objective of **SCD** 3 is to clarify the **Frequency** control procedures required by **OETC** to maintain the security and quality of electricity **Supply** from the **Total System** and, as far as possible, to maintain the **Electric Time** in accordance with the limits specified in this code **SDC** 3.

SDC 3.3 Scope

In addition to **OETC** and **PWP**, **SDC** 3 applies to;

- **Power Producers**;
- **Users**;
- **Licensed Distributors**;
- **Directly Connected Consumers**;
- **Internally Interconnected Parties**;
- **International Interconnected Parties**;
- **RAEC** if **Connected** to the **Total System**; and
- **PWP** (for information).

SDC 3.4 Response from Generating Units

SDC 3.4.1 Capability

Each **Centrally Dispatched Generating Unit**, including **Wind Turbine Generating Units** and **Solar Generating Units** must at all times have the capability to operate automatically so as to provide response to changes to **System Frequency**. This will be provided for and complied with in accordance with the requirements of a relevant **PWPA** or **PPA**.

Frequency Sensitive Mode is the generic description whereby the **Active Power Output** of a **Generating Unit** will change automatically in response to changes in **System Frequency**. This also permits the **Generating Unit** to operate in accordance with an instruction to provide **Primary Response** and/or **Secondary Response**. A **Power Producer** must not countermand a change in the **Active Power Output** of a **Centrally Dispatched Generating Unit** induced by a change in **System Frequency** that assists recovery to **Target Frequency**. The only exceptions are where a change in the **Active Power Output** of a **Generating Unit** must be carried out on safety grounds (relating to either **Persons** or **Plant**) or to ensure the integrity of the **Generation Plant**.

SDC 3.4.2 OETC Dispatch Instructions

OETC will issue **Dispatch Instructions** to regulate the **Frequency** of the **Total System** to meet the requirements of **Frequency** control. **Generation Plant** operating in **Frequency Sensitive Mode** is required to operate taking into account the **Target Frequency** notified by **OETC**.

OETC will give 15 minutes notice of variation of **Target Frequency**.

The **Frequency** of the **Total System** shall be nominally 50.00 **Hz** with **System Frequency** set points between 49.95 **Hz** and 50.05 **Hz**. Normal control deviations will not exceed 49.70 **Hz** to 50.30 **Hz**. Under transient disturbed conditions, **System Frequency** could rise to 51.5 **Hz** or fall to 47.5 **Hz**.

SDC 3.4.3 Low Frequency Initiated Response from Generating Units

If **Frequency** falls below **Target Frequency**, **Output** from the **Centrally Dispatched Generating Unit** should be maintained. **Centrally Dispatched Generating Units**, including **Wind Turbine Generating Units** and **Solar Generating Units** whether or not they have provided **Primary Response** shall not be de-energised provided that the **System Frequency** is above 47.5**Hz**. A **Power Producer** must not reduce the power increase of a **Centrally Dispatched Generating Unit** induced by a change in **Frequency** of the **Total System** that assists recovery to **Target Frequency**, but this shall only apply to **Wind Turbine Generating Units** and **Solar Generating Units** to the extent that climatic conditions allow.

Below 47.5**Hz**, **Generating Unit**s may be de-energised from the **Total System** to ensure integrity of the **Plant** but **Synchronous Generating Units** should be kept running to supply house **Load** and appropriate local **Demand** which has been separated from the **Total System** so that these **Generating Units** are **Available** to assist in **Total System** recovery promptly. **Wind Turbine Generating Units** and **Solar Generating Units** shall not supply local **Demand** unless in the presence of adequate **Synchronous Generation** to maintain stable **Frequency** and voltage.

If the **Frequency** of the **Total System** falls below 47.5 **Hz**, **Power Producers** will be required to take action to protect their **Generation Plant**, and in such circumstances the requirement not to disconnect **Centrally Dispatched Generating Units** from the **Transmission System** does not apply.

OETC, in certain circumstances may issue **Emergency Instructions** to **Centrally Dispatched Generating Units** and for **Plant** held as **Tertiary Reserve** to be **Synchronised** and **Generate Output**.

SDC 3.5 Low Frequency Initiated Response from Users

Licensed Suppliers and **Directly Connected Consumers** shall follow the requirements of **OC** 4 – **Demand Control** that sets out the procedures that may be instructed by **OETC** in the event of low **Frequency**.

The situations covered in **OC** 4 relevant to action in the event of low **Frequency** include:

- **Planned Rota Demand Shedding** or other manual de-energisation or **Emergency Manual Demand Shedding** initiated by **OETC**; and
- de-energisation of **Demand** by automatic **Demand** shedding equipment and automatic relays to preserve **Total System** security.

SDC 3.6 Action to be Taken by International Connected Parties

OETC shall agree with **International Interconnected Parties** plans of action in the event of abnormal **Frequency** that could occur due to events on either **System**. Where possible, adjacent **Systems** shall endeavour to provide mutual support, but the over-riding priority shall be to maintain their **Systems** in **Operation**. Suitable automatic relaying may be, or need to be, put in place to assist this.

SDC 3.7 Actions to be Taken by Internally Interconnected Parties

OETC shall agree with **Internally Interconnected Parties** plans of action in the event of abnormal **Frequency** occurring on the **Total System**. These plans shall require **Generation Plant** owned by the **Internally Interconnected Party** to be operated in **Frequency Sensitive Mode** and respond positively to attempts to correct the **Frequency** deviation.

OETC may also agree **Demand Control** arrangements whereby the **Internally Interconnected Party** reduces **Demand** on instruction from **OETC** or by automatic under **Frequency** relays.

The over-riding priority of **Internally Interconnected Parties** shall be to maintain their **Systems** in **Operation** and be able to assist **OETC** in restoring the **Total System**. Suitable automatic relaying may be, or may have to be, put in place to assist safe separation of the **Systems**. **OETC** will discuss each situation with the respective party and they should jointly determine the optimum solution for that situation. **OETC** will implement and meet the costs of the relaying system unless the benefits are solely, or in part, attributable to the other party, in which case implementation and costs fall to the other party in proportion to allocation of the benefits. If **OETC** and the other party cannot reach agreement, **OETC** will determine and implement the required relaying system.

SDC 3.8 Actions to be Undertaken during Sustained Abnormal Frequency Conditions

SDC 3.8.1 Actions during Sustained Low Frequency Conditions

OETC shall issue instructions to minimize the duration of any low **Frequency** conditions. Instructions will be given to **Power Producers** to **Synchronise Available Centrally Dispatched Generating Units** and maximize **Centrally Dispatched Generating Unit Output** whilst maintaining some reserve **Capacity** to manage **Frequency** control.

OETC shall also issue instructions to **Licensed Distributors** and **Directly Connected Consumers** to institute pre-arranged **Demand Control** to reduce **Demand** to match **Available Generation Output** and so restore the **Frequency** of the **Total System** to within the normal set point range. The instructions may include:

- **Consumer Demand Control** initiated by **Licensed Distributors**;
- **Consumer Demand Control** initiated by **OETC**; and
- **Planned Rota Demand Shedding** or other manual de-energistion or **Emergency Manual Demand Shedding** initiated by **OETC**.

SDC 3.8.2 Actions during Sustained High Frequency Conditions

Centrally Dispatched Generating Units that have provided negative **Primary Response** shall not be de-energised provided that the **System Frequency** is below 51.50 **Hz** and the **Centrally Dispatched Generating Unit** loading is above Minimum **Generation**. If the **Frequency** of the **Total System** is at or above 51.50 **Hz**, the **Power Producer** is required to take action to protect the **Generation Plant** and the requirement to make all reasonable efforts to avoid tripping does not apply.

In the event of the **Frequency** of the **Total System** becoming stable above 50.50 **Hz**, after all **Centrally Dispatched Generating Unit** action has taken place, **OETC** shall issue **Dispatch Instructions** to trip appropriate **Generating Units**, to bring the **Frequency** of the **Total System** to 50.00 **Hz** or below and follow this with **Dispatch Instructions** to return the **Frequency** to **Target Frequency**.

SDC 3.9 Electric Time

OETC shall, endeavour (in so far as it is able*)* to, control **Electric Time** to within plus or minus 10 seconds of Oman official time by specifying changes to **Target Frequency** as part of **Dispatch Instructions**, taking into account the **Generation Schedule** and **Desalination Schedule** and forecast **Generation Plant/Demand** margins.

OETC shall be responsible for monitoring and recording **Electric Time** error.

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

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Version-3.0 August 2020

Ancillary Services Code

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Ancillary Services Code

ASC 1 Introduction

Ancillary Services are services ancillary to the transmission of electricity that **OETC** requires to operate the **Transmission System** in accordance with its statutory obligations.

OETC has a number of specific obligations regarding **Ancillary Services**:

- **OETC** is required to ensure sufficient **Ancillary Services** will be available on the day ahead when preparing the **Generation Schedule** and Desalination Schedule (see **SDC** 1); and
- **OETC** is required by the terms of the **Transmission and Dispatch Licence** to cooperate with **PWP** in determining which **Ancillary Services** should be procured by the **PWP** from **Production Facilities**.

This **Ancillary Services Code** (**ASC**) lists the **Ancillary Services** required by **OETC**, the contractual arrangements governing the provision of such services and details of the **Ancillary Services** to be provided by **Power Producers** and other **Users**. This code also sets down the form of instruction that will be used by **OETC** to implement the requirements for **Ancillary Services**.

ASC 2 Objectives

The objectives of the **ASC** are as follows:

- to list the **Ancillary Services** that **OETC** requires to operate the **Transmission System** in accordance with statutory requirements;
- to clarify the contractual arrangements governing the purchase of **Ancillary Services** from **Power Producers** and **Users**; and
- to clarify the process for scheduling and instructing the requirements for the use of **Ancillary Services**.

ASC 3 Scope

In addition to **OETC**, **ASC** applies to:

- **PWP** (as the purchaser of **Ancillary Services** from **Power Producers**);
- **Power Producers**;
- **Licensed Distributors;**
- **Licensed Suppliers;**

- **Directly Connected Consumers;**
- **International Interconnected Parties;**
- **Internally Interconnected Parties**; and
- **RAEC** if **Connected** to the **Total System**.

ASC 4 Requirement for Ancillary Services

The requirements for **Ancillary Services** can be categorised as follows:

- regulation of **System Frequency**;
- **Reactive Power** and voltage control; and
- **Black Start** capability for **System** restoration.

ASC 4.1 Regulation of System Frequency

OETC is required to maintain **Frequency** within the following limits.

- During normal operating conditions, the nominal **System Frequency** of the **Transmission System** shall be 50.00 **Hz** and will be controlled normally between 49.95 **Hz** and 50.05 **Hz**. During exceptional steady state conditions, **Frequency** deviations will not exceed 49.90 **Hz** to 50.10 **Hz** unless disturbed circumstances prevail.
- Under disturbed conditions, **System Frequency** could rise transiently to 51.50 **Hz** or fall to 47.5 **Hz**.
- The **Frequency** of the **Total System** is responsive to changes in the balance between **Demand** and total **Available Generation Capacity**. **OETC** must therefore ensure that at all times sufficient **Generation Capacity** and **Demand** is **Available** and **Connected** to the **System** to respond automatically to **Active Power** imbalances and correct any credible **Frequency** change.

The **Grid Code** requires all **Centrally Dispatched Generating Units**, **Wind Farm Power Production Facilities** and **Solar Power Production Facilities** to have the capability to contribute to **Frequency** control. **Synchronised Generating Units** can provide continuous **Frequency** control through their automatic governing systems. **Asynchronous Generating Units** spill **Active Power** when in **Frequency Sensitive Mode** until they detect a shift in **Frequency** and respond accordingly, having regard to the prevailing climatic conditions. **Frequency** control will also be assisted by **Synchronised Generating Units** through changes in **Output** in response to **Dispatch Instructions** issued by **OETC**.

Frequency control can also be provided through **Demand Side Management** arrangements with **Users** that allow **Demand** to be adjusted for short periods for the purposes of **Active Power** balance and **Frequency** control.

ASC 4.2 Reactive Power and Voltage Control

OETC is required to maintain voltage control within certain limits. The voltage on the 220**kV** and 132**kV** parts of the **Transmission System** at each **Connection Site** with a **User** will remain within the limits of a minimum voltage of -10% and a maximum voltage of +10%. The voltage on the 400**kV System** is maintained between ± 5% of the nominal value but may reach -10% for a maximum period of 30 minutes or as otherwise agreed, as stated in **CC** 6.1.2 (a).

The voltage on the 33**kV** and 11**kV** sides of **Transmission** transformers at **Connection Sites** with **Users** will normally remain within the limits ±6% of the nominal value unless abnormal conditions prevail.

During some **System** disturbances such as where short circuits occur, the voltage may collapse transiently to zero at the point of fault until the fault is cleared.

Voltage regulation requires both **Active Power** and **Reactive Power** flows across the **Transmission System** to be carefully controlled. The physical characteristics of the **Plant** of the **Transmission System** also give rise to the **Generation** and absorption of **Reactive Power**. **Reactive Power** flows across the **System** can give rise to substantial voltage differences and it is therefore necessary to maintain **Reactive Power** balances between sources of **Capacity** and **Demand** on a "zonal" basis.

Unlike **Frequency**, which is consistent across an interconnected **Transmission System**, voltages at different points on an interconnected **System** are determined by the local sources of **Demand** and **Capacity**, by the prevailing network configuration and by the **Reactive Power** flows across the network. The voltages at different points on an interconnected **System** thus form a "voltage profile".

The management of voltage requires control of **Reactive Power** and this can be provided by **Generating Units including Autogenerators**, or by means of **Synchronous** or static compensators/reactors.

ASC 4.3 System Restoration

Black Start is an **Ancillary Service** required to restore the **Total System** following a **Partial Shutdown** or **Total Shutdown** of the **System**. **System** restoration procedures and the procedures to be followed in **Black Start** situations are dealt with in section **OC** 7 of the **Grid Code**.

Black Start capability would normally be **Available** as required from certain **Power Producers** in accordance with the terms of a **PPA** or **PWPA**. **Autogenerators** may also have **Black Start** capability.

ASC 4.4 Automatic Generation Control

OETC may contract with **Power Producers** to provide **Automatic Generation Control** to increase the effectiveness or efficiency of the operation of the **Total System**. For the purpose **of Scheduling and Dispatch Codes**, **AGC** control shall be interpreted as signals issued by the **SCADA** system.

ASC 5 Ancillary Service Contractual Arrangements

The **Sector Law** requires that **Ancillary Services** are provided for in either:

(i) an agreement between a **Licensed Generator** or a **Licensed Generator/Desalinator** and the **PWP** or

(ii) an agreement established under the **Grid Code** or the **Distribution Code**.

OETC can enter **Ancillary Service Agreements** with **Users** for **Ancillary Services** provided the facilities providing the **Ancillary Services** are not party to a **PPA** or a **PWPA** with **PWP**.

OETC is responsible for identifying the **Transmission System Ancillary Services** requirements both in the short term, when preparing the day ahead **Schedule**, and in accordance with the **System** expansions plans of the **PWP**.

The **Transmission and Dispatch Licence** and the Power and Water Procurement Licence require **OETC** and the **PWP** to liaise and cooperate on the issue of providing and contracting for **Ancillary Services**.

All **Ancillary Services** whether provided through a **PPA**, **PWPA** or **Ancillary Service Agreement** shall be utilised in accordance with **OETC** instructions and the requirements of the **Grid Code**.

ASC 6 Ancillary Services Provided by Power Producers

The **PPA** or **PWPA** for each **Power Producer** shall state the **Active Power** and **Reactive Power** ranges for each **Centrally Dispatched Generating Unit**. It also shall state that each **Centrally Dispatched Generating Unit** must be capable of contributing to **Frequency** and voltage control by continuous modulation of **Active Power** and **Reactive Power** supplied to the **Transmission System** or the **User System** in which it is embedded. These services cover the requirements for **Primary Response**, **Secondary Response** and **Tertiary Reserve** and the provision of **Reactive Power** response from **Power Producers**.

The **Turbine Speed Controller** of a **Centrally Dispatched Generating Unit** in co-ordination with other control devices must control the **Active Power Output** with stability over the entire operating range of the **Centrally Dispatched Generating Unit**. The speed governor shall be capable of being set so that it operates with an overall speed-**Droop** of between 3.0% and 5.0%.

OETC may instruct a **Power Producer** to operate a **Centrally Dispatched Generating Unit** anywhere within the operating envelop defined in its **Generator Performance Chart**. This envelope is contained between declared **Active Power** capability and registered minimum **Generation** and between the practical stability limit line (leading **Reactive Power**) and the lagging **Reactive Power** line determined by the rotor-heating limit. The **Reactive Power** limits are shown by way of illustration in Appendix D of **OC** 2.

Each **Centrally Dispatched Generating Unit** should be capable of providing constant voltage control at its terminals over the entire operating range without instability. This shall be by a continuously acting **Automatic Voltage Regulator** which should be in service at all times when the **Centrally Dispatched Generating Unit** is **Synchronised** unless otherwise instructed by **OETC**.

It is essential that **OETC** has **Black Start** capability **Available** to it. **Black Start Capability** will be provided in accordance with a **PPA** or **PWPA**. Non-availability of this capability must be declared in the **Daily Status Form**.

ASC 7 Ancillary Services Provided by Users

OETC may have **Ancillary Service Agreements** with **Licensed Suppliers, Directly Connected Consumers** and/or other **Users** not party to a **PPA** or **PWPA** for the provision of **Ancillary Services** such as **Demand Control**, **Reactive Power Output** and response and **Black Start** capability.

Licensed Suppliers, **Directly Connected Consumers** or other **Users** not party to a **PPA** or **PWPA** may make arrangements for the switching out of or a reduction in discrete levels of **Demand**.

Switching out of **Demand** or reduction of **Demand** may take place following:

- instructions from **OETC** or a **Licensed Distributor** to reduce **Load** on the respective networks; and
- instructions from **OETC** to assist in matching **Available Active Power Output** to **Demand**.

An **Ancillary Service Agreement** may also provide for automatic operation of under **Frequency** relays to switch off **Demand** to assist **System** response in cases of emergencies. The **Frequency** settings and any time delays of relays will be agreed between **OETC** and the **User**.

Additionally, **Ancillary Service Agreements** with **Licensed Suppliers**, **Licensed Distributors** and/or other **Users** not party to a **PPA** or **PWPA** may provide for the **Supply** of **Reactive Power** capability and/or response. This may be provided from rotating **Plant** or switched static **Plant**.

OETC will instruct the use of such **Ancillary Services** at the appropriate time.

Autogenerators, or other **Users** with **Generating Units** not centrally **Dispatched,** may wish to offer **Black Start** capabilities to **OETC** to assist restoring the **Total System** following **Emergency Conditions**. Appropriate commercial arrangements may be put in place for this purpose. **OETC** would issue the necessary instructions calling for the use of **Black Start** capability at the appropriate time.

ASC 8 OETC Instructions to Users

OETC will normally schedule the requirements for use of **Ancillary Services** within in its day ahead **Scheduling** plans provided for in **Code** section **SDC** 1. **Users** will be

informed by 16:00 hours on the day preceding the relevant **Schedule Day** of the potential requirements.

Potential requirements are not firm instructions but are indicative only, and are provided as a guide to the expected output requirements from **Ancillary Service** providers.

Instructions to **Ancillary Service** providers relating to the **Schedule Day** will normally be issued as a list of special actions in respect of that **Schedule Day** at any time during the period beginning immediately after the issue of the **Generation Schedule** and Desalination Schedule at 16:00 hours as provided for in **SDC** 2. **OETC** will issue instructions directly to the **Users** at each **Control Centre** in relation to special actions, and **Demand Control.** instructions may include:

- a requirement for **Demand** reduction, de-energisation or restoration;
- an instruction to effect a **Load** transfer between **Connection Points**;
- an instruction to switch in a **Demand Intertrip Scheme**; and
- an instruction to switch in or out reactive control **P**lant.

The procedure for a **Black Start** situation will be that specified by **OETC** at the time of the **Black Start** situation, as provided for in **OC** 7. **Users** shall abide by **OETC** instructions during a **Black Start** situation provided the instructions are to operate within the declared operational capability of the **Plant**.

OETC may issue instructions to:

- a **Production Facility** with **Black Start** capability or to a **Licensed Distributor** with an embedded **Production Facility** with **Black Start** capability relating to the commencement of **Generation** output;
- a **Licensed Distributor** or to a **Directly Connected Consumer** relating to the restoration of **Demand**; and
- a **Production Facility** relating to commencement of **Generation Output** when an external power **Supply** is made available to it.

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

The Grid Code

Metering and Data Exchange Code

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Version-3.0 August 2020

Metering and Data Exchange Code

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Metering and Data Exchange Code

MDEC 1 Introduction

This code sets out the rights, obligations and responsibilities of code participants associated with the measurements of electricity and water and the provision of **Metering** services, the rules for the provision of installations at **Connections Points** or water connection points, and the rules for the provision of **Metering** services, standing data and energy data.

All **Active Power** and **Reactive Power** entering or exiting the **Transmission System** and **Distribution System**s of **Licensed Operators** shall be metered using one or more **Metering Systems**. Electricity delivered to **Consumer** premises shall also be metered.

All water exiting **Production Facilities'** sites must be metered and recorded using one or more **Water Meters** or **Water Metering Systems**.

The **Metering** of all such quantities and flows is required for a variety of purposes, including:

i) for the purpose of establishing a record of electrical quantities entering or exiting the systems of a **Licensed Transmission System Operator** and **Licensed Distribution System** Operators;

ii) for the purpose of establishing the quantities of electricity delivered to **Consumer** premises;

iii) for the purpose of establishing a record of the quantities of water exiting **Production Facilities;**

iv) for calculating amounts to be paid in accordance with agreements between **Persons** to whom this code applies;

v) for certain contractual purposes between **Persons** to whom this code applies;

vi) for the provision of data to the **Regulatory Authority** in connection with the monitoring and enforcement of **Licensees**, the **Sector Law** and related matters, including the calculation and establishment of cost reflective tariffs and the monitoring of the electricity supply market;

vii) for the purpose of establishing compliance with the **Grid Code** by those **Persons** who are bound by it; and

viii) such other purposes as may be expedient or requisite from time to time in connection with matters contemplated by the **Sector Law** and/or under this **Grid Code**.

The requirements of this **Metering and Data Exchange Code** (**MDEC**) are complimentary to the **Metering** and data exchange requirements of agreements between **Persons** to whom this code applies.

References in this **MDEC** to the **Meter Owner** include **Meters** and **Metering Systems** used by **Persons** under any agreement with a third **Party**.

MDEC 2 Objectives

The objectives of the **Metering and Data Exchange Code** (**MDEC**) are to establish:

- the standards to be met in the provision, location, installation, testing, commissioning (ref appendix D) operation and maintenance of **Metering Systems**;
- the standards to be met by those bound by **MDEC** in relation to all matters associated with **Metering Systems**;
- the responsibilities of each **Person** bound by **MDEC** in relation to ownership and management of **Metering Systems** and **Meters** and the provision and use of **Meter Data**;
- the responsibilities of all **Persons** bound by **MDEC** in relation to the storage of **Meter Data**; and
- security and ownership and rights of access to energy data and water data;

It is important that all relevant **Persons** may prepare, calculate, assess and validate invoices between such **Persons** with a view to their prompt settlement, having available to them all necessary **Meter Data** of reliable quality and accuracy for those purposes at the times at which they require the same.

MDEC 3 Scope

The **Metering and Data Exchange Code** applies to **OETC** and:

- **Power Procurer;**
- **Market Operator;**
- **PAW**;
- **Power Producers**:
- **Licensed Distributors**;
- **Licensed Suppliers**;
- **International Interconnected Parties**;
- **Internally Interconnected Parties**;
- **Directly Connected Consumers**; and
- **RAEC** if **Connected** to the **Total System**.

MDEC is concerned with the **Metering Systems** and related **Meters** and **Meter Data** associated with electrical **Production Facilities** and water **Production Facilities,** the systems of **Licensed Transmission System Operators**, and **Meters** to final **Consumers**.

MDEC 4 General

Metering Systems and **Meters** shall be established, **Metering** shall take place and **Meter Data** shall be recorded, checked and exchanged between **Persons** bound by this code and then stored, sufficient to ensure that all such **Persons** are able to prepare and calculate, assess and validate and, keep appropriate records concerning and where appropriate, challenge, invoices as listed below, on a prompt, comprehensive and accurate basis.

Meter Data shall be permanently recorded and stored for these purposes in accordance with other provisions of **MDEC**. If a contract between relevant **Persons** has additional requirements for **Metering Systems** or in relation to **Meters**, those requirements shall, so long as they do not prevent compliance with **MDEC**, apply in addition to **MDEC**.

At each **Electrical** and **Water Delivery Point**, **Meters** and/or **Metering Systems** shall be installed, operated and maintained and **Metering** shall take place sufficient for all purposes of this code. The **Delivery Points** shall be at the ownership boundary and shall be set out in each **Connection Agreement**.

OETC, **Licensed Distributor**s, **Licensed Suppliers** and **Users** shall each respectively take all reasonable steps to ensure that each relevant **Metering System** is located as close as is reasonably practicable to the **Delivery Point** at each **Connection Point**, particularly where **Metering Systems** are required for settlement purposes or other purposes set out in **MDEC**.

The actual location of a **Metering System** is referred to as the "**Actual Metering Point**". This may be different from the **Delivery Point** established pursuant to the relevant **Connection Agreement**. Where the **Actual Metering Point** is not coincident with the **Delivery Point**, compensation shall be provided for power transformer and/or line losses so that the overall accuracy requirement at the **Delivery Point** is met.

Each **Centrally Dispatched Generating Unit** shall have a **Metering System** to measure **Capacity** and **Output**. Each production facility that produces water shall have a **Metering System** to measure the **Capacity** and **Output** of water production units at the production facility.

MDEC 5 Meter and Metering System Ownership

The term, **Meter Owner**, also relates to **Meters** and **Metering Systems** used by **Persons** under any agreement with a third **Party**.

The **Meter Owner** shall be responsible for all aspects of ownership, purchase, maintenance, **Calibration** and testing unless stated otherwise in **MDEC**.

Meter Ownership shall be determined as follows;

- **Power Producer**s shall own and be responsible for electricity **Metering Systems** for entry/exit to/from **OETC** busbars;
- **Power Producer**s shall own and be responsible for electricity **Metering Systems** between the **Production Facility** and **Licensed Distributor** busbars located on the **Production Facility** site whether or not there is another **User Connected** to the busbars;
- **Power Producer**s shall own and be responsible for the **Water Metering Systems** where the production facility is **Connected** to **PAW** 's system;
- **OETC** shall own and be responsible for the **Metering Systems** at a substation with a single **Licensed Distributor**;
- Where ownership by a single **Party** of a complete **Metering System** at a substation is not possible, ownership shall be as follows:
  - **VT**s shall be owned by the owner of the busbar or circuit to which the **VT** is **Connected**,
  - **CT**s shall be owned by the owner of the circuit of which the **CT** is installed,
  - Cabling associated with the **VT**s and CTs shall be owned by the **Measurement Transformer** owners up to the local junction box, thereafter the cabling shall be part of the general substation cabling owned by the substation site owner,
  - **Meters** and the **Meter** cubicles on which **Meters** are located shall be owned by the substation site owner,
  - The substation site owner shall have overall responsibility for the specification, maintenance, **Calibration** and testing of the **Metering Systems** on the site;
- For **Metering Systems** that **Meter** electricity flows between **Licensed Distributor**s, the owner of the **Metering System** shall be the owner of the site or site on which the **Measurement Transformers** are located; and
- The ownership and responsibility for **Metering Systems** between **OETC** or **Licensed Distributor**s and **Consumer**s shall be as determined in the **Connection Agreement** or other agreement between the parties.

MDEC 6 Electricity Meters

MDEC 6.1 General

A **Meter Owner** must, for each **Metering** installation on its network, ensure that the **Metering** installation is secured to the standard of good electricity industry practice.

If the **Meter Owner** becomes aware that a **Metering** installation does not comply with this code, the **Meter Owner** must:

a) immediately advise affected parties of the non-compliance; and

b) arrange for the non-compliance to be corrected as soon as practicable following the **Meter Owner** becoming aware of it.

All **Meters** and **Metering Systems** procured, installed, operated and maintained for the purposes of this code shall be sufficient for all purposes of this code such that the standards to be met in relation to those **Meters** and **Metering Systems**, **Metering** and the recording and exchange of **Meter Data** set out in this code are met.

Each **Meter** and **Metering System** shall comply with the all provisions of this code, including those as to the standards of accuracy and **Calibration** to be achieved in **Metering Systems**.

All data communications equipment required for the purposes of this code and forming part of or associated with any **Meter** or **Metering System** shall perform to the relevant International Telecommunications Union (ITU) standards and recommendations for data transmission over telecommunication systems, or such other communication **Protocols** as the **Metering and Data Exchange Code** Review Panel may specify.

MDEC 6.2 Meter, CT and VT Requirements

MDEC 6.2.1 Equipment required

MDEC 6.2.1.1 Meters

For **Connections** greater than or equal to 20 **MVA**, **Metering Systems** shall include Main and **Check Meter** equipment both having the same levels of accuracy and functionality.

Main Meters and **Check Meters** shall be installed, operated and maintained so as to comply at all relevant times with the standards and accuracy classes indicated in Appendix A.

For **Connections** to **Consumer**s, **Metering Systems** shall be in accordance with Appendix B.

For each **Delivery Point**, a **Metering System** shall be installed, operated and maintained to measure the following parameters:

i) entry and exit **Active Energy**; and

ii) entry and exit **Reactive Energy**

The **Meter Owner** shall configure **Active Energy Meters** such that the number of measuring elements is equal to or one less than the number of primary system conductors. These include the neutral and/or earth conductor where system configurations enable the flow of energy in such conductors.

All **Meters** shall be labelled by the **Meter Owner** or otherwise be readily identifiable in accordance with Appendix C.

The **Metering Systems** shall **Meter** quantities on a continuous basis and the information shall be displayed on a non-volatile **Meter Register**. The **Meter Registers** shall not pass through zero more than once within the normal **Meter** reading cycle.

Where **Main Meters** and **Check Meters** are provided with **Outstations**, the **Outstations** shall provide two outputs per measured quantity. The **Outstations** shall enable **Meter Data** to be interrogated locally and at a later date for **Meter Data** to be provided remotely over communications channels.

Where **Meters** provide **Meter Data** to **Outstations** external to the **Meter**, the **Outstations** shall provide two outputs per measured quantity.

The **Meter Owner** shall provide test terminals for **Main Meters** and **Check Meters** to facilitate on-site tests. These terminals shall be in close proximity to the **Meters** and shall be capable of providing suitable means for accessing current and voltage signals, injecting test quantities, connecting test **Meters**, and replacing **Meters** without a circuit outage.

MDEC 6.2.1.2 Power Producers

For **Power Producers** with **Connections** greater than or equal to 5 MVA **Metering Systems** shall include Main and Check Meter equipment both having the same levels of accuracy and functionality.

MDEC 6.2.1.3 Current transformers

The **Plant Owner** shall provide current transformers in accordance with the standards and accuracy classes indicated in Appendix A3.

Where **Main Meters** and **Check Meters** are required, the **Plant Owner** shall provide two sets of current transformers. The current transformers supplying **Main Meters**, the current transformer windings and cables connecting such windings to **Main Meters** shall be dedicated for such purposes and such cables and connections shall be securely sealed.

The current transformers supplying **Check Meters** may be used for other purposes provided that overall accuracy requirements are met. Evidence of the additional **Burden** imposed by such purposes shall be made available for inspection by relevant parties.

The additional **Burden** shall not be modified without prior agreement from relevant parties and evidence of the value of the modified additional **Burden** shall be available for inspection by relevant parties. The total **Burden** on each current transformer shall not exceed the rated **Burden** of such current transformer.

Current transformer test certificates showing errors at the overall working **Burden** or at Burdens which allow the error at working **Burden** to be calculated shall be made available by the **Plant Owner** for inspection by the relevant parties.

MDEC 6.2.1.4 Voltage transformers

The **Plant Owner** shall provide voltage transformers in accordance with standards and accuracy classes indicated in Appendix A3.

Where **Main Meters** and **Check Meters** are required the **Plant Owner** shall provide two voltage transformers or one voltage transformer with two or more secondary windings.

The voltage transformer winding supplying **Main Meter**s shall be dedicated to that purpose and such windings and connections shall be securely sealed.

The voltage transformer secondary winding supplying **Check Meters** may be used for other purposes provided the overall **Burden** and accuracy requirements are met and evidence of the additional **Burden** imposed by such purposes is available for inspection by the relevant parties.

The additional **Burden** shall not be modified without prior consideration by the relevant parties and evidence of the value of such additional **Burden** shall be available for inspection by the relevant parties. The total **Burden** on each voltage transformer shall not exceed the rated **Burden** of such voltage transformer.

Voltage transformer test certificates showing errors at the overall working **Burden** or at **Burdens** that allow the error at working **Burden** to be calculated shall, wherever possible, be available by the **Plant Owner** for inspection by relevant parties.

Separately fused voltage transformer supplies shall be provided by the **Plant Owner** for the **Main Meter**, the **Check Meter**, and any additional **Burden**. The fuses shall be located as close to the voltage transformer as possible.

As far as possible, there should be a remote indication of the failure of voltage from a **VT** that is used for **Metering** purposes.

The total **Burden** connected to each **VT** shall not exceed the rated **Burden**.

MDEC 6.2.2 Accuracy requirements

MDEC 6.2.2.1 Overall accuracy

The accuracy of the various items of measuring equipment comprising **Meters** and **Metering Systems** shall conform to the relevant IEC standards current at the time that the **User's Connection Agreement** is signed. Standards relevant to this code are listed in Appendix A1 and A2.

Accuracy requirements for the purpose of this code are defined by circuit **Capacity**, rated in **MVA**. Circuit **Capacity** shall be determined by the lowest rated primary plant of the circuit (i.e. transformer, line, etc.) and must be based on the primary plant maximum continuous ratings. The rating and accuracy requirements of **Metering Systems** shall anticipate future uprating of the primary **Plant**.

Where relevant standards change from time to time, the **Metering and Data Exchange Code Review Panel** will review such changes and recommend to the **Regulatory Authority** the extent to which any such changes should be implemented.

MDEC 6.2.2.2 Compensation for power transformer or Line losses

Where the **Actual Metering Point** is not coincident with the **Delivery Point**, compensation shall be provided for power transformer and/or line losses so that the overall accuracy requirement at the **Delivery Point** is met. The compensation may be applied locally within the **Metering System** or remotely. Compensation factors and their justification shall be established in accordance with **Good Industry Practice** and must be recorded in the **Meter Registration System**.

MDEC 6.2.2.3 Compensation for Measurement Transformer error

Errors arising from the **Measurement Transformers** and associated leads to the **Meters** that affect the overall accuracy shall be compensated such that the overall accuracy requirement is met. Values of the compensation factors and their justification including test certificates shall be established in accordance with **Good Industry Practice** and recorded in the **Meter Registration System** and shall be available for inspection by relevant parties.

MDEC 6.2.3 Meter approval and certification

Meters used in accordance with this code shall be approved **Meter** types. The **Grid Code Review Panel** shall maintain a list of approved **Meter** types that shall be made available on request. The **Grid Code Review Panel** shall also be responsible for type approval of **Meters** to ensure compliance with the provisions of this code in accordance with **Good Industry Practice**.

The **Grid Code Review Panel** will issue **Meter Certificates** to ~~**PWP**~~ the **Power Procurer,** the **Market Operator**, the relevant **Meter Owner** and the **Regulatory Authority** in accordance with **Good Industry Practice** to confirm that **Meters** and **Metering Systems** comply with the requirements of this code. **Meter Owners** shall provide certification and other documentation as required to the **Grid Code Review Panel** to enable the **Grid Code Review Panel** to carry out this responsibility. **Meter Certificates** shall be issued for specified time spans and the duration may differ for different **Meter** types.

MDEC 6.2.4 Operation and maintenance

Metering Systems shall be operated and maintained in accordance with the manufacturer's recommendations or as otherwise necessary for the **Meter Owner** to comply with its obligations under this code.

The **Consumer** representatives of each **Licensed Distributor** shall be responsible for providing **Consumer**s supplied at **LV** with the **Meter** requirements applicable to **Consumer Metering Systems**.

MDEC 6.3 Metering System Calibration and Testing

MDEC 6.3.1 Initial Calibration

All new **Meters** shall undergo relevant certification tests in accordance with **Good Industry Practice**.

All initial **Calibration** of **Meters** shall be performed in a recognised test facility (including any **Meter** manufacturer's works). These tests shall be performed in accordance with the relevant IEC standards and shall confirm that **Meter** accuracy is within the limits stated in Appendix A2. A uniquely identifiable **Calibration** record shall be provided by the recognised test facility before the **Connection** is made live. The **Calibration** record shall also include the expiry date of calibration.

The **Meter Owner** will apply a certification seal following initial **Calibration**. The **Meter Owner** must maintain this seal intact in order for the **Meter** to retain certified status. No **Person** bound by this code shall break the seal unless properly authorised to do so. The **Meter Owner** is responsible for ensuring that **Meter** certification is carried out for compliance with the provisions of this code.

Meters removed from service must be re-certified before reconnection for use under this code.

New voltage transformers and current transformers shall be **Calibrated** prior to installation on site. **Meter Owners** shall provide manufacturers' test certificates to **OETC** for inclusion in the **Meter Registration System** to show compliance with the accuracy classes.

MDEC 6.3.2 Commissioning

Commissioning tests shall be carried out on all new **Metering Systems** providing **Meter Data** before the **Connection** is made live and in accordance with **Good Industry Practice**. Commissioning tests shall also be carried out before reconnection where a replacement **Metering System** is fitted as part of an existing **Metering System**. No **Connection** or reconnection shall be permitted unless the tests are passed.

Following commissioning, the **Meter Owner** shall provide such evidence that relevant parties may require confirming that a **Metering System** meets the requirements of this code.

All **Meters**, current transformers and voltage transformers shall be tested by the respective **Meter Owner** for accuracy in accordance with **Good Industry Practice** at initial commissioning before the **Connection** is made live, as indicated in Appendix D. Appendix D sets out the tests and checks that as a minimum shall be included in a commissioning programme.

MDEC 6.3.3 Periodic Calibration and testing

MDEC 6.3.3.1 General

Periodic **Calibration** of **Metering Systems** shall be undertaken by the **Meter Owners** to ensure that the requirements of this code are met at all relevant times.

Periodic **Calibration** of **Meters** shall be performed in a recognised test facility (including any **Meter** manufacturer's works) or by competent persons using standard **Meters** certified by a recognised authority. **Accuracy Tests** shall be performed in accordance with the relevant IEC standards and shall confirm that **Meter** accuracy is within the limits stated in Appendix A. The **Calibration** record shall be uniquely identifiable, retained in a safe place and the significant details (Identification Number, date, names and status of authorised testing persons and accuracy results) recorded in the **Meter Registration System**.

Periodic **Calibration** of all **Meters** other than **Active Energy** class 0.2S may be performed on site provided that the percentage error limits associated with the accuracy classes as set out in the Appendices are met.

Periodic **Calibration** of class 0.2S and more accurate **Active Energy Meters** and other **Meters** not meeting the error limits as described above, shall be performed in a recognised test facility (including any **Meter** manufacturer's works).

Meters shall also be tested outside of the prescribed intervals stated in **MDEC** 6.3.3.2 below if the **Main Meters** and **Check Meters** diverge by more than 1.5 times the prescribed limit of error associated with the accuracy classes given in Appendix A.

Complete and accurate records of **Accuracy Tests**, work carried out and pertinent data to confirm successful testing/**Calibration** in accordance with the requirements of this code shall be kept by the **Meter Owner** and promptly registered in the **Meter Registration System** where appropriate.

MDEC 6.3.3.2 Frequency of testing

Electromechanical **Meters;**

Shall be **Calibrated** and refurbished as necessary at intervals not exceeding ten years.

Active Energy Meters of accuracy class 0.5 shall have on-site **Accuracy Tests** performed at intervals not exceeding 5 years.

On-site **Accuracy Tests** are not required for all other types of electromechanical **Meters**.

For electronic **Meters**;

At least one of each type of electronic **Meter** owned by each **Meter Owner** shall be **Calibrated** in any 5-year period. A minimum of 20% of the total of each type of **Meter** on-circuit with a **Meter Owner** shall be **Calibrated** in an evenly phased programme over a 10-year period.

Where the **Main Meters** and **Check Meters** employed on a circuit are of the same manufacture and type (and are thus likely to have similar failure characteristics), on-site **Accuracy Tests** shall be performed at intervals not exceeding 5 years for **Active Energy Meters** and intervals not exceeding ten years for **Reactive Energy Meters**.

Where the **Main Meters** and **Check Meters** employed on a circuit are of a different manufacture or type, no on-site **Accuracy Tests** are required.

Where only a main **Active Energy Meter** is employed on a circuit, on-site **Accuracy Tests** shall be performed at intervals not exceeding five years.

Where only a main **Reactive Energy Meter** is employed, on-site **Accuracy Tests** shall be performed at intervals not exceeding ten years.

Periodic testing of **Measurement Transformers** is not required.

The testing intervals may be modified by the **Metering and Data Exchange Code Review Panel**.

MDEC 6.3.3.3 Suspected Metering errors

If any item of a **Metering System** is suspected of performing incorrectly, any affected **Party** may request the **Meter Owner** to carry out **Accuracy Tests** in accordance with **Good Industry Practice** to confirm correct operation and accuracy. The **Meter Owner**

shall carry out any test so requested. The **Party** requesting the **Accuracy Test** shall bear the reasonable costs of such testing if the **Meter** is found to be operating within the prescribed limits of error, otherwise the cost of the **Accuracy Test** shall be borne by the **Meter Owner**. All affected parties shall be given 24 hours' notice of such tests and be invited to witness the tests. **Accuracy Test** results shall be made available promptly and in writing to the affected parties.

Certified test equipment and reference standards (all traceable to recognised national or international standards) shall be used in such tests and if, by agreement, it is deemed necessary, an approved independent laboratory may be employed.

Where an **Accuracy Test** indicates that an error exceeds the limits of error associated with the accuracy classes given in Appendix A, the errors shall be recorded before promptly adjusting, repairing or renewing the **Metering System** (or part thereof) or replacing defective components. In such cases substitute **Meter Data** shall be provided in accordance with **PWP's/Licensed Distributors'/Licensed Suppliers'** procedures.

The method of calculating the overall error of a **Metering** installation is the vector sum of the errors of each component part i.e. a+b+c where:

- a=the error of the **VT;**
- b=the error of the **CT**;
- c=the error of the **Meter**.

If compensation is carried out within the **Meter** then the resultant **Metering System** error must be as close as practical to zero.

The **Metering System** shall be restored to service and proved to be operating within the prescribed limits of accuracy as soon as is reasonably practicable. Upon the completion, examination, maintenance, repair, re-**Calibration** or replacement of any component in the **Metering System**, the **Metering System** shall be sealed.

MDEC 6.3.3.4 Meter Failures

General

If at any time, any **Metering Equipment** or any part thereof, is destroyed or damaged or otherwise ceases to function, or is found to be outside the prescribed limits of accuracy, the **Meter Owner** has to promptly adjust, renew or repair the same or replace any defective component so as to ensure that the relevant **Metering Equipment** is back in service and operating within the prescribed limits of accuracy as quickly as is reasonably practicable in all the circumstances.

Meter Data

If at any time any **Metering Equipment** ceases to function or is found to be outside the prescribed limits of accuracy then until the date of adjustment, replacement, repair or renewal of such **Metering Equipment,** the **Meter Data** shall be deemed to be those determined to be most appropriate in accordance with best engineering procedures.

MDEC 6.4 Meter and Data Security and Registration

MDEC 6.4.1 Meter access and sealing

All **Metering Systems** and associated communications equipment shall be located in dedicated and secure **Metering** cabinets located in an area that is readily accessible, free from obstructions and well lit by artificial light. The cabinets shall include as a minimum, effective protection from moisture and dust ingress and from physical damage, including vibration. Appropriate temperature controls shall be provided. The cabinets must be lockable and capable of being sealed to prevent unauthorised access.

Meter Owners and the relevant parties, as appropriate, shall jointly seal the **Metering System** that shall include data collection equipment and associated communications links and telephone links. Only the **Meter Owner's** personnel shall break such seals. All other affected **Parties** shall be given at least forty-eight (48) hours' advance notice of the breaking of seals on any part of the **Metering System**. No such notice will be necessary when the breaking of a seal is necessitated by the occurrence of an emergency.

Neither **Party** shall tamper or otherwise interfere with any part of the **Metering System** in any way. Where it is established that the **Metering System** has been tampered or interfered with, then until such tampering or interference has been rectified either:

(a) the quantity measured or recorded shall be that measured or recorded by any other relevant installed **Metering System**; or

(b) if there is no other relevant **Metering System** or it is established to have been tampered or interfered with, the quantity shall be agreed by the parties, or, in the absence of such agreement, either **Party** shall be entitled to refer the matter to an expert for determination.

If the **Meter Owner** is not the **Person** who owns or controls the land on which the **Meter** or **Metering System** is situated, that **Person** (if bound by this code) shall grant the **Meter Owner** and all other **Persons** who require the same for the purposes of this code sufficient rights of access for **Metering** purposes and for the purposes of testing **Calibration**, operation and maintenance and replacement of the **Meter** and **Metering System**.

Where any **Person** requires right of access or to deal in some other way with a **Meter** or **Metering System** for the purposes of this code, all such necessary rights shall be granted by the **Person** with the power to grant them if that **Person** is bound by this code. All such rights shall be set down in the relevant **Connection Agreement** where this is practicable.

The right of access provided for in this code includes the right to bring onto such a **Party's** property any vehicles, plant, machinery and maintenance or other materials as shall be reasonably necessary for the purposes of performance of obligations under this code.

Each **Party** shall ensure that all reasonable arrangements and provisions are made and/or revised from time to time as and when necessary or desirable in accordance with **Good Industry Practice** to facilitate the safe exercise of any right of access.

MDEC 6.4.2 Meter Records

The **Meter Owner** shall label all **Meters** with a unique identification number from lists maintained by **OETC**.

Each **Meter Owner** shall ensure that complete and accurate records are maintained of the **Calibration** and operation of **Metering System**. These records shall include but not be limited to the dates and results of any tests, readings, adjustments or inspection carried out and the dates on which any seal was applied or broken. The reasons for any seal being broken and the persons, and their affiliations, attending any such tests, readings, inspections or sealings shall be recorded.

Meter Owners shall ensure that the pertinent data (Appendix E) is provided promptly to **OETC** for entry into the **Meter Registration System**. Such data shall be kept up to date. They shall also provide any other **Metering System** data requested by other involved parties.

MDEC 6.4.3 Meter Registration

Metering Systems shall be registered in a central database, the **Meter Registration System**, which is to be operated and maintained by **OETC** in accordance with **Good Industry Practice**. The purpose of the **Meter Registration System** is to provide a complete, accurate and up to date central database of all **Meter** data and to ensure an auditable trail to demonstrate compliance with this code. The **Meter Registration System** shall contain, as a minimum, specific information at each **Actual Metering Point** as indicated in Appendix E.

All **Users** are responsible for ensuring that data relating to all changes to **Users' Metering Systems** including any changes to the types of data set out in Appendix E and any site de-energisations or disconnections are promptly reported in writing, to the **Meter Registration System**. Any other information regarding each **Metering** point as may be reasonably required by the involved parties.

The **Meter Registration System** shall maintain the specified information for a minimum of seven years after the replacement or disconnection of a **Meter**.

Any data held in the **Meter Registration System** (a) shall be the intellectual property of **OETC** and (b) may be freely accessed by:

- the **Meter Owner**;
- the **Regulatory Authority**;
- **OETC**;
- **the Power Procurer;**
- **the Market Operator ;** and
- any **User** but with access limited to that equipment directly associated with the **Metering System** of that **User**.

MDEC 7 Water Meters

MDEC 7.1 General

All **Water Meters** and **Water Metering Systems** procured, installed, operated and maintained for the purposes of this code shall be sufficient for all purposes of this code such that the standards to be met in relation to those **Water Meters** and **Water Metering Systems**, **Metering** and the recording and exchange of **Meter Data** set out in this code are met.

Each **Water Meter** and **Water Metering System** shall comply with the all provisions of this code, including those as to the standards of accuracy and **Calibration** to be achieved in **Metering Systems**.

All data communications equipment required for the purposes of this code and forming part of or associated with any **Meter** or **Metering System** shall perform to the relevant International Telecommunications Union (ITU) standards and recommendations for data transmission over telecommunication systems.

The relevant **Connection Agreement** may provide for site-specific isolation or other requirements in accordance with established **Good Industry Practice** and in particular, to comply with the requirements of any telecommunications service providers.

MDEC 7.2 Water Meter Requirements

Water Metering Systems shall include main **Water Meter** equipment and check **Water Meter** equipment in series with a means of removing each **Meter** without affecting the operation of the other. Both **Meters** shall have at all relevant times the same levels of accuracy and functionality.

Water Meters shall include a pulsed output providing instantaneous and integrated flow readings and shall be equipped with battery backup power supplies for 24 hours operation.

All **Water Meters** and/or **Water Metering Systems** shall comply with the technical requirements specified in Appendix F.

Water Metering Systems shall **Meter** the quantities on a continuous basis and the information shall be displayed on a non-volatile **Meter Register**. The **Meter Registers** shall not pass through to zero more than once within the normal reading cycle.

The **Water Meter Owner** shall provide **Water Metering Systems** with **Outstations** that shall provide two outputs per measured quantity. The **Outstations** shall enable **Water Meter Data** to be interrogated locally and at a later date for **Water Meter Data** to be provided remotely over communications channels.

MDEC 7.2.1 Accuracy requirements

The **Meter** accuracy over the normal operating range shall not be more than ± 0.20 % of full-scale reading plus error percentage equivalent to 1mm/s of flow velocity. For the purpose of clarity, The error percentage equivalent to 1mm/s is calculated based on

the measured flow rate (m3/hr) and pipe diameter (m) i.e. 1 mm/sec multiplied by cross sectional area of the pipe divided by the measured flow rate multiplied by 100 (with usual notation).

MDEC 7.2.2 Meter approval and certification

Water Meters used in accordance with this code shall be approved **Water Meter** types. The **Grid Code Review Panel** shall maintain a list of approved **Water Meter** types that shall be made available on request.

The **Grid Code Review Panel** will issue **Meter Certificates** to the **Water Meter Owner** and the **Regulatory Authority** in accordance with **Good Industry Practice** to confirm that **Water Meters** and **Water Metering System** comply with the requirements of this code. **Water Meter Owners** shall provide certification and other documentation as required to the **Grid Code Review Panel** to enable the **Grid Code Review Panel** to carry out this responsibility. **Meter Certificates** shall be issued for specified time spans and the duration may differ for different **Water Meter** types.

MDEC 7.2.3 Operation and maintenance

Water Metering System shall be operated and maintained in accordance with the manufacturer's recommendations or as otherwise necessary for the **Water Meter Owner** to comply with its obligations under this code.

MDEC 7.3 Water Metering System Calibration and Testing

MDEC 7.3.1 Initial Calibration

The **Water Meter** owner will apply a certification seal following initial **Calibration**. The **Water Meter Owner** must maintain this seal intact in order for the **Meter** to retain certified status. No **Person** bound by this code shall break the seal unless properly authorised to do so. The **Water Meter Owner** is responsible for ensuring that **Meter** certification is carried out for compliance with the provisions of this code.

All new **Water Metering Systems** shall undergo relevant certification tests in accordance with **Good Industry Practice**.

All initial **Calibration** of **Water Meters** shall be performed in a recognised test facility (including any **Meter** manufacturer's works). These tests shall be performed in accordance with the relevant IEC standards. A uniquely identifiable **Calibration** record shall be provided by the recognised test facility before the **Meter** enters service.

The **Water Meter Owner** will apply a certification seal following initial **Calibration**. The **Water Meter Owner** must maintain this seal intact in order for the **Meter** to retain certified status. No **Person** bound by this code shall break the seal unless properly authorised to do so. The **Water Meter Owner** is responsible for ensuring that **Meter** certification is carried out for compliance with the provisions of this code.

Water Meters removed from service must be re-certified before reconnection for use under this code.

MDEC 7.3.2 Commissioning

Commissioning tests shall be carried out on all new **Water Metering Systems** to ensure **Meter Data** can be provided before the connection is placed into service and in accordance with **Good Industry Practice**. Commissioning tests shall also be carried out before reconnection where a replacement **Water Metering System** is fitted as part of an existing **Water Metering System**. No connection or reconnection shall be permitted unless the tests are passed.

Following commissioning, the **Water Meter Owner** shall provide such evidence that the relevant parties may require confirming that the **Water Metering System** meets the requirements of this code.

MDEC 7.3.3 Periodic Calibration and testing

MDEC 7.3.3.1 General

Periodic **verification** tests of all **Water Meters** shall be undertaken by the **Meter Owners** to ensure that the requirements of this code are met at all relevant times. The accuracy verification of **Meters** shall be performed in-situ by a qualified third party. The tests shall be performed in accordance with the relevant ISO standards and shall confirm that **Meter** accuracy is within the limits stated in **MDEC** 7.2.1. The **Calibration** record shall be uniquely identifiable, retained in a safe place and the significant details (identification number, date, names and status of authorised testing persons and accuracy results) recorded in the **Meter Registration System**.

Meter Owners shall test in accordance with **Good Industry Practice** all **Water Meters** at specified intervals for accuracy to verify that operation is within the limits of accuracy given in **MDEC** 7.2.1.

The testing intervals are shown in **MDEC** 7.3.3.2 below but may be modified by the **Water Metering System** Review Panel. **Water Meters** shall also be tested if the main **Water Meter** and check **Water Meter** in a **Water Metering System** diverge by more than 1.5 times the limit of error associated with the accuracy given in **MDEC** 7.2.1.

Complete and accurate records of tests, work carried out and pertinent data to confirm successful testing/**Calibration** in accordance with the requirements of this Code shall be kept by the **Water Meter Owner** and promptly registered in the **Water Meter Registration System** where appropriate in accordance with **Good Industry Practice**.

MDEC 7.3.3.2 Timing of Water Meter tests

The accuracy of All **Water Meters** shall be verified at intervals not exceeding 2 years. In the event the verified accuracy exceeds the range of accuracy given in MDEC 7.2.1, then the Water Meter shall be re-calibrated.

MDEC 7.3.3.3 Suspected Metering errors

If any item of a **Water Metering System** is suspected of performing incorrectly, any affected **Party** may request the **Water Meter Owner** to carry out **Accuracy Tests** in accordance with **Good Industry Practice** to confirm correct operation and accuracy.

The **Meter Owner** shall carry out any **Accuracy Test** so requested. The **Party** requesting the **Accuracy Test** shall bear the reasonable costs of such testing if the **Water Meter** is found to be operating within the prescribed limits of error, otherwise the cost of the test shall be borne by the **Water Meter Owner**. All affected parties shall be given 24 hours' notice of such tests and be invited to witness the tests. **Accuracy Test** results shall be made available promptly and in writing to the affected parties.

Certified test equipment and reference standards (all traceable to recognised national or international standards) shall be used in such tests and if, by agreement, it is deemed necessary, an approved independent laboratory may be employed.

Where an **Accuracy Test** indicates that an error exceeds the limits of error associated with the accuracy given in this code, then these errors shall be recorded before promptly adjusting, repairing or renewing the **Water Metering System** (or part thereof) or replacing defective components. In such cases substitute **Meter Data** shall be provided in accordance with procedures agreed by the **Metering and Data Exchange Code Review Panel**.

The **Water Metering System** shall be restored to service and proved to be operating within the prescribed limits of accuracy as soon as is reasonably practicable. Upon the completion, examination, maintenance, repair, re-**Calibration** or replacement of any component in the **Water Metering System** in accordance with **Good Industry Practice**, the **Water Metering System** shall be sealed.

MDEC 7.4 Water Meter and Data Security and Registration

MDEC 7.4.1 Water Meter access and sealing

All **Water Metering Systems** and associated communications equipment shall be located in a secure **Metering** cabinet located in an area that is readily accessible, free from obstructions and well lit by artificial light. The cabinets shall include as a minimum, effective protection from moisture and dust ingress and from physical damage, including vibration. Appropriate temperature and humidity controls shall be provided. The cabinets must be lockable and capable of being sealed to prevent unauthorised access.

Water Meter Owners and **PAW** as appropriate shall jointly seal the **Water Metering System** including data collection equipment and associated modems and telephone links. Only the **Water Meter Owner's** personnel shall break such seals. All other affected parties shall be given at least forty-eight (48) hours' advance notice of the breaking of seals on any part of the **Water Metering System**. No such notice will be necessary when the breaking of a seal is necessitated by the occurrence of an Emergency.

Neither **Party** shall tamper or otherwise interfere with any part of the **Water Metering System** in any way. Where it is established that the **Water Metering System** has been tampered or interfered with, then until such tampering or interference has been rectified either:

(a) the quantity measured or recorded shall be that measured or recorded by any other relevant installed **Water Metering System**; or

(b) if there is no other relevant **Water Metering System** or it is established to have been tampered or interfered with, the quantity shall be agreed by the parties, or, in the absence of such agreement, either **Party** shall be entitled to refer the matter to an expert for determination.

If the **Water Meter Owner** is not the **Person** who owns or controls the land on which the **Water Meter** or **Water Metering System** is situated, that **Person** (if bound by this code) shall grant the **Water Meter Owner** and all other **Persons** who require the same for the purposes of this code sufficient rights of access for **Water Metering System** purposes and for the purposes of testing **Calibration**, operation and maintenance, replacement, etc. of the **Water Meter** and **Water Metering System**.

Where any **Person** requires right of access or to deal in some other way with a **Water Meter** or **Water Metering System** for the purposes of this code, all such necessary rights shall be granted by the **Person** with the power to grant them if that **Person** is bound by this code. All such rights shall be set down in the relevant **Water Connection Agreement** where this is practicable.

Each **Party** shall ensure that all reasonable arrangements and provisions are made and/or revised from time to time as and when necessary or desirable in accordance with **Good Industry Practice** to facilitate the safe exercise of any right of access.

MDEC 7.4.2 Water Meter records

Water Meter Owners shall label all **Water Meters** with a unique identification number from lists maintained by **PWP**.

Each **Water Meter Owner** shall ensure that complete and accurate records are maintained of the **Calibration** and operation of **Water Metering System**. These records shall include but not be limited to the dates and results of any tests, readings, adjustments or inspection carried out and the dates on which any seal was applied or broken. The reasons for any seal being broken and the Persons, and their affiliations, attending any such tests, readings, inspections or sealings shall be recorded.

Water Meter Owners shall ensure that the pertinent data (Appendix E) is provided promptly to **PWP** for entry into the **Water Meter Registration System**. Such data shall be kept up to date. They shall also provide any other **Water Metering System** data requested by **PAW** or **PWP**.

MDEC 7.4.3 Water Meter registration

Water Metering Systems shall be registered in a central database, the **Water Meter Registration System**, which is to be operated and maintained by **PWP** in accordance with **Good Industry Practice**. The purpose of the **Water Meter Registration System** is to provide a complete accurate and up to date central database of all **Water Meter Data** and to ensure an auditable trail to demonstrate compliance with this code. The **Water Meter Registration System** shall contain, as a minimum, specific information at each Water **Delivery Point** as indicated in Appendix E.

All **Users** are responsible for ensuring that data relating to all changes to a **Water Metering System** including any changes to the types of data set out in Appendix E. Any other information regarding each Water **Delivery Point** as may be reasonably

required by **PAW** and **PWP** shall be recorded in the **Water Meter Registration System**.

The **Water Meter Registration System** shall maintain the specified information for a minimum of seven years after the replacement or disconnection of a **Water Meter**.

Any data held in the **Water Meter Registration System** (a) shall be the intellectual property of **PWP** and (b) may be freely accessed by:

i) the **Water Meter Owner**;

ii) the **Regulatory Authority**;

iii) **PAW**; and

iv) **PWP**.

MDEC 8 Data Exchange

MDEC 8.1 General

Meter Data covered by this code is required by **Persons** to prepare and calculate invoices and to assess, verify and where appropriate, challenge invoices. **Meter Data** is also required for accounting and record keeping purposes.

Meters and/or **Metering Systems** shall be installed, operated and maintained and **Metering** shall take place sufficient for all purposes of this code at each electrical **Delivery Point** and water **Delivery Point**.

The **Delivery Points** shall be at the ownership boundary and shall be set out in a relevant **Connection Agreement**.

Meter Owners shall in good faith, and in accordance with **Good Industry Practice** conduct such **Metering** operations as may be necessary to produce and record complete and accurate **Meter Data**. **Meter Owners** shall provide **Meter Data** to other **Persons** bound by this code in accordance with the following provisions of this code.

Where this code requires data to be exchanged between such **Persons** or invoices to pass between them supported by **Meter Data**, **Meter Owners** shall undertake **Meter** reading at the times required by this code. If no time is specified for **Meter** reading to take place, **Meter** reading shall take place as close in time as possible to the time required in relation to the relevant invoice or **Meter Data** flow specified in this code. All **Meter Data** shall include the time or times at which **Meter** reading took place.

Where **Meter Data** is required for the purpose of this code or relevant contracts referred to in this code, the **Meter Data** shall be provided by making accurate readings of the relevant **Meter** or **Meters**, accurately recording the **Meter Data** arising from those readings and supplying that **Meter Data** to other **Persons** in accordance with the requirements of this code

MDEC 8.2 Data Exchange Requirements and Flows

The principal transactions and agreements to which the data exchange requirements of this code apply are listed below;

a) Payments by **Power Procurer** to **Power Producer**s and **Internally Interconnected Parties** for **Capacity** and **Output** of Production Facilities and **Ancillary Services** (**PPA**s & **PWPA**s);

b) Payments between **Power Procurer** and **International Interconnected Parties** for **Active Energy** transfers across an **International Interconnection** (**Import**/export Contracts);

c) Payments by **Licensed Suppliers** to **Power Procurer** for bulk purchases of **Active Energy** (**Bulk Supply** agreement);

d) Payments by **PAW** to **Power Procurer** for bulk purchases of **Desalinated** water (**Bulk Supply** agreement);

e) Payments by relevant to **Power Procurer** for purchases of demineralised water (demineralised water contracts);

f) Payments by **Licensed Suppliers** acting as agent for the **Power Procurer** to **Internally Interconnected Parties** for **Active Energy** (agency contracts);

g) Payments by **Directly Connected Consumers** to **Licensed Suppliers** for **Active Energy** (**Supply** contracts);

h) Payments by **OETC** to providers of **Ancillary Services** (**Ancillary Service Agreements**);

i) Payments by **Power Producer**s to a **Licensed Transmission System Operator** or **Licensed Distributor** for **Connection** to its **System** (**Connection Agreements**); and

j) Payments by **Licensed Suppliers** to a **Licensed Transmission System Operator** or **Licensed Distributor** for Use of System (Use of System agreements).

k) **Payments by the Power Procurer to Power Producers under the Market Rules.**

This code also covers the technical requirements of **Metering** at **Consumer** premises and the storage of the associated **Meter Data**, although the contractual arrangements and data exchange requirements of such **Metering** are outside the scope of this code and shall be covered in the relevant **Connection Agreement**.

The data that must be exchanged between the various **Persons** to satisfy the conditions of the agreements listed above are shown in Appendix H. All data exchanges shall be in the English language.

The table shows;

- In column A - The data item;
- In column B - The **Person** who is obliged to conduct **Metering** as the producer of the data;
- In column C - The **Person** who is obliged to send the data to the recipient of the data;
- In column D - The recipient of the data.

MDEC 8.3 Meter Data Validation and Quality Checks

Meter Data shall be collected, validated and aggregated as required for the proper functioning of invoicing in accordance with the relevant parties.

In cases where **Meter Data** is not available due to a failure of the **Main Meter** or its associated equipment such as **CT**, **VT**, cabling or protection devices, or in cases where the **Main Meter** has been proven to have operated outside the prescribed limits of error, the **Meter Data** obtained from the **Check Meter** shall be admissible.

In cases where **Check Meters** are not provided, estimated or substitute **Meter Data** will be used as required in accordance with procedures agreed between the relevant parties.

MDEC 8.4 Meter Data Communications System

Local or remote communications provided in connection with any **Metering System** shall conform to the requirements of this section, **MDEC** 8.4.

Meters may be provided with either integral or separate **Local Outstations**. Any **Local Outstations** must be capable of being connected to and be interrogated by the **OETC** Load Dispatch Centre (**LDC**). Equipment at the **LDC** will read the **Meter Data** at the specified time and frequency.

Any **Meter Communications System** will be independent from the operational **SCADA Data** systems in order to avoid potential conflicts of interfacing and **Protocol**. However, new communication routes using fibre optic cables and digital PLC communications have been installed over all main transmission routes to serve the **SCADA** system. These communication routes have adequate capacity and provide duplicate routes to all major substations and Production Facilities and can be used also for the communication of **Meter Data**.

The **Meter Communications System** will be a duplex system, wherever possible, i.e., each **LDC Remote Instation** shall be able to interrogate both the **Main Meter** and **Check Meter Outstations** over either of two communication routes.

MDEC 8.4.1 Local Outstations

Any **Local Outstation** that is installed (whether internal or external) shall have facilities to enable **Meter Data** to be interrogated locally and for the required **Meter Data** to be provided to **Remote Instations**. Separate ports shall be used for local and remote interrogations wherever possible.

The interrogation ports shall be opto – isolator ports with a serial **Protocol** such as IEC Standard 61107 or equivalent as agreed by the **Metering and Data Exchange Code** Review Panel. The local interrogation port shall be capable of use for commissioning, maintenance and fault finding, time setting, in addition to the transfer of **Meter Data** and alarms. A series of security levels and coding facilities shall be provided so that only **Authorised Persons** limit access to data and other features.

Local Outstations may perform some processing of data.

The **Local Outstation** data shall conform to a format and **Protocol** specified by relevant parties.

Facilities shall be provided to select a relevant **Demand Period** from one of the following values; 60, 30, 15, and 10 minutes with, in each case, one **Demand Period** ending on the hour.

A secure power supply shall be provided to each **Local Outstation** system with separate fusing for each **Local Outstation**.

Where a **Local Outstation** system uses a separate modem the modem shall be provided with a secure supply, separately fused. Alternatively, line or battery powered modem types may be used.

The **Local Outstations** shall provide an alarm output signal at a manned point in the event of a supply failure.

Meter Data together with alarm indications, and **Local Outstation** time and date shall be capable of being transferred on request during the interrogation process.

In the event of a **Local Outstation** failure, any partial **Demand Values**, **Data** associated with a **Local Outstation** supply failure and/or restoration, and zero **Demand Values** associated with a **Local Outstation** supply failure, shall be marked so that a future interrogation can identify them.

Local Interrogation Units may be used by authorised **Users** to interrogate the **Local Outstations** for the purposes of commissioning, maintenance/fault finding and when necessary the retrieval of stored **Meter Data**.

MDEC 8.4.2 Remote Instations

Remote Instations if provided shall be computer-based systems that collect or receive **Meter Data** on a routine basis from **Local Outstations**.

The broad specification for the **Remote Instations** shall be similar to those for **Local Outstations** outlined above. The **Remote Instations** shall be fitted with separate ports for local and remote interrogations. The local interrogation port would be capable of use for commissioning, maintenance and fault finding and time setting. A series of security levels and coding facilities will be provided to limit access to data and other features to **Authorised Persons** only.

Remote Instations shall be capable of collecting all **Meter Data** by daily interrogation or other time interval to be specified. It should however, be possible to repeat collections of **Meter Data** at any time throughout the **Local Outstation** data storage period.

One pair of **Remote Instation**s shall be located at the **LDC** to communicate directly with all **Local Outstations**. Such **Remote Instations** at the **LDC** shall interface with the **LDC** computers to enable required calculations to be carried out and data to be presented within **LDC**.

MDEC 8.4.3 Communications

All data communications equipment shall conform to the relevant International Telecommunications Union (ITU) standards and recommendations for data transmission over telecommunications systems.

Interrogation of **Local Outstations** shall be possible using any of the following media, as specified by relevant parties:

- public switched telephone networks;
- radio data networks;
- private network of a **Licensed Transmission System Operator**;
- mains signalling / power line carrier channels/fibre optic channels; and
- Low power radio.

In addition the relevant parties may specify other media and the format and **Protocol** of any **Meter Data** provided that such other media is consistent with the requirements of this code.

Error checking facilities shall be included in all communication facilities between **Local Outstations** and **Remote Instations**.

MDEC 8.5 Data Display and Storage

MDEC 8.5.1 Registers

The **Metering Systems** shall **Meter** the quantities on a continuous 24 hour basis and the data shall be displayed on a non-volatile **Meter Register**. The language of displays shall be English.

Where **Meters** provide **Meter Data** to **Local Outstations** external to the **Meter**, the **Local Outstations** shall provide two outputs per measured quantity.

Where a separate **Local Outstation** is used, cumulative register values shall be provided in the **Local Outstation** that can be set to match and increment with the **Meter Registers**.

MDEC 8.5.2 Storage

Any **Local Outstations** provided shall have the capability to store all **Meter Data** collected by the respective **Meters** including alarms and other functions for relevant parties for two (2) complete calender months.

All **Users** responsible for providing **Meter Data** in accordance with this code shall retain a copy of the data in electronic format in accordance with Table 7.1. The format of data to be stored shall be agreed by the **Metering and Data Exchange Code Review Panel** but shall include the following essential parameters; time period, **Meter** Indentification number and **Meter** readings.

OETC shall maintain a log in the form of electronic storage of digital data of all data from all **Metering Systems** and **Local Outstations** and the associated data received

from relevant parties for at least ten (10)] complete operational years other than the **Meter Data** for sales between **Licensed Suppliers** and final **Consumer**s.

OETC and **Users** shall ensure that back-up copies of data in electronic format are made in accordance with Table 7.1. All back up copies shall be made promptly at the end of the period or immediately following completion of the data set.

Table 8.1 Data storage by OETC and Users

Data	Frequency of back up	Place of storage	Retained for	Comment
Current day's working data; (1)	End of each working day;	On site;	One complete week;	Each day's back up stored separately;
Current week's working data; (1)	Each Thursday at the end of working day;	One copy at **User** site; One copy at another site;	One complete month;	Each week's back up stored separately;
Current month's working data; (1)	Each month at the end of the last working day;	One copy at **User** site; One copy at **OETC**;	One complete year;	
Each month of finalised data;	First working day of following month;	One copy at **User** site; One copy at **OETC**;	Five Financial Years;	Finalised means all settlements agreed;
One Financial Year's set of finalised data;		One copy at **OETC**; One copy at another site;	Ten Financial Years;	

Notes:

(1) The period of a day, a week or a month will depend on locally agreed arrangements

(2) Current period, i.e., day, etc., means all work undertaken in that period including new data and changes to existing data.

Providers of **Meter Data** shall be provided promptly with a copy at no cost, in electronic or paper format, as agreed in writing with **OETC**, of current working data relevant to its transactions by giving 24 hours' notice to **OETC**.

Any **User** shall be provided promptly with a copy, in electronic or paper format, as agreed in writing with **OETC**, of selected archived data relevant to its transactions by giving 24 hours' notice to **OETC**. **OETC** shall agree with the **Regulatory Authority** a scale of charges for the supply of such data and any limitations on the supply of such data to individual **Users**.

Licensed Suppliers shall maintain records of **Meter Data** associated with final

Consumers in accordance with Table 7.2. Most of such **Meter Data** will be read and recorded manually. The records shall be transcribed to electronic format. All back up copies shall be made promptly at the end of the individual periods or immediately following completion of the data set whichever is sooner.

Table 8.2 Data storage by Licensed Suppliers

Data		Manual readings		Electronic record	
	Place of storage	**Retained for**	**Frequency of back up**	**Place of storage**	**Retained for**
Current month's working data;	On site;	One year;	Daily;	On site;	One complete year;
Each month of finalised data;	On site;	Two years;	Weekly;	One copy on site; One copy at another site;	Five Financial Years;
One Financial Year's set of finalised data;	On site;	Ten Years;	Annually;	One copy on site; One copy at another site;	Ten Financial Years;

Notes:

(1) The term site in this table means the site or offices of a **Licensed Supplier**

(2) Current period, i.e., day, etc., means all work undertaken in that period including new data and changes to existing data.

The providers of **Meter Data** referred to in Table 7.2 shall be provided promptly with a copy at no cost, in electronic or paper format, as agreed in writing with the **Licensed Supplier**, of current working data relevant to its transactions by giving 24 hours' notice to the **Licensed Supplier**.

Any **User** shall be provided promptly with a copy, in electronic or paper format, as agreed in writing with the **Licensed Supplier**, of selected archived data relevant to its transactions by giving 24 hours' notice to the **Licensed Supplier**. The **Licensed Supplier** shall agree with the **Regulatory Authority** a scale of charges for the supply of such data and any limitations on the supply of such data to individual **Users**.

MDEC 9 Metering and Data Exchange Code Review

MDEC 9.1 Electricity Meter and Data Exchange Code Review

MDEC 9.1.1 Electricity Meter and Data Exchange Code Review management

A **Metering and Data Exchange Code Review Panel** shall be established for the purposes of reviewing and updating the **Metering and Data Exchange Code** excluding those parts of the **MDEC** that refer to **Water Meters**. The **Grid Code Review Panel** will review all recommendations and guidance proposed by this panel. If the **Grid Code Review Panel** supports the recommendations, they will be passed to the **Regulatory**

Authority for approval. Otherwise, the recommendations will be returned to the **Metering** and **Data Exchange Code Review Panel** with comments for further consideration.

OETC shall have overall responsibility for the management of the **Metering and Data Exchange Code**.

MDEC 9.1.2 Electricity Meter and Data Exchange Code Review Panel

The **Metering and Data Exchange Code Review Panel** shall carry out the following functions;

i) generally review, discuss and develop the **Metering and Data Exchange Code** and its implementation with particular reference to electricity **Metering** and all **Data** exchange;

ii) review and discuss proposals for amendments to the **Metering and Data Exchange Code** which **OETC**, the **Regulatory Authority** or any **Party** with **Metering Systems** or **Meters** may submit for consideration by the **Metering and Data Exchange Code Review Panel** from time to time;

iii) discuss changes necessary to the **Metering and Data Exchange Code** arising from unforeseen circumstances referred to it by relevant parties;

iv) publish recommendations and ensure that **User** consultation upon such recommendations has occurred through **Metering and Data Exchange Review Panel** members; and

v) issue guidance in relation to the **Metering and Data Exchange Code** and its implementation, performance and interpretation when asked to by any **Party** with **Metering Systems** or **Meters**

vi) The **Metering and Data Exchange Code Review Panel** shall convene to hold a minimum of 1 meeting per year.

MDEC 9.1.2.1 Membership

The **Panel** shall consist of;

- a **Chairperson (MDEC)** and up to 2 members appointed by **OETC**;
- 1 **Person** appointed by the **Regulatory Authority**;
- 1 **Person** representing each **Licensed Distributor**;
- 1 **Person** representing each **Licensed Supplier**;
- 1 Person appointed by **Power Procurer**;
- 2 **Persons** (rotated between **Power Producers**) representing all **Power Producers)**
- 1 **Person** representing Internally **Connected** parties; and
- 1 **Person** representing **Consumers** with **Demand** greater than 5 **MW**.

MDEC 9.1.2.2 Rules

The **Metering and Data Exchange Code Review Panel** shall establish its own rules and procedures relating to the conduct of its business and shall comply with them at all times. The rules shall be submitted to the **Grid Code Review Panel** for review and then to the **Regulatory Authority** for approval.

MDEC 9.1.2.3 Amendments to the code

Relevant **Parties** shall submit all proposed amendments and comments concerning the **Metering and Data Exchange Code** to **OETC** for consideration by the **Metering and Data Exchange Code Review Panel**. **OETC** shall also notify in writing all **Users** that are likely to be materially affected by proposed amendments to the **Metering and Data Exchange Code**.

All proposed amendments to the **Metering and Data Exchange Code** must be reviewed by the **Metering and Data Exchange Code Review Panel** and shall be submitted to the **Grid Code Review Panel** for review and then to the **Regulatory Authority** for approval.

MDEC 9.2 Water Meter System Review

MDEC 9.2.1 Water Meter System review management

A **Water Metering System Review Panel** will be established for the purposes of reviewing and updating the parts of the **Metering and Data Exchange Code** referring to **Water Meters**. All recommendations and guidance proposed by this panel will be passed to the **Metering and Data Exchange Code Review Panel** for approval.

PWP shall have the overall responsibility for the management of the **Water Metering** parts of the **Meter and Data Exchange Code**.

MDEC 9.2.2 Water Metering System Review Panel

A **Water Metering System Review Panel** shall be established which shall be a standing body to carry out the following functions:

- review proposals for amendments to those parts of the **Metering and Data Exchange Code** applicable to **Water Metering Systems** or **Water Meters** that any **Party** with such systems may wish to submit to **PWP** for consideration by the **Panel** from time to time;
- make recommendations for amendments to those parts of the **Metering and Data Exchange Code** that refer to **Water Metering Systems** or **Water Meters**;
- issue guidance in relation to those parts of the **Metering and Data Exchange Code** that refer to **Water Metering Systems** or **Water Meters** and their implementation, performance and interpretation if requested by any **Party** with **Water Metering Systems** or **Water Meters**; and

- consider changes proposed to those parts of the **Metering and Data Exchange Code** that refer to **Water Metering Systems** or **Water Meters** arising from unforeseen circumstances referred to it.

MDEC 9.2.2.1 Membership

The Panel shall consist of;

- a **Chairperson** (**MDEC** - Water) and one other **Person** appointed by **PWP**:
- 1 **Person** appointed by the **Regulatory Authority**;
- 1 **Person** appointed by **PAW**; and
- 2 **Persons** (rotated between **Power Producers**) representing all **Power Producers** with **Water Production** capability.

MDEC 9.2.2.2 Rules

The **Water Metering System Review Panel** shall establish its own rules and procedures relating to the conduct of its business and shall comply with them at all times. The rules shall be submitted to the **Metering and Data Exchange Code Review Panel** for review and then to the **Regulatory Authority** for approval.

MDEC 9.2.2.3 Amendments

Relevant parties shall submit all proposed amendments and comments those parts of the **Metering and Data Exchange Code** that refer to **Water Metering Systems** or **Water Meters** to **PWP** for consideration by the **Water Metering Systems Review Panel**. **PWP** shall also notify in writing all **Users** that are likely to be materially affected by proposed amendments to those parts of the **Metering and Data Exchange Code** that refer to **Water Metering Systems** or **Water Meters**.

All proposed relevant amendments to the **Metering and Data Exchange Code** must be reviewed by the **Water Metering Systems Review Panel** and shall be submitted to the **Grid Code Review Panel** for review and then to the **Regulatory Authority** for approval.

MDEC 10 Appendices

Appendix A Accuracy of **Metering System**

Appendix B **Metering Systems** for **Consumer** Connections

Appendix C Labelling of **Meters**

Appendix D Commissioning Tests

Appendix E **Meter Registration Data**

Appendix F **Water Meter** Technical Requirements

Appendix G Locations of **Metering Systems**

Appendix H Data Flow Tables

Appendix A: Accuracy of Metering System

A 1: Standards

The following standards are among those related to this code;

IEC Standard 60687 – Alternating current static watt-hour meters for active energy (classes 0.2 S and 0.5 S);

IEC Standard 61036 - Alternating current static watt-hour meters for active energy (classes 1 and 2);

IEC Standard 60521 – Alternating current watt-hour meters (classes 0.5, 1 and 2);

IEC Standard 61268 – Alternating current static var-hour meters for reactive energy (classes 2 and 3);

IEC Standard 60044 Part 1 – Current transformers;

IEC Standard 60044 Part 2 – Voltage transformers;

IEC Standard 60044 Part 3 – Combined transformers;

IEC Standard 61107 – Data exchange for meter reading – direct local data exchange;

All **Metering Systems** and **Meters** shall comply with the relevant standards current at the time that the **User's Connection Agreement** is signed.

Where relevant standards change from time to time, the **Metering and Data Exchange Code** Review Panel will review such changes and recommend to the **Regulatory Authority** the extent to which any such changes should be implemented.

A 2: Overall Accuracy Requirements

For the measurement and **Metering** of **Active Energy**, **Reactive Energy**, Active Power and Demand, **Metering System** shall be tested and **Calibrated** to operate within the overall limits of error set out in Table A -1, after taking due account of **CT** and **VT** errors and the resistance of cabling or circuit protection. **Calibration** equipment shall be traceable to a recognised national or international standard.

Table A 1 : Overall accuracy of Metering System

Condition	Limits of error at stated Power Factor for Active Power and Energy measurement				
Current expressed as a percentage of rated measuring current	Power Factor	Limits of error for Connections			
		>100 MVA	>20–100 MVA	>1–20 MVA	<=1 MVA
120% to 10% inclusive	1	±0.5%	±1.0%	±1.5%	±1.5%
Below 10% to 5%	1	±0.7%	±1.5%	±2.0%	±2.5%
Below 5% to 1%	1	±1.5%	±2.5%		
120% to 10% inclusive	0.5 lag	±1.0%	±2.0%	±2.5%	±2.5%
120% to 10% inclusive	0.8 lead	±1.0%	±2.0%	±2.5%	±2.5%
Condition	**Limits of error for Reactive Power and Energy at stated Power Factor**				
Current expressed as a percentage of rated measuring current	**Power Factor**	**Limits of error for Connections**			
		>100 MVA	**>20–100 MVA**	**>1–20 MVA**	**<=1 MVA**
120% to 10% inclusive	0	±4.0%	±4.0%	±4.0%	±4.0%
120% to 20% inclusive	0.866 lag	±5.0%	±5.0%	±5.0%	±5.0%
120% to 20% inclusive	0.866 lead	±5.0%	±5.0%	±5.0%	±5.0%

A 3: Metering System Accuracy Classes

The accuracy class or equivalent, is based on the **MVA** Capacity of the **Connection** and shall as a minimum be as follows;

Table A 2: Equipment accuracy classes

Equipment type	Equipment accuracy class for Connections			
	>100 MVA	**>20–100 MVA**	**>1–20 MVA**	**<=1 MVA**
Current transformers (Note 1)	0.2S	0.2S	0.5	0.5
Voltage transformers (Note 2)	0.2	0.5	1	1
Active Energy and Power **Meters** (Note 3)	0.2S	0.5S/0.5	1	2
Reactive Energy and Power **Meters**	2	2	2	2

Note 1: Current transformers shall meet the class accuracy requirements irrespective of **CT** secondary ratings.

Note 2: OES14 specifies Class 1 accuracy to BS 3941/IEC186 for VTs used at 11kV

Note 3: A **Meter** accuracy class of 0.5 may be used where energy transfers to be measured by the entry/exit **Meter** during normal operating conditions is such that the metered current will be above

5% of the rated measuring current for periods equivalent to 10% or greater per annum (excluding periods of zero current).

A 4: Service Connections

Kilowatthour **Meters** for service Connections shall conform to IEC Standard 60521 as set out in the following Table A3. These requirements are in accordance with OES as shown in the table.

Table A 3: Kilowatthour Meters for service Connections

Type	Voltage	Current	Accuracy	OES Number
Single phase	240v	20 – 100A	Class 2	22A
Three phase, Direct **Connected**	415v, 3 phase, 4 wire	50A, 100A	Class 2	22B
Three phase, With current transformers	415v, 3 phase, 4 wire	200A, 300A, 400A	Class 2	22C

Appendix B: Metering Systems for Consumer Connections

This Appendix is concerned with the **Metering System** requirements of **Consumer**s and applies to all **Consumer**s. Direct **Connected Consumer**s are those **Connected** to the **Transmission System**. Other **Consumer**s will be **Connected** to the **Distribution System** at 33kV, 11kV or **LV**, the **Connection** voltage generally being a function of the size of the **Consumer** Demand.

The **Metering Systems** that shall be applied to the different sizes of **Consumer** Connections are given in Table B1.

Table B 1: Metering System requirements

Cat.	**Connection** size **MW**	**Meters** required				Check Energy **Meters** required
		KWh	**kVArh**	Maximum **Demand**		
				kW	**kVAr**	
1.	>5MW	Yes	Yes	Yes	Yes	Yes
2.	>1MW to 5MW	Yes	Yes	Yes	Yes	No
3.	>500**kW** to 1MW	Yes	Yes	Yes	No	No
4.	>100 **kW** to 500**kW**	Yes	Yes	Yes	No	No
5.	# 100**kW**	Yes	No	No	No	No

The **Metering Systems** shall be in accordance with the requirements of the **MDEC**.6 except as determined by the conditions in Table C1 and those that follow:

i) **Local Outstations** (internal or external) shall be provided for category 1 Connections only;

ii) Separate test terminals for accessing current and voltage signals, injecting test quantities and connecting test **Meters** shall be provided for categories 1 and 2 **Connections** only;

iii) **Meters** for category 5 **Connections** may be accepted based on sample inspection and certification by manufacturers;

iv) **Meters** for category 5 **Connections** shall be re-**Calibrated** at least once every ten years; and

v) The requirements of **MDEC**.7 for access, sealing and Registration shall be met for all categories of **Connections**.

The **Licensed Distributor** companies' **Consumer** representatives shall provide appropriate summaries of the **Metering** requirements applicable to **Consumer Metering**.

Appendix C: Labelling of Meters

C 1: General

Each **Meter** shall be allocated a unique **Meter** identification number that will be given by **OETC** and recorded in the **Meter Registration System**.

The number shall be marked permanently on the **Meter** in a position that is clearly visible under all normal viewing of the **Meter**.

The number will be quoted on all records arising from and related to the **Meter** including **Meter** readings.

Test blocks and other related **Metering Equipment** shall be clearly identified with the **Metering System** with which they are associated.

C 2: Entry and Exit Labelling

The following standard method of labelling **Meters**, test blocks, etc.; based on the definitions for entry and exit shall be incorporated. The required labelling shall be as follows:

Active Energy:

Meters or **Meter Registers** shall be labelled

"Entry" for all **Active Energy** Flows normally entering the **Transmission System**, and

"Exit" for all **Active Energy** Flows normally leaving or exiting the **Transmission System**.

Reactive Energy:

Within the context of this code the relationship between **Active Energy** and **Reactive Energy** can be best established by means of the Power Factor. The following table gives the relationship:

Table C.1: Reactive Energy entry/exit convention

Flow of Active Energy	Power Factor	Flow of Reactive Energy
Entry	Lagging	Entry
Entry	Leading	Exit
Entry	Unity	zero
Exit	Lagging	Exit
Exit	Leading	Entry
Exit	Unity	zero

Meters or **Meter Registers** for registering entry **Reactive Energy** shall be labelled "Entry" and those for registering exit **Reactive Energy** shall be labelled "Exit".

Appendix D: Commissioning Tests

This Appendix sets out the tests and checks that shall be included in the **Metering Systems** commissioning programme. **Metering System** shall in addition have basic tests carried out on earthing, insulation, together with all other tests that would normally be conducted in accordance with **Good Industry Practice**.

D 1: Measurement Transformers

For all installations with new/replaced **Measurement Transformers** the **Meter Owner** shall ensure that from site tests and inspections the following are confirmed and recorded;

1. Details of the installed units, including serial numbers, rating, accuracy classes, ratio(s);
2. **CT** ratio and polarity for selected tap; and
3. **VT** ratio and phasing for each winding.

For installations with existing **Measurement Transformers** the **Meter Owner** shall ensure that, wherever practically possible, 1, 2 and 3 above are implemented, but as a minimum must confirm and record **VT** and **CT** ratios. If it is not possible to confirm the **CT** ratio on site, the reason must be recorded on the commissioning record and details must be obtained from any relevant **Party**.

D 2: Measurement Transformers Leads and Burdens

For all installations the **Meter Owner** shall wherever practically possible:

1. Confirm that the **VT** and **CT** connections are correct;
2. Confirm that the **VT** and **CT Burden** ratings are not exceeded; and
3. Determine and record the value of any Burdens (including any Burdens not associated with **Metering Systems** or **Meters**) necessary to provide evidence of the overall **Metering** accuracy.

D 3: Metering

D 3.1: General tests and checks

The following may be performed on-site or elsewhere (e.g. factory, **Meter** test station, laboratory, etc.).

1. Record the **Metering System** details required by the **Meter Registration System**.
2. Confirm that the **VT**/**CT** ratios applied to the **Meter**(s) agree with the site Measurement Transformer ratios.
3. Confirm correct operation of **Meter** test terminal blocks where these are fitted (e.g. **CT**/**VT** operated **Metering**).

4. Check that all cabling and wiring of the new or modified installation is correct.
5. Confirm that **Meter Registers** advance (and that output pulses are produced for **Meters** which are linked to separate **Outstations**) for entry and where appropriate exit flow directions. Confirm **Meter** operation separately for each phase current and for normal polyphase current operation.
6. Where separate **Outstations** are used confirm the **Meter** to **Outstation** channel allocations and that the **Meter** units per pulse values or equivalent data are correct.
7. Confirm that the local interrogation facility (**Meter** or **Outstation**) and local display etc. operate correctly.

D 3.2: Site Tests

The following tests shall be performed on site;

1. Check any site cabling, wiring, connections not previously checked under clauses D.1, D.2 and D.3.1 above;
2. Confirm that **Meter**/**Outstation** is set to UTC (Oman time) within +/- 5 seconds;
3. Check that the voltage and the phase rotation of the measurement supply at the **Meter** terminals are correct;
4. Record **Meter** start readings (including date and time of readings);
5. Wherever practically possible, a primary prevailing load test (or where necessary a Primary injection test) shall be performed which confirms that the **Meter**(s) is registering the correct primary energy values and that the overall installation and operation of the **Metering** installation are correct;
6. Where for practical or safety reasons (5) is not possible then the reason shall be recorded on the commissioning record and a secondary prevailing load or injection test shall be performed to confirm that the **Meter** registration is correct including, where applicable, any **Meter VT**/**CT** ratios. In such cases the **VT**/**CT** ratios shall have been determined separately as detailed under D.1, **Measurement Transformers**, above;
7. Record values of the **Meter**(s)/**Outstation**(s) displayed or stored **Meter Data** (at a minimum one complete half-hour unless otherwise approved by the **Metering and Data Exchange Code** Review Panel) value with the associated date and time of the reading) on the commissioning record;
8. Confirm the operation of **Metering System** alarms (not data alarm or flags in the transmitted data); and
9. Confirm from **Meter Owner** that accuracy certificates exist for the **Meters**.

Appendix E: Meter Registration Data

The **Meter Registration System**s are the **Meter** database that holds **Meter** data for both electricity and **Water Metering System** installations.

Data in the **Meter Registration System**s shall be treated as confidential and only relevant **Meter Data** shall be released to the appropriate **Party**.

Meter Data to be contained in the **Meter Registration System**s shall include, but is not limited to the following:

(a) A unique **Meter** identification number;

(b) **Connection Point** and **Metering** point reference details for both **Delivery Point** and **Actual Metering Point**, including:

i) location and reference details (i.e. drawing numbers),

ii) participant details at the **Connection Point**,

iii) site identification nomenclature,

iv) **Meter Owner**, and

v) loss compensation calculation details where **Actual Metering Point** and **Delivery Point** differ;

(c) Main and **Check Meter** installation details, including:

vi) serial numbers,

i) **Metering** installation identification name,

ii) **Meter** types and models,

iii) instrument transformer ratios (available and connected),

iv) test and **Calibration** programme details; test results and reference test certificates for **Meters** and **Measurement Transformers**,

v) asset management plan and testing schedule,

vi) **Calibration** tables, where applied to achieve **Meter** installation accuracy, and

vii) any **Meter** summation scheme values and multipliers;

(d) data register coding details;

(e) data communication details (when communication systems are used);

(f) telephone number for access to data;

(g) communication equipment type and serial numbers;

(h) communication **Protocol** details or references;

(i) data conversion details;

(j) **User** identifications and access rights;

(k) data validation and substitution processes agreed between affected parties, including;

i) algorithm;

ii) data comparison technique;

iii) processing and alarms (i.e. voltage source limits, phase-angle limits); and

iv) **Check Metering** compensation details.

Appendix F: Water Meter Technical Requirements

F 1. General

The **Water Metering Systems** shall include **Main Meter**s and **Check Meters** each with sensors and converter units/**Outstations**. The **Outstations** may be integral with the converter units. The sensor shall be sited in or above the water being measured.

The **Outstations** shall provide two outputs per measured quantity and shall enable **Water Meter Data** to be interrogated locally and at a later date for **Water Meter Data** to be provided remotely over communications channels.

Converter units/**Outstations** shall provide, by means of the local interrogation port, facilities for configuring the instrumentation system. It shall provide a local LCD display of the measured parameter, programming facilities and fault annunciation. The circuit boards shall comply with BS 6221 (IEC 60326).

The **Water Metering System** and associated communications equipment shall be located in a secure **Metering** cabinet located in an area that is readily accessible, free from obstructions and well lit by artificial light. The cabinets shall include as a minimum, effective protection from moisture and dust ingress and from physical damage, including vibration. Appropriate temperature controls shall be provided. The cabinets must be lockable and capable of being sealed to prevent unauthorised access

The **Water Metering Systems** shall be resistant to corrosion for the lifetime of the works. Materials, which are exposed to the Desalinated Water, shall not corrode. In all cases materials shall be chosen that are compatible and that no chemical or electrochemical actions are present other than those intended. Support systems and housings for instrumentation devices mounted close to water pipes shall be non-metallic.

All **Water Metering Systems** shall function within the limits of their normal performance specification over the temperature range -20° to 50°C at a relative humidity of between 10% and 90%.

The **Meter** cabinet and any associated **Metering Systems** shall be rated IP 55 indoors and IP 65 outdoors as a minimum. Where an instrumentation device is located below the flood level it shall be rated to IP 68 (submersible). Cable connections to **Metering Systems** shall not reduce the IP rating of the device.

Instrumentation systems shall be designed such that failure of the system shall not result in damage to plant or result in the development of a hazardous situation.

F 2. Flow Meters

Each flow **Metering System** shall comply with BS EN ISO 6817 and comprise a flow sensor mounted in the pipeline and a separate signal converter.

Where electromagnetic flow **Meters** are used, they shall be of the pulsed dc type with automatic zero error averaging and low power consumption.

The system accuracy over the normal operating range shall not be more than ±0.2% of full-scale reading.

Flow sensors shall comprise a **Meter** tube assembly containing all necessary electrodes, housing and terminations. **Water Meter** tubes shall be made from a non-magnetic material lined with an inert substance suitable for the medium and flanged. The lining material shall extend from the bore of the tube to fully cover the raised face of the tube flanges. There shall be no protruding parts to restrict the flow.

Water Meter tubes installed in areas susceptible to flooding shall be environmentally protected to IP 68 and shall be suitable for continual submergence at the likely depth of any flood water. Where potting compounds are used to achieve this performance it shall not prevent disconnection of the sensor cabling.

The flow **Meter** converter shall provide the following facilities:

- adjustment of flow range according to size of flow sensor;
- independent 4 to 20 mA output proportional to flow rate and a 24 V dc pulse output suitable for an integration counter drive;
- manual adjustment of pulsed and current output response time;
- failure of the flow **Meter** shall cause the output to be driven down scale;
- means of testing the converter electronics shall be an integral part of the converter design.

Appendix G: Locations of Metering Systems

Metering Systems must be installed at each **Delivery Point** at the ownership boundaries of the systems of the various parties, as follows:

1. Between a Licensed **Transmission System** and

    - **Power Producers**;
    - **Licensed Distributors**;
    - **Externally Interconnected Parties**;
    - **Internal Interconnected Parties**; and
    - **Directly Connected Consumers**.

2. Between the **Systems** of **Licensed Distributors**; and

    - **Embedded Power Producers** and **Autogenerators**;
    - **International Interconnected Parties** where interconnections exist;
    - **Internal Interconnected Parties**, where interconnections exist; and
    - **Consumers**.

3. Between the Production Facilities of power and water producers and **PAW**.

The **Delivery Points** shall be at the ownership boundary and shall be specified in each **Connection Agreement** or **Electrical Connection and Use of System Agreement**.

The actual location of a **Metering System** is referred to as the "**Actual Metering Point**". This may be different from the **Delivery Point** established pursuant to the relevant **Connection Agreement**.

OETC, **Licensed Distributors**, **Licensed Suppliers** and **Users** shall each respectively take all reasonable steps to ensure that each relevant **Metering System** is located as close as is reasonably practicable to the **Delivery Point** at each **Connection Point**.

Appendix H: Data Exchange Tables

See notes at foot of table H1.

Table H.1: Data Exchange

Data Item	Data		
	Provider	Sender	Receiver
A	B	C	D
Data exchange relating to PWPAs and PPAs			
MW	**Meter Owner**	**Power Producer**	**PWP**
MWh	**Meter Owner**	**Power Producer**	**PWP**
Water Production	**Meter Owner**	**Power Producer**	**PWP/ PAW**
Data Exchange relating Bulk Supply Agreement			
MWh	**Meter Owner**	**Meter Owner**	**PWP**
MVArh	**Meter Owner**	**Meter Owner**	**PWP**
Water Production	**Meter Owner**	**Meter Owner**	**PWP/ PAW**
Data Exchange relating to Supply Contracts			
MW	**Meter Owner**	**Meter Owner**	**Licensed Supplier**
MWh	**Meter Owner**	**Meter Owner**	**Licensed Supplier**
MVArh	**Meter Owner**	**Meter Owner**	**Licensed Supplier**
Data Exchange relating to Agency Contracts			
MW	**Meter Owner**	**Meter Owner**	**Licensed Suppliers /PWP**
MWh	**Meter Owner**	**Meter Owner**	**Licensed Suppliers /PWP**
Data exchange relating to Import and Export Contracts			
MW	**Meter Owner**	**Meter Owner**	**PWP**
MWh	**Meter Owner**	**Meter Owner**	**PWP**
Data exchange relating to Transmission and Distribution Use of System Agreements			
MW	**Meter Owner**	**Meter Owner**	**OETC/ Licensed Distributor**
MWh	**Meter Owner**	**Meter Owner**	**OETC/ Licensed Distributor**
MVArh	**Meter Owner**	**Meter Owner**	**OETC/ Licensed Distributor**

Notes

1 All **Meter Data** in the above table is required for invoices

2 Electronic formats shall be used for data collection and for data transmission

3 The frequency of all measurements will be hourly

4 The frequency of sending all measurements will be monthly.

5 The provisions contained within the **Market Rules Document** shall apply in relation to data exchanged under the **Market Rules**.

Oman Electricity Transmission Company S.A.O.G.

Sultanate of Oman

The Grid Code Glossary

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Version-3.0 August 2020

Glossary

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Abbreviations

Abbreviation	Meaning
A	Ampere and kA is construed accordingly
AC	Alternating current
AGC	Automatic Generation Control
ASC	**Ancillary Services Code**
AVR	**Automatic Voltage Regulation**
CC	**Connection Conditions**
CCGT	Combined Cycle Gas Turbine
CD	**Centrally Dispatched / Central Dispatch**
CT	Current Transformer
DC	Direct Current
DCC	**Directly Connected Consumer**
DTC	**Data Transfer Code**
DSM	**Demand Side Management**
ECA	**Electrical Connection Agreement**
G	Giga or 10^9
GC	**General Conditions** of this **Grid Code**
GCRP	**Grid Code Review Panel**
GWh	Giga Watt Hour
HP	High Pressure
HV	**High Voltage**
Hz	Hertz
IEC	International Electro-technical Commission
ITU	International Telecommunications Union
k	Kilo or 10^3

Abbreviation	Meaning
kV	Kilo-Volt
kVA	Kilo-Volt-Ampere
kVAr	Kilo-Volt-Ampere Reactive (**Reactive Power)**
kW	Kilo-Watt (**Active Power**)
LD	**Licensed Distributer**
LDC	Load Dispatch Centre
LV	**Low Voltage**
M	Mega or 10^6
MCR	Maximum continuous rating (of a generator)
MDEC	**Metering and Data Exchange Code**
MO	Meter owner
ms	millisec
MVA	Mega-Volt-Ampere
MVAr	Mega-Volt-Ampere Reactive / Mega-var (**Reactive Power**)
MVArh	Mega-VAr- hour (**Reactive Energy**)
MW	Mega-Watt (**Active Power**)
MWh	Mega-Watt-hour (**Active Energy**)
OC	**Operating Code** (of this **Grid Code**)
OCP	Other Connected Parties (to cover interconnectors etc)
OETC	Oman Electricity Transmission Company – refer to the definitions section
OLTC	On-load tap changer
PAW	Public Authority for Water
PC	**Planning Code**
PLC	Power Line Carrier
PP	**Power Producer**
PPA	Power Purchase Agreement
PSS	**Power System Stabiliser**

Abbreviation	Meaning
PWP	**Power and Water Procurer** (at present Oman Power and Water Procurement Company)
PWPA	**Power and Water Purchase Agreement**
RA	**Regulatory Authority**
RAEC	Rural Areas Electricity Company
SCADA	Supervisory Control and Data Acquisition
SD1	**Schedule Day** 1 (or another day as the number indicates)
SDC	**Scheduling and Dispatch Code**
SPD	**Standard Planning Data**
SPPF	**Solar Power Production Facility**
VA	Volt-Ampere
VAr	Volt-Ampere Reactive (**Reactive Power**)
VT	Voltage Transformer
WFPPF	**Wind Farm Power Production Facility**

Definitions

Term	Meaning
Accuracy Test	A test to determine the percentage error of any item of a **Metering System**.
Active Energy	The electrical energy produced during a time interval, measured in units of watt-hours or standard multiples thereof. Where the term **Energy** is used without any modifier, this will have the same meaning.
Active Power	The product of voltage and the in-phase component of alternating current, measured in units of watts or multiples thereof. When the term **Power** is used without any modifier, this will have the same meaning.
Actual Metering Point	The physical point at which electricity is **Metered**.
Alert	A warning issued by **OETC** to inform **Users** of potential **Emergency Conditions** on the **System**.
Alerts Summary Code	is the section of this **Grid Code** with the same name.
Ancillary Services	The services which: 1. **Licensed Generators**, **Licensed Generators/Desalinators** or other **Persons Connected** to a **Transmission System** may be required to provide from time to time in connection with the security and stability of such **Transmission System** or the **Total System**; and 2. are provided for in either: (i) an agreement between a **Licensed Transmission System Operator** or a **Licensed Distribution System Operator** and any **Person**, or an agreement between a **Licensed Generator** or a **Licensed Generator/Desalinator** and the **PWP**.
Ancillary Services Agreement (ASA)	An agreement for the purchase of **Ancillary Services** by **OETC** or **PWP** from a **User**.
Ancillary Services Code (ASC)	is the section of this **Grid Code** with the same name.
Apparent Power	is the vector sum of **Active Power** and **Reactive Power** and is measured in **VA** or multiples thereof (**MVA**).
Asynchronous	Refers to generating **Plant** and electric drives, and has the meaning that the **Plant** or drive is not linked to the **System Frequency** by a **Synchronising** torque. In general, this means that there is no natural contribution to the inertia of the **Total System**, although control mechanisms may be employed to synthesise a contribution which assists in stabilising the **Total System** after a disturbance.

Term	Meaning
Authorised Person	(as used in **MDEC**) a competent **Person** authorized to carry out the duties of the **MO** in accordance with the **Metering Code**.
Autogenerator	A **Person** that **Generates** electricity primarily for the purposes of self-supply.
Automatic Under-Frequency Relays	**Frequency** relays used for the automatic de-energising of feeders **Connecting Consumers** at pre-set **Frequencies** to assist in stabilising the **Active Power** balance between **Demand** and **Available Generation**.
Automatic Voltage Regulation (AVR)	A continuously acting automatic excitation system to control **Generating Unit** terminal voltage; and **Automatic Voltage Regulator** shall be construed accordingly.
Availability	The **MW Capacity** of a **Centrally Dispatched Generating Unit** declared **Available** to **OETC** and/or **PWP** by a **Power Producer**; and **Available** shall be construed accordingly.
Availability Notice	A notice issued by a **Power Producer**, in the form set out in **SDC** 1, stating the **Availability** of a **Generating Unit**, to be applied for the following **Schedule Day**.
Back-Up Protection	**Protection** equipment or system that is intended to operate when a **System** fault is not cleared because of a failure of the **Main Protection** to operate.
Black Start	The procedure to be applied for the recovery from a **Partial System Shutdown** or a **Total System Shutdown**.
Block Load	means the level of **Output** that a **Generating Unit** immediately produces following **Synchronisation**. For avoidance of doubt, **Block Load** can equal 0 **MW**.
Bulk Supply	The delivery of wholesale quantities by the **PWP** of: (i) electricity to any **Licensed Supplier** or; (ii) **Desalinated** water to the Public Authority of Water.
Bulk Supply Point	The point at the interface between the **Transmission System** and **Licensed Distributors** where **Bulk Supply Metering** is located.
Burden	The electrical load, measured in **VA**, connected to current and/or voltage transformers for the purposes of **Metering**, **Protection** or measurement.
Business Day	A day on which banks in Oman are open for business purposes.

Term	Meaning
Calibration	The procedure whereby the relevant percentage errors of any item of **Metering Systems** are determined by comparison with a standard and, where appropriate, adjusted. Calibrated shall be construed accordingly.
Capability Curve	A diagram showing the combination of **Reactive Power** and **Active Power** which it is possible to produce by a **Generating Unit** under all credible steady state conditions.
Capacity	The capacity of any **Plant**, apparatus or equipment to produce, deliver or receive electricity, as the case may be, stated in **MW** at an assumed or agreed **Power Factor**, or in **MVA**.
Caution Notice	A notice issued in accordance with **Safety Rules** approved by **OETC** and placed at a point of adequate physical separation, which must be fitted in accordance with, and be maintained in position in accordance with **Safety Rules** to allow safe working.
CCGT Installation Matrix	A table of values similar to that shown in Appendix E to the **Connection Conditions** indicating the range of operation and associated **MW Output** of a **CCGT** installation.
CCGT Module	A group of **Generating Units**, comprising one or more **Gas Turbine Generating Units** (or other gas based engine set) and one or more **Steam Turbine Generating Units** where, under normal **Operation**, the waste heat from the gas turbines, is used to drive the steam turbine(s) and the component sets within the **CCGT** Module are designed to **Operate** together for increased efficiency and are registered as a **CCGT** Module under this **Code**. A **CCGT** module is a single **Generating Unit**.
Central Dispatch (CD)	The process of **Scheduling** and issuing **Dispatch** Instructions by **OETC**; and **Centrally Dispatched** shall be construed accordingly.
Centrally Dispatched Generating Unit	A **Connected Generating Unit** with a **Registered Capacity** in excess of 5 **MW** and which is subject to the procedure of **Central Dispatch**.
Chairperson	Means the person referred to in the **General Conditions** of this **Grid Code** who is appointed by **OETC** for the purpose of chairing meetings of the **Grid Code Review Panel** and to be responsible for the proper functioning of the **GCRP** or their alternate as the context requires.
Chairperson (MDEC)	Means the person referred to in the **MDEC** who is appointed by **OETC** for the purpose of chairing meetings of the **MDEC Panel** and to be responsible for the proper functioning of the **MDEC** or their alternate as the context requires.

Term	Meaning
Check Meter	A device, where required, that duplicates and provides back up to the **Main Meter** for measuring and recording units of **Active Power**, **Active Energy**, **Reactive Power** or **Reactive Energy** or other electrical quantities.
Code	Refer to **Grid Code**. Note that the undefined word "code" is used to refer to a section rather than the entirety of the **Grid Code**.
Code Notice	A notice served under, or for the purposes of, the **Grid Code**.
Cold	A situation in which a **Generating Unit** has been shut down for: • more than forty-eight (48) hours, if the **Generating Unit** is a steam cycle **Generating Unit** or is in combined cycle configuration; and more than twenty-four (24) hours if the **Generating Unit** is in open cycle configuration.
Committed Project Planning Data	The data (as specified in the Planning Code) relating to the proposed **User** development at the time of acceptance of an offer for a **Connection Agreement** and the subsequent data required by **OETC**.
Communication Link	A line or link that is dedicated to an **Outstation** system. A communication line may comprise of electrical circuits, optical fibers, radio links or any other media permitted by the **Meter Owner (MO)**.
Completion Date	Has the meaning set out in the **Connection Agreement** with each **User**, or in the absence of a definition set down in the **Connection Agreement**, it shall mean the date when a **User** is expected to **Connect** to or start using **OETC**'s **Transmission System**.
Complex	One or more **Connection Sites** together with the associated **Production Facility**, **Transmission** substation and/or **Distribution** substation and/or associated **Plant**, as appropriate.
Connected Planning Data	The estimated values assumed for planning purposes by **OETC** if and when confirmed or replaced by validated actual data (as specified in the **Planning Code**).
Connection	In relation to any **Premises**, **Production Facility** or **System**, the presence of a physical connection between those **Premises**, **Production Facility** or **System** and the **System** of a **Licensed Transmission System Operator** or **Licensed Distribution System Operator** other than a **System** owned or **Operated** by the **Rural Areas Electricity Company**; and **Connect** ,and **Connected** shall be construed accordingly.
Connection Agreement	Refer to **Electrical Connection Agreement**.

Term	Meaning
Connection Charging Statement	A statement in a form approved by the **Regulatory Authority** issued by **OETC** and updated from time to time indicating the methodology and rates used to calculate charges for **Connecting** to or modifying the use of a **Connection** to the **System** and such other matters as the **Regulatory Authority** may determine necessary for transparency of the **Connection** process.
Connection Conditions	Is the section of this **Grid Code** with the same name.
Connection Offer	The terms and conditions offered by **OETC** to a **User** for **Connection** of a **User**'s **System** to the **Transmission System** as a result of application for **Connection** of **Plant** made in accordance with **OETC**'s **Licence**.
Connection Point	The point on the **Transmission System** to which a **User Connects** its **System** to the **Transmission System**.
Connection Site	The physical site belonging to **OETC** or a **User** where a **Connection Point** is located.
Connections Conditions	Is the section of this **Grid Code** with the same name.
Constitution	Means the rules and composition of the **Grid Code Review Panel** or the **MDEC** as the context requires, to be found with the **General Conditions** of this **Grid Code** or **MDEC**.
Constrained Schedule	A **Generation Schedule** and **Desalination Schedule** produced by **OETC** that takes account of limits on the **Total System** and that is developed in accordance with the **Scheduling** and **Dispatch Code SDC** 1.4.9.
Consumer	A **Person** who is **Supplied** with electricity at **Premises** for consumption at those **Premises**.
Contingency Reserve	The margin of **Available Generation Capacity** over forecast **Demand** that is required in the period from 24 hours ahead down to real time to cover against uncertainties in **Generating Unit Availability**, renewable **Generation** uncertainty and against **Demand** forecast errors.
Control Centre	The centre from where **Scheduling**, **Dispatch** and **Operational Instructions** are given to other control rooms or **Plant** operators. The term is used to describe any such centre which may be: a fully fitted control centre, an operational room; or a **Person** designated with such responsibilities.
Control Phase	The phase from the issue of the **Generation Schedule** and **Desalination Schedule** on the day ahead (D-1) to real time **Operation**.

Term	Meaning
Daily Status Form	The form used by **Power Producers** for submission of data to **OETC** and **PWP** under **SDC** 1.
Daily Status Form – OETC Assumed Data	A form used by **OETC** to inform **Power Producers** of the data to be used by **OETC** in connection with **Scheduling** and **Dispatch** following failure by the **Power Producer** to submit the **Daily Status Form**.
Data Transfer Code (DTC)	Is the section of this **Grid Code** with the same name.
Dead Band	In relation to a control device (e.g. a **Governor** or **Automatic Voltage Regulator)**, is the maximum quantum of change in the controlled parameter for which the control system takes no corrective action.
Delivery Point	Points of connection where water or electricity metering systems are installed
De-loaded	The condition under which a **Synchronous Centrally Dispatched Generating Unit** has reduced or is not delivering **Active Power** to the **System** to which it is **Synchronised** and de-loading shall be construed accordingly.
Demand	The **Demand** for **Active Power** or **Reactive Power** or as the context requires **Apparent Power**.
Demand Control	Any method of achieving a reduction or increase in **Demand**.
Demand Control Imminent Warning	A message that may be issued to provide up to 30 minutes warning (relating to a **Demand** reduction) which will be issued by **OETC** to **Licensed Distributors** and to **Power Producers** at **Production Facilities** and to **Directly Connected Consumers**.
Demand Control Red Warning	Has the meaning set down in Table 3 of the **Alerts Code**.
Demand Intertrip Scheme	Automatically initiated circuit breaker tripping sequences that are switched into service following instructions from **OETC** or a **Licensed Distributor**.
Demand Period	the period over which **Active Energy or Reactive Energy** are integrated to produce **Demand Values**. Each demand period shall be of 30 minutes duration, one of which shall finish at 24:00 hours.
Demand Side Management	The controlled reduction in **Demand** achieved in real time by a **User**, although such reduction may have been planned or advised in advance.
Demand Values	expressed in **kW**, **kVAr** or **kVA**, recorded during any **Demand Period**.
Desalination	The production of demineralised or potable water by desalination; and **Desalinated** shall be construed accordingly.

Term	Meaning
Desalination Schedule	Refer to **Generation Schedule (& Desalination Schedule)**.
Desalination Unit	A unit forming part of the **Production Facility** and which is capable of producing **Desalinated** water.
Designated Operator	The operator approved in writing by the relevant **User** as competent to carry out the procedures in agreed **Operational Instructions**.
Desynchronise	The act of taking a **Generating Unit** off a **System** to which it has been **Synchronised** by opening any connecting circuit breaker; and **Desynchronised** or **Desynchronising** shall be construed accordingly.
Detailed Planning Data	The additional data required by **OETC** as part of the **Planning Code** to allow detailed stability studies to be carried out;
Directly Connected	A **Consumer** or **User** which imports and/or exports electricity directly from/to the **Transmission System**; and **Direct Connected** shall be construed accordingly.
Dispatch	The general process by which instructions are determined and the issuing of those instructions, to: (i) any **Licensed Generator** and/or **Licensed Generator/Desalinator** as to the **Operation** or cessation of **Operation** of their **Production Facilities**; and (ii) other **Persons** whose facilities are **Connected**; and **Dispatch Instructions** shall be construed accordingly.
Dispatch Instruction	An instruction issued pursuant to **SDC** 2.
Distribution	Means In relation to electricity, the transport of electricity by means of a **Distribution System**; and **Distribute** shall be construed accordingly.
Distribution Code	The **Distribution Code** for **Oman**.
Distribution System	A **System** which: (i) is not a **Transmission System**; (ii) is used to transport electricity; (iii) consists (wholly or mainly) of **Electric Lines** and **Electric Plant** (namely, **Electric Lines** and **Electric Plant** with voltage levels of less than a nominal 132**kV**); and which is used wholly or mainly for the transport of electricity to **Premises**.

Term	Meaning
Disturbance	Any sudden significant change to the **Total System** caused by a sudden loss of a **Generating Unit**, or the interruption of **Demand**, or the failure of **Plant**.
Droop	In relation to the operation of the governor of a **Generating Unit** (including in a **WFPPF** or **Solar Power Production Facility)**, the percentage drop in Oman **System Frequency** which would cause the **Generating Unit** under free governor action to change its **Output** from zero to **Full Load**.
Earthing	Has the meaning ascribed in **OC** 6.4.
Earthing Device	A means of providing a connection between a conductor and the general mass of **Earth**, being adequate to allow the flow of the maximum prospective earth fault current, at the point on the **Total System**; and **Earthing** shall be construed accordingly.
Economic Purchase	The purchase on the best economic terms reasonably obtainable, having regard to: • the quality, quantity, the nature; • the **Available** (see **SDC** 1) manner of delivery and the future security; and • the reliability and diversity of supply of the things to be purchased.
Electric Line	Any line, whether underground or overground, which is used for carrying electricity for any purpose and includes, unless the context otherwise requires; (a) any support for any such line, including, without limitation, any structure, pole, pylon or other thing in, on, by or from which any such line is or may be supported, carried or suspended; (b) any **Plant Connected** to any such line for the purpose of carrying electricity; and (c) any wire, cable, tube, pipe or other similar thing (including its casing, insulator or coating) which surrounds or supports, or is surrounded or supported by, or is installed in close proximity to, or is supported, carried or suspended, in association with, any such line.
Electric Plant	As the context requires, any mechanical or electrical apparatus, equipment or appliance used for, or for purposes connected with, the **Generation**, **Transmission**, **Dispatch**, **Distribution** or **Supply** of electricity, other than. (a) an **Electric Line**; (b) a **Meter** used for ascertaining the quantity of electricity supplied to any **Premises**; and (c) an electrical appliance under the control of a **Consumer**;

Term	Meaning
Electric Time	The time shown on an electric clock connected to the **Total System**.
Electrical Connection Agreement (ECA)	(In abbreviated reference, **Connection Agreement)** an agreement between **OETC** and a **System User** to provide principally for: (i) the **Connection** of a **System User**'s **System** to the **Transmission System**; and (ii) to record the mechanism relating to the payment of **Connection** fees.
Electrical Delivery Point	The point on the **High Voltage** terminals of the **Production Facility** at which the **Production Facility Connects** to the **Transmission System** and at which electrical **Energy** is delivered in accordance with **PPAs** and **PWPAs** and by reference to which the electrical **Energy** is measured.
Electrical and Water Connection Point	The **Connection Point** where electricity or water is supplied to a **Consumer**
Embedded Generating Unit	Generators that are **Connected** to a **Distribution System** or the **System** of any other **User**, such **Connection** being either a **Direct Connection** or a **Connection** via the busbar of another **User** but with no **Direct Connection** to the **Transmission System**, and which have a **Registered Capacity** of 5**MW** or more; and **Embedded Centrally Dispatched Generating Units** shall be construed accordingly.
Embedded Genset	Generators that are **Connected** to a **Distribution System** or the **System** of any other **User**, such **Connection** being either a **Direct Connection** or a **Connection** via the busbar of another **User** but with no **Direct Connection** to the **Transmission System**, and which have a **Registered Capacity** of less than 5**MW**.
Embedded Power Producer	A **User Operating** an **Embedded Generating Unit** (or **Embedded Genset**).
Emergency Conditions	Abnormal **System** conditions that require automatic or rapid manual action to prevent or limit loss of **Transmission** facilities, **Distribution** facilities or **Generation Capacity** that could adversely affect the reliability of the **Transmission System**.
Emergency Instructions	A **Dispatch Instruction** issued by **OETC** that may require an action or response that is outside the limits implied by a **Daily Status Form** submitted for a **Centrally Dispatched Generating Unit** or instructions issued by **OETC** to prevent or limit abnormal **System** conditions.
Emergency Manual Demand Shedding	The manual de-energisation of **Consumers** installations or electric lines feeding **Consumers** installations in **Emergency Conditions** to assist regaining the **Active Power** balance between **Available Generation Capacity** and **Demand**.

Term	Meaning
Energisation Notice	A document issued by **OETC** indicating that, on information received, it is safe to energise **User**'s **Plant** and associated equipment. The notice is issued to allow a **User** to carry out performance testing which can only be carried out when the equipment is **Connected** to the **Transmission System**. For the avoidance of doubt, the issuing of an Energisation Notice by **OETC** in no way implies that the **User**'s **Plant** and associated equipment is compliant with the **Grid Code**, only that it is so arranged and protected as to be safe to first **Connect**.
Energy	Refer to **Active Energy**.
Expert	A **Person** with appropriate educational and practical experience to provide relevant advice to the subject in question and whose advise may be considered to be accurate, fair and without prejudice to any of the parties;
Exported	In relation to electricity, electricity which is **Generated** in Oman and which is transported from Oman, and the term **Export** shall be construed accordingly.
Fast Acting	In respect of a control system for a **WFPS** or **Solar Power Station** has the meaning set out in Schedule 2 of the **Connection Conditions** and is further defined by being a control system which complies with the criteria set out in any commissioning and testing document issued by **OETC** for the same types of **Plant**.
Final Compliance Certificate	Is a document issued by **OETC** to a **User** indicating that the **User**'s installation is **Grid Code** compliant, or is compliant with the **Grid Code** as derogated.
Final Significant Incident Report	Has the meaning attributed in **OC** 5.6.
Final Station Outage Schedule	The **Outage Schedule** submitted by a **User** to **OETC** for **Operational Year** 1 specifying for each **Centrally Dispatched Generating Unit** and **Desalination Unit** owned by that **User**, the proposed timing for **Outages** and **Winter Downtime**.
Final System Outage Schedule	The **Outage Schedule** for **Operational Year** 1 produced by **OETC** in accordance with the provisions of **OC** 2, specifying for each **Centrally Dispatched Generating Unit** and **Desalination Unit** in the **Total System** the proposed timing for **Outage**s and **Winter Downtime**.
Five-Year Statement	A statement, prepared by **OETC**, in accordance with the terms of the **Transmission Licence** showing for each of the 5 succeeding **Operational Years**, amongst other matters, the forecast **Demands** and **Power** flows on the **Transmission System**.
Flexible Outage	A **Planned Outage** that, at the request of **OETC**, can be deferred or advanced by a period;

Term	Meaning
Forced Outage	An **Outage** for which no timely notice can be provided by the **User** to **OETC**.
Frequency	The number of alternating current cycles per second (expressed in Hertz) at which a **Total System** is running.
Frequency Emergency Control Units	**Generating Units** designated by **OETC**, or **OETC** and **Power Producers** acting together, which will be used by designated **Power Producers** to control **System Frequency** during a **System Incident** involving the loss of **OETC Control Centre** function or the inability of **OETC** to send **Dispatch Instructions**, as further described in **OC** 7.
Frequency Sensitive Mode	The **Operation** of a **Centrally Dispatched Generating Unit** (which can be part of a **CCGT Module**) that will result in **Active Power Output** changing automatically in response to changes in **Total System Frequency**.
Fuel	Natural gas or fuel oil.
Gas (SF_6) Zone Diagram	A single line diagram showing boundaries of, and interfaces between, SF_6 gas-insulated **HV Plant** modules which comprise part, or the whole, of a substation at a **Connection Site**, together with the associated stop valves and SF_6 gas monitors required for the safe **Operation** of the **Transmission System** or the **User System**.
Gas Turbine Generating Unit	A **Generating Unit** with a gas turbine as its prime mover.
General Conditions (GC)	Is the section of this **Grid Code** with the same name.
Generating Unit (Generating Set)	Any electrical generator and its associated prime mover, together with all associated **Plant** and apparatus up to the **High Voltage** bushings at the **Generator Transformer**. Generating units could be **Synchronous** or **Asynchronous**. **Asynchronous** generating units include **Wind Turbine Generating Unit**s and **Solar Generating Unit**s.
Generating Unit De-loading Rate	The rate at which a **Generating Unit** can decrease its output of **Active Power** from **Maximum Generation** to **Minimum Generation**. The **Generating Unit De-loading Rate** for each **Generating Unit** will be as detailed in the **Operating Parameters**.
Generating Unit Loading Rate	The rate at which a **Generating Unit** can increase its output of **Active Power** from **Minimum Generation** to **Maximum Generation**.
Generating Unit Run-Down Time	The time taken for a gas turbine or steam turbine rotor to come to a complete stop after the opening of the **Generating Unit** circuit breaker following initiation of a normal stop signal initiation.

Term	Meaning
Generating Unit Run-Up Time	The time taken for a gas turbine or steam turbine to reach full speed at no load from the initiation of a start signal. The **Generating Unit Run Up Time** for each **Generating Unit** will be detailed in the **Operating Parameters**.
Generation	Means the production of electricity by any means and **"Generate"** and **"Generated"** shall be construed accordingly;
Generation Schedule (and Desalination Schedule)	A statement prepared by **OETC** of the **Centrally Dispatched Generating Unit**s and **Desalination Unit**s that may be required to meet the **Total System Demand** at all times, and ensure (as far as possible) the integrity of the **Transmission System** and the security and quality of **Supply**, taking account of an appropriate margin of reserve.
Generation Security Planning Standard	The standards by which **PWP**'s performance in maintaining **Generation** security, and the **Availability** and quality of the **Total System** may be measured, as prescribed in its **Licence**.
Generator Performance Chart	A diagram which shows the **MW** and **MVAr** capability limits within which a **Generating Unit** will be expected to **Operate** under steady state conditions.
Generator Transformer	The main transformer for a **Centrally Dispatched Generating Unit (**including a **Wind Farm Generating Unit** or **Solar Generating Unit)** through which power passes to the **Transmission System**.
Good Industry Practice	Acting in good faith to perform obligations in accordance with the requirements of the **Sector Law** and international good practice in the electricity and desalination industries.
Government	The Government of the Sultanate of Oman.
Governor	Refer to **Speed Governor**.
Grid Code	Is this **Grid Code** (as amended from time to time) prepared pursuant to Condition 3 of **OETC**'s **Transmission Licence**. The short form "**Code"** has the same meaning, being a reference to the entire **Grid Code**, whereas the undefined word "code" is a reference to a specific section of the **Grid Code** e.g. within the **Planning Code**, the word "code" refers only to the **Planning Code**.
Grid Code Review Panel (GCRP)	The panel with the functions set out in **GC** 4 of the **General Conditions** of this **Grid Code**.
High Frequency Response	An automatic reduction in the **Active Power Output** from a **Centrally Dispatched Generating Unit** in response to an increase in **Total System Frequency** above the **Target Frequency** notified by **OETC** under **SDC** 3.
High Voltage (HV)	A nominal alternating voltage equal to or exceeding one kilovolt.

Term	Meaning
Hot	When referring to a **Generating Unit**, it means a **Generating Unit** that has been shut down for less than eight (8) hours if the **Generating Unit** is dependent upon a steam cycle or is in combined cycle configuration and less than two (2) hours after such **Generating Unit** has been shut down if the **Generating Unit** is in open cycle configuration.
House Load Operation	The operation of a **Generating Unit** which is isolated from the **Transmission System** and is providing power supply only to the station load.
Import/Export Contract	A contract entered into in accordance with Article [(85)(2)] of the **Sector Law** for the **Import** or **Export** of electricity.
Imported	In relation to electricity, electricity that is **Generated** outside Oman and which is transported into Oman; and **Import** shall be construed accordingly.
Incident	An unscheduled or unplanned occurrence on, or relating to, a **System** (including **Embedded Generating Units or Embedded Gensets**) including, faults, events and breakdowns and adverse weather conditions being experienced.
Incident Centre	Has the meaning ascribed in **OC** 7.4.
Inflexible Outage	A **Planned Outage** that cannot be deferred or advanced by a period at the request of **OETC**, under **OC**2.
Instation	Equipment located within **OETC Premises** that receives and stores **Metering Data** from **Outstations**.
Interconnection Agreement	An agreement made between **OETC**, a **Licensed Distributor** or **RAEC** and a **Person** external to the Sultanate of Oman, relating to the transfer of **Power** and or **Active Energy**/**Reactive Energy** and or **Ancillary Services** across an **Interconnector**.
Interconnector	A facility that **Connects** two (or more) **Systems**; and **Interconnect** / **Interconnected / Interconnection** shall be construed accordingly.
Interface Agreement	An agreement between a **User** and **OETC** containing provisions for dealing with the consequences of a **User** owning or **Operating Plant** which is sited on another **User**'s land and/or for the sharing of facilities and/or the provision of services at or near a **Connection Site**.
Internal Interconnection	A **Connection** that facilitates the transfer of electricity to or from **OETC**'s **Transmission System**, the **Distribution System** of a **Licensed Distributor** or a **User System** into or out of another **System** located within **Oman**. A single internal **Interconnection** may comprise several circuits **Operating** in parallel; and **Internal Interconnector** shall be construed accordingly.

Term	Meaning
Internally Interconnected Party	A **Licensed Person** located in Oman that owns and/or **Operates** a **Transmission System**, a **Licensed Distribution System** and/or **Plant** for the purpose of providing **Energy** and/or **Ancillary Services** to other **Users** and/or **OETC**.
International Interconnected Party	A **Person** responsible for the operation of an electrical **Transmission System** or **Distribution System** outside the Sultanate of Oman that is **Connected** to a **System** that exists within Oman.
International Interconnection	An **Interconnector** that **Connects** a **System** that exists within Oman with a **System** that exists outside Oman; and **International Interconnector** shall be construed accordingly.
Islanded	Following a **Total System Disturbance**, a situation in which a part or parts of the **System** with their **Connected Production Facilities** become detached from the rest of the **Total System**.
Isolating Device	A device used for achieving electrical **Isolation**.
Isolation	Has the meaning ascribed in **OC** 6.4.
Licence	An authorisation issued by the **Regulatory Authority** pursuant to the **Sector Law** entitling the **Licensee** to undertake a set of regulated activities.
Licensed Distribution System Operator	A **Person** who is the holder of a **Distribution Licence** in Oman; and **Licensed Distributor** shall be construed accordingly.
Licensed Generator	A **Person** who is the holder of a **Generation Licence** in Oman;
Licensed Generator/Desalinator	A **Person** who is the holder of a **Generation** and **Desalination Licence**.
Licensed Supplier	A **Person** who is the holder of a **Supply Licence** in Oman.
Licensed Transmission System Operator	**OETC** and each other **Person** who is the holder of a **Transmission Licence** in Oman.
Licensee	The holder of a **Licence**.
Load	The **Active Power** and/or **Reactive Power**, as the context requires, **Generated**, **Transmitted** or **Distributed**; and **Loading** shall be construed accordingly.
Local Interrogation Unit	Portable or fixed equipment capable of interrogating, updating and/or programming an **Outstation**.
Local Outstation	Is a provision on a metering system to enable output **Meter Data** to be interrogated locally.

Term	Meaning
Local Safety Instructions	Instructions, applying on each **User Site** and any **OETC Site**, approved by **OETC** or the relevant **User**, setting out the methods to achieve safety for **Persons** working on **Plant** to which either the **User**'s or **OETC**'s **Safety Rules** apply.
Low Voltage or LV	An alternating voltage less than a nominal value of one kilovolt.
Main Meter	The primary **Meter** for measuring and recording electrical quantities.
Main Protection	**Protection** equipment or **System** expected to have priority in initiating fault clearance or an action to alleviate an abnormal condition on the **Total System**.
Market Operator	means **PWP** acting in the capacity of market operator pursuant to **PWP Licence**
Market Rules	means the rules set out in the **Market Rules Document.**
Market Rules Document	means the document designated as such by the **Regulatory Authority** pursuant to the **PWP** Licence and from time to time modified in accordance with its provisions for modification.
Maximum Generation (Max Gen)	The maximum stable electrical **Output** that a **Production Facility** can make **Available** under **Emergency Conditions**.
Maximum Water Production	The maximum water production achievable in one hour on the **Schedule Day**;
Measurement Transformers	Voltage and/or current transformers or combinations thereof used in **Metering Systems**.
Member	A **Person** who is a member of the **Grid Code Review Panel** or the **Metering and Data Exchange Code Review Panel** as the context requires and who is appointed in accordance with the **General Conditions** of the **Grid Code** or the **Metering and Data Exchange Code**.
Merit Order	An order for ranking **Available Production Facilities** which order shall aim to optimise **Total System**, security, stability reliability and economy; and shall otherwise be determined by **OETC** having regard to guidelines agreed with each other **Licensed Transmission System Operator** in accordance with its **Transmission Licence**.
Meter	A device for measuring and recording units of **Active Power**, **Active Energy**, **Reactive Power** or **Reactive Energy** or other electrical and water quantities; and **Metered** / **Metering** shall be construed accordingly.
Meter Certificate	The statement issued by the **Grid Code Review Panel** confirming that a **Meter** or **Metering System** complies with the requirements of the **Metering and Data Exchange Code**.

Term	Meaning
Meter Data	**Active Energy** and **Reactive Energy Demand Values** and other **User** data obtained in the process of **Metering**.
Meter Owner	The **Person** responsible for ensuring the procurement, installation, testing, commissioning, operation and maintenance of **Meters**.
Meter Register	A device associated with a **Meter**, from which it is possible to obtain a visual reading of the quantities that have passed the **Meter**.
Meter Registration System	A system that uniquely identifies the **Meter** and **Users** associated with the **Meter** and contains pertinent data relating to the **Meter** as required by the **Meter and Data Exchange Code**.
Meter Service Provider	A **Person** that provides, to a **Meter Owner**, **Meter** services such as the installation, commissioning, operation, maintenance, and general servicing of **Metering Systems**.
Metering	The activity of measuring and recording units of **Active Power**, **Active Energy**, **Reactive Power** or **Reactive Energy** or other electrical and water quantities using a **Metering System** or a **Meter**.
Metering and Data Exchange Code (MDEC)	Is the section of this **Grid Code** with the same name.
Metering and Data Exchange Code Review Panel	The panel with the functions set out in of the **Metering and Data Exchange Code**.
Metering Communication System	The system of communications **between Meters**, **Local Outstations** and **Remote Installations**.
Metering System	The group of equipment, including **Meters**, time switches, **Measurement Transformers**, metering protection and **Isolation** equipment including alarms, circuitry, associated data storage and data communications equipment that are part of the **Active Energy**, **Reactive Energy** and **Demand** measuring equipment at or relating to a **Connection Site**.
Metering System Registration Data	Data held by a **Meter Owner** or operator related to the **Meter Registration System**.
Minimum Generation (Min Gen)	The minimum stable **Output Power** which is registered for a **Centrally Dispatched Generating Unit** through the **Planning Code** and/or the **Scheduling and Dispatch Code**, with **OETC**.
Minimum Shutdown Time	The minimum amount of time between a **Centrally Dispatched Generating Unit** being **Desychronised** and being able to **Synchronise** again.

Term	Meaning
Notice to Synchronise	The amount of time (in minutes) that is declared by a **Power Producer** for a **Centrally Dispatched Generating Unit** to enable it to be **Synchronised** following receipt of a **Dispatch Instruction** from **OETC**.
Numbering and Nomenclature Policy	The policy document of **OETC** or a **Licensed Distributor** setting out a consistent and distinct numbering and nomenclature system of **HV Plant** and such arrangements are subject to compliance with **OC**8 at interface locations.
OETC	The Oman Electricity Transmission Company SAOC established pursuant to Article (6), of the **Sector Law**, which company is a **Transmission** and **Dispatch Licensee**.
Oman Electrical Standards (OES)	Standards and regulations in relation to safety of equipment and electrical **Systems** and procedures associated with the specification and **Operation** of electrical **Systems**, formerly issued by the Ministry of Housing Electricity and Water, and known as Oman Electrical Standards. Such standards may from time to time be reviewed, modified or replaced pursuant to the **Sector Law** and including any such new standards as may be established, reviewed or modified from time to time pursuant to the **Sector Law**.
Oman Electricity Market	has the same meaning given to the term “Pool” under the **Market Rules**.
Operating Code (OC)	Is the section of this **Grid Code** with the same name and is comprised of nine separate codes.
Operating Margin	The combination of **Contingency Reserve** and **Operating Reserve**.
Operating Parameters	The technical capabilities, flexibilities and limitations of a **Generating Unit**, taking into account changes due to site rating, registered in the **Operating Code**, **OC** 2 “Operational Planning” and notified under the **Scheduling and Dispatch Code** through the **Daily Status Form**, as amended in accordance with these codes.
Operating Reserve	The additional output from **Generating Units** or agreed input from **Interconnection** or as otherwise contracted by **OETC**, or the reduction in **Demand** that can be realised in real time **Operation**, to contribute to containing or correcting a **Frequency** deviation to an acceptable level following a sudden change in **Demand** or **Generation**.
Operation	A planned, scheduled or erroneous action relating to the operation of part of the **Total System**; and the terms **Operate** and **Operating** will be construed accordingly. For the avoidance of doubt such words not emboldened have the ordinary meaning in the English language.

Term	Meaning
Operation Diagram	A diagram that is a schematic representation of the **HV Plant** and the **Connections** to all **HV** equipment at that location whether owned by **OETC** or a **User(s)** as further explained in CC 8.3.1.
Operational Effect	Any effect on the **Operation** of another **System** that causes the **Transmission System** or the **User**'s **System** to **Operate** (or be materially at increased risk of **Operating**) differently to the way in which they would or may have normally **Operated** in the absence of that effect.
Operational Instructions	Instructions and procedures issued in connection with the actual **Operation** of **Plant**.
Operational Log	A chronological record of messages relating to **Operational Instructions** and safety coordination sent and received either: between operators in the case of **Operational Instructions**, or by each operator and involving **Safety Coordinators** under **OC** 8.
Operational Planning	The process carried out by **OETC** pursuant to **Operating Code OC** 2.
Operational Planning Phase	The period from 8 weeks to the end of the 2nd **Operational Year** ahead; and **Operational Planning** shall be construed accordingly.
Operational Test	A test carried out in order to acquire information in respect of **Plant** under pre-determined **System** conditions;
Operational Year	The year running from 1 April to 31 March where **Operational Year** 0 means the current operational year, **Operational Year** 1 means the following operational year, etc.
Opto-isolator	Is a device that uses a short optical transmission path to transfer a signal between elements of a circuit, typically a transmitter and a receiver, whilst keeping them electrically isolated.
Open Access	Means the non-discriminatory provision for use of **Transmission** lines or **Distribution System** or associated facilities with such lines or system by any **Licensee** or **Consumer** or a [**Person** engaged in **Generation**].
Outage	In relation to a **Generating Unit** or **Desalination Unit**, an event (planned or unplanned), which affects a **Power Producer**'s ability to make **Capacity Available**. In relation to **OETC**, or a **Licensed Distributor**, the removal of any part of the **Transmission** or **Distribution Systems** for alteration, addition, repair or maintenance, or as a result of failure or breakdown.

Term	Meaning
Output	The actual **Active Power** output in **MW** of a **Generating Unit**, **Wind Turbine Generating Unit** or **Solar Generating Unit.** as at the **Connection Point,** derived from data measured pursuant to the **Metering Code**.
Outstation	On-site equipment which receives data from local equipment and may perform some processing of data before transmitting the data to an installation or **SCADA** system or downloading to a **Local Interrogation Unit** on request. When used with **Metering Systems** the outstation will store data from a **Meter(s)** and may perform some processing of data. These functions may be facilitated in one or more separate units or may be integral with the **Meter**.
Overall Speed Droop	The percentage drop in the **Total System Frequency** that would cause the **Generating Unit**, under free governor action, to alter its **Output** from zero to its full **Capacity**. (also refer to **Droop**.)
Panel	Refer to **Grid Code Review Panel** or **Metering and Data Exchange Code Review Panel** as the context requires.
Partial System Shutdown	As for a **Total System Shutdown** except that all **Generation** has ceased in a part of the **Total System** that has become detached from other parts of the **Total System** and there is no electricity **Supply** from other parts of the **Total System**, so it is necessary to invoke **Black Start** procedures.
Partially Constrained Schedule	A **Generation Schedule** and **Desalination Schedule** produced by **OETC** that takes account of limits on the **Total System** imposed by the **Transmission System** and as described in **SDC** 1.4.9.
Party	any **Person** subject to the provisions of the **Metering Code**.
Person	An individual, partnership, company, firm, trust, body corporate, government, government body, authority, emanation, agency, instrumentality, unincorporated body or an association;
Planned Outage	An **Outage** planned at least seven days in advance of the event.
Planned Rota Demand Shedding	The manual de-energisation and re-energisation according to planned rotas of: **Consumers** installations, or **Electric Lines** feeding **Consumers** installations, in **Emergency Conditions** to maintain the **Active Power** balance between **Available Generation** and **Demand**.
Planning Code	Is the section of this **Grid Code** with the same name.

Term	Meaning
Planning Margin	The margin by which electricity **Generation Capacity** must exceed forecast **Demand** in the planning years to ensure that **the Generation Security Planning Standard** is met;
Plant	As the context implies, an **Electric Plant** or a **Water Plant** or an installation by a **User** connected to the **System**.
Plant Owner	The **Person** responsible for ensuring the procurement, installation, testing, commissioning and **Operation** and maintenance of **Plant**.
Point of Common Coupling	That point of the **Transmission System** electrically nearest to the **User** installation at which more than one **User** is **Connected**;
Power and Water Purchase Agreement (PWPA)	An agreement entered into by **PWP** and a **Licensed Generator/Desalinator** pursuant to which the **PWP** agrees, amongst other things, to purchase the **Production Capacity** and **Output** associated with the relevant **Production Facilities**.
Power and Water Purchaser (PWP)	The **Person** of this name performing the functions assigned to it under the **Sector Law**.
Power Factor	The cosine of the phase angle between the Volt-Amperes and the **Active Power** component.
Power Island	Has the meaning ascribed in OC 7.4.
Power Procurer	means **PWP** acting in the capacity of power procurer pursuant to the PWP Licence other than the conditions relating to the **Market Operator**
Power Producer	Any **Person** (whether **Licensed** or exempt from holding a **Licence**) that **Generates** electricity and/or which **Operates** one or more **Generating Unit**(s), which **Connect** to the **Transmission System**, or **Distribution System** and **Operate Synchronously** with that **Transmission System** or **Distribution System**. This includes a **Person** that **Operates** a **Desalination Unit**.
Power Purchase Agreement (PPA)	An agreement entered into by **PWP** and a **Licensed Power Producer** pursuant to which the **PWP** agrees, amongst other things, to purchase the **Production Capacity** and **Output** associated with the relevant **Production Facilities**;
Power System Stabiliser	A control device placed on a **Generating Unit** and used in conjunction with an **Automatic Voltage Regulator (AVR)** to provide additional control of oscillations.
Preliminary Project Planning Data	Means the data relating to the proposed **User** development at the time a **User** applies for a **Connection Agreement** but before an offer is made by **OETC** and accepted by the applicant **User**.

Term	Meaning
Preliminary Significant Incident Report	Has the meaning attributed in **OC** 5.6.
Premises	Any land, building or structure occupied or used by a **Person** for any purpose relevant to this **Grid Code**.
Primary Control	A **Centrally Dispatched Generating Unit** operating mode which will result in **Active Power Output** changing in response to a change in **Frequency** in a direction which assists to stabilise the **Frequency** at any level by operating so as to provide **Primary Response** and/or **Secondary Response** proportional to the difference between the speed/**Frequency Target** value and the measured speed/**Frequency** value.
Primary Negative Reserve	The number of **MW** of decrease in **Output** that can be achieved in the **Primary Response** time without any new **Dispatch Instructions**. It is the sum of all **Primary Responses** to increasing **Frequency** on the **System**.
Primary Reserve	The numerical value in **MW** attributable to the sum of **Primary Responses** for any loading condition of generation and other response contributor.
Primary Response	The automatic increase in **Active Power Output** of a **Centrally Dispatched Generating Unit** or a decrease in the **Demand** for **Active Power** in response to a fall in the **Frequency** of the **Total System**. The response will be fully **Available** within 5 seconds from the time of the **Frequency** fall.
Production Capacity	The electricity **Generation Capacity** or the combined electricity **Generation** and water desalination **Capacity** of a **Production Facility**, as the context so requires.
Production Facility	An installation comprising one or more **Generating Units** (even where sited separately) owned and/or controlled by the same **Power Producer**, which may reasonably be considered as being managed as a single commercial entity and which may also include **Plant** used for the combined / co-located **Generation** of electricity and **Desalination** of water and includes, as applicable, all associated **Electric Lines**, **Electric Plant** and water equipment.
Programming Phase	The period from 8 weeks down to the issue of the **Generation Schedule** and **Desalination Schedule** on the day ahead (D-1) of the **Schedule Day**.
Proposed Station Outage Schedule	The proposed **Outage Schedule** submitted by a **User** to **OETC** for **Operational Year** 2 specifying for each **Centrally Dispatched Generating Unit** and **Desalination Unit** installed in the **Production Facility** owned by that **User**, the proposed timing for **Outages** and **Winter Downtime**.

Term	Meaning
Proposed System Outage Schedule	The **Outage Schedule** for **Operational Year** 2 produced by **OETC** in accordance with the provisions of **OC** 2 specifying, for each **Centrally Dispatched Generating Unit** and **Desalination Unit** in the **Total System**, the proposed timing for **Outages** and **Winter Downtime**.
Protection	The provision for the detection of fault, overvoltage or overload conditions on the **Total System** and the automatic or manual initiation of fault, overvoltage or overload clearance action, including audible and visual alarms, indications and data logging.
Protocol	Is the set of rules implemented to allow the exchange the information with external device or equipment through an interfacing communication port.
Provisional Running Order	A statement prepared and issued by **OETC** to the **Power Producer** pursuant to **SDC**1, which indicates for each **Centrally Dispatched Generating Unit** and **Desalination Unit** owned or controlled by the **Power Producer**, the expected output pattern and the required **Synchronising** and **Desynchronising** times for the following day.
Ramp Rate	Is the rate of change (increasing or decreasing, as the context requires) in the **Output** (measured in **MW**/s or **MW**/min as the context requires) of a **Generating Unit**.
Reactive Compensation Plant	Reactors and capacitors **Connected** to the **System** to compensate in part for insufficiency or excess of **Reactive Power**.
Reactive Energy	The integral with respect to **Reactive Power**, measured in units of volt-ampere reactive hours (**VArh**) and standard multiples thereof.
Reactive Power	The product of alternating voltage and current and the sine of the phase angle between them. Reactive Power is measured in units of voltamperes reactive (**VArs**) and standard multiples thereof. **Reactive Power Generation** or **Output** is an export onto the **System** and is referred to as lagging **Reactive Power** or lagging **MVAr**, and **Reactive Power** absorption is an import from the **System** and is referred to as leading **Reactive Power** or leading **MVAr**.
Red Warning	A warning that will be issued by **OETC** by 16:00 hours on the day ahead to those **Licensed Distributors** and **Directly Connected Customers** who will or may subsequently receive instructions under the **Operating Code OC** 4.

Term	Meaning
Reference Conditions	Has the meaning stated in the relevant **PPA** and **PWPA**. as "Reference Ambient Conditions". Where no **PPA** exists these conditions shall be assumed to be ambient air temperature of 50Deg.C, relative humidity of 30%, ambient air pressure in milli bars specific to the site of the **Plant** (normally around 1013 milli bars), sea water temperature in Deg.C site specific (normally around 35Deg.C). The **PPA** also defines linked issues e.g. Lower Heating Value of the fuel, which in the absence of a **PPA** shall be determined as a reference condition under this **Grid Code** evaluated with the same system of assessment and conditions as if a **PPA** did exist.
Registered Capacity	In relation to a **Generating Unit** and/or a **Desalination Unit** that does not form part of a **CCGT Module**, the **Production Capacity** of that **Generating Unit** taking into account changes due to site rating as registered with **OETC** and, as amended from time to time in accordance with the **Grid Code**. In the case of a **CCGT Module**, the **Production Capacity** of the **CCGT Module** taking into account changes due to site rating, as declared by the **Power Producer** and amended from time to time in accordance with the **Grid Code**.
Registered Data	Data submitted to **OETC** by **Users** describing the parameters of their **Plant** and **Systems**, including the **Operating Parameters** of **Generating Units** and **Standard Planning Data** and **Detailed Planning Data** and which is maintained by **OETC** as a continuing record that can be changed by a formal documented process.
Regulatory Authority	The body established pursuant to Article (19) of the **Sector Law**.
Remote Instations	Computer-based **Systems** operated by **OETC** that may receive or collect and interpret **Metering** data on a routine basis from **Outstations**.
Restricted Compliance Certificate	Is a document issued by **OETC** to a **User** indicating that the **User**'s installation is not: • initially compliant; or • has ceased to be compliant with the **Grid Code**, or with the **Grid Code** as derogated.
Risk of Trip	The **Operation** of a **Generating Unit** when the failure of any single piece of auxiliary equipment could result in the loss of the **Generating Unit**'s **Active Power** and/or **Reactive Power Output**.
Rural Areas Electricity Company (RAEC)	The Company of that name established pursuant to Article (6) of the **Sector Law**.

Term	Meaning
Safety Coordinator	A **Person** nominated by a **User** to be responsible for the coordination of **Safety Precautions** at a **Connection Point** and/or a **Bulk Supply Point** when work which includes testing is to be carried out on a **System** which necessitates the provision of **Safety Precautions** on **HV Plant**; and **Safety Coordination** shall be construed accordingly.
Safety Earthing	The connection to the general mass of earth of **HV** conductors by an **Earthing Device** in accordance with **OC** 8.
Safety From The System	The condition that safeguards **Persons** when work is to be carried out on a **System** from the dangers that are inherent in the **System**.
Safety Permits	Safety documents issued under the **Safety Rules** relating to safe conditions for working on **Plant**.
Safety Precautions	The **Isolation** and or **Earthing** of **HV Plant**, posting of safety tags, use of safety equipment and other measures to ensure safety.
Safety Rules	The rules of **OETC** or a **User** that establish a safe system of working on **HV Plant**.
Schedule Day	The 24 hour period starting at 0000 hrs (midnight) of the day concerned. **Schedule Days** are designated **SD**0, **SD**1, **SD**2 etc, where **SD**0 is today in real time.
Scheduling	The process of compiling a **Generation Schedule** and **Desalination Schedule** in accordance with **SDC** 1; and **Schedule** will be construed accordingly.
Scheduling and Dispatch Code (SDC)	Is the section of this **Grid Code** with the same name.
Secondary Negative Reserve	The number of **MW** of decrease in **Output** that can be achieved in the **Secondary Response** time without altering the **Generation Schedule**. It is the sum of all **Secondary Responses** to increasing **Frequency** on the **System**.
Secondary Reserve	The numerical value in **MW** attributable to the sum of **Secondary Responses** for any loading condition of generation and other response contributor.
Secondary Response	The automatic increase in **Active Power Output** of a **Centrally Dispatched Generating Unit** or a decrease in the **Demand** for **Active Power** in response to a fall in the **Frequency** of the **Total System** being fully available within 30 seconds and sustainable to 30 minutes.
Secretary	Is the Secretary of **the Grid Code Review Panel,** or the **Metering and Data Exchange Code** as the context requires, referred to in the **General Conditions (GC** 4 of this **Grid Code)** or the general conditions of the **MDEC** as the context requires.

Term	Meaning
Sector Law	The law promulgated by Royal Decree (78/2004).
Short Notice Outage	An **Outage** for maintenance performed at no less than 48 hours of notice to **OETC**, the approval of which will be at the sole discretion of **OETC**, as further explained in **OC** 2.
Significant Incident	An **Incident** that **OETC** has determined shall be defined as significant in the context of reporting in **OC**5.
Site Common Drawings	Drawings that incorporate **Connection Site** layout drawings, electrical layout drawings, common protection/control drawings and common services drawings prepared for each **Connection Site**.
Site Investigation	A test conducted in relation to **Plant** and operational procedures at **Production Facilities** and **User** sites or to monitor and assess the characteristics of **Plant**.
Site Investigation Test	Has the meaning ascribed in **OC** 9.4.
Site Responsibility Schedule	A schedule forming part of the **Connection Agreement** containing the information and prepared in accordance with the **Connection Conditions**.
Solar Generating Unit	Is a group of devices which are controlled together to collect or concentrate the sun's rays together with all **Plant** and apparatus and any step-up transformer which relates exclusively to the operation of those solar devices.
Solar Power Production Facility	Is an installation comprising one or more **Solar Generating Units** (even where sited separately) owned and/or controlled by the same **Generator**, which may reasonably be considered as being managed as one solar **Production Facility** and having one **Connection Point** with the **Transmission System** or the **Distribution System**.
Speed Governor (Speed Control) **short form (Governor)**	The mechanical and/or electrical equipment used to control the rotational speed of a **Synchronous Generating Unit** rotor according to a speed droop characteristic or equipment which has similar effect in relation to achievement of allowing an **Asynchronous Generating Unit** to obey a **Droop** characteristic when operating in **Frequency Sensitive Mode**.
Spill	Energy supplied to the **Total System** after some captive on-site **Demand** has been met.
Spill Contract	A contract between a **Licensed Supplier** and an **Autogenerator**, entered into in accordance with Article (35)(7) of the **Sector Law** and Condition 3 of the **PWP Licence** for the purchase by the **Power and Water Procurer** of **Production Capacity** and/or **Output**.
Spinning Reserve	that portion of the **Operating Reserve** derived from **Generating Units** which are **Synchronised** to the **Total System**

Term	Meaning
Standard Planning Data	The general data required by **OETC** under the **Planning Code**.
Start-up	The action of bringing a **Generating Unit** from **Shutdown** to the speed required by the **Generating Unit** to enable it to be **Synchronised** to a **System**.
Steam Turbine Generating Unit	A **Generating Unit** with a steam turbine as its prime mover.
Summer Period	The period commencing 00:00 on 1 April in a Gregorian calendar year and ending at 24:00 on 30 September in the same Gregorian calendar year.
Supply	In relation to electricity, the **Supply** of electricity to any **Premises**; and **Supplied** and **Supplies** shall be construed accordingly.
Synchronised	The condition where a **Generating Unit**, or a **System**, is **Connected** to the busbars of another **System** or **Total System**, so that the **Frequencies** and phase relationships of that **Generating Unit** or **System** are identical (within operational tolerances) to those of the other **System** or **Total System**; and the terms **Synchronise Synchronisation**, **Synchronism** and similar derivative words will be construed accordingly.
Synchronous	Refers to a **Generating Unit** or drive, and has the meaning that the **Plant** or drive is linked to the **System Frequency** by a **Synchronising** torque. In general, this means that there is a natural contribution to the inertia of the **Total System**, which assists in stabilising the **Total System** after a disturbance.
System	A **Distribution System** or a **Transmission System**, as the context requires.
System Incident	Has the meaning ascribed in **OC** 7.4.
System Incident Communications Procedures	Has the meaning ascribed in **OC** 7.4.
System Normalisation Procedures	The procedures necessary for a recovery from a **Partial System Shutdown** or **Total System Shutdown** as further explained in **OC7**.
System Separation	A situation where following an **Incident** parts of the **Transmission System** are out of **Synchronism** with each other.
Target Frequency	That **Frequency** determined by **OETC** as the desired **Frequency** of the **Total System**. This will normally be 50.00 **Hz** plus or minus 0.05 **Hz** except in exceptional circumstances as determined by **OETC**.

Term	Meaning
Temporary Compliance Certificate	Is a document issued by **OETC** to a **User** indicating that the **User**'s installation is **Grid Code** compliant (or is compliant with the **Grid Code** as derogated) except for certain matters which have not yet been tested.
Tertiary Reserve	A component of the **Operating Reserve** (as further explained in **OC** 3) and which is used to replace **Secondary Reserves** following a **Frequency** change event on the **Total System**. Such reserve could be made **Available** as a result of a **Notice to Synchronise Plant**.
Test Document	Has the meaning ascribed in **OC** 9.4
Test Panel	Has the meaning ascribed in **OC** 9.4
Test Request	Has the meaning ascribed in **OC**9.4
Total System	The entire **Interconnected** electricity **Systems** of **Licensees** in Oman, including all **Production Facilities** and all **Transmission Systems** and **Distribution Systems**, as the same may be developed or modified from time to time and includes any such **System** which **Interconnects** with any **System** which is outside Oman.
Total System Shutdown	The situation when all **Generation Connected** to the **Total System** has ceased and the **Total System** has ceased to function.
Transmission	Means, in relation to electricity, the transport of electricity by means of a **Transmission System**; and **Transmit** shall be construed accordingly.
Transmission (& Dispatch) Licence	A licence to **Transmit** and /or **Dispatch** electricity.
Transmission Security Standard	The standards as set down in the Condition 28 of the **Transmission Licence** and to which the **Transmission System** will be developed, **Operated** and maintained.

Term	Meaning
Transmission System	A **System** for the transport of electricity, which **System** consists (wholly or mainly) of **High Voltage Electric Lines** and **Electric Plant** (namely, **Electric Lines** and **Electric Plant** with a nominal voltage equal to or greater than 132**kV**) and which is used for transporting electricity from a **Production Facility** to a sub-station, from one **Production Facility** to another, from one sub-station to another or to or from any **Interconnector**, **Premises**, or **Distribution System** and any electric **Plant** used for the purposes of **Dispatch** (For the avoidance of doubt: in the case of **Bulk Supply Points**, the **Transmission System** ends at the location where the lower voltage supplies enter the **Distribution** switchboard or other first **Distribution** equipment, and in the case of a **Directly Connected Customer**, the **ECA** and the **Ownership and Control Diagram** indicate the limits of the **Transmission System)**.
Transmission System Outage Plan	The **Outage Schedule** for the **Operational Year** produced by **OETC** in accordance with the provisions of **OC** 2 regarding **Outage**s of **Plant** and/or **Electric Lines** of the **Transmission System**.
Transmission Use of System Charges	Charges made by **OETC** for the use of the **Transmission System** determined in accordance with the **Transmission Licence**.
OETC Site	Has the meaning ascribed in **OC** 8.4.
Turbine Speed Controller	Any control device that is provided to govern the turbine output according to set values (speed control, power control, extraction flow control, temperature limitation control, etc.).
Unconstrained Schedule	A **Generation Schedule** and **Desalination Schedule** produced by **OETC** that does not take account of any limits on the **Total System** imposed by the **Transmission System** and as described in **SDC** 1.4.9.
User	A term used to refer to **Persons** using the **Transmission System** including all **Power Producer**s having **Centrally Dispatched Generating Units**, all **Internally Interconnected Parties** and **International Interconnected Parties Connected** to the **Transmission System**, **Licensed Distributors** and all **Directly Connected Consumers**. In some instances, this term means any **Person** to whom the **Grid Code** applies.
User Site	Has the meaning ascribed in **OC** 8.4.
Voltage Control	The process of regulation of **System** voltages to maintain them within specified limits.

Term	Meaning
Warm	When referring to a **Generating Unit**, it means a **Generating Unit** that has been shut down for more than eight (8) hours but not more than forty-eight (48) hours if the **Generating Unit** is in combined cycle configuration and more than two (2) hours but not more than twenty four (24) hours after such **Generating Unit** has been shut down if the **Generating Unit** is in open cycle configuration.
Water Capacity	The maximum amount of water produced.
Water Connection Agreement	(In abbreviated reference, **Connection Agreement)** an agreement between **OETC** and a **System User** to provide principally for: • the **Connection** of a **User**'s **System** to the Water **Transmission or distribution System ;** and to record the mechanism relating to the payment of **Connection** fees.
Water Delivery Point	The point at the boundary of the **Production Facility** at which **Desalinated** water is delivered in accordance with **PWPAs** and by reference to which the **Desalinated** water flow is measured.
Water Meter	A device for measuring and recording water quantities.
Water Meter Owner	Refer to **Meter Owner.**
Water Meter Registration System	The central database operated and maintained by the **PWP** for the purposes of registering all **Water Metering** systems.
Water Metering System	The group of equipment including meters, time switches, initiating devices, protection and isolation equipment including alarms, circuitry, associated data storage and data communications equipment that are part of the water quantity measuring equipment at or relating to a connection site.
Water Metering Systems Review Panel	A committee set up with responsibility of reviewing the **Water Metering System.**
Water Output	Amount of water produced from a production facility
Water Plant	A facility/process set up to specifically produce water. **Water Production** shall be construed accordingly.
Wind Farm Power Production Facility (WFPPF)	Means a collection of one or more **Wind Turbine Generating Units**: owned and/or operated by the same **Power producer**, and joined together by a **System,** and having a single **Connection Point** to the **Transmission System** or the **Distribution System**.

Term	Meaning
Wind Turbine Generating Unit	Comprises one or more wind turbine generators that are controlled together and including all **Plant** and apparatus and any step up transformer which relates exclusively to the operation of those wind turbine generators.
Winter Downtime	In respect of a **Centrally Dispatched Generating Unit** or **Desalination Unit**, those hours of the **Winter Period** where the **Availability** of the respective **Centrally Dispatched Generating Unit** or **Desalination Unit** is not affected by an **Outage** and for which no **Dispatch Instruction** will be given nor **Capacity** payments will be made.
Winter Period	The period commencing 00:00 on 1 October in a Gregorian calendar year and ending at 24:00 on 31 March in the following Gregorian calendar year.