# PLANNING CODE (PC)

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PC.1 INTRODUCTION

PC.1.1 The Planning Code ("PC") specifies the technical and design criteria and procedures to be applied by The Company in the planning and development of the National Electricity Transmission System and to be taken into account by Users in the planning and development of their own Systems. In the case of OTSUA, the PC also specifies the technical and design criteria and procedures to be applied by the User in the planning and development of the OTSUA. It details information to be supplied by Users to The Company, and certain information to be supplied by The Company to Users. In Scotland and Offshore, The Company has obligations under the STC to inform Relevant Transmission Licensees of data required for the planning of the National Electricity Transmission System. In respect of PC data, The Company may pass on User data to a Relevant Transmission Licensee, as detailed in PC.3.4 and PC.3.5.

PC.1.1A Provisions of the PC which apply in relation to OTSDUW and OTSUA shall apply up to the OTSUA Transfer Time, whereupon such provisions shall (without prejudice to any prior non-compliance) cease to apply, without prejudice to the continuing application of provisions of the PC applying in relation to the relevant Offshore Transmission System and/or Connection Site.

PC.1.1B As used in the PC:

(a) National Electricity Transmission System excludes OTSDUW Plant and Apparatus (prior to the OTSUA Transfer Time) unless the context otherwise requires;

(b) and User Development includes OTSDUW unless the context otherwise requires.

PC.1.2 The Users referred to above are defined, for the purpose of the PC, in PC.3.1.

PC.1.3 Development of the National Electricity Transmission System, involving its reinforcement or extension, will arise for a number of reasons including, but not limited to:

(a) a development on a User System already connected to the National Electricity Transmission System;

(b) the introduction of a new Connection Site or the Modification of an existing Connection Site between a User System and the National Electricity Transmission System;

(c) the cumulative effect of a number of such developments referred to in (a) and (b) by one or more Users.

PC.1.4 Accordingly, the reinforcement or extension of the National Electricity Transmission System may involve work:

(a) at a substation at a Connection Site where User's Plant and/or Apparatus is connected to the National Electricity Transmission System (or in the case of OTSDUW, at a substation at an Interface Point);

(b) on transmission lines or other facilities which join that Connection Site (or in the case of OTSDUW, Interface Point) to the remainder of the National Electricity Transmission System;

(c) on transmission lines or other facilities at or between points remote from that Connection Site (or in the case of OTSDUW, Interface Point).

PC.1.5 The time required for the planning and development of the National Electricity Transmission System will depend on the type and extent of the necessary reinforcement and/or extension work, the need or otherwise for statutory planning consent, the associated possibility of the need for a public inquiry and the degree of complexity in undertaking the new work while maintaining satisfactory security and quality of supply on the existing National Electricity Transmission System.
For the avoidance of doubt and the purposes of the Grid Code, DC Connected Power Park Modules are treated as belonging to Generators. Generators who own DC Connected Power Park Modules would therefore be expected to supply the same data as required under this PC in respect of Power Stations comprising Power Park Modules other than where specific references to DC Connected Power Park Modules are made.

**PC.2 **

**OBJECTIVE**

The objectives of the PC are:

(a) to promote The Company/User interaction in respect of any proposed development on the User System which may impact on the performance of the National Electricity Transmission System or the direct connection with the National Electricity Transmission System;

(b) to provide for the supply of information to The Company from Users in order that planning and development of the National Electricity Transmission System can be undertaken in accordance with the relevant Licence Standards, to facilitate existing and proposed connections, and also to provide for the supply of certain information from The Company to Users in relation to short circuit current contributions and OTSUA;

(c) to specify the Licence Standards which will be used in the planning and development of the National Electricity Transmission System; and

(d) to provide for the supply of information required by The Company from Users in respect of the following to enable The Company to carry out its duties under the Act and the Transmission Licence:

   - Mothballed Generating Units, Mothballed Power Generating Modules, and
   - capability of gas-fired Synchronous Power Generating Modules or Generating Units to run using alternative fuels.

The Company will use the information provided under PC.2.1(d) in providing reports to the Authority and the Secretary of State and, where directed by the Authority or the Secretary of State to do so, The Company may publish the information. Where it is known by The Company that such information is intended for wider publication the information provided under PC.2.1(d) shall be aggregated such that individual data items should not be identifiable.

(e) in the case of OTSUA:

   - to specify the minimum technical and design criteria and procedures to be applied by Users in the planning and development of OTSUA; and thereby
   - to ensure that the OTSUA can from the OTSUA Transfer Time be operated as part of the National Electricity Transmission System; and
   - to provide for the arrangements and supply of information and data between The Company and a User to ensure that the User is able to undertake OTSDUW; and
   - to promote The Company/User interaction and co-ordination in respect of any proposed development on the National Electricity Transmission System or the OTSUA, which may impact on the OTSUA or (as the case may be) the National Electricity Transmission System.

**PC.3 **

**SCOPE**

The PC applies to The Company and to Users, which in the PC means:

(a) Generators;

(b) Generators undertaking OTSDUW;

(c) Network Operators;

(d) Non-Embedded Customers;
(e) DC Converter Station owners; and

(f) HVDC System Owners

The above categories of User will become bound by the PC prior to them generating, operating, or consuming or importing/exporting, as the case may be, and references to the various categories (or to the general category) of User should, therefore, be taken as referring to them in that prospective role as well as to Users actually connected.

PC.3.2 In the case of Embedded Power Stations, Embedded DC Converter Stations and Embedded HVDC Systems, unless provided otherwise, the following provisions apply with regard to the provision of data under this PC:

(a) each Generator shall provide the data direct to The Company in respect of (i) Embedded Large Power Stations, (ii) Embedded Medium Power Stations subject to a Bilateral Agreement and (iii) Embedded Small Power Stations which form part of a Cascade Hydro Scheme;

(b) each DC Converter owner or HVDC System Owner shall provide the data direct to The Company in respect of Embedded DC Converter Stations and Embedded HVDC Systems subject to a Bilateral Agreement;

(c) each Network Operator shall provide the data to The Company in respect of each Embedded Medium Power Station not subject to a Bilateral Agreement or Embedded DC Converter Station not subject to a Bilateral Agreement or Embedded HVDC System not subject to a Bilateral Agreement connected, or proposed to be connected within such Network Operator’s System;

(d) although data is not normally required specifically on Embedded Small Power Stations or on Embedded installations of direct current converters which do not form a DC Converter Station or HVDC System under this PC, each Network Operator in whose System they are Embedded should provide the data (contained in the Appendix) to The Company in respect of Embedded Small Power Stations or Embedded installations of direct current converters which do not form a DC Converter Station or Embedded installations of HVDC Systems if:

(i) it falls to be supplied pursuant to the application for a CUSC Contract or in the Statement of Readiness to be supplied in connection with a Bilateral Agreement and/or Construction Agreement, by the Network Operator; or

(ii) it is specifically requested by The Company in the circumstances provided for under this PC.

PC.3.3 Certain data does not normally need to be provided in respect of certain Embedded Power Stations, Embedded DC Converter Stations or Embedded HVDC Systems, as provided in PC.A.1.12.

In summary, Network Operators are required to supply the following data in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement or Embedded DC Converter Stations not subject to a Bilateral Agreement or Embedded HVDC Systems not subject to a Bilateral Agreement connected, or is proposed to be connected, within such Network Operator’s System:

PC.A.2.1.1
PC.A.2.2.2
PC.A.2.5.5.2
PC.A.2.5.5.7
PC.A.2.5.6
PC.A.3.1.5
PC.A.3.2.2
PC.A.3.3.1
For the avoidance of doubt Network Operators are required to supply the above data in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems not subject to a Bilateral Agreement which are located Offshore and which are connected or proposed to be connected within such Network Operator’s System. This is because Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems not subject to a Bilateral Agreement are treated as Onshore Generators or Onshore DC Converter Station owners or HVDC System Owners connected to an Onshore User System Entry Point.

The Company may provide to the Relevant Transmission Licensees any data which has been submitted to The Company by any Users pursuant to the following paragraphs of the PC. For the avoidance of doubt, The Company will not provide to the Relevant Transmission Licensees, the types of data specified in Appendix D. The Relevant Transmission Licensees’ use of such data is detailed in the STC.

(and in addition in respect of the data submitted in respect of the OTSUA)
In addition to the provisions of PC.3.4 The Company may provide to the Relevant Transmission Licensees any data which has been submitted to The Company by any Users in respect of Relevant Units pursuant to the following paragraphs of the PC.

In the case of Offshore Embedded Power Stations connected to an Offshore User System which directly connects to an Offshore Transmission System, any additional data requirements in respect of such Offshore Embedded Power Stations may be specified in the relevant Bilateral Agreement with the Network Operator or in any Bilateral Agreement between The Company and such Offshore Embedded Power Station.

In the case of a Generator undertaking OTSDUW connecting to an Onshore Network Operator's System, any additional requirements in respect of such OTSDUW Plant and Apparatus will be specified in the relevant Bilateral Agreement with the Generator. For the avoidance of doubt, requirements applicable to Generators undertaking OTSDUW and connecting to a Network Operator's User System, shall be consistent with those applicable requirements of Generators undertaking OTSDUW and connecting to a Transmission Interface Point.

Pursuant to Condition C11 of The Company's Transmission Licence, the means by which Users and proposed Users of the National Electricity Transmission System are able to assess opportunities for connecting to, and using, the National Electricity Transmission System comprise two distinct parts, namely:
(a) a statement, prepared by The Company under its Transmission Licence, showing for each of the seven succeeding Financial Years, the opportunities available for connecting to and using the National Electricity Transmission System and indicating those parts of the National Electricity Transmission System most suited to new connections and transport of further quantities of electricity (the "Seven Year Statement"); and

(b) an offer, in accordance with its Transmission Licence, by The Company to enter into a CUSC Contract. A Bilateral Agreement is to be entered into for every Connection Site (and for certain Embedded Power Stations and Embedded DC Converter Stations and Embedded HVDC Systems) within the first two of the following categories and the existing Bilateral Agreement may be required to be varied in the case of the third category:

(i) existing Connection Sites (and for certain Embedded Power Stations) as at the Transfer Date;

(ii) new Connection Sites (and for certain Embedded Power Stations, Embedded DC Converter Stations and Embedded HVDC Systems) with effect from the Transfer Date;

(iii) a Modification at a Connection Site (or in relation to the connection of certain Embedded Power Stations, Embedded DC Converter Stations and Embedded HVDC Systems whether or not the subject of a Bilateral Agreement) (whether such Connection Site or connection exists on the Transfer Date or is new thereafter) with effect from the Transfer Date.

In this PC, unless the context otherwise requires, “connection” means any of these 3 categories.

PC.4.2 Introduction to Data

User Data

PC.4.2.1 Under the PC, two types of data to be supplied by Users are called for:

(a) Standard Planning Data; and

(b) Detailed Planning Data,

as more particularly provided in PC.A.1.4.

PC.4.2.2 The PC recognises that these two types of data, namely Standard Planning Data and Detailed Planning Data, are considered at three different levels:

(a) Preliminary Project Planning Data;

(b) Committed Project Planning Data; and

(c) Connected Planning Data,

as more particularly provided in PC.5

PC.4.2.3 Connected Planning Data is itself divided into:

(a) Forecast Data;

(b) Registered Data; and

(c) Estimated Registered Data,

as more particularly provided in PC.5.5
Clearly, an existing User proposing a new Connection Site (or Embedded Power Station or Embedded DC Converter Station or Embedded HVDC System) in the circumstances outlined in PC.4.1) will need to supply data both in an application for a Bilateral Agreement and under the PC in relation to that proposed new Connection Site (or Embedded Power Station or Embedded DC Converter Station or Embedded HVDC System in the circumstances outlined in PC.4.1) and that will be treated as Preliminary Project Planning Data or Committed Project Planning Data (as the case may be), but the data it supplies under the PC relating to its existing Connection Sites will be treated as Connected Planning Data.  

Network Data  

In addition, there is Network Data supplied by The Company in relation to short circuit current contributions and in relation to OTSUA.  

Data Provision  

Seven Year Statement  

To enable the Seven Year Statement to be prepared, each User is required to submit to The Company (subject to the provisions relating to Embedded Power Stations and Embedded DC Converter Stations and Embedded HVDC Systems in PC.3.2) both the Standard Planning Data and the Detailed Planning Data as listed in parts 1 and 2 of the Appendix. This data should be submitted in calendar week 24 of each year (although Network Operators may delay the submission of data (other than that to be submitted pursuant to PC.3.2(c) and PC.3.2(d)) until calendar week 28) and should cover each of the seven succeeding Financial Years (and in certain instances, the current year). 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, instead of re-submitting the data, a User may submit a written statement that there has been no change from the data (or in some of the data) submitted the previous time. In addition, The Company will also use the Transmission Entry Capacity and Connection Entry Capacity data from the CUSC Contract, and any data submitted by Network Operators in relation to an Embedded Medium Power Station not subject to a Bilateral Agreement or Embedded DC Converter Station not subject to a Bilateral Agreement, or Embedded HVDC System not subject to a Bilateral Agreement in the preparation of the Seven Year Statement and to that extent the data will not be treated as confidential.  

Network Data  

To enable Users to model the National Electricity Transmission System in relation to short circuit current contributions, The Company is required to submit to Users the Network Data as listed in Part 3 of the Appendix. The data will be submitted in week 42 of each year and will cover that Financial Year.  

Network Data  

To enable Users to model the National Electricity Transmission System in relation to OTSUA, The Company is required to submit to Users the Network Data as listed in Part 3 of Appendix A and Appendix F. The Company shall provide the Network Data with the offer of a CUSC Contract in the case of the data in PC F2.1 and otherwise in accordance with the OTSDUW Development and Data Timetable.  

Offer of Terms for Connection  

CUSC Contract – Data Requirements/Offer Timing  

The completed application form for a CUSC Contract to be submitted by a User when making an application for a CUSC Contract will include:  

(a) a description of the Plant and/or Apparatus (excluding OTSDUW Plant and Apparatus) to be connected to the National Electricity Transmission System or of the Modification relating to the User’s Plant and/or Apparatus (and prior to the OTSUA Transfer Time, any OTSUA) already connected to the National Electricity Transmission System or, as the case may be, of the proposed new connection or Modification to the connection within the User System of the User, each of which shall be termed a “User Development” in the PC.
(b) the relevant **Standard Planning Data** as listed in Part 1 of the Appendix (except in respect of any OTSUA); and

(c) the desired **Completion Date** of the proposed **User Development**.

(d) the desired **Connection Entry Capacity** and **Transmission Entry Capacity**.

The completed application form for a **CUSC Contract** will be sent to **The Company** as more particularly provided in the application form.

**PC.4.4.2**

Any offer of a **CUSC Contract** will provide that it must be accepted by the applicant **User** within the period stated in the offer, after which the offer automatically lapses. Except as provided in the **CUSC Contract**, acceptance of the offer renders the **National Electricity Transmission System** works relating to that **User Development**, reflected in the offer, committed and binds both parties to the terms of the offer. The User shall then provide the **Detailed Planning Data** as listed in Part 2 of the Appendix (and in the case of OTSUA the **Standard Planning Data** as listed in Part 1 of Appendix A within the timeline provided in PC.A.1.4). In respect of DPD I this shall generally be provided within 28 days (or such shorter period as **The Company** may determine, or such longer period as **The Company** may agree, in any particular case) of acceptance of the offer and in respect of DPD II this shall generally be provided at least two years (or such longer period as **The Company** may determine, or such shorter period as **The Company** may agree, in any particular case or in the case of OTSUA such shorter period as **The Company** shall require) prior to the **Completion Date** of the **User Development**.

**PC.4.4.3**

**Embedded Development Agreement - Data Requirements**

The **Network Operator** shall submit the following data in relation to an **Embedded Medium Power Station** not subject to, or proposed to be subject to, a **Bilateral Agreement** or **Embedded DC Converter Station** not subject to, or proposed to be subject to, a **Bilateral Agreement** as soon as reasonably practicable after receipt of an application from an **Embedded Person** to connect to its **System**:

(a) details of the proposed new connection or variation (having a similar effect on the **Network Operator's System** as a **Modification** would have on the **National Electricity Transmission System**) to the connection within the **Network Operator's System**, each of which shall be termed an **"Embedded Development"** in the **PC** (where a **User Development** has an impact on the Network Operator's System details shall be supplied in accordance with PC.4.4 and PC.4.5);

(b) the relevant **Standard Planning Data** as listed in Part 1 of the Appendix;

(c) the proposed completion date (having a similar meaning in relation to the **Network Operator's System** as **Completion Date** would have in relation to the **National Electricity Transmission System**) of the **Embedded Development**; and

(d) upon the request of **The Company**, the relevant **Detailed Planning Data** as listed in Part 2 of the Appendix.

**PC.4.4.4**

The **Network Operator** shall provide the **Detailed Planning Data** as listed in Part 2 of the Appendix. In respect of DPD I this shall generally be provided within 28 days (or such shorter period as **The Company** may determine, or such longer period as **The Company** may agree, in any particular case) of entry into the **Embedded Development Agreement** and in respect to DPD II this shall generally be provided at least two years (or such longer period as **The Company** may determine, or such shorter period as **The Company** may agree, in any particular case) prior to the **Completion Date** of the **Embedded Development**.

**PC.4.5**

**Complex Connections**
PC.4.5.1 The magnitude and complexity of any National Electricity Transmission System extension or reinforcement will vary according to the nature, location and timing of the proposed User Development which is the subject of the application and it may, in the event, be necessary for The Company to carry out additional more extensive system studies to evaluate more fully the impact of the proposed User Development on the National Electricity Transmission System. Where The Company judges that such additional more detailed studies are necessary the offer may indicate the areas that require more detailed analysis and before such additional studies are required, the User shall indicate whether it wishes The Company to undertake the work necessary to proceed to make a revised offer within the 3 month period normally allowed or, where relevant, the timescale consented to by the Authority.

PC.4.5.2 To enable The Company to carry out any of the above mentioned necessary detailed system studies, the User may, at the request of The Company, be required to provide some or all of the Detailed Planning Data listed in part 2 of the Appendix in advance of the normal timescale referred in PC.4.4.2 provided that The Company can reasonably demonstrate that it is relevant and necessary.

PC.4.5.3 To enable The Company to carry out any necessary detailed system studies, the relevant Network Operator may, at the request of The Company, be required to provide some or all of the Detailed Planning Data listed in Part 2 of the Appendix in advance of the normal timescale referred in PC.4.4.4 provided that The Company can reasonably demonstrate that it is relevant and necessary.

PC.5 PLANNING DATA

PC.5.1 As far as the PC is concerned, there are three relevant levels of data in relation to Users. These levels, which relate to levels of confidentiality, commitment and validation, are described in the following paragraphs.

Preliminary Project Planning Data

PC.5.2 At the time the User applies for a CUSC Contract but before 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. Data relating to an Embedded Development provided by a Network Operator in accordance with PC.4.4.3, and PC.4.4.4 if requested, will be considered as Preliminary Project Planning Data. All such data will be treated as confidential within the scope of the provisions relating to confidentiality in the CUSC.

PC.5.3 Preliminary Project Planning Data will normally only contain the Standard Planning Data unless the Detailed Planning Data is required in advance of the normal timescale to enable The Company to carry out additional detailed system studies as described in PC.4.5.

Committed Project Planning Data

PC.5.4 Once the offer for a CUSC Contract is accepted, the data relating to the User Development already submitted as Preliminary Project Planning Data, and subsequent data required by The Company under this PC, will become Committed Project Planning Data. Once an Embedded Person has entered into an Embedded Development Agreement, as notified to The Company by the Network Operator, the data relating to the Embedded Development already submitted as Preliminary Project Planning Data, and subsequent data required by The Company under the PC, will become Committed Project Planning Data. Such data, together with Connection Entry Capacity and Transmission Entry Capacity data from the CUSC Contract and other data held by The Company relating to the National Electricity Transmission System will form the background against which new applications by any User will be considered and against which planning of the National Electricity Transmission System will be undertaken. Accordingly, Committed Project Planning Data, Connection Entry Capacity and Transmission Entry Capacity data will not be treated as confidential to the extent that The Company:

(a) is obliged to use it in the preparation of the Seven Year Statement and in any further information given pursuant to the Seven Year Statement;
(b) is obliged to use it when considering and/or advising on applications (or possible applications) of other Users (including making use of it by giving data from it, both orally and in writing, to other Users making an application (or considering or discussing a possible application) which is, in The Company's view, relevant to that other application or possible application);

(c) is obliged to use it for operational planning purposes;

(d) is obliged under the terms of an Interconnection Agreement to pass it on as part of system information on the Total System;

(e) is obliged to disclose it under the STC;

(f) is obliged to use and disclose it in the preparation of the Offshore Development Information Statement;

(g) is obliged to use it in order to carry out its EMR Functions or is obliged to disclose it under an EMR Document.

To reflect different types of data, Preliminary Project Planning Data and Committed Project Planning Data are themselves divided into:

(a) those items of Standard Planning Data and Detailed Planning Data which will always be forecast, known as Forecast Data; and

(b) those items of Standard Planning Data and Detailed Planning Data which relate to Plant and/or Apparatus which upon connection will become Registered Data, but which prior to connection, for the seven succeeding Financial Years, will be an estimate of what is expected, known as Estimated Registered Data.

Connected Planning Data

The PC requires that, at the time that a Statement of Readiness is submitted under the Bilateral Agreement and/or Construction Agreement, any estimated values assumed for planning purposes are confirmed or, where practical, replaced by validated actual values and by updated estimates for the future and by updated forecasts for forecast data items such as Demand. In the case of an Embedded Development the relevant Network Operator will update any estimated values assumed for planning purposes with validated actual values as soon as reasonably practicable after energisation. This data is then termed Connected Planning Data.

To reflect the three types of data referred to above, Connected Planning Data is itself divided into:

(a) those items of Standard Planning Data and Detailed Planning Data which will always be forecast data, known as Forecast Data; and

(b) those items of Standard Planning Data and Detailed Planning Data which upon connection become fixed (subject to any subsequent changes), known as Registered Data; and

(c) those items of Standard Planning Data and Detailed Planning Data which for the purposes of the Plant and/or Apparatus concerned as at the date of submission are Registered Data but which for the seven succeeding Financial Years will be an estimate of what is expected, known as Estimated Registered Data,

as more particularly provided in the Appendix.

Connected Planning Data, together with Connection Entry Capacity and Transmission Entry Capacity data from the CUSC Contract, and other data held by The Company relating to the National Electricity Transmission System, will form the background against which new applications by any User will be considered and against which planning of the National Electricity Transmission System will be undertaken. Accordingly, Connected Planning Data, Connection Entry Capacity and Transmission Entry Capacity data will not be treated as confidential to the extent that The Company:
(a) is obliged to use it in the preparation of the **Seven Year Statement** and in any further information given pursuant to the **Seven Year Statement**;

(b) is obliged to use it when considering and/or advising on applications (or possible applications) of other **Users** (including making use of it by giving data from it, both orally and in writing, to other **Users** making an application (or considering or discussing a possible application) which is, in **The Company's** view, relevant to that other application or possible application);

(c) is obliged to use it for operational planning purposes;

(d) is obliged under the terms of an **Interconnection Agreement** to pass it on as part of system information on the **Total System**.

(e) is obliged to disclose it under the **STC**;

(f) is obliged to use it in order to carry out its **EMR Functions** or is obliged to disclose it under an **EMR Document**.

PC.5.7 **Committed Project Planning Data** and **Connected Planning Data** will each contain both **Standard Planning Data** and **Detailed Planning Data**.
PLANNING STANDARDS

PC.6.1 The Company shall apply the Licence Standards relevant to planning and development, in the planning and development of its Transmission System. The Company shall procure that each Relevant Transmission Licensee shall apply the Licence Standards relevant to planning and development, in the planning and development of the Transmission System of each Relevant Transmission Licensee and that a User shall apply the Licence Standards relevant to planning and development, in the planning and development of the OTSUA.

PC.6.2 In relation to Scotland, Appendix C lists the technical and design criteria applied in the planning and development of each Relevant Transmission Licensee’s Transmission System. The criteria are subject to review in accordance with each Relevant Transmission Licensee’s Transmission Licence conditions. Copies of these documents are available from The Company on request. The Company will charge an amount sufficient to recover its reasonable costs incurred in providing this service.

PC.6.3 In relation to Offshore, Appendix E lists the technical and design criteria applied in the planning and development of each Offshore Transmission System. The criteria are subject to review in accordance with each Offshore Transmission Licensee’s Transmission Licence conditions. Copies of these documents are available from The Company on request. The Company will charge an amount sufficient to recover its reasonable costs incurred in providing this service.

PC.6.4 In planning and developing the OTSUA, the User shall comply with (and shall ensure that (as at the OTSUA Transfer Time) the OTSUA comply with):
(a) the Licence Standards; and
(b) the technical and design criteria in Appendix E.

PC.6.5 In addition the User shall, in the planning and development of the OTSUA, to the extent it is reasonable and practicable to do so, take into account the reasonable requests of The Company (in the context of its obligation to develop an efficient, co-ordinated and economical system) relating to the planning and development of the National Electricity Transmission System.

PC.6.6 In planning and developing the OTSUA the User shall take into account the Network Data provided to it by The Company under Part 3 of Appendix A and Appendix F, and act on the basis that the Plant and Apparatus of other Users complies with:
(a) the minimum technical design and operational criteria and performance requirements set out in either CC.6.1, CC.6.2, CC.6.3 and CC.6.4 or ECC.6.1, ECC.6.2, ECC.6.3 and ECC.6.4; or
(b) such other criteria or requirements as The Company may from time to time notify the User are applicable to specified Plant and Apparatus pursuant to PC.6.7.

PC.6.7 Where the OTSUA are likely to be materially affected by the design or operation of another User’s Plant and Apparatus and The Company:
(a) becomes aware that such other User has or is likely to apply for a derogation under the Grid Code;
(b) is itself applying for a derogation under the Grid Code in relation to the Connection Site on which such other User’s Plant and Apparatus is located or to which it otherwise relates; or
(c) is otherwise notified by such other User that specified Plant or Apparatus is normally capable of operating at levels better than those set out in CC.6.1, CC.6.2, CC.6.3 and CC.6.4 or ECC.6.1, ECC.6.2, ECC.6.3 and ECC.6.4,

The Company shall notify the User.
PC.7    PLANNING LIAISON

PC.7.1    This PC.7 applies to The Company and Users, which in PC.7 means

(a)    Network Operators

(b)    Non-Embedded Customers

PC.7.2    As described in PC.2.1 (b) an objective of the PC is to provide for the supply of information to The Company by Users in order that planning and development of the National Electricity Transmission System can be undertaken in accordance with the relevant Licence Standards.

PC.7.3    Grid Code amendment B/07 (“Amendment B/07”) implemented changes to the Grid Code which included amendments to the datasets provided by both The Company and Users to inform the planning and development of the National Electricity Transmission System. The Authority has determined that these changes are to have a phased implementation. Consequently the provisions of Appendix A to the PC include specific years (ranging from 2009 to 2011) with effect from which certain of the specific additional obligations brought about by Amendment B/07 on The Company and Users are to take effect. Where specific provisions of paragraphs PC.A.4.1.4, PC.A.4.2.2 and PC.A.4.3.1 make reference to a year, then the obligation on The Company and the Users shall be required to be met by the relevant calendar week (as specified within such provision) in such year.

In addition to the phased implementation of aspects of Amendment B/07, Users must discuss and agree with The Company by no later than 31 March 2009 a more detailed implementation programme to facilitate the implementation of Grid Code amendment B/07.

It shall also be noted by The Company and Users that the dates set out in PC.A.4 are intended to be minimum requirements and are not intended to restrict a User and The Company from the earlier fulfilment of the new requirements prior to the specified years. Where The Company and a User wish to follow the new requirements from earlier dates than those specified, this will be set out in the more detailed implementation programme agreed between The Company and the User.

The following provisions of PC.7 shall only apply with effect from 1 January 2011.

PC.7.4    Following the submission of data by a User in or after week 24 of each year The Company will provide information to Users by calendar week 6 of the following year regarding the results of any relevant assessment that has been made by The Company based upon such data submissions to verify whether Connection Points are compliant with the relevant Licence Standards.

PC.7.5    Where the result of any assessment identifies possible future non-compliance with the relevant Licence Standards, The Company shall notify the relevant User(s) of this fact as soon as reasonably practicable and shall agree with Users any opportunity to resubmit data to allow for a reassessment in accordance with PC.7.6.

PC.7.6    Following any notification by The Company to a User pursuant to PC.7.5 and following any further discussions held between the User and The Company:

(i)    The Company and the User may agree revisions to the Access Periods for relevant Transmission Interface Circuits, such revisions shall not however permit an Access Period to be less than 4 continuous weeks in duration or to occur other than between calendar weeks 10 and 43 (inclusive); and/or,

(ii)   The User shall as soon as reasonably practicable

(a)    submit further relevant data to The Company that is to The Company’s reasonable satisfaction; and/or,

(b)    modify data previously submitted pursuant to this PC, such modified data to be to The Company’s reasonable satisfaction; and/or

(c)    notify The Company that it is the intention of the User to leave the data as originally submitted to The Company to stand as its submission.
PC.7.7 Where an Access Period is amended pursuant to PC.7.6 (i) The Company shall notify The Authority that it has been necessary to do so.

PC.7.8 When it is agreed that any resubmission of data is unlikely to confirm future compliance with the relevant Licence Standards the Modification process in the CUSC may apply.

PC.7.9 A User may at any time, in writing, request further specified National Electricity Transmission System network data in order to provide The Company with viable User network data (as required under this PC). Upon receipt of such request The Company shall consider, and where appropriate provide such National Electricity Transmission System network data to the User as soon as reasonably practicable following the request.

PC.8 OTSDUW PLANNING LIAISON

PC.8.1 This PC.8 applies to The Company and Users, which in PC.8 means Users undertaking OTSDUW.

PC.8.2 As described in PC.2.1 (e) an objective of the PC is to provide for the supply of information between The Company and a User undertaking OTSDUW in order that planning and development of the National Electricity Transmission System can be co-ordinated.

PC.8.3 Where the OTSUA also require works to be undertaken by The Company and/or any Relevant Transmission Licensee on its Transmission System The Company and the User shall throughout the construction and commissioning of such works:

(a) co-operate and assist each other in the development of co-ordinated construction programmes or any other planning or, in the case of The Company, analysis it undertakes in respect of the works; and

(b) provide to each other all information relating to its own works (and in the case of The Company the works on other Transmission Systems) reasonably necessary to assist each other in the performance of that other's part of the works, and shall use all reasonable endeavours to co-ordinate and integrate their respective part of the works; and

the User shall plan and develop the OTSUA, taking into account to the extent that it is reasonable and practicable to do so the reasonable requests of The Company relating to the planning and development of the National Electricity Transmission System.

PC.8.4 Where The Company becomes aware that changes made to the investment plans of The Company and any Relevant Transmission Licensee may have a material effect on the OTSUA, The Company shall notify the User and provide the User with the necessary information about the relevant Transmission Systems sufficient for the User to assess the impact on the OTSUA.
PC.A.1 INTRODUCTION

PC.A.1.1 The Appendix specifies data requirements to be submitted to The Company by Users, and in certain circumstances to Users by The Company.

PC.A.1.2 Submissions by Users
(a) Planning data submissions by Users shall be:
   (i) with respect to each of the seven succeeding Financial Years (other than in the case of Registered Data which will reflect the current position and data relating to Demand forecasts which relates also to the current year);
   (ii) provided by Users in connection with a CUSC Contract (PC.4.1, PC.4.4 and PC.4.5 refer);
   (iii) provided by Users on a routine annual basis in calendar week 24 of each year to maintain an up-to-date data bank (although Network Operators may delay the submission of data (other than that to be submitted pursuant to PC.3.2(c) and PC.3.2(d)) until calendar week 28). Where from the date of one annual submission to another there is no change in the data (or in some of the data) to be submitted, instead of re-submitting the data, a User may submit a written statement that there has been no change from the data (or some of the data) submitted the previous time; and
   (iv) provided by Network Operators in connection with Embedded Development (PC.4.4 refer).
(b) Where there is any change (or anticipated change) in Committed Project Planning Data or a significant change in Connected Planning Data in the category of Forecast Data or any change (or anticipated change) in Connected Planning Data in the categories of Registered Data or Estimated Registered Data supplied to The Company under the PC, notwithstanding that the change may subsequently be notified to The Company under the PC as part of the routine annual update of data (or that the change may be a Modification under the CUSC), the User shall, subject to PC.A.3.2.3 and PC.A.3.2.4, notify The Company in writing without delay.
(c) The notification of the change will be in the form required under this PC in relation to the supply of that data and will also contain the following information:
   (i) the time and date at which the change became, or is expected to become, effective;
   (ii) if the change is only temporary, an estimate of the time and date at which the data will revert to the previous registered form.
(d) The routine annual update of data, referred to in (a)(iii) above, need not be submitted in respect of Small Power Stations or Embedded installations of direct current converters which do not form a DC Converter Station or HVDC System (except as provided in PC.3.2(c)), or unless specifically requested by The Company, or unless otherwise specifically provided.

PC.A.1.3 Submissions by The Company
Network Data release by The Company shall be:
(a) with respect to the current Financial Year;
(b) provided by The Company on a routine annual basis in calendar week 42 of each year. Where from the date of one annual submission to another there is no change in the data (or in some of the data) to be released, instead of repeating the data, The Company may release a written statement that there has been no change from the data (or some of the data) released the previous time.

The three parts of the Appendix
The data requirements listed in this Appendix are subdivided into the following four parts:

(a) **Standard Planning Data**

This data (as listed in Part 1 of the Appendix) is first to be provided by a **User** at the time of an application for a **CUSC Contract** or in accordance with PC.4.4.3. It comprises data which is expected normally to be sufficient for **The Company** to investigate the impact on the **National Electricity Transmission System** of any **User Development** or **Embedded Development** associated with an application by the **User** for a **CUSC Contract**. **Users** should note that the term **Standard Planning Data** also includes the information referred to in PC.4.4.1.(a) and PC.4.4.3.(a). In the case of **OTSUA**, this data is first to be provided by a **User** in accordance with the time line in Appendix F.

(b) **Detailed Planning Data**

This data (as listed in Part 2 of the Appendix) includes both **DPD I** and **DPD II** and is to be provided in accordance with PC.4.4.2 and PC.4.4.4. It comprises additional, more detailed, data not normally expected to be required by **The Company** to investigate the impact on the **National Electricity Transmission System** of any **User Development** associated with an application by the **User** for a **CUSC Contract** or **Embedded Development Agreement**. **Users** and **Network Operators** in respect of **Embedded Developments** should note that the term **Detailed Planning Data** also includes **Operation Diagrams** and **Site Common Drawings** produced in accordance with the **CC** and **ECC**.

The **User** may, however, be required by **The Company** to provide the **Detailed Planning Data** in advance of the normal timescale before **The Company** can make an offer for a **CUSC Contract**, as explained in PC.4.5.

(c) **Network Data**

The data requirements for **The Company** in this Appendix are in Part 3.

(d) **Offshore Transmission System (OTSDUW) Data**

**Generators** who are undertaking **OTSDUW** are required to submit data in accordance with Appendix A as summarised in Schedule 18 of the **Data Registration Code**.

**Forecast Data, Registered Data and Estimated Registered Data**

As explained in PC.5.4 and PC.5.5, **Planning Data** is divided into:

(i) those items of **Standard Planning Data** and **Detailed Planning Data** known as **Forecast Data**; and

(ii) those items of **Standard Planning Data** and **Detailed Planning Data** known as **Registered Data**; and

(iii) those items of **Standard Planning Data** and **Detailed Planning Data** known as **Estimated Registered Data**.

The following paragraphs in this Appendix relate to **Forecast Data**:

3.2.2(b), (h), (i) and (j)

4.2.1

4.3.1

4.3.2

4.3.3

4.3.4

4.3.5

4.5
The following paragraphs in this Appendix relate to Registered Data and Estimated Registered Data:

2.2.1
2.2.4
2.2.5
2.2.6
2.3.1
2.4.2
3.2.2(a), (c), (d), (e), (f), (g), (i)(part) and (j)
3.4.1
3.4.2
4.2.3
4.5(a)(i), (a)(iii), (b)(i) and (b)(iii)
4.6
5.3.2
5.4
5.4.2
5.4.3
5.5
5.6.3
6.2
6.3

The data supplied under PC.A.3.3.1, although in the nature of Registered Data, is only supplied either upon application for a CUSC Contract, or in accordance with PC.4.4.3, and therefore does not fall to be Registered Data, but is Estimated Registered Data.

Forecast Data must contain the User’s best forecast of the data being forecast, acting as a reasonable and prudent User in all the circumstances.

Registered Data must contain validated actual values, parameters or other information (as the case may be) which replace the estimated values, parameters or other information (as the case may be) which were given in relation to those data items when they were Preliminary Project Planning Data and Committed Project Planning Data, or in the case of changes, which replace earlier actual values, parameters or other information (as the case may be). Until amended pursuant to the Grid Code, these actual values, parameters or other information (as the case may be) will be the basis upon which the National Electricity Transmission System is planned, designed, built and operated in accordance with, amongst other things, the Transmission Licences, the STC and the Grid Code, and on which The Company therefore relies. In following the processes set out in the BC, The Company will use the data which has been supplied to it under the BC and the data supplied under OC2 in relation to Gensets, but the provision of such data will not alter the data supplied by Users under the PC, which may only be amended as provided in the PC.
PC.A.1.11 Estimated Registered Data must contain the User's best estimate of the values, parameters or other information (as the case may be), acting as a reasonable and prudent User in all the circumstances.

PC.A.1.12 Certain data does not need to be supplied in relation to Embedded Power Stations or Embedded DC Converter Stations or Embedded HVDC Systems where these are connected at a voltage level below the voltage level directly connected to the National Electricity Transmission System except in connection with a CUSC Contract, or unless specifically requested by The Company.

PC.A.1.13 In the case of OTSUA, Schedule 18 of the Data Registration Code shall be construed in such a manner as to achieve the intent of such provisions by reference to the OTSUA and the Interface Point and all Connection Points.
Each User, whether connected directly via an existing Connection Point to the National Electricity Transmission System, or seeking such a direct connection, or providing terms for connection of an Offshore Transmission System to its User System to The Company, shall provide The Company with data on its User System (and any OTSUA) which relates to the Connection Site (and in the case of OTSUA, the Interface Point) and/or which may have a system effect on the performance of the National Electricity Transmission System. Such data, current and forecast, is specified in PC.A.2.2 to PC.A.2.5. In addition each Generator in respect of its Embedded Large Power Stations and its Embedded Medium Power Stations subject to a Bilateral Agreement and each Network Operator in respect of Embedded Medium Power Stations within its System not subject to a Bilateral Agreement connected to the Subtransmission System, shall provide The Company with fault infeed data as specified in PC.A.2.5.5 and each DC Converter owner with Embedded DC Converter Stations subject to a Bilateral Agreement and Embedded HVDC System Owner subject to a Bilateral Agreement, or Network Operator in the case of Embedded DC Converter Stations not subject to a Bilateral Agreement or Embedded HVDC Systems not subject to a Bilateral Agreement, connected to the Subtransmission System shall provide The Company with fault infeed data as specified in PC.A.2.5.6.

Each User must reflect the system effect at the Connection Site(s) of any third party Embedded within its User System whether existing or proposed.

Although not itemised here, each User with an existing or proposed Embedded Small Power Station, Embedded Medium Power Station, Embedded DC Converter Station or HVDC System with a Registered Capacity of less than 100MW or an Embedded installation of direct current converters which does not form a DC Converter Station or HVDC System in its User System may, at The Company's reasonable discretion, be required to provide additional details relating to the User's System between the Connection Site and the existing or proposed Embedded Small Power Station, Embedded Medium Power Station, Embedded DC Converter Station, Embedded HVDC System or Embedded installation of direct current converters which does not form a DC Converter Station or Embedded installation which does not form an HVDC System.

At The Company's reasonable request, additional data on the User's System (or OTSUA) will need to be supplied. Some of the possible reasons for such a request, and the data required, are given in PC.A.6.2, PC.A.6.4, PC.A.6.5 and PC.A.6.6.

Each User shall provide a Single Line Diagram, depicting both its existing and proposed arrangement(s) of load current carrying Apparatus relating to both existing and proposed Connection Points (including in the case of OTSUA, Interface Points).

The Single Line Diagram (three examples are shown in Appendix B) must include all parts of the User System operating at Supergrid Voltage throughout Great Britain and, in Scotland and Offshore, also all parts of the User System operating at 132kV, and those parts of its Subtransmission System at any Transmission Site. In the case of OTSDUW, the Single Line Diagram must also include the OTSUA. In addition, the Single Line Diagram must include all parts of the User's Subtransmission System (and any OTSUA) throughout Great Britain operating at a voltage greater than 50kV, and, in Scotland and Offshore, also all parts of the User's Subtransmission System (and any OTSUA) operating at a voltage greater than 30kV, which, under either intact network or Planned Outage conditions:-

(a) normally interconnects separate Connection Points, or busbars at a Connection Point which are normally run in separate sections; or
(b) connects Embedded Large Power Stations, or Embedded Medium Power Stations, or Embedded DC Converter Stations, or Embedded HVDC Systems or Offshore Transmission Systems connected to the User’s Subtransmission System, to a Connection Point or Interface Point.

At the User’s discretion, the Single Line Diagram can also contain additional details of the User’s Subtransmission System (and any OTSUA) not already included above, and also details of the transformers connecting the User’s Subtransmission System to a lower voltage. With The Company’s agreement, the Single Line Diagram can also contain information about the User’s System (and any OTSUA) at a voltage below the voltage of the Subtransmission System.

The Single Line Diagram for a Power Park Module (including DC Connected Power Park Modules) must include all parts of the System connecting generating equipment to the Grid Entry Point (or User System Entry Point if Embedded). As an alternative the User may choose to submit a Single Line Diagram with the equipment between the equivalent Power Park Unit and the Common Collection Busbar reduced to an electrically equivalent network. The format for a Single Line Diagram for a Power Park Module (including DC Connected Power Park Modules) electrically equivalent system is shown in Appendix B.

The Single Line Diagram must include the points at which Demand data (provided under PC.A.4.3.4 and PC.A.4.3.5, or in the case of Generators, PC.A.5.) and fault infeed data (provided under PC.A.2.5) are supplied.

PC.A.2.2.3 The above mentioned Single Line Diagram shall include:

(a) electrical circuitry (ie. overhead lines, identifying which circuits are on the same towers, underground cables, power transformers, reactive compensation equipment and similar equipment); and

(b) substation names (in full or abbreviated form) with operating voltages.

In addition, for all load current carrying Apparatus operating at Supergrid Voltage throughout Great Britain and, in Scotland and Offshore, also at 132kV, (and any OTSUA) the Single Line Diagram shall include:-

(a) circuit breakers

(b) phasing arrangements.

PC.A.2.2.3.1 For the avoidance of doubt, the Single Line Diagram to be supplied is in addition to the Operation Diagram supplied pursuant to CC.7.4.

PC.A.2.2.4 For each circuit shown on the Single Line Diagram provided under PC.A.2.2.1, each User shall provide the following details relating to that part of its User System and OTSUA:

Circuit Parameters:
Rated voltage (kV)
Operating voltage (kV)
Positive phase sequence reactance
Positive phase sequence resistance
Positive phase sequence susceptance
Zero phase sequence reactance (both self and mutual)
Zero phase sequence resistance (both self and mutual)
Zero phase sequence susceptance (both self and mutual)
In the case of a **Single Line Diagram** for a **Power Park Module** (including **DC Connected Power Park Modules**) electrically equivalent system the data should be on a 100MVA base. Depending on the equivalent system supplied an equivalent tap changer range may need to be supplied. Similarly mutual values, rated voltage and operating voltage may be inappropriate. Additionally in the case of **OTSUA**, seasonal maximum continuous ratings and circuit lengths are to be provided in addition to the data required under PC.A.2.2.4.

PC.A.2.2.5 For each transformer shown on the **Single Line Diagram** provided under PC.A.2.2.1, each **User** (including those undertaking **OTSDUW**) shall provide the following details:

- Rated MVA
- Voltage Ratio
- Winding arrangement
- Positive sequence reactance (max, min and nominal tap)
- Positive sequence resistance (max, min and nominal tap)
- Zero sequence reactance

PC.A.2.2.5.1. In addition, for all interconnecting transformers between the **User’s Supergrid Voltage System** and the **User’s Subtransmission System** throughout **Great Britain** and, in **Scotland and Offshore**, also for all interconnecting transformers between the **User’s 132kV System** and the **User’s Subtransmission System** (and any **OTSUA**) the **User** shall supply the following information:-

- Tap changer range
- Tap change step size
- Tap changer type: on load or off circuit
- Earthing method: Direct, resistance or reactance
- Impedance (if not directly earthed )

PC.A.2.2.6 Each **User** shall supply the following information about the **User’s** equipment installed at a **Transmission Site** (or in the case of **OTSUA**, all **OTSDUW Plant and Apparatus**) :-

(a) **Switchgear**. For all circuit breakers:-

- Rated voltage (kV)
- Operating voltage (kV)
- Rated 3-phase rms short-circuit breaking current, (kA)
- Rated 1-phase rms short-circuit breaking current, (kA)
- Rated 3-phase peak short-circuit making current, (kA)
- Rated 1-phase peak short-circuit making current, (kA)
- Rated rms continuous current (A)
- DC time constant applied at testing of asymmetrical breaking abilities (secs)

In the case of **OTSDUW Plant and Apparatus** operating times for circuit breaker, **Protection**, trip relay and total operating time should be provided.

(b) **Substation Infrastructure**. For the substation infrastructure (including, but not limited to, switch disconnectors, disconnectors, current transformers, line traps, busbars, through bushings, etc):-

- Rated 3-phase rms short-circuit withstand current (kA)
- Rated 1-phase rms short-circuit withstand current (kA).
- Rated 3-phase short-circuit peak withstand current (kA)
Rated 1-phase short-circuit peak withstand current (kA)
Rated duration of short circuit withstand (secs)
Rated rms continuous current (A)
A single value for the entire substation may be supplied, provided it represents the most restrictive item of current carrying apparatus.

PC.A.2.2.7 In the case of OTSUA the following should also be provided
(a) Automatic switching scheme schedules including diagrams and an explanation of how the System will operate and what plant will be affected by the schemes Operation.
(b) Intertripping schemes both Generation and Demand. In each case a diagram of the scheme and an explanation of how the System will operate and what Plant will be affected by the schemes Operation.

PC.A.2.3 Lumped System Susceptance
PC.A.2.3.1 For all parts of the User's Subtransmission System (and any OTSUA) which are not included in the Single Line Diagram provided under PC.A.2.2.1, each User shall provide the equivalent lumped shunt susceptance at nominal Frequency.

PC.A.2.3.1.1 This should include shunt reactors connected to cables which are not normally in or out of service independent of the cable (ie. they are regarded as part of the cable).

PC.A.2.3.1.2 This should not include:
(a) independently switched reactive compensation equipment connected to the User's System specified under PC.A.2.4, or;
(b) any susceptance of the User's System inherent in the Demand (Reactive Power) data specified under PC.A.4.3.1.

PC.A.2.4 Reactive Compensation Equipment
PC.A.2.4.1 For all independently switched reactive compensation equipment (including any OTSUA), including that shown on the Single Line Diagram, not operated by The Company and connected to the User's System at 132kV and above in England and Wales and 33kV and above in Scotland and Offshore (including any OTSDUW Plant and Apparatus operating at High Voltage), other than Power Factor correction equipment associated directly with Customers’ Plant and Apparatus, the following information is required:
(a) type of equipment (eg. fixed or variable);
(b) capacitive and/or inductive rating or its operating range in MVAR;
(c) details of any automatic control logic to enable operating characteristics to be determined;
(d) the point of connection to the User’s System (including OTSUA) in terms of electrical location and System voltage.
(e) In the case of OTSDUW Plant and Apparatus the User should also provide:-
   (i) Connection node, voltage, rating, power loss, tap range and connection arrangement.
   (ii) A mathematical representation in block diagram format to model the control of any dynamic compensation plant. The model should be suitable for RMS dynamic stability type studies where each time constant should be no less than 10ms.
   (iii) For Static Var Compensation equipment the User should provide:
HV Node
LV Node
Control Node
Nominal Voltage (kV)
PC.A.2.4.2  DC Converter Station owners, HVDC System Owners (and a User where the OTSUA includes an OTSDUW DC Converter) are also required to provide information about the reactive compensation and harmonic filtering equipment required to ensure that their Plant and Apparatus (and the OTSUA) complies with the criteria set out in CC.6.1.5 or ECC.6.1.5 (as applicable).

PC.A.2.5  Short Circuit Contribution to National Electricity Transmission System

PC.A.2.5.1  General

(a) To allow The Company to calculate fault currents, each User is required to provide data, calculated in accordance with Good Industry Practice, as set out in the following paragraphs of PC.A.2.5.

(b) The data should be provided for the User’s System with all Generating Units (including Synchronous Generating Units), Power Park Units, HVDC Systems and DC Converters Synchronised to that User’s System (and any OTSUA where appropriate). The User must ensure that the pre-fault network conditions reflect a credible System operating arrangement.

(c) The list of data items required, in whole or part, under the following provisions, is set out in PC.A.2.5.6. Each of the relevant following provisions identifies which data items in the list are required for the situation with which that provision deals.

The fault currents in sub-paragraphs (a) and (b) of the data list in PC.A.2.5.6 should be based on an a.c. load flow that takes into account any pre-fault current flow across the Point of Connection (and in the case of OTSUA, Interface Points and Connection Points) being considered.

Measurements made under appropriate System conditions may be used by the User to obtain the relevant data.

(d) The Company may at any time, in writing, specifically request for data to be provided for an alternative System condition, for example minimum plant, and the User will, insofar as such request is reasonable, provide the information as soon as reasonably practicable following the request.

PC.A.2.5.2  Network Operators and Non-Embedded Customers are required to submit data in accordance with PC.A.2.5.4. Generators, DC Converter Station owners, HVDC System Owners and Network Operators, in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems within such Network Operator’s Systems are required to submit data in accordance with PC.A.2.5.5.

PC.A.2.5.3  Where prospective short-circuit currents on equipment owned, operated or managed by The Company are close to the equipment rating, and in The Company’s reasonable opinion more accurate calculations of the prospective short circuit currents are required, then The Company will request additional data as outlined in PC.A.6.6 below.

PC.A.2.5.4  Data from Network Operators and Non-Embedded Customers
PC.A.2.5.4.1 Data is required to be provided at each node on the Single Line Diagram provided under PC.A.2.2.1 at which motor loads and/or Embedded Small Power Stations and/or Embedded Medium Power Stations and/or Embedded installations of direct current converters which do not form a DC Converter Station or HVDC System are connected, assuming a fault at that location, as follows:

The data items listed under the following parts of PC.A.2.5.6:-

(a) (i), (ii), (iii), (iv), (v) and (vi);

and the data items shall be provided in accordance with the detailed provisions of PC.A.2.5.6(c) - (f).

PC.A.2.5.4.2 Network Operators shall provide the following data items in respect of each Interface Point within their User System:

(a) Maximum Export Capacity;
(b) Maximum Import Capacity; and,
(c) Interface Point Target Voltage/Power Factor

Network Operators shall alongside these parameters include details of any manual or automatic post fault actions to be taken by the owner / operator of the Offshore Transmission System connected to such Interface Point that are required by the Network Operator.

PC.A.2.5.5 Data from Generators (including Generators undertaking OTSDUW and those responsible for DC Connected Power Park Modules), DC Converter Station owners, HVDC System Owners and from Network Operators in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems within such Network Operator's Systems.

PC.A.2.5.5.1 For each Generating Unit (including Synchronous Generating Units forming part of a Synchronous Power Generating Module) with one or more associated Unit Transformers, the Generator, or the Network Operator in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems within such Network Operator's System is required to provide values for the contribution of the Power Station Auxiliaries (including Auxiliary Gas Turbines or Auxiliary Diesel Engines) to the fault current flowing through the Unit Transformer(s).

The data items listed under the following parts of PC.A.2.5.6(a) should be provided:-

(i), (ii) and (v);

(iii) if the associated Generating Unit (including Synchronous Generating Units forming part of a Synchronous Power Generating Module) step-up transformer can supply zero phase sequence current from the Generating Unit side to the National Electricity Transmission System;

(iv) if the value is not 1.0 p.u;

and the data items shall be provided in accordance with the detailed provisions of PC.A.2.5.6(c) - (f), and with the following parts of this PC.A.2.5.5.

PC.A.2.5.5.2 Auxiliary motor short circuit current contribution and any Auxiliary Gas Turbine Unit contribution through the Unit Transformers must be represented as a combined short circuit current contribution at the Generating Unit’s (including Synchronous Generating Units forming part of a Synchronous Power Generating Module) terminals, assuming a fault at that location.

PC.A.2.5.5.3 If the Power Station or HVDC System or DC Converter Station (or OTSDUW Plant and Apparatus which provides a fault infeed) has separate Station Transformers, data should be provided for the fault current contribution from each transformer at its high voltage terminals, assuming a fault at that location, as follows:-
The data items listed under the following parts of PC.A.2.5.6

- (a) (i), (ii), (iii), (iv), (v) and (vi);

and the data items shall be provided in accordance with the detailed provisions of PC.A.2.5.6(b) - (f).

PC.A.2.5.5.4 Data for the fault infeeds through both Unit Transformers and Station Transformers shall be provided for the normal running arrangement when the maximum number of Generating Units (including Synchronous Generating Units forming part of a Synchronous Power Generating Module) are Synchronised to the System or when all the DC Converters at a DC Converter Station or HVDC Converters within an HVDC System are transferring Rated MW in either direction. Where there is an alternative running arrangement (or transfer in the case of a DC Converter Station or HVDC System) which can give a higher fault infeed through the Station Transformers, then a separate data submission representing this condition shall be made.

PC.A.2.5.5.5 Unless the normal operating arrangement within the Power Station is to have the Station and Unit Boards interconnected within the Power Station, no account should be taken of the interconnection between the Station Board and the Unit Board.

PC.A.2.5.5.6 Auxiliary motor short circuit current contribution and any auxiliary DC Converter Station contribution or HVDC System contribution through the Station Transformers must be represented as a combined short circuit current contribution through the Station Transformers.

PC.A.2.5.5.7 Where a Manufacturer’s Data & Performance Report exists in respect of the model of the Power Park Unit, the User may opt to reference the Manufacturer’s Data & Performance Report as an alternative to the provision of data in accordance with this PC.A.2.5.5.7. For the avoidance of doubt, all other data provision pursuant to the Grid Code shall still be provided including a Single Line Diagram and those data pertaining thereto.

For each Power Park Module (including DC Connected Power Park Modules) and each type of Power Park Unit (eg. Doubly Fed Induction Generator) (and any OTSDUW Plant and Apparatus which provides a fault infeed), including any Auxiliaries, positive, negative and zero sequence root mean square current values are to be provided of the contribution to the short circuit current flowing at:

- (i) the Power Park Unit terminals, or the Common Collection Busbar if an equivalent Single Line Diagram and associated data as described in PC.A.2.2.2 is provided, and

- (ii) the Grid Entry Point (and in case of OTSUA, Transmission Interface Point), or User System Entry Point if Embedded

for the following solid faults at the Grid Entry Point (and in case of OTSUA, Interface Point), or User System Entry Point if Embedded:

- (i) a symmetrical three phase short circuit
- (ii) a single phase to earth short circuit
- (iii) a phase to phase short circuit
- (iv) a two phase to earth short circuit

For a Power Park Module (including DC Connected Power Park Modules) in which one or more of the Power Park Units utilise a protective control such as a crowbar circuit, the data should indicate whether the protective control will act in each of the above cases and the effects of its action shall be included in the data. For any case in which the protective control will act, the data for the fault shall also be submitted for the limiting case in which the protective circuit will not act, which may involve the application of a non-solid fault, and the positive, negative and zero sequence retained voltages at

- (i) the Power Park Unit terminals, or the Common Collection Busbar if an equivalent Single Line Diagram and associated data is provided and

- (ii) the Grid Entry Point, or User System Entry Point if Embedded
in this limiting case shall be provided.

For each fault for which data is submitted, the data items listed under the following parts of PC.A.2.5.6(a) shall be provided:

(iv), (vii), (viii), (ix), (x);

In addition, if an equivalent Single Line Diagram has been provided the data items listed under the following parts of PC.A.2.5.6(a) shall be provided:

(xi), (xii), (xiii);

In addition, for a Power Park Module (including DC Connected Power Park Modules) in which one or more of the Power Park Units utilise a protective control such as a crowbar circuit:

the data items listed under the following parts of PC.A.2.5.6(a) shall be provided:

(xiv), (xv);

All of the above data items shall be provided in accordance with the detailed provisions of PC.A.2.5.6(c), (d), (f).

Should actual data in respect of fault infeeds be unavailable at the time of the application for a CUSC Contract or Embedded Development Agreement, a limited subset of the data, representing the maximum fault infeed that may result from all of the plant types being considered, shall be submitted. This data will, as a minimum, represent the root mean square of the positive, negative and zero sequence components of the fault current for both single phase and three phase solid faults at the Grid Entry Point (or User System Entry Point if Embedded) at the time of fault application and 50ms following fault application. Actual data in respect of fault infeeds shall be submitted to The Company as soon as it is available, in line with PC.A.1.2

PC.A.2.5.6 Data Items

(a) The following is the list of data utilised in this part of the PC. It also contains rules on the data which generally apply:

(i) Root mean square of the symmetrical three-phase short circuit current infeed at the instant of fault, \(I_{1}^{*}\);

(ii) Root mean square of the symmetrical three-phase short circuit current after the subtransient fault current contribution has substantially decayed, \(I_{1}^{*}\);

(iii) the zero sequence source resistance and reactance values of the User’s System as seen from the node on the Single Line Diagram provided under PC.A.2.2.1 (or Power Generating Module or Station Transformer high voltage terminals or Generating Unit terminals or DC Converter terminals or HVDC System terminals, as appropriate) consistent with the infeed described in PC.A.2.5.1.(b);

(iv) root mean square of the pre-fault voltage at which the maximum fault currents were calculated;

(v) the positive sequence X/R ratio at the instant of fault;

(vi) the negative sequence resistance and reactance values of the User’s System seen from the node on the Single Line Diagram provided under PC.A.2.2.1 (or Power Generating Module or Station Transformer high voltage terminals, or Generating Unit terminals or DC Converter terminals or HVDC System terminals as appropriate) if substantially different from the values of positive sequence resistance and reactance which would be derived from the data provided above;

(vii) A continuous trace and a table showing the root mean square of the positive, negative and zero sequence components of the short circuit current between zero and 140ms at 10ms intervals;
(viii) The **Active Power** (or **Interface Point Capacity**) being exported pre-fault by the **OTSDUW Plant and Apparatus** being generated pre-fault by the **Power Park Module** (including **DC Connected Power Park Modules**) and by each type of **Power Park Unit**;

(ix) The reactive compensation shown explicitly on the **Single Line Diagram** that is switched in;

(x) The **Power Factor** of the **Power Park Module** (including **DC Connected Power Park Modules**) and of each **Power Park Unit** type;

(xi) The positive sequence X/R ratio of the equivalent at the **Common Collection Busbar** or **Interface Point** in the case of OTSUA;

(xii) The minimum zero sequence impedance of the equivalent seen from the **Common Collection Busbar** or **Interface Point** in the case of OTSUA;

(xiii) The number of **Power Park Units** represented in the equivalent **Power Park Unit**;

(xiv) The additional rotor resistance and reactance (if any) that is applied to the **Power Park Unit** under a fault condition;

(xv) A continuous trace and a table showing the root mean square of the positive, negative and zero sequence components of the retained voltage at the fault point and **Power Park Unit** terminals, or the **Common Collection Busbar** if an equivalent **Single Line Diagram** and associated data as described in PC.A.2.2.2 is provided or **Interface Point** in the case of OTSUA, representing the limiting case, which may involve the application of a non-solid fault, required to not cause operation of the protective control;

(b) In considering this data, unless the **User** notifies The Company accordingly at the time of data submission, The Company will assume that the time constant of decay of the subtransient fault current corresponding to the change from $I_1$" to $I_1'$, $(T")$ is not significantly different from 40ms. If that assumption is not correct in relation to an item of data, the **User** must inform The Company at the time of submission of the data.

(c) The value for the X/R ratio must reflect the rate of decay of the d.c. component that may be present in the fault current and hence that of the sources of the initial fault current. All shunt elements and loads must therefore be deleted from any system model before the X/R ratio is calculated.

(d) In producing the data, the **User** may use "time step analysis" or "fixed-point-in-time analysis" with different impedances.

(e) If a fixed-point-in-time analysis with different impedances method is used, then in relation to the data submitted under (a) (i) above, the data will be required for "time zero" to give $I_1"$. The figure of 120ms is consistent with a decay time constant $T"$ of 40ms, and if that figure is different, then the figure of 120ms must be changed accordingly.

(f) Where a "time step analysis" is carried out, the X/R ratio may be calculated directly from the rate of decay of the d.c. component. The X/R ratio is not that given by the phase angle of the fault current if this is based on a system calculation with shunt loads, but from the Thévenin equivalent of the system impedance at the instant of fault with all non-source shunts removed.
PC.A.3.1.1 Each Generator, HVDC System Owner and DC Converter Station owner (and a User where the OTSUA includes an OTSDUW DC Converter) with an existing, or proposed, Power Station or DC Converter Station or HVDC System directly connected, or to be directly connected, to the National Electricity Transmission System (or in the case of OTSUA, the Interface Point), shall provide The Company with data relating to that Power Station or DC Converter Station or HVDC System, both current and forecast, as specified in PC.A.3.2 to PC.A.3.4.

Embedded

PC.A.3.1.2 (a) Each Generator, HVDC System Owner and DC Converter Station owner in respect of its existing, and/or proposed, Embedded Large Power Stations and/or Embedded HVDC Systems and/or Embedded DC Converter Stations and/or its Embedded Medium Power Stations subject to a Bilateral Agreement and each Network Operator in respect of its Embedded Medium Power Stations not subject to a Bilateral Agreement and/or Embedded DC Converter Stations not subject to a Bilateral Agreement and/or Embedded HVDC Systems not subject to a Bilateral Agreement within such Network Operator's System in each case connected to the Subtransmission System, shall provide The Company with data relating to that Power Station or DC Converter Station or HVDC System, both current and forecast, as specified in PC.A.3.2 to PC.A.3.4.

(b) No data need be supplied in relation to any Small Power Station or any Medium Power Station or installations of direct current converters which do not form a DC Converter Station or HVDC System, connected at a voltage level below the voltage level of the Subtransmission System except:-

(i) in connection with an application for, or under, a CUSC Contract, or

(ii) unless specifically requested by The Company under PC.A.3.1.4.

PC.A.3.1.3 (a) Each Network Operator shall provide The Company with the data specified in PC.A.3.2.2(c)(i) and (ii) and PC.A.3.2.2(i).

(b) Network Operators need not submit planning data in respect of an Embedded Small Power Station unless required to do so under PC.A.1.2(b) or unless specifically requested under PC.A.3.1.4 below, in which case they will supply such data.

PC.A.3.1.4 (a) PC.A.4.2.4(b) and PC.A.4.3.2(a) explain that the forecast Demand submitted by each Network Operator must be net of the output of all Small Power Stations and Medium Power Stations and Customer Generating Plant and all installations of direct current converters which do not form a DC Converter Station or HVDC System, Embedded within that Network Operator's System. The Network Operator must inform The Company of:

(i) the number of such Embedded Power Stations and such Embedded installations of direct current converters (including the number of Generating Units or Power Park Modules (including DC Connected Power Park Modules) or DC Converters or HVDC Systems) together with their summated capacity; and

(ii) beginning from the 2015 Week 24 data submission, for each Embedded Small Power Station of registered capacity (as defined in the Distribution Code) of 1MW or more:

1. A reference which is unique to each Network Operator;

2. The production type as follows:

   a) In the case of an Embedded Small Power Station first connected on or after 1 January 2015, the production type must be selected from the list below derived from the Manual of Procedures for the ENTSO-E Central Information Transparency Platform:

      - Biomass;
      - Fossil brown coal/lignite;
- Fossil coal-derived gas;
- Fossil gas;
- Fossil hard coal;
- Fossil oil;
- Fossil oil shale;
- Fossil peat;
- Geothermal;
- Hydro pumped storage;
- Hydro run-of-river and poundage;
- Hydro water reservoir;
- Marine;
- Nuclear;
- Other renewable;
- Solar;
- Waste;
- Wind offshore;
- Wind onshore; or
- Other;

Together with a statement as to whether the generation forms part of a CHP scheme;

b) In the case of an Embedded Small Power Station first connected to the Users’ System before 1 January 2015, as an alternative to the production type, the technology type(s) used, selected from the list set out at paragraph 2.23 in Version 2 of the Regulatory Instructions and Guidance relating to the distributed generation incentive, innovation funding incentive and registered power zones, reference 83/07, published by Ofgem in April 2007;

3. The registered capacity (as defined in the Distribution Code) in MW;
4. The lowest voltage level node that is specified on the most up-to-date Single Line Diagram to which it connects or where it will export most of its power;
5. Where it generates electricity from wind or PV, the geographical location using either latitude or longitude or grid reference coordinates of the primary or higher voltage substation to which it connects;
6. The reactive power and voltage control mode, including the voltage set-point and reactive range, where it operates in voltage control mode, or the target Power Factor, where it operates in Power Factor mode;
7. Details of the types of loss of mains Protection in place and their relay settings which in the case of Embedded Small Power Stations first connected to the Users’ System before 1 January 2015 shall be provided on a reasonable endeavours basis.
On receipt of this data, the Network Operator or Generator (if the data relates to Power Stations referred to in PC.A.3.1.2) may be further required, at The Company’s reasonable discretion, to provide details of Embedded Small Power Stations and Embedded Medium Power Stations and Customer Generating Plant and Embedded installations of direct current converters which do not form a DC Converter Station or HVDC System, both current and forecast, as specified in PC.A.3.2 to PC.A.3.4. Such requirement would arise where The Company reasonably considers that the collective effect of a number of such Embedded Power Stations and Customer Generating Plants and Embedded installations of direct current converters may have a significant system effect on the National Electricity Transmission System.

**Busbar Arrangements**

**PC.A.3.1.5**
Where Generating Units, which term includes CCGT Units and Synchronous Generating Units within a Synchronous Power Generating Module and Power Park Modules (including DC Connected Power Park Modules), and DC Converters, and HVDC Systems are connected to the National Electricity Transmission System via a busbar arrangement which is or is expected to be operated in separate sections, the section of busbar to which each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module), DC Converter, HVDC System or Power Park Module (including DC Connected Power Park Modules) is connected is to be identified in the submission.

**PC.A.3.2**
Output Data

**PC.A.3.2.1**

(a) **Large Power Stations and Gensets**

Data items PC.A.3.2.2 (a), (b), (c), (d), (e), (f) and (h) are required with respect to each Large Power Station and each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) and Power Park Module (including DC Connected Power Park Modules) of each Large Power Station and for each Genset (although (a) is not required for CCGT Units and (b), (d) and (e) are not normally required for CCGT Units and (a), (b), (c), (d), (e), (f) and (h) are not normally required for Power Park Units).

(b) **Embedded Small Power Stations and Embedded Medium Power Stations**

Data item PC.A.3.2.2 (a) is required with respect to each Embedded Small Power Station and Embedded Medium Power Station and each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) and Power Park Module (including DC Connected Power Park Modules) of each Embedded Small Power Station and Embedded Medium Power Station (although (a) is not required for CCGT Units or Power Park Units). In addition, data item PC.A.3.2.2(c)(ii) is required with respect to each Embedded Medium Power Station.

(c) **CCGT Units/Modules**

(i) Data item PC.A.3.2.2 (g) is required with respect to each CCGT Unit;

(ii) data item PC.A.3.2.2 (a) is required with respect to each CCGT Module; and

(iii) data items PC.A.3.2.2 (b), (c), (d) and (e) are required with respect to each CCGT Module unless The Company informs the relevant User in advance of the submission that it needs the data items with respect to each CCGT Unit for particular studies, in which case it must be supplied on a CCGT Unit basis.

Where any definition utilised or referred to in relation to any of the data items does not reflect CCGT Units, such definition shall be deemed to relate to CCGT Units for the purposes of these data items. Any Schedule in the DRC which refers to these data items shall be interpreted to incorporate the CCGT Unit basis where appropriate;

(d) **Cascade Hydro Schemes**

Data item PC.A.3.2.2(i) is required with respect to each Cascade Hydro Scheme.

(e) **Power Park Units/Modules**
Data items PC.A.3.2.2 (k) is required with respect to each Power Park Module (including DC Connected Power Park Modules).

(f) DC Converters and HVDC Systems

Data items PC.A.3.2.2 (a), (b), (c), (d) (e) (f) (h) and (i) are required with respect of each HVDC System, each DC Converter Station and each DC Converter in each DC Converter Station. For installations of direct current converters which do not form a DC Converter Station only data item PC.A.3.2.2.(a) is required.

PC.A.3.2.2

Items (a), (b), (d), (e), (f), (g), (h), (i), (j) and (k) are to be supplied by each Generator, DC Converter Station owner, HVDC System Owner or Network Operator (as the case may be) in accordance with PC.A.3.1.1, PC.A.3.1.2, PC.A.3.1.3 and PC.A.3.1.4. Items (a), and (f)/(iv) to be supplied (as applicable) by a User in the case of OTSUA which includes an OTSDUW DC Converter. Item (c) is to be supplied by each Network Operator in all cases:-

(a) Registered Capacity (MW), Maximum Capacity (in the case of Power Generating Modules in addition to Registered Capacity on a Power Station basis) or Interface Point Capacity in the case of OTSDUW;

(b) Output Usable (MW) on a monthly basis;

(c) (i) System Constrained Capacity (MW) ie. any constraint placed on the capacity of the Embedded Generating Unit (including a Synchronous Generating Unit within a Synchronous Power Generating Module), Embedded Power Park Module (including DC Connected Power Park Modules) an Offshore Transmission System at an Interface Point, Embedded HVDC System or DC Converter at an Embedded DC Converter Station due to the Network Operator’s System in which it is Embedded. Where Generating Units (which term includes CCGT Units and Synchronous Generating Units within a Synchronous Power Generating Module), Power Park Modules (including DC Connected Power Park Modules), Offshore Transmission Systems at an Interface Point, HVDC Systems or DC Converters are connected to a Network Operator’s User System via a busbar arrangement which is or is expected to be operated in separate sections, details of busbar running arrangements and connected circuits at the substation to which the Embedded Generating Unit (including Synchronous Generating Units within a Embedded Synchronous Power Generating Module), Embedded Power Park Module (including DC Connected Power Park Modules), Offshore Transmission System at an Interface Point, or Embedded HVDC System or Embedded DC Converter is connected sufficient for The Company to determine where the MW generated by each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module), Power Park Module (including DC Connected Power Park Modules), HVDC System or DC Converter at that Power Station or DC Converter Station or Offshore Transmission System at an Interface Point would appear onto the National Electricity Transmission System;

(ii) any Reactive Despatch Network Restrictions;

(d) Minimum Generation (MW), and in the case of Power Generating Modules only Minimum Stable Operating Level (MW) and Minimum Regulating Level ;

(e) MW obtainable from Generating Units (including Synchronous Generating Units within a Synchronous Power Generating Module), Power Park Modules (including DC Connected Power Park Modules), HVDC Systems or DC Converters at a DC Converter Station in excess of Registered Capacity or Maximum Capacity;

(f) Generator Performance Chart:

(i) GB Code Users in respect of Generating Units shall provide a Generator Performance Chart and EU Code Users in respect of Power Generating Modules shall provide a Power Generating Module Performance Chart and a Synchronous Generating Unit Performance Chart.
(ii) at the electrical point of connection to the Offshore Transmission System for an Offshore Synchronous Generating Unit and Offshore Synchronous Power Generating Module.

(iii) at the electrical point of connection to the National Electricity Transmission System (or User System if Embedded) for a Non Synchronous Generating Unit (excluding a Power Park Unit), Power Park Module (including DC Connected Power Park Modules), HVDC System and DC Converter at a DC Converter Station;

(iv) at the Interface Point for OTSDUW Plant and Apparatus

Where a Reactive Despatch Network Restriction applies, its existence and details should be highlighted on the Generator Performance Chart, in sufficient detail for The Company to determine the nature of the restriction.

(g) a list of the CCGT Units within a CCGT Module, identifying each CCGT Unit, and the CCGT Module of which it forms part, unambiguously. In the case of a Range CCGT Module, details of the possible configurations should also be submitted, together:-

(i) (in the case of a Range CCGT Module connected to the National Electricity Transmission System) with details of the single Grid Entry Point (there can only be one) at which power is provided from the Range CCGT Module;

(ii) (in the case of an Embedded Range CCGT Module) with details of the single User System Entry Point (there can only be one) at which power is provided from the Range CCGT Module;

Provided that, nothing in this sub-paragraph (g) shall prevent the busbar at the relevant point being operated in separate sections;

(h) expected running regime(s) at each Power Station, HVDC System or DC Converter Station and type of Power Generating Module or Generating Unit (as applicable), eg. Steam Unit, Gas Turbine Unit, Combined Cycle Gas Turbine Unit, Power Park Module (including DC Connected Power Park Modules), Novel Units (specify by type), etc;

(i) a list of Power Stations and Generating Units within a Cascade Hydro Scheme, identifying each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) and Power Station and the Cascade Hydro Scheme of which each form part unambiguously. In addition:

(i) details of the Grid Entry Point at which Active Power is provided, or if Embedded the Grid Supply Point(s) within which the Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) is connected;

(ii) where the Active Power output of a Generating Unit is split between more than one Grid Supply Points the percentage that would appear under normal and outage conditions at each Grid Supply Point.

(j) The following additional items are only applicable to DC Converters at DC Converter Stations and HVDC Systems.

Registered Import Capacity (MW);

Import Usable (MW) on a monthly basis;

Minimum Import Capacity (MW);

MW that may be absorbed by a DC Converter or HVDC System in excess of Registered Import Capacity and Maximum HVDC Active Power Transmission Capacity under importing conditions and the duration for which this is available;
(k) the number and types of the **Power Park Units** within a **Power Park Module** (including **DC Connected Power Park Modules**), identifying each **Power Park Unit**, the **Power Park Module** of which it forms part and identifying the **BM Unit** of which each **Power Park Module** forms part, unambiguously. In the case of a **Power Station** directly connected to the **National Electricity Transmission System** with multiple **Power Park Modules** (including **DC Connected Power Park Modules**) where **Power Park Units** can be selected to run in different **Power Park Modules** and/or **Power Park Modules** can be selected to run in different **BM Units**, details of the possible configurations should also be submitted. In addition for **Offshore Power Park Modules** (including **DC Connected Power Park Modules**), the number of **Offshore Power Park Strings** that are aggregated into one **Offshore Power Park Module** should also be submitted.

(l) the number and types of the **Synchronous Generating Units** within a **Synchronous Power Generating Module**, identifying each **Synchronous Generating Unit**, the **Synchronous Power Generating Module** of which it forms part and identifying the **BM Unit** of which each **Synchronous Power Generating Module** forms part, unambiguously. In the case of a **Power Station** directly connected to the **National Electricity Transmission System** with multiple **Synchronous Power Generating Modules** where **Synchronous Generating Units** can be selected to run in different **Synchronous Power Generating Modules** and/or **Synchronous Power Generating Modules** can be selected to run in different **BM Units**, details of the possible configurations should also be submitted.

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Notwithstanding any other provision of this PC, the **CCGT Units** within a **CCGT Module**, details of which are required under paragraph (g) of PC.A.3.2.2, can only be amended in accordance with the following provisions:-

(a) if the **CCGT Module** is a **Normal CCGT Module**, the **CCGT Units** within that **CCGT Module** can only be amended such that the **CCGT Module** comprises different **CCGT Units** if **The Company** gives its prior consent in writing. Notice of the wish to amend the **CCGT Units** within such a **CCGT Module** must be given at least 6 months before it is wished for the amendment to take effect;

(b) if the **CCGT Module** is a **Range CCGT Module**, the **CCGT Units** within that **CCGT Module** and the **Grid Entry Point** at which the power is provided can only be amended as described in BC1.A1.6.4.

Notwithstanding any other provision of this PC, the **Power Park Units** within a **Power Park Module** (including **DC Connected Power Park Modules**), and the **Power Park Modules** (including **DC Connected Power Park Modules**) within a **BM Unit**, details of which are required under paragraph (k) of PC.A.3.2.2, can only be amended in accordance with the following provisions:-

(a) if the **Power Park Units** within that **Power Park Module** can only be amended such that the **Power Park Module** comprises different **Power Park Units** due to repair/replacement of individual **Power Park Units** if **The Company** gives its prior consent in writing. Notice of the wish to amend a **Power Park Unit** within such a **Power Park Module** (including **DC Connected Power Park Modules**) must be given at least 4 weeks before it is wished for the amendment to take effect;

(b) if the **Power Park Units** within that **Power Park Module** (including **DC Connected Power Park Modules** and/or **Power Park Modules**) within that **BM Unit** can be selected to run in different **Power Park Modules** and/or **BM Units** as an alternative operational running arrangement the **Power Park Units** within the **Power Park Module**, the **BM Unit** of which each **Power Park Module** forms part, and the **Grid Entry Point** at which the power is provided can only be amended as described in BC1.A.1.8.4.

Notwithstanding any other provision of this PC, the **Synchronous Generating Units** within a **Synchronous Power Generating Module**, and the **Synchronous Power Generating Modules** within a **BM Unit**, details of which are required under paragraph (l) of PC.A.3.2.2, can only be amended in accordance with the following provisions:-
(a) if the Synchronous Generating Units within that Synchronous Power Generating Module can only be amended such that the Synchronous Power Generating Module comprises different Synchronous Generating Units due to repair/replacement of individual Synchronous Generating Units if The Company gives its prior consent in writing. Notice of the wish to amend a Synchronous Generating Unit within such a Synchronous Power Generating Module must be given at least 4 weeks before it is wished for the amendment to take effect;

(b) if the Synchronous Generating Units within that Synchronous Power Generating Module and/or the Synchronous Power Generating Modules within that BM Unit can be selected to run in different Synchronous Power Generating Modules and/or BM Units as an alternative operational running arrangement the Synchronous Generating Units within the Synchronous Power Generating Module, the BM Unit of which each Synchronous Power Generating Module forms part, and the Grid Entry Point at which the power is provided can only be amended as described in BC1.A.1.9.4(c). The requirements of PC.A.3.2.5 need not be satisfied if Generators have already submitted data in respect of PC.A.3.2.3, PC.A.3.2.4 and PC.A.3.2.5 for the same Power Generating Module.

PC.A.3.3. Rated Parameters Data
PC.A.3.3.1 The following information is required to facilitate an early assessment, by The Company, of the need for more detailed studies;

(a) for all Generating Units (excluding Power Park Units) and Power Park Modules (including DC Connected Power Park Modules):

- Rated MVA
- Rated MW;

(b) for each Synchronous Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module):

- Short circuit ratio
- Direct axis transient reactance;
- Inertia constant (for whole machine), MWsecs/MVA;

(c) for each Synchronous Generating Unit step-up transformer (including the step up transformer of a Synchronous Generating Unit within a Synchronous Power Generating Module):

- Rated MVA
- Positive sequence reactance (at max, min and nominal tap);

(d) for each DC Converter at a DC Converter Station, HVDC System, DC Converter connecting an existing Power Park Module (including DC Connected Power Park Modules) and Transmission DC Converter (forming part of an OTSUA).

- DC Converter or HVDC Converter type (e.g. current/voltage sourced)
- Rated MW per pole for import and export
- Number of poles and pole arrangement
- Rated DC voltage/pole (kV)
- Return path arrangement
- Remote AC connection arrangement (excluding OTSDUW DC Converters)

Minimum HVDC Active Power Transmission Capacity

(e) for each type of Power Park Unit in a Power Park Module not connected to the Total System by a DC Converter or HVDC System:
Rated MVA
Rated MW
Rated terminal voltage
Inertia constant, (MWsec/MVA)

Additionally, for Power Park Units that are squirrel-cage or doubly-fed induction generators driven by wind turbines:

- Stator reactance.
- Magnetising reactance.
- Rotor resistance (at rated running)
- Rotor reactance (at rated running)
- The generator rotor speed range (minimum and maximum speeds in RPM) (for doubly-fed induction generators only)
- Converter MVA rating (for doubly-fed induction generators only)

For a Power Park Unit consisting of a synchronous machine in combination with a back-to-back DC Converter or HVDC Converter, or for a Power Park Unit not driven by a wind turbine, the data to be supplied shall be agreed with The Company in accordance with PC.A.7.

This information should only be given in the data supplied in accordance with PC.4.4 and PC.4.5.

PC.A.3.4 General Generating Unit, Power Park Module (including DC Connected Power Park Modules), Power Generating Module, HVDC System and DC Converter Data

PC.A.3.4.1 The point of connection to the National Electricity Transmission System or the Total System, if other than to the National Electricity Transmission System, in terms of geographical and electrical location and system voltage is also required.

PC.A.3.4.2 (a) Type of Generating Unit (ie Synchronous Power Generating Unit within a Power Generating Module, Synchronous Generating Unit, Non-Synchronous Generating Unit, DC Converter, Power Park Module (including DC Connected Power Park Modules) or HVDC System).

(b) In the case of a Synchronous Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) details of the Exciter category, for example whether it is a rotating Exciter or a static Exciter or in the case of a Non-Synchronous Generating Unit the voltage control system.

(c) Whether a Power System Stabiliser is fitted.

PC.A.3.4.3 Each Generator shall supply The Company with the production type(s) used as the primary source of power in respect of each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module), selected from the list set out below:

- Biomass
- Fossil brown coal/lignite
- Fossil coal-derived gas
- Fossil gas
- Fossil hard coal
- Fossil oil
- Fossil oil shale
- Fossil peat
- Geothermal
- Hydro pumped storage
- Hydro run-of-river and poundage
- Hydro water reservoir
- Marine
- Nuclear
- Other renewable
- Solar
- Waste
- Wind offshore
- Wind onshore
- Other

PC.A.4 DEMAND AND ACTIVE ENERGY DATA

PC.A.4.1 Introduction

PC.A.4.1.1 Each User directly connected to the National Electricity Transmission System with Demand shall provide The Company with the Demand data, historic, current and forecast, as specified in PC.A.4.2 and PC.A.4.3. Paragraphs PC.A.4.1.2 and PC.A.4.1.3 apply equally to Active Energy requirements as to Demand unless the context otherwise requires.

PC.A.4.1.2 Data will need to be supplied by:

(a) each Network Operator, in relation to Demand and Active Energy requirements on its User System;
(b) each Non-Embedded Customer (including Pumped Storage Generators with respect to Pumping Demand) in relation to its Demand and Active Energy requirements.
(c) each DC Converter Station owner or HVDC System Owner in relation to Demand and Active Energy transferred (imported) to its DC Converter Station or HVDC System.
(d) each OTSDUW DC Converter in relation to the Demand at each Interface Point and Connection Point.

Demand of Power Stations directly connected to the National Electricity Transmission System is to be supplied by the Generator under PC.A.5.2.

PC.A.4.1.3 References in this PC to data being supplied on a half hourly basis refer to it being supplied for each period of 30 minutes ending on the hour or half-hour in each hour.

PC.A.4.1.4 Access Periods and Access Groups

PC.A.4.1.4.1 Each Connection Point must belong to one, and only one, Access Group.

PC.A.4.1.4.2 Each Transmission Interface Circuit must have an Access Period.

PC.A.4.1.4.3 The Access Period shall

(a) normally be a minimum of 8 continuous weeks and can occur in any one of three maintenance years during the period from calendar week 13 to calendar week 43 (inclusive) in each year; or,
(b) exceptionally and provided that agreement is reached between The Company and the relevant User(s), such agreement to be sought in accordance with PC.7, the Access Period may be of a period not less than 4 continuous weeks and can occur in any one of three maintenance years during the period from calendar week 10 to calendar week 43 (inclusive) in each year.

PC.A.4.1.4.4 The Company shall submit in writing no later than calendar week 6 in each year:
(a) the calendar weeks defining the proposed start and finish of each Access Period for each Transmission Interface Circuit; and

(b) the Connection Points in each Access Group.

The submission by The Company under PC.A.4.1.4.4 (a) above shall commence in 2010 and shall then continue each year thereafter. The submission by The Company under PC.A.4.1.4.4 (b) shall commence in 2009 and then continue each year thereafter.

PC.A.4.1.4.5 It is permitted for Access Periods to overlap in the same Access Group and in the same maintenance year. However, where possible Access Periods will be sought by The Company that do not overlap with any other Access Period within the same Access Group for each maintenance year. Where it is not possible to avoid overlapping Access Periods, The Company will indicate to Users by calendar week 6 its initial view of which Transmission Interface Circuits will need to be considered out of service concurrently for the purpose of assessing compliance to Licence Standards. The obligation on The Company to indicate which Transmission Interface Circuits will need to be considered out of service concurrently for the purpose of assessing compliance to Licence Standards shall commence in 2010 and shall continue each year thereafter.

PC.A.4.1.4.6 Following the submission(s) by The Company by week 6 in each year and where required by either party, both The Company and the relevant User(s) shall use their reasonable endeavours to agree the appropriate Access Group(s) and Access Period for each Transmission Interface Circuit prior to week 17 in each year. The requirement on The Company and the relevant User(s) to agree, shall commence in respect of Access Groups only in 2010. This paragraph PC.A.4.1.4.6 shall apply in its entirety in 2011 and shall then continue each year thereafter.

PC.A.4.1.4.7 In exceptional circumstances, and with the agreement of all parties concerned, where a Connection Point is specified for the purpose of the Planning Code as electrically independent Subtransmission Systems, then data submissions can be on the basis of two (or more) individual Connection Points.

PC.A.4.2 User's User System Demand (Active Power) and Active Energy Data

PC.A.4.2.1 Forecast daily Demand (Active Power) profiles, as specified in (a), (b) and (c) below, in respect of each of the User's User Systems (each summated over all Grid Supply Points in each User System) are required for:

(a) peak day on each of the User's User Systems (as determined by the User) giving the numerical value of the maximum Demand (Active Power) that in the Users' opinion could reasonably be imposed on the National Electricity Transmission System;

(b) day of peak National Electricity Transmission System Demand (Active Power) as notified by The Company pursuant to PC.A.4.2.2;

(c) day of minimum National Electricity Transmission System Demand (Active Power) as notified by The Company pursuant to PC.A.4.2.2.

In addition, the total Demand (Active Power) in respect of the peak National Electricity Transmission System Demand in the preceding Financial Year in respect of each of the User's User Systems (each summated over all Grid Supply Points in each User System) both outturn and weather corrected shall be supplied.

PC.A.4.2.2 No later than calendar week 17 each year The Company shall notify each Network Operator and Non-Embedded Customer in writing of the following, for the current Financial Year and for each of the following seven Financial Years, which will, until replaced by the following year’s notification, be regarded as the relevant specified days and times under PC.A.4.2.1:

(a) the date and time of the annual peak of the National Electricity Transmission System Demand;

(b) the date and time of the annual minimum of the National Electricity Transmission System Demand;

(c) the relevant Access Period for each Transmission Interface Circuit; and,
(d) Concurrent Access Periods of two or more Transmission Interface Circuits (if any) that are situated in the same Access Group.

The submissions by The Company made under PC.A.4.2.1 (c) and PC.A.4.2.1 (d) above shall commence in 2010 and shall then continue in respect of each year thereafter.

PC.A.4.2.3 The total Active Energy used on each of the Network Operators’ or Non-Embedded Customers’ User Systems (each summated over all Grid Supply Points in each User System) in the preceding Financial Year, both outturn and weather corrected, together with a prediction for the current financial year, is required. Each Active Energy submission shall be subdivided into the following categories of Customer tariff:

- LV1
- LV2
- LV3
- HV
- EHV
- Traction
- Lighting

In addition, the total User System losses and the Active Energy provided by Embedded Small Power Stations and Embedded Medium Power Stations shall be supplied.

PC.A.4.2.4 All forecast Demand (Active Power) and Active Energy specified in PC.A.4.2.1 and PC.A.4.2.3 shall:

(a) in the case of PC.A.4.2.1(a), (b) and (c), be such that the profiles comprise average Active Power levels in ‘MW’ for each time marked half hour throughout the day;

(b) in the case of PC.A.4.2.1(a), (b) and (c), be that remaining after any deductions reasonably considered appropriate by the User to take account of the output profile of all Embedded Small Power Stations and Embedded Medium Power Stations and Customer Generating Plant and imports across Embedded External Interconnections including imports across Embedded installations of direct current converters which do not form a DC Converter Station or HVDC System and Embedded DC Converter Stations and Embedded HVDC Systems with a Registered Capacity or HVDC Active Power Transmission Capacity of less than 100MW;

(c) be based upon Annual ACS Conditions for times that occur during week 44 through to week 12 (inclusive) and based on Average Conditions for weeks 13 to 43 (inclusive).

PC.A.4.3 Connection Point Demand (Active and Reactive Power)

PC.A.4.3.1 Forecast Demand (Active Power) and Power Factor (values of the Power Factor at maximum and minimum continuous excitation may be given instead where more than 95% of the total Demand at a Connection Point is taken by synchronous motors) to be met at each Connection Point within each Access Group is required for:

(a) the time of the maximum Demand (Active Power) at the Connection Point (as determined by the User) that in the User’s opinion could reasonably be imposed on the National Electricity Transmission System;

(b) the time of peak National Electricity Transmission System Demand as provided by The Company under PC.A.4.2.2;

(c) the time of minimum National Electricity Transmission System Demand as provided by The Company under PC.A.4.2.2;

(d) the time of the maximum Demand (Apparent Power) at the Connection Point (as determined by the User) during the Access Period of each Transmission Interface Circuit;
(e) at a time specified by either The Company or a User insofar as such a request is reasonable.

Instead of such forecast Demand to be met at each Connection Point within each Access Group the User may (subject to PC.A.4.3.4) submit such Demand at each node on the Single Line Diagram.

In addition, the Demand in respect of each of the time periods referred to in PC.A.4.3.1 (a) to (e) in the preceding Financial Year in respect of each Connection Point within each Access Group both outturn and weather corrected shall be supplied. The “weather correction” shall normalise outturn figures to Annual ACS Conditions for times that occur during calendar week 44 through to calendar week 12 (inclusive) or Average Conditions for the period calendar weeks 13 to calendar week 43 (inclusive) and shall be performed by the relevant User on a best endeavours basis.

The submission by a User pursuant to PC.A.4.3.1 (d) shall commence in 2011 and shall then continue each year thereafter.

**PC.A.4.3.2** All forecast Demand specified in PC.A.4.3.1 shall:

(a) be that remaining after any deductions reasonably considered appropriate by the User to take account of the output of all Embedded Small Power Stations and Embedded Medium Power Stations and Customer Generating Plant and imports across Embedded External Interconnections, including Embedded installations of direct current converters which do not form a DC Converter Station, HVDC System and Embedded DC Converter Stations and Embedded HVDC Systems and such deductions should be separately stated;

(b) include any User's System series reactive losses but exclude any reactive compensation equipment specified in PC.A.2.4 and exclude any network susceptance specified in PC.A.2.3;

(c) be based upon Annual ACS Conditions for times that occur during calendar week 44 through to calendar week 12 (inclusive) and based on Average Conditions for calendar weeks 13 to calendar week 43 (inclusive), both corrections being made on a best endeavours basis;

(d) reflect the User's opinion of what could reasonably be imposed on the National Electricity Transmission System.

**PC.A.4.3.3** The date and time of the forecast maximum Demand (Apparent Power) at the Connection Point as specified in PC.A.4.3.1 (a) and (d) is required.

**PC.A.4.3.4** Each Single Line Diagram provided under PC.A.2.2.2 shall include the Demand (Active Power) and Power Factor (values of the Power Factor at maximum and minimum continuous excitation may be given instead where more than 95% of the Demand is taken by synchronous motors) at the time of the peak National Electricity Transmission System Demand (as provided under PC.A.4.2.2) at each node on the Single Line Diagram. These Demands shall be consistent with those provided under PC.A.4.3.1(b) above for the relevant year.

**PC.A.4.3.5** The Single Line Diagram must represent the User's User System layout under the period specified in PC.A.4.3.1(b) (at the time of peak National Electricity Transmission System Demand). Should the User's User System layout during the other times specified in PC.A.4.3.1 be planned to be materially different from the Single Line Diagram submitted to The Company pursuant to PC.A.2.2.1 the User shall in respect of such other times submit:

(i) an alternative Single Line Diagram that accurately reflects the revised layout and in such case shall also include appropriate associated data representing the relevant changes, or;

(ii) submit an accurate and unambiguous description of the changes to the Single Line Diagram previously submitted for the time of peak National Electricity Transmission System Demand.
Where a User does not submit any changes, The Company will assume that the Single Line Diagram (and associated circuit and node data) provided at the time of peak National Electricity Transmission System Demand will be valid for all other times. In respect of such other times, where the User does not submit such nodal demands at the times defined in PC.A.4.3.1(a), (c), (d) and (e), the nodal demands will be pro-rata, to be consistent with the submitted Connection Point Demands.

PC.A.4.4  
The Company will assemble and derive in a reasonable manner, the forecast information supplied to it under PC.A.4.2.1, PC.A.4.3.1, PC.A.4.3.4 and PC.A.4.3.5 above into a cohesive forecast and will use this in preparing Forecast Demand information in the Seven Year Statement and for use in The Company's Operational Planning. If any User believes that the cohesive forecast Demand information in the Seven Year Statement does not reflect its assumptions on Demand, it should contact The Company to explain its concerns and may require The Company, on reasonable request, to discuss these forecasts. In the absence of such expressions, The Company will assume that Users concur with The Company's cohesive forecast.

PC.A.4.5  
Post Fault User System Layout

PC.A.4.5.1  
Where for the purposes of The Company assessing against the Licence Standards an Access Group, the User reasonably considers it appropriate that revised post fault User System layouts should be taken into account by The Company, the following information is required to be submitted by the User:

(i) the specified Connection Point assessment period (PC.A.4.3.1,(a)-(e)) that is being evaluated;

(ii) an accurate and unambiguous description of the Transmission Interface Circuits considered to be switched out due to a fault;

(iii) appropriate revised Single Line Diagrams and/or associated revised nodal Demand and circuit data detailing the revised User System(s) conditions;

(iv) where the User's planned post fault action consists of more than one component, each component must be explicitly identified using the Single Line Diagram and associated nodal Demand and circuit data;

(v) the arrangements for undertaking actions (eg the time taken, automatic or manual and any other appropriate information).

The User must not submit any action that it does not have the capability or the intention to implement during the assessment period specified (subject to there being no further unplanned outages on the User's User System).

PC.A.4.6  
Control of Demand or Reduction of Pumping Load Offered as Reserve

Magnitude of Demand or pumping load which is tripped  $\text{MW}$  
System Frequency at which tripping is initiated  $\text{Hz}$  
Time duration of System Frequency below trip setting for tripping to be initiated  $\text{s}$  
Time delay from trip initiation to tripping  $\text{s}$

PC.A.4.7  
General Demand Data

PC.A.4.7.1  
The following information is infrequently required and should be supplied (wherever possible) when requested by The Company:

(a) details of any individual loads which have characteristics significantly different from the typical range of Domestic, Commercial or Industrial loads supplied;

(b) the sensitivity of the Demand (Active and Reactive Power) to variations in voltage and Frequency on the National Electricity Transmission System at the time of the peak Demand (Active Power). The sensitivity factors quoted for the Demand (Reactive Power) should relate to that given under PC.A.4.3.1 and, therefore, include any User's System series reactive losses but exclude any reactive compensation equipment specified in PC.A.2.4 and exclude any network susceptance specified in PC.A.2.3;
(c) details of any traction loads, e.g. connection phase pairs and continuous load variation with time;

(d) the average and maximum phase unbalance, in magnitude and phase angle, which the User would expect its Demand to impose on the National Electricity Transmission System;

(e) the maximum harmonic content which the User would expect its Demand to impose on the National Electricity Transmission System;

(f) details of all loads which may cause Demand fluctuations greater than those permitted under Engineering Recommendation P28, Stage 1 at a Point of Common Coupling including the Flicker Severity (Short Term) and the Flicker Severity (Long Term).
PART 2 - DETAILED PLANNING DATA

PC.A.5 POWER GENERATING MODULE, GENERATING UNIT, POWER PARK MODULE (INCLUDING DC CONNECTED POWER PARK MODULES), DC CONVERTER, HVDC EQUIPMENT AND OTSDUW PLANT AND APPARATUS DATA

PC.A.5.1 Introduction

Directly Connected

PC.A.5.1.1 Each Generator (including those undertaking OTSDUW), with existing or proposed Power Stations directly connected, or to be directly connected, to the National Electricity Transmission System, shall provide The Company with data relating to that Plant and Apparatus, both current and forecast, as specified in PC.A.5.2, PC.A.5.3, PC.A.5.4 and PC.A.5.7 as applicable.

Each DC Converter Station owner or HVDC System Owner, with existing or proposed DC Converter Stations or HVDC Systems (including Generators undertaking OTSDUW which includes an OTSDUW DC Converter) directly connected, or to be directly connected, to the National Electricity Transmission System, shall provide The Company with data relating to that Plant and Apparatus, both current and forecast, as specified in PC.A.5.2 and PC.A.5.4.

GB Generators, DC Converter Station owners, EU Generators and HVDC System Owners shall ensure that the models supplied in respect of their Plant and Apparatus provide a true and accurate behaviour of the plant as built as required under PC.A.5.3.2(c), PC.A.5.4.2(a) and PC.A.5.4.3 and verified through the Compliance Processes (CP) or European Compliance Processes (ECP) as applicable.

Embedded

PC.A.5.1.2 Each Generator, in respect of its existing, or proposed, Embedded Large Power Stations and its Embedded Medium Power Stations subject to a Bilateral Agreement and each Network Operator in respect of Embedded Medium Power Stations not subject to a Bilateral Agreement within its System shall provide The Company with data relating to each of those Large Power Stations and Medium Power Stations, both current and forecast, as specified in PC.A.5.2, PC.A.5.3, PC.A.5.4 and PC.A.5.7 as applicable.

Each DC Converter Station owner or HVDC System Owner, or Network Operator in the case of an Embedded DC Converter Station or Embedded HVDC System not subject to a Bilateral Agreement within its System with existing or proposed HVDC Systems or DC Converter Stations shall provide The Company with data relating to each of those HVDC Systems or DC Converter Stations, both current and forecast, as specified in PC.A.5.2 and PC.A.5.4.

However, no data need be supplied in relation to those Embedded Medium Power Stations or Embedded DC Converter Stations or Embedded HVDC Systems if they are connected at a voltage level below the voltage level of the Subtransmission System except in connection with an application for, or under a, CUSC Contract or unless specifically requested by The Company under PC.A.5.1.4.

GB Generators, DC Converter Station owners, EU Generators and HVDC System Owners shall ensure that the models supplied in respect of their Plant and Apparatus provide a true and accurate behaviour of the plant as built as required under PC.A.5.3.2(c), PC.A.5.4.2(a) and PC.A.5.4.3 and verified through the Compliance Processes (CP) or European Compliance Processes (ECP) as applicable

PC.A.5.1.3 Each Network Operator need not submit Planning Data in respect of Embedded Small Power Stations unless required to do so under PC.A.1.2(b), PC.A.3.1.4 or unless specifically requested under PC.A.5.1.4 below, in which case they will supply such data.
PC.A.5.1.4  PC.A.4.2.4(b) and PC.A.4.3.2(a) explained that the forecast Demand submitted by each Network Operator must be net of the output of all Medium Power Stations and Small Power Stations and Customer Generating Plant Embedded within that User's System. In such cases, the Network Operator must provide The Company with the relevant information specified under PC.A.3.1.4. On receipt of this data further details may be required at The Company's discretion as follows:

(i) in the case of details required from the Network Operator for Embedded Medium Power Stations not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement and Embedded HVDC Systems not subject to a Bilateral Agreement and Embedded Small Power Stations and Embedded DC Converters and Embedded HVDC Systems in each case within such Network Operator’s System and Customer Generating Plant; and

(ii) in the case of details required from the Generator of Embedded Large Power Stations and Embedded Medium Power Stations subject to a Bilateral Agreement; and

(iii) in the case of details required from the DC Converter Station owner of an Embedded DC Converter or DC Converter Station or HVDC System Owner of an Embedded HVDC System Owner subject to a Bilateral Agreement.

both current and forecast, as specified in PC.A.5.2 and PC.A.5.3. Such requirement would arise when The Company reasonably considers that the collective effect of a number of such Embedded Small Power Stations, Embedded Medium Power Stations, Embedded DC Converter Stations, Embedded HVDC Systems, DC Converters and Customer Generating Plants may have a significant system effect on the National Electricity Transmission System.

PC.A.5.1.5  DPD I and DPD II

The Detailed Planning Data described in this Part 2 of the Appendix comprises both DPD I and DPD II. The required data is listed and collated in the Data Registration Code. The Users need to refer to the DRC to establish whether data referred to here is DPD I or DPD II.

PC.A.5.2  Demand

PC.A.5.2.1  For each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) which has an associated Unit Transformer, the value of the Demand supplied through this Unit Transformer when the Generating Unit is at Rated MW output is to be provided.

PC.A.5.2.2  Where the Power Station or DC Converter Station or HVDC System has associated Demand additional to the unit-supplied Demand of PC.A.5.2.1 which is supplied from either the National Electricity Transmission System or the Generator's User System the Generator, DC Converter Station owner, HVDC System Owner or the Network Operator (in the case of Embedded Medium Power Stations not subject to a Bilateral Agreement within its System), as the case may be, shall supply forecasts for each Power Station or DC Converter Station or HVDC System of:

(a) the maximum Demand that, in the User's opinion, could reasonably be imposed on the National Electricity Transmission System or the Generator's User System as appropriate;

(b) the Demand at the time of the peak National Electricity Transmission System Demand

(c) the Demand at the time of minimum National Electricity Transmission System Demand.
PC.A.5.2.3 No later than calendar week 17 each year The Company shall notify each Generator in respect of its Large Power Stations and its Medium Power Stations and each DC Converter owner in respect of its DC Converter Station and each HVDC System Owner in respect of its HVDC System subject to a Bilateral Agreement and each Network Operator in respect of each Embedded Medium Power Station not subject to a Bilateral Agreement and each Embedded DC Converter Station or Embedded HVDC System not subject to a Bilateral Agreement within such Network Operator’s System in writing of the following, for the current Financial Year and for each of the following seven Financial Years, which will be regarded as the relevant specified days and times under PC.A.5.2.2:

(a) the date and time of the annual peak of the National Electricity Transmission System Demand at Annual ACS Conditions;

(b) the date and time of the annual minimum of the National Electricity Transmission System Demand at Average Conditions.

PC.A.5.2.4 At its discretion, The Company may also request further details of the Demand as specified in PC.A.4.6

PC.A.5.2.5 In the case of OTSDUW Plant and Apparatus the following data shall be supplied:

(a) The maximum Demand that could occur at the Interface Point and each Connection Point (in MW and MVAr);

(b) Demand at specified time of annual peak half hour of National Electricity Transmission System Demand at Annual ACS Conditions (in MW and MVAr); and

(c) Demand at specified time of annual minimum half-hour of National Electricity Transmission System Demand (in MW and MVAr).

For the avoidance of doubt, Demand data associated with Generators undertaking OTSDUW which utilise an OTSDUW DC Converter should supply data under PC.A.4.

PC.A.5.3 Synchronous Power Generating Modules, Synchronous Generating Unit and Associated Control System Data

PC.A.5.3.1 The data submitted below are not intended to constrain any Ancillary Services Agreement

PC.A.5.3.2 The following Synchronous Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) and Power Station data should be supplied:

(a) Synchronous Generating Unit Parameters

   Rated terminal volts (kV)
   Maximum terminal voltage set point (kV)

   Terminal voltage set point step resolution – if not continuous (kV)
   * Rated MVA
   * Rated MW
   * Minimum Generation MW
   * Short circuit ratio
     Direct axis synchronous reactance
   * Direct axis transient reactance
     Direct axis sub-transient reactance
     Direct axis short-circuit transient time constant.
     Direct axis short-circuit sub-transient time constant.
   Quadrature axis synchronous reactance
   Quadrature axis sub-transient reactance
Quadrature axis short-circuit sub-transient time constant.
Stator time constant
Stator leakage reactance
Armature winding direct-current resistance.

Note: The above data item relating to armature winding direct-current resistance need only be supplied with respect to Generating Units commissioned after 1st March 1996 and in cases where, for whatever reason, the Generator or the Network Operator, as the case may be is aware of the value of the relevant parameter.

* Turbogenerator inertia constant (MWsec/MVA)
Rated field current (amps) at Rated MW and MVAr output and at rated terminal voltage.
Field current (amps) open circuit saturation curve for Generating Unit terminal voltages ranging from 50% to 120% of rated value in 10% steps as derived from appropriate manufacturers test certificates.

(b) Parameters for Generating Unit Step-up Transformers
* Rated MVA
Voltage ratio
* Positive sequence reactance (at max, min, & nominal tap)
Positive sequence resistance (at max, min, & nominal tap)
Zero phase sequence reactance
Tap changer range
Tap changer step size
Tap changer type: on load or off circuit

(c) Excitation Control System parameters
Note: The data items requested under Option 1 below may continue to be provided in relation to Generating Units connected to the System at 09 January 1995 (in this paragraph, the "relevant date") or the new data items set out under Option 2 may be provided. Generators or Network Operators, as the case may be, must supply the data as set out under Option 2 (and not those under Option 1) for Generating Unit excitation control systems commissioned after the relevant date, those Generating Unit excitation control systems recommissioned for any reason such as refurbishment after the relevant date and Generating Unit excitation control systems where, as a result of testing or other process, the Generator or Network Operator, as the case may be, is aware of the data items listed under Option 2 in relation to that Generating Unit.

Option 1
DC gain of Excitation Loop
Rated field voltage
Maximum field voltage
Minimum field voltage
Maximum rate of change of field voltage (rising)
Maximum rate of change of field voltage (falling)
Details of Excitation Loop described in block diagram form showing transfer functions of individual elements.
Dynamic characteristics of Over-excitation Limiter.
Dynamic characteristics of Under-excitation Limiter

Option 2

Excitation System Nominal Response
Rated Field Voltage
No-Load Field Voltage
Excitation System On-Load Positive Ceiling Voltage
Excitation System No-Load Positive Ceiling Voltage
Excitation System No-Load Negative Ceiling Voltage

Stator Current Limiter (applicable only to Synchronous Power Generating Modules)

Details of Excitation System (including PSS if fitted) described in block diagram form showing transfer functions of individual elements.

Details of Over-excitation Limiter described in block diagram form showing transfer functions of individual elements.

Details of Under-excitation Limiter described in block diagram form showing transfer functions of individual elements.

The block diagrams submitted after 1 January 2009 in respect of the Excitation System (including the Over-excitation Limiter and the Under-excitation Limiter) for Generating Units with a Completion date after 1 January 2009 or subject to a Modification to the Excitation System after 1 January 2009, should have been verified as far as reasonably practicable by simulation studies as representing the expected behaviour of the system.

(d) Governor Parameters

Incremental Droop values (in %) are required for each Generating Unit at six MW loading points (MLP1 to MLP6) as detailed in PC.A.5.5.1 (this data item needs only be provided for Large Power Stations)

Note: The data items requested under Option 1 below may continue to be provided by Generators in relation to Generating Units on the System at 09 January 1995 (in this paragraph, the "relevant date") or they may provide the new data items set out under Option 2. Generators must supply the data as set out under Option 2 (and not those under Option 1) for Generating Unit governor control systems commissioned after the relevant date, those Generating Unit governor control systems recommissioned for any reason such as refurbishment after the relevant date and Generating Unit governor control systems where, as a result of testing or other process, the Generator is aware of the data items listed under Option 2 in relation to that Generating Unit. EU Generators are also required to submit the data as set out in option 2. Additional data required from EU Generators which own or operate Type C or Type D Power Generating Modules are marked in brackets with an asterisk (eg (*)). For the avoidance of doubt, items marked as (*) need not be supplied by GB Generators.

Option 1

(i) Governor Parameters (for Reheat Steam Units)

HP governor average gain MW/Hz
Speeder motor setting range
HP governor valve time constant
HP governor valve opening limits
HP governor valve rate limits

Reheater time constant (Active Energy stored in re heater)
IP governor average gain MW/Hz
IP governor setting range
IP governor valve time constant
IP governor valve opening limits
IP governor valve rate limits

Details of acceleration sensitive elements in HP & IP governor loop.
A governor block diagram showing transfer functions of individual elements.

(ii) Governor Parameters (for Non-Reheat Steam Units and Gas Turbine Units)
Governor average gain
Speeder motor setting range
Time constant of steam or fuel governor valve
Governor valve opening limits
Governor valve rate limits
Time constant of turbine
Governor block diagram

The following data items need only be supplied for Large Power Stations:

(iii) Boiler & Steam Turbine Data
Boiler Time Constant (Stored Active Energy) s
HP turbine response ratio:
   proportion of Primary Response arising from HP turbine %
HP turbine response ratio:
   proportion of High Frequency Response arising from HP turbine %

[End of Option 1]

Option 2

(i) Governor and associated prime mover Parameters - All Generating Units
   (including Synchronous Generating Units within a Synchronous Power Generating Module)
Governor Block Diagram showing transfer function of individual elements
   including acceleration sensitive elements.
Governor Time Constant (in seconds)

Speeder Motor Setting Range (%)
Average Gain (MW/Hz)

Governor Deadband (and Governor Insensitivity Governor Deadband*)
need only be provided for Large Power Stations (and both Governor Deadband and Governor Insensitivity should be supplied in respect of Type C and D Power Generating Modules within Large Power Station and Medium Power Stations excluding Embedded Medium Power Stations not subject to a Bilateral Agreement*)
- Maximum Setting ±Hz
- Normal Setting ±Hz
- Minimum Setting ±Hz

Where the Generating Unit governor does not have a selectable Governor Deadband (or Governor Insensitivity*) facility as specified above, then the actual value of the Governor Deadband (or Governor Insensitivity*) need only be provided.

The block diagrams submitted after 1 January 2009 in respect of the Governor system for Generating Units with a Completion date after 1 January 2009 or subject to a Modification to the governor system after 1 January 2009, should have been verified as far as reasonably practicable by simulation studies as representing the expected behaviour of the system.

(ii) Governor and associated prime mover Parameters - Steam Units

HP Valve Time Constant (in seconds)
HP Valve Opening Limits (%)
HP Valve Opening Rate Limits (%/second)
HP Valve Closing Rate Limits (%/second)
HP Turbine Time Constant (in seconds)

IP Valve Time Constant (in seconds)
IP Valve Opening Limits (%)
IP Valve Opening Rate Limits (%/second)
IP Valve Closing Rate Limits (%/second)
IP Turbine Time Constant (in seconds)

LP Valve Time Constant (in seconds)
LP Valve Opening Limits (%)
LP Valve Opening Rate Limits (%/second)
LP Valve Closing Rate Limits (%/second)
LP Turbine Time Constant (in seconds)
Reheater Time Constant (in seconds)
Boiler Time Constant (in seconds)
HP Power Fraction (%)
IP Power Fraction (%)

(iii) Governor and associated prime mover Parameters - Gas Turbine Units

Inlet Guide Vane Time Constant (in seconds)
Inlet Guide Vane Opening Limits (%)
Inlet Guide Vane Opening Rate Limits (%/second)
Inlet Guide Vane Closing Rate Limits (%/second)
Fuel Valve Constant (in seconds)
Fuel Valve Opening Limits (%)

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Fuel Valve Opening Rate Limits (%/second)
Fuel Valve Closing Rate Limits (%/second)
Waste Heat Recovery Boiler Time Constant (in seconds)

(iv) Governor and associated prime mover Parameters - Hydro Generating Units
   Guide Vane Actuator Time Constant (in seconds)
   Guide Vane Opening Limits (%)
   Guide Vane Opening Rate Limits (%/second)
   Guide Vane Closing Rate Limits (%/second)
   Water Time Constant (in seconds)

[End of Option 2]

(e) Unit Control Options
The following data items need only be supplied with respect to Large Power Stations:

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Maximum</th>
<th>Normal</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Droop</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Governor Deadband</td>
<td>±Hz</td>
<td>±Hz</td>
<td>±Hz</td>
</tr>
<tr>
<td>Governor Insensitivity*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maximum output Governor Deadband (and Governor Insensitivity*)
   ±MW

Normal output Governor Deadband (and Governor Insensitivity*)
   ±MW

Minimum output Governor Deadband (and Governor Insensitivity*)
   ±MW

Frequency settings between which Unit Load Controller Droop applies:
   - Maximum Hz
   - Normal Hz
   - Minimum Hz

State if sustained response is normally selected.

(* GB Generators which are not required to satisfy the requirements of the European Connection Conditions are not required to supply Governor Insensitivity data).

(f) Plant Flexibility Performance
The following data items need only be supplied with respect to Large Power Stations, and should be provided with respect to each Genset:

# Run-up rate to Registered Capacity,
# Run-down rate from Registered Capacity,
# Synchronising Generation,
Regulating range
Load rejection capability while still **Synchronised** and able to supply **Load**.

Data items marked with a hash (#) should be applicable to a **Genset** which has been **Shutdown** for 48 hours.

* Data items marked with an asterisk are already requested under partx1, PC.A.3.3.1, to facilitate an early assessment by **The Company** as to whether detailed stability studies will be required before an offer of terms for a **CUSC Contract** can be made. Such data items have been repeated here merely for completeness and need not, of course, be resubmitted unless their values, known or estimated, have changed.

(g) Generating Unit Mechanical Parameters

It is occasionally necessary for **The Company** to assess the interaction between the **Total System** and the mechanical components of **Generating Units**. For **Generating Units** (including **Synchronous Generating Units** within a **Synchronous Power Generating Module**) with a **Completion Date** on or after 01 April 2015, the following data items should be supplied:

- The number of turbine generator masses.
- Diagram showing the Inertia and parameters for each turbine generator mass (kgm²) and Stiffness constants and parameters between each turbine generator mass for the complete drive train (Nm/rad).
- Number of poles.
- Relative power applied to different parts of the turbine (%).
- Torsional mode frequencies (Hz).
- Modal damping decrement factors for the different mechanical modes.

PC.A.5.4 **Power Park Module, Non-Synchronous Generating Unit and Associated Control System Data**

PC.A.5.4.1 The data submitted below are not intended to constrain any **Ancillary Services Agreement**

PC.A.5.4.2 The following **Power Park Unit, Power Park Module** and **Power Station** data should be supplied in the case of a **Power Park Module** not connected to the **Total System** by a **DC Converter** or **HVDC System** (and in the case of PC.A.5.4.2(f) any **OTSUA**):

Where a **Manufacturer's Data & Performance Report** exists in respect of the model of the **Power Park Unit**, the **User** may subject to **The Company**'s agreement, opt to reference the **Manufacturer's Data & Performance Report** as an alternative to the provision of data in accordance with PC.A.5.4.2 except for:

1. the section marked thus # at sub paragraph (b); and
2. all of the harmonic and flicker parameters required under sub paragraph (h); and
3. all of the site specific model parameters relating to the voltage or frequency control systems required under sub paragraphs (d) and (e),

which must be provided by the **User** in addition to the **Manufacturer's Data & Performance Report** reference.

(a) **Power Park Unit** model
A mathematical model of each type of Power Park Unit capable of representing its transient and dynamic behaviour under both small and large disturbance conditions. The model shall include non-linear effects and represent all equipment relevant to the dynamic performance of the Power Park Unit as agreed with The Company. The model shall be suitable for the study of balanced, root mean square, positive phase sequence time-domain behaviour, excluding the effects of electromagnetic transients, harmonic and sub-harmonic frequencies.

The model shall accurately represent the overall performance of the Power Park Unit over its entire operating range including that which is inherent to the Power Park Unit and that which is achieved by use of supplementary control systems providing either continuous or stepwise control. Model resolution should be sufficient to accurately represent Power Park Unit behaviour both in response to operation of Transmission System protection and in the context of longer-term simulations.

The overall structure of the model shall include:

(i) any supplementary control signal modules not covered by (c), (d) and (e) below.

(ii) any blocking, deblocking and protective trip features that are part of the Power Park Unit (e.g. “crowbar”).

(iii) any other information required to model the Power Park Unit behaviour to meet the model functional requirement described above.

The model shall be submitted in the form of a transfer function block diagram and may be accompanied by dynamic and algebraic equations.

This model shall display all the transfer functions and their parameter values, any non wind-up logic, signal limits and non-linearities.

The submitted Power Park Unit model and the supplementary control signal module models covered by (c), (d) and (e) below shall have been validated and this shall be confirmed by the Generator. The validation shall be based on comparing the submitted model simulation results against measured test results. Validation evidence shall also be submitted and this shall include the simulation and measured test results. The latter shall include appropriate short-circuit tests. In the case of an Embedded Medium Power Station not subject to a Bilateral Agreement the Network Operator will provide The Company with the validation evidence if requested by The Company. The validation of the supplementary control signal module models covered by (c), (d) and (e) below applies only to a Power Park Module with a Completion Date after 1 January 2009 or Power Park Modules within a Power Generating Module.

(b) Power Park Unit parameters

* Rated MVA
* Rated MW
* Rated terminal voltage
* Average site air density (kg/m³), maximum site air density (kg/m³) and minimum site air density (kg/m³) for the year
  
Year for which the air density is submitted

Number of pole pairs

Blade swept area (m²)

Gear box ratio

Mechanical drive train

For each Power Park Unit, details of the parameters of the drive train represented as an equivalent two mass model should be provided. This model should accurately represent the behaviour of the complete drive train for the purposes of power system analysis studies and should include the following data items:-
Equivalent inertia constant (MWsec/MVA) of the first mass (e.g. wind turbine rotor and blades) at minimum, synchronous and rated speeds

Equivalent inertia constant (MWsec/MVA) of the second mass (e.g. generator rotor) at minimum, synchronous and rated speeds

Equivalent shaft stiffness between the two masses (Nm/electrical radian)

Additionally, for **Power Park Units** that are induction generators (e.g. squirrel cage, doubly-fed) driven by wind turbines:

* Stator resistance
* Stator reactance
* Magnetising reactance.
* Rotor resistance (at starting)
* Rotor resistance (at rated running)
* Rotor reactance (at starting)
* Rotor reactance (at rated running)

Additionally for doubly-fed induction generators only:

The generator rotor speed range (minimum and maximum speeds in RPM)

The optimum generator rotor speed versus wind speed submitted in tabular format

Power converter rating (MVA)

The rotor power coefficient \( (C_p) \) versus tip speed ratio \( (\lambda) \) curves for a range of blade angles (where applicable) together with the corresponding values submitted in tabular format. The tip speed ratio \( (\lambda) \) is defined as \( \Omega R/U \) where \( \Omega \) is the angular velocity of the rotor, \( R \) is the radius of the wind turbine rotor and \( U \) is the wind speed.

The electrical power output versus generator rotor speed for a range of wind speeds over the entire operating range of the **Power Park Unit**, together with the corresponding values submitted in tabular format.

The blade angle versus wind speed curve together with the corresponding values submitted in tabular format.

The electrical power output versus wind speed over the entire operating range of the **Power Park Unit**, together with the corresponding values submitted in tabular format.

Transfer function block diagram, including parameters and description of the operation of the power electronic converter and fault ride through capability (where applicable).

For a **Power Park Unit** consisting of a synchronous machine in combination with a back to back **DC Converter** or **HVDC System**, or for a **Power Park Unit** not driven by a wind turbine, the data to be supplied shall be agreed with **The Company** in accordance with PC.A.7.

(c) Torque / speed and blade angle control systems and parameters

For the **Power Park Unit**, details of the torque / speed controller and blade angle controller in the case of a wind turbine and power limitation functions (where applicable) described in block diagram form showing transfer functions and parameters of individual elements.

(d) Voltage/Reactive Power/Power Factor control system parameters
For the Power Park Unit and Power Park Module details of voltage/Reactive Power/Power Factor controller (and PSS if fitted) described in block diagram form showing transfer functions and parameters of individual elements.

(e) Frequency control system parameters

For the Power Park Unit and Power Park Module details of the Frequency controller described in block diagram form showing transfer functions and parameters of individual elements.

(f) Protection

Details of settings for the following Protection relays (to include): Under Frequency, over Frequency, under voltage, over voltage, rotor over current, stator over current, high wind speed shut down level.

(g) Complete Power Park Unit model, parameters and controls

An alternative to PC.A.5.4.2 (a), (b), (c), (d), (e) and (f), is the submission of a single complete model that consists of the full information required under PC.A.5.4.2 (a), (b), (c), (d), (e) and (f) provided that all the information required under PC.A.5.4.2 (a), (b), (c), (d), (e) and (f) individually is clearly identifiable.

(h) Harmonic and flicker parameters

When connecting a Power Park Module, it is necessary for The Company to evaluate the production of flicker and harmonics on The Company’s and User’s Systems. At The Company’s reasonable request, the User (a Network Operator in the case of an Embedded Power Park Module not subject to a Bilateral Agreement) is required to submit the following data (as defined in IEC 61400-21 (2001)) for each Power Park Unit:

- Flicker coefficient for continuous operation.
- Flicker step factor.
- Number of switching operations in a 10 minute window.
- Number of switching operations in a 2 hour window.
- Voltage change factor.
- Current Injection at each harmonic for each Power Park Unit and for each Power Park Module

* Data items marked with an asterisk are already requested under part 1, PC.A.3.3.1, to facilitate an early assessment by The Company as to whether detailed stability studies will be required before an offer of terms for a CUSC Contract can be made. Such data items have been repeated here merely for completeness and need not, of course, be resubmitted unless their values, known or estimated, have changed.

PC.A.5.4.3 DC Converter and HVDC Systems

PC.A.5.4.3.1 For a DC Converter at a DC Converter Station or an HVDC System or Power Park Module connected to the Total System by a DC Converter or HVDC System (or in the case of OTSUA which includes an OTSDUW DC Converter) the following information for each DC Converter, HVDC System and DC Network should be supplied:

(a) DC Converter and HVDC System parameters

* Rated MW per pole for transfer in each direction;
* DC Converter type (i.e. current or voltage source (including a HVDC Converter in an HVDC System));
* Number of poles and pole arrangement;
* Rated DC voltage/pole (kV);
* Return path arrangement;

(b) **DC Converter and HVDC System** transformer parameters
   - Rated MVA
   - Nominal primary voltage (kV);
   - Nominal secondary (converter-side) voltage(s) (kV);
   - Winding and earthing arrangement;
   - Positive phase sequence reactance at minimum, maximum and nominal tap;
   - Positive phase sequence resistance at minimum, maximum and nominal tap;
   - Zero phase sequence reactance;
   - Tap-changer range in %;
   - number of tap-changer steps;

(c) **DC Network** parameters
   - Rated DC voltage per pole;
   - Rated DC current per pole;
   - Single line diagram of the complete DC Network and HVDC System;
   - Details of the complete DC Network, including resistance, inductance and capacitance of all DC cables and/or DC lines and HVDC System;
   - Details of any DC reactors (including DC reactor resistance), DC capacitors and/or DC-side filters that form part of the DC Network and/or HVDC System;

(d) **AC filter reactive compensation equipment parameters**
   - Note: The data provided pursuant to this paragraph must not include any contribution from reactive compensation plant owned or operated by The Company.
   - Total number of AC filter banks.
   - Type of equipment (e.g. fixed or variable)
   - Single line diagram of filter arrangement and connections;
   - Reactive Power rating for each AC filter bank, capacitor bank or operating range of each item of reactive compensation equipment, at rated voltage;
   - Performance chart showing Reactive Power capability of the DC Converter and HVDC System, as a function of MW transfer, with all filters and reactive compensation plant, belonging to the DC Converter Station or HVDC System working correctly.

Note: Details in PC.A.5.4.3.1 are required for each DC Converter connected to the DC Network and HVDC System, unless each is identical or where the data has already been submitted for an identical DC Converter or HVDC System at another Connection Point.

Note: For a Power Park Module and DC Connected Power Park Module connected to the Grid Entry Point or (User System Entry Point if Embedded) by a DC Converter or HVDC System the equivalent inertia and fault infeed at the Power Park Unit should be given.

**DC Converter and HVDC System Control System Models**

PC.A.5.4.3.2 The following data is required by The Company to represent DC Converters and associated DC Networks and HVDC Systems (and including OTSUA which includes an OTSDUW DC Converter) in dynamic power system simulations, in which the AC power system is typically represented by a positive sequence equivalent. DC Converters and HVDC Systems are represented by simplified equations and are not modelled to switching device level.
(i) Static $V_{DC-IAC}$ (DC voltage - DC current) characteristics, for both the rectifier and inverter modes of a current source converter. Static $V_{DC-POC}$ (DC voltage - DC power) characteristics, for both the rectifier and inverter modes of a voltage source converter. Transfer function block diagram including parameters representation of the control systems of each DC Converter and of the DC Converter Station and the HVDC System, for both the rectifier and inverter modes. A suitable model would feature the DC Converter or HVDC Converter firing angle as the output variable.

(ii) Transfer function block diagram representation including parameters of the DC Converter or HVDC Converter transformer tap changer control systems, including time delays.

(iii) Transfer function block diagram representation including parameters of AC filter and reactive compensation equipment control systems, including any time delays.

(iv) Transfer function block diagram representation including parameters of any Frequency and/or load control systems.

(v) Transfer function block diagram representation including parameters of any small signal modulation controls such as power oscillation damping controls or sub-synchronous oscillation damping controls, that have not been submitted as part of the above control system data.

(vi) Transfer block diagram representation of the Reactive Power control at converter ends for a voltage source converter.

In addition and where not provided for above, HVDC System Owners shall also provide the following dynamic simulation sub-models

(i) HVDC Converter unit models

(ii) AC component models

(iii) DC Grid models

(iv) Voltage and power controller

(v) Special control features if applicable (eg power oscillation damping (POD) function, subsynchronous torsional interaction (SSTI) control;

(vi) Multi terminal control, if applicable

(vii) HVDC System protection models as agreed between The Company and the HVDC System Owner.

HVDC System Owners are also required to supply an equivalent model of the control system when adverse control interactions may result with HVDC Converter Stations and other connections in close proximity if requested by The Company. The equivalent model shall contain all necessary data for the realistic simulation of the adverse control interactions.

Plant Flexibility Performance

PC.A.5.4.3.3 The following information on plant flexibility and performance should be supplied (and also in respect of OTSUA which includes an OTSDUW DC Converter):

(i)Nominal and maximum (emergency) loading rate with the DC Converter or HVDC Converter in rectifier mode.

(ii) Nominal and maximum (emergency) loading rate with the DC Converter or HVDC Converter in inverter mode.

(iii) Maximum recovery time, to 90% of pre-fault loading, following an AC system fault or severe voltage depression.

(iv) Maximum recovery time, to 90% of pre-fault loading, following a transient DC Network fault.

Harmonic Assessment Information
**PC.A.5.4.3.4**  DC Converter owners and HVDC System Owners shall provide such additional further information as required by The Company in order that compliance with CC.6.1.5 can be demonstrated.

* Data items marked with an asterisk are already requested under part 1, PC.A.3.3.1, to facilitate an early assessment by The Company as to whether detailed stability studies will be required before an offer of terms for a C USC Contract can be made. Such data items have been repeated here merely for completeness and need not, of course, be resubmitted unless their values, known or estimated, have changed.

**PC.A.5.5**  
**Response Data For Frequency Changes**  
The information detailed below is required to describe the actual frequency response capability profile as illustrated in Figure CC.A.3.1 of the Connection Conditions, and need only be provided for each:

(i) Genset at Large Power Stations; and

(ii) Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module), Power Park Module (including a DC Connected Power Park Module) or CCGT Module at a Medium Power Station or DC Converter Station or HVDC System that has agreed to provide Frequency response in accordance with a C USC Contract.

In the case of (ii) above for the rest of this PC.A.5.5 where reference is made to Gensets, it shall include such Generating Units (including Synchronous Generating Units within a Synchronous Power Generating Module), CCGT Modules, Power Park Modules (including DC Connected Power Park Modules), HVDC Systems and DC Converters as appropriate, but excludes OTSDUW Plant and Apparatus utilising OTSDUW DC Converters.

In this PC.A.5.5, for a CCGT Module with more than one Generating Unit, the phrase Minimum Generation or Minimum Regulating Level applies to the entire CCGT Module operating with all Generating Units (including Synchronous Generating Units within a Synchronous Power Generating Module) Synchronised to the System. Similarly for a Power Park Module (including a DC Connected Power Park Module) with more than one Power Park Unit, the phrase Minimum Generation or Minimum Regulating Level applies to the entire Power Park Module operating with all Power Park Units Synchronised to the System.

**PC.A.5.5.1**  
**MW Loading Points At Which Data Is Required**  
Response values are required at six MW loading points (MLP1 to MLP6) for each Genset. Primary and Secondary Response values need not be provided for MW loading points which are below Minimum Generation or Minimum Stable Operating Level. MLP1 to MLP6 must be provided to the nearest MW.

Prior to the Genset being first Synchronised, the MW loading points must take the following values :

- **MLP1**  Designed Minimum Operating Level or Minimum Regulating Level
- **MLP2**  Minimum Generation or Minimum Stable Operating Level
- **MLP3**  70% of Registered Capacity or Maximum Capacity
- **MLP4**  80% of Registered Capacity or Maximum Capacity
- **MLP5**  95% of Registered Capacity or Maximum Capacity
- **MLP6**  Registered Capacity or Maximum Capacity

When data is provided after the Genset is first Synchronised, the MW loading points may take any value between the Designed Minimum Operating Level or Minimum Regulating Level and Registered Capacity or Minimum Regulating Level and Maximum Capacity but the value of the Designed Minimum Operating Level or Minimum Regulating Level must still be provided if it does not form one of the MW loading points.
PC.A.5.5.2 Primary And Secondary Response To Frequency Fall

Primary and Secondary Response values for a -0.5Hz ramp are required at six MW loading points (MLP1 to MLP6) as detailed above.

PC.A.5.5.3 High Frequency Response To Frequency Rise

High Frequency Response values for a +0.5Hz ramp are required at six MW loading points (MLP1 to MLP6) as detailed above.

PC.A.5.6 Mothballed Power Generating Module, Mothballed Generating Unit, Mothballed Power Park Module (including DC Connected Power Park Modules), Mothballed HVDC Systems or Mothballed DC Converter At A DC Converter Station And Alternative Fuel Information

Data identified under this section PC.A.5.6 must be submitted as required under PC.A.1.2 and at The Company's reasonable request.

In the case of Embedded Medium Power Stations not subject to a Bilateral Agreement, Embedded HVDC Systems not subject to a Bilateral Agreement and Embedded DC Converter Stations not subject to a Bilateral Agreement, upon request from The Company each Network Operator shall provide the information required in PC.A.5.6.1, PC.A.5.6.2, PC.A.5.6.3 and PC.A.5.6.4 on respect of such Embedded Medium Power Stations and Embedded DC Converters Stations and Embedded HVDC Systems with their System.

PC.A.5.6.1 Mothballed Generating Unit Information

Generators, HVDC System Owners and DC Converter Station owners must supply with respect to each Mothballed Power Generating Module, Mothballed Generating Unit, Mothballed Power Park Module (including a DC Connected Power Park Module), Mothballed HVDC System or Mothballed DC Converter at a DC Converter Station the estimated MW output which could be returned to service within the following time periods from the time that a decision to return was made:

- < 1 month;
- 1-2 months;
- 2-3 months;
- 3-6 months;
- 6-12 months; and
- >12 months.

The return to service time should be determined in accordance with Good Industry Practice assuming normal working arrangements and normal plant procurement lead times. The MW output values should be the incremental values made available in each time period as further described in the DRC.

PC.A.5.6.2 Generators, HVDC System Owners and DC Converter Station owners must also notify The Company of any significant factors which may prevent the Mothballed Power Generating Module, Mothballed Generating Unit, Mothballed Power Park Module (including DC Connected Power Park Modules), Mothballed HVDC Systems or Mothballed DC Converter at a DC Converter Station achieving the estimated values provided under PC.A.5.6.1 above, excluding factors relating to Transmission Entry Capacity.

PC.A.5.6.3 Alternative Fuel Information

The following data items must be supplied with respect to each Generating Unit (including Synchronous Generating Units within a Synchronous Power Generating Module) whose main fuel is gas.

For each alternative fuel type (if facility installed):
(a) Alternative fuel type e.g. oil distillate, alternative gas supply

(b) For the changeover from main to alternative fuel:
   - Time to carry out off-line and on-line fuel changeover (minutes).
   - Maximum output following off-line and on-line changeover (MW).
   - Maximum output during on-line fuel changeover (MW).
   - Maximum operating time at full load assuming typical and maximum possible stock levels (hours).
   - Maximum rate of replacement of depleted stocks (MWh electrical/day) on the basis of Good Industry Practice.
   - Is changeover to alternative fuel used in normal operating arrangements?
   - Number of successful changeovers carried out in the last of The Company’s Financial Year (choice of 0, 1-5, 6-10, 11-20, >20).

(c) For the changeover back to main fuel:
   - Time to carry out off-line and on-line fuel changeover (minutes).
   - Maximum output during on-line fuel changeover (MW).

PC.A.5.6.4 Generators must also notify The Company of any significant factors and their effects which may prevent the use of alternative fuels achieving the estimated values provided under PC.A.5.6.3 above (e.g. emissions limits, distilled water stocks etc.)

PC.A.5.7 Black Start Related Information

Data identified under this section PC.A.5.7 must be submitted as required under PC.A.1.2. This information may also be requested by The Company during a Black Start and should be provided by Generators where reasonably possible. Generators in this section PC.A.5.7 means Generators only in respect of their Large Power Stations.

The following data items/text must be supplied, from each Generator to The Company, with respect to each BM Unit at a Large Power Station (excluding the Generating Units (including Synchronous Generating Units within a Synchronous Power Generating Module) that are contracted to provide Black Start Capability, Power Park Modules (including DC Connected Power Park Modules) or Generating Units with an Intermittent Power Source);

(a) Expected time for each BM Unit to be Synchronised following a Total Shutdown or Partial Shutdown. The assessment should include the Power Station’s ability to re-synchronise all BM Units, if all were running immediately prior to the Total Shutdown or Partial Shutdown. Additionally this should highlight any specific issues (i.e. those that would impact on the BM Unit’s time to be Synchronised) that may arise, as time progresses without external supplies being restored.

(b) Block Loading Capability. This should be provided in either graphical or tabular format showing the estimated block loading capability from 0MW to Registered Capacity. Any particular ‘hold’ points should also be identified. The data of each BM Unit should be provided for the condition of a ‘hot’ unit that was Synchronised just prior to the Total Shutdown or Partial Shutdown and also for the condition of a ‘cold’ unit. The block loading assessment should be done against a frequency variation of 49.5Hz – 50.5Hz.

PC.A.6 USERS’ SYSTEM DATA

PC.A.6.1 Introduction
PC.A.6.1.1 Each **User**, whether connected directly via an existing **Connection Point** to the **National Electricity Transmission System** or seeking such a direct connection, or providing terms for connection of an **Offshore Transmission System** to its **User System** to **The Company** or undertaking **OTSDUW**, shall provide **The Company** with data on its **User System** or **OTSDUW Plant and Apparatus** which relates to the **Connection Site** containing the **Connection Point** (or **Interface Points** or **Connection Points** in the case of **OTSUA**) both current and forecast, as specified in PC.A.6.2 to PC.A.6.6.

PC.A.6.1.2 Each **User** must reflect the system effect at the **Connection Site(s)** of any third party **Embedded** within its **User System** whether existing or proposed.

PC.A.6.1.3 PC.A.6.2, and PC.A.6.4 to PC.A.6.7 consist of data which is only to be supplied to **The Company** at **The Company’s** reasonable request. In the event that **The Company** identifies a reason for requiring this data, **The Company** shall write to the relevant **User(s)**, requesting the data, and explaining the reasons for the request. If the **User(s)** wishes, **The Company** shall also arrange a meeting at which the request for data can be discussed, with the objective of identifying the best way in which **The Company’s** requirements can be met. In respect of EU Code **User(s)** only, **The Company** may request the need for electromagnetic transient simulations at **The Company’s** reasonable request. **User(s)** with EU Grid Supply **Points** may be required to provide electromagnetic transient simulations in relation to those EU Grid Supply **Points** at **NGET’s** reasonable request.

Where **NGET** makes a request to a **User** or EU Code **User** for dynamic models under PC.A.6.7, each relevant **User** shall ensure that the models supplied in respect of their **Plant** and **Apparatus** reflect the true and accurate behaviour of the **Plant** and **Apparatus** as built and verified through the **European Compliance Processes** (ECP).

PC.A.6.2 **Transient Overvoltage Assessment Data**

PC.A.6.2.1 It is occasionally necessary for **The Company** to undertake transient overvoltage assessments (e.g. capacitor switching transients, switchgear transient recovery voltages, etc). At **The Company’s** reasonable request, each **User** is required to provide the following data with respect to the **Connection Site** (and in the case of **OTSUA**, **Interface Points** and **Connection Points**), current and forecast, together with a **Single Line Diagram** where not already supplied under PC.A.2.2.1, as follows:

(a) busbar layout plan(s), including dimensions and geometry showing positioning of any current and voltage transformers, through bushings, support insulators, disconnectors, circuit breakers, surge arresters, etc. Electrical parameters of any associated current and voltage transformers, stray capacitances of wall bushings and support insulators, and grading capacitances of circuit breakers;

(b) Electrical parameters and physical construction details of lines and cables connected at that busbar. Electrical parameters of all plant e.g., transformers (including neutral earthing impedance or zig-zag transformers, if any), series reactors and shunt compensation equipment connected at that busbar (or to the tertiary of a transformer) or by lines or cables to that busbar;

(c) Basic insulation levels (BIL) of all **Apparatus** connected directly, by lines or by cables to the busbar;

(d) characteristics of overvoltage **Protection** devices at the busbar and at the termination points of all lines, and all cables connected to the busbar;

(e) fault levels at the lower voltage terminals of each transformer connected directly or indirectly to the **National Electricity Transmission System** (including OTSUA at each **Interface Point** and **Connection Point**) without intermediate transformation;

(f) the following data is required on all transformers operating at **Supergrid Voltage** throughout **Great Britain** and, in Scotland and **Offshore**, also at 132kV (including OTSUA): three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage;
(g) an indication of which items of equipment may be out of service simultaneously during Planned Outage conditions.

PC.A.6.3 User’s Protection Data

PC.A.6.3.1 Protection

The following information is required which relates only to Protection equipment which can trip or inter-trip or close any Connection Point circuit-breaker or any Transmission circuit-breaker (or in the case of OTSUA, any Interface Point or Connection Point circuit breaker). This information need only be supplied once, in accordance with the timing requirements set out in PC.A.1.4(b), and need not be supplied on a routine annual basis thereafter, although The Company should be notified if any of the information changes:

(a) a full description, including estimated settings, for all relays and Protection systems installed or to be installed on the User’s System;

(b) a full description of any auto-reclose facilities installed or to be installed on the User’s System, including type and time delays;

(c) a full description, including estimated settings, for all relays and Protection systems or to be installed on the generator, generator transformer, Station Transformer and their associated connections;

(d) for Generating Units (including Synchronous Generating Units forming part of a Synchronous Power Generating Module but excluding Power Park Units) or Power Park Modules (including DC Connected Power Park Modules) or HVDC Systems or DC Converters at a DC Converter Station or OTSDUW Plant and Apparatus having (or intended to have) a circuit breaker at the generator terminal voltage, clearance times for electrical faults within the Generating Unit (including Synchronous Generating Units forming part of a Synchronous Power Generating Module but excluding a Power Park Unit) or Power Park Module (including DC Connected Power Park Modules) zone, or within the OTSDUW Plant and Apparatus;

(e) the most probable fault clearance time for electrical faults on any part of the User’s System directly connected to the National Electricity Transmission System including OTSDUW Plant and Apparatus; and

(f) in the case of OTSDUW Plant and Apparatus, synchronisation facilities and delayed auto reclose sequence schedules (where applicable).

PC.A.6.4 Harmonic Studies

PC.A.6.4.1 It is occasionally necessary for The Company to evaluate the production/magnification of harmonic distortion on The Company’s and User’s Systems (and OTSUA), especially when The Company is connecting equipment such as capacitor banks. At The Company’s reasonable request, each User is required to submit data with respect to the Connection Site (and in the case of OTSUA, each Interface Point and Connection Point), current and forecast, and where not already supplied under PC.A.2.2.4 and PC.A.2.2.5, as follows:

PC.A.6.4.2 Overhead lines and underground cable circuits of the User’s Subtransmission System must be differentiated and the following data provided separately for each type:

Positive phase sequence resistance;
Positive phase sequence reactance;
Positive phase sequence susceptance;

and for all transformers connecting the User’s Subtransmission System and OTSDUW Plant and Apparatus to a lower voltage:

Rated MVA;
Voltage Ratio;
Positive phase sequence resistance;
Positive phase sequence reactance;
and at the lower voltage points of those connecting transformers:

- Equivalent positive phase sequence susceptance;
- Connection voltage and MVAr rating of any capacitor bank and component design parameters if configured as a filter;
- Equivalent positive phase sequence interconnection impedance with other lower voltage points;
- The minimum and maximum Demand (both MW and MVAr) that could occur;
- Harmonic current injection sources in Amps at the Connection voltage points. Where the harmonic injection current comes from a diverse group of sources, the equivalent contribution may be established from appropriate measurements;
- Details of traction loads, eg connection phase pairs, continuous variation with time, etc;
- An indication of which items of equipment may be out of service simultaneously during Planned Outage conditions.

PC.A.6.5 Voltage Assessment Studies

It is occasionally necessary for The Company to undertake detailed voltage assessment studies (e.g., to examine potential voltage instability, voltage control co-ordination or to calculate voltage step changes). At The Company’s reasonable request, each User is required to submit the following data where not already supplied under PC.A.2.2.4 and PC.A.2.2.5:

For all circuits of the User’s Subtransmission System (and any OTSUA):

- Positive Phase Sequence Reactance;
- Positive Phase Sequence Resistance;
- Positive Phase Sequence Susceptance;
- MVAr rating of any reactive compensation equipment;

and for all transformers connecting the User’s Subtransmission System to a lower voltage (and any OTSUA):

- Rated MVA;
- Voltage Ratio;
- Positive phase sequence resistance;
- Positive Phase sequence reactance;
- Tap-changer range;
- Number of tap steps;
- Tap-changer type: on-load or off-circuit;
- AVC/tap-changer time delay to first tap movement;
- AVC/tap-changer inter-tap time delay;

and at the lower voltage points of those connecting transformers (and any OTSUA):

- Equivalent positive phase sequence susceptance;
- MVAr rating of any reactive compensation equipment;
- Equivalent positive phase sequence interconnection impedance with other lower voltage points;
- The maximum Demand (both MW and MVAr) that could occur;
- Estimate of voltage insensitive (constant power) load content in % of total load at both winter peak and 75% off-peak load conditions.
PC.A.6.6  Short Circuit Analysis

PC.A.6.6.1  Where prospective short-circuit currents on equipment owned, operated or managed by The Company are greater than 90% of the equipment rating, and in The Company’s reasonable opinion more accurate calculations of short-circuit currents are required, then at The Company’s request each User is required to submit data with respect to the Connection Site (and in the case of OTSUA, each Interface Point and Connection Point), current and forecast, and where not already supplied under PC.A.2.2.4 and PC.A.2.2.5, as follows:

PC.A.6.6.2  For all circuits of the User’s Subtransmission System (and any OTSUA):

- Positive phase sequence resistance;
- Positive phase sequence reactance;
- Positive phase sequence susceptance;
- Zero phase sequence resistance (both self and mutuals);
- Zero phase sequence reactance (both self and mutuals);
- Zero phase sequence susceptance (both self and mutuals);

and for all transformers connecting the User’s Subtransmission System to a lower voltage (and any OTSUA):

- Rated MVA;
- Voltage Ratio;
- Positive phase sequence resistance (at max, min and nominal tap);
- Positive Phase sequence reactance (at max, min and nominal tap);
- Zero phase sequence reactance (at nominal tap);
- Tap changer range;
- Earthing method: direct, resistance or reactance;
- Impedance if not directly earthed;

and at the lower voltage points of those connecting transformers (and any OTSUA):

- The maximum Demand (in MW and MVAR) that could occur;
- Short-circuit infeed data in accordance with PC.A.2.5.6 unless the User’s lower voltage network runs in parallel with the User’s Subtransmission System, when to prevent double counting in each node infeed data, a π equivalent comprising the data items of PC.A.2.5.6 for each node together with the positive phase sequence interconnection impedance between the nodes shall be submitted.

PC.A.6.7  Dynamic Models

PC.A.6.7.1  It is occasionally necessary for NGET to evaluate the dynamic performance of User’s Plant and Apparatus at each EU Grid Supply Point or in the case of EU Code Users, their System. At NGETs reasonable request and as agreed between NGET and the relevant Network Operator or Non-Embedded Customer, each User is required to provide the following data. Where such data is required, NGET will work with the Network Operator or Non-Embedded Customer to establish the scope of the dynamic modelling work and share the required information where it is available:-

- (a) Dynamic model structure and block diagrams including parameters, transfer functions and individual elements (as applicable);
- (b) Power control functions and block diagrams including parameters, transfer functions and individual elements (as applicable);
- (c) Voltage control functions and block diagrams including parameters, transfer functions and individual elements (as applicable);
(d) Converter control models and block diagrams including parameters, transfer functions and individual elements (as applicable).

ADDITIONAL DATA FOR NEW TYPES OF POWER STATIONS, DC CONVERTER STATIONS, OTSUA AND CONFIGURATIONS

Notwithstanding the Standard Planning Data and Detailed Planning Data set out in this Appendix, as new types of configurations and operating arrangements of Power Stations, HVDC Systems, DC Converter Stations and OTSUA emerge in future, The Company may reasonably require additional data to represent correctly the performance of such Plant and Apparatus on the System, where the present data submissions would prove insufficient for the purpose of producing meaningful System studies for the relevant parties.
PART 3 - DETAILED PLANNING DATA

PC.A.8 To allow a User to model the National Electricity Transmission System, The Company will provide, upon request, the following Network Data to Users, calculated in accordance with Good Industry Practice:

To allow a User to assess undertaking OTSDUW and except where provided for in Appendix F, The Company will provide upon request the following Network Data to Users, calculated in accordance with Good Industry Practice:

PC.A.8.1 Single Point of Connection

For a Single Point of Connection to a User's System (and OTSUA), as an equivalent 400kV or 275kV source and also in Scotland and Offshore as an equivalent 132kV source, the data (as at the HV side of the Point of Connection (and in the case of OTSUA, each Interface Point and Connection Point) reflecting data given to The Company by Users) will be given to a User as follows:

The data items listed under the following parts of PC.A.8.3:

(a) (i), (ii), (iii), (iv), (v) and (vi)

and the data items shall be provided in accordance with the detailed provisions of PC.A.8.3 (b) - (e).

PC.A.8.2 Multiple Point of Connection

For a Multiple Point of Connection to a User's System equivalents suitable for use in loadflow and fault level analysis shall be provided. These equivalents will normally be in the form of a π model or extension with a source (or demand for a loadflow equivalent) at each node and a linking impedance. The boundary nodes for the equivalent shall be either at the Connection Point (and in the case of OTSDUW, each Interface Point and Connection Point) or (where The Company agrees) at suitable nodes (the nodes to be agreed with the User) within the National Electricity Transmission System. The data at the Connection Point (and in the case of OTSDUW, each Interface Point and Connection Point) will be given to a User as follows:

The data items listed under the following parts of PC.A.8.3:

(a) (i), (ii), (iv), (vi), (vii), (viii), (ix), (x) and (xi)

and the data items shall be provided in accordance with the detailed provisions of PC.A.8.3 (b) - (e).

When an equivalent of this form is not required The Company will not provide the data items listed under the following parts of PC.A.8.3:

(a) (vii), (viii), (ix), (x) and (xi)

PC.A.8.3 Data Items

(a) The following is a list of data utilised in this part of the PC. It also contains rules on the data which generally apply.

(i) symmetrical three-phase short circuit current infeed at the instant of fault from the National Electricity Transmission System, \( I_1^a \);

(ii) symmetrical three-phase short circuit current from the National Electricity Transmission System after the subtransient fault current contribution has substantially decayed, \( I_1^a \);

(iii) the zero sequence source resistance and reactance values at the Point of Connection (and in case of OTSUA, each Interface Point and Connection Point), consistent with the maximum infeed below;

(iv) the pre-fault voltage magnitude at which the maximum fault currents were calculated;

(v) the positive sequence X/R ratio at the instant of fault;
(vi) the negative sequence resistance and reactance values of the National Electricity Transmission System seen from the (Point of Connection and in case of OTSUA, each Interface Point and Connection Point), if substantially different from the values of positive sequence resistance and reactance which would be derived from the data provided above;

(vii) the initial positive sequence resistance and reactance values of the two (or more) sources and the linking impedance(s) derived from a fault study constituting the (π) equivalent and evaluated without the User network and load and where appropriate without elements of the National Electricity Transmission System between the User network and agreed boundary nodes (and in case of OTSUA, each Interface Point and Connection Point);

(viii) the positive sequence resistance and reactance values of the two (or more) sources and the linking impedance(s) derived from a fault study, considering the short circuit current contributions after the subtransient fault current contribution has substantially decayed, constituting the (π) equivalent and evaluated without the User network and load, and where appropriate without elements of the National Electricity Transmission System between the User network and agreed boundary nodes (and in case of OTSUA, each Interface Point and Connection Point);

(ix) the corresponding zero sequence impedance values of the (π) equivalent produced for use in fault level analysis;

(x) the Demand and voltage at the boundary nodes and the positive sequence resistance and reactance values of the linking impedance(s) derived from a loadflow study considering National Electricity Transmission System peak Demand constituting the (π) loadflow equivalent; and,

(xi) where the agreed boundary nodes are not at a Connection Point (and in case of OTSUA, Interface Point or Connection Point), the positive sequence and zero sequence impedances of all elements of the National Electricity Transmission System between the User network and agreed boundary nodes that are not included in the equivalent (and in case of OTSUA, each Interface Point and Connection Point).

(b) To enable the model to be constructed, The Company will provide data based on the following conditions.

(c) The initial symmetrical three phase short circuit current and the transient period three phase short circuit current will normally be derived from the fixed impedance studies. The latter value should be taken as applying at times of 120ms and longer. Shorter values may be interpolated using a value for the subtransient time constant of 40ms. These fault currents will be obtained from a full System study based on load flow analysis that takes into account any existing flow across the point of connection being considered.

(d) Since the equivalent will be produced for the 400kV or 275kV and also in Scotland and Offshore132kV parts of the National Electricity Transmission System The Company will provide the appropriate supergrid transformer data.

(e) The positive sequence X/R ratio and the zero sequence impedance value will correspond to the The Company’s source network only, that is with the section of network if any with which the equivalent is to be used excluded. These impedance values will be derived from the condition when all Generating Units (including Synchronous Generating Units forming part of a Synchronous Power Generating Module) are Synchronised to the National Electricity Transmission System or a User’s System and will take account of active sources only including any contribution from the load to the fault current. The passive component of the load itself or other system shunt impedances should not be included.
(f) **A User** may at any time, in writing, specifically request for an equivalent to be prepared for an alternative **System** condition, for example where the **User's System** peak does not correspond to the **National Electricity Transmission System** peak, and **The Company** will, insofar as such request is reasonable, provide the information as soon as reasonably practicable following the request.
APPENDIX B - SINGLE LINE DIAGRAMS

PC.B.1 The diagrams below show three examples of single line diagrams, showing the detail that should be incorporated in the diagram. The first example is for a Network Operator connection, the second for a Generator connection, the third for a Power Park Module electrically equivalent system.

Network Operator Single Line Diagram
Generator Single Line Diagram

TRANSMISSION SUBSTATION —— 400kV

RYB ——

BYR ——

——— 132kV

——— 11kV

KEY

——— TRANSMISSION OWNERSHIP
——— USER OWNERSHIP
← DEMAND SUPPLIED

——— TWO CIRCUITS

ON SAME TOWERS
(DOUBLE CIRCUIT)

←— UNDERGROUND CABLE

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29-07-04
Power Park Module Single Line Diagram

Notes:

(1) The electrically equivalent Power Park Unit consists of a number of actual Power Park Units of the same type ie. any equipment external to the Power Park Unit terminals is considered as part of the Equivalent Network. Power Park Units of different types shall be included in separate electrically equivalent Power Park Units. The total number of equivalent Power Park Units shall represent all of the actual Power Park Units in the Power Park Module (which could be a DC Connected Power Park Module).

(2) Separate electrically equivalent networks are required for each different type of electrically equivalent Power Park Unit. The electrically equivalent network shall include all equipment between the Power Park Unit terminals and the Common Collection Busbar.

(3) All Plant and Apparatus including the circuit breakers, transformers, lines, cables and reactive compensation plant between the Common Collection Busbar and Substation A shall be shown.
APPENDIX C - TECHNICAL AND DESIGN CRITERIA

PC.C.1 Planning and design of the SPT and SHETL Transmission Systems is based generally, but not totally, on criteria which evolved from joint consultation among various Transmission Licensees responsible for design of the National Electricity Transmission System.

PC.C.2 The above criteria are set down within the standards, memoranda, recommendations and reports and are provided as a guide to system planning. It should be noted that each scheme for reinforcement or modification of the Transmission System is individually designed in the light of economic and technical factors associated with the particular system limitations under consideration.

PC.C.3 The tables below identify the literature referred to above, together with the main topics considered within each document.

PART 1 – SHETL’s TECHNICAL AND DESIGN CRITERIA

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<th>DOCUMENT</th>
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Pursuant to PC.3.4, The Company will not disclose to a Relevant Transmission Licensee data items specified in the below extract:

<table>
<thead>
<tr>
<th>PC REFERENCE</th>
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<td></td>
<td>(ii) For EU Code Users:</td>
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<td></td>
<td>The Power Generating Module Performance Chart, and Synchronous Generating Unit Performance Chart;</td>
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<tr>
<td>PC.A.3.2.2 (b)</td>
<td>Output Usable (on a monthly basis)</td>
<td>MW</td>
<td>SPD</td>
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<td>PC.A.5.3.2 (d) Option 1 (iii)</td>
<td>GOVERNOR AND ASSOCIATED PRIME MOVER PARAMETERS</td>
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<td>Option 1</td>
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<td>BOILER &amp; STEAM TURBINE DATA</td>
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<td>Boiler time constant (Stored Active Energy)</td>
<td>S</td>
<td>DPD II</td>
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<td></td>
<td>HP turbine response ratio: (Proportion of Primary Response arising from HP turbine)</td>
<td>%</td>
<td>DPD II</td>
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<td></td>
<td>HP turbine response ratio: (Proportion of High Frequency Response arising from HP turbine)</td>
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<td>Part of PC.A.5.3.2 (d) Option 2 (i)</td>
<td>Option 2</td>
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<td>All Generating Units (including Synchronous Generating Units forming part of a Synchronous Power Generating Module)</td>
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<td></td>
<td>Governor Deadband and Governor Insensitivity*</td>
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<td>- Maximum Setting ±Hz</td>
<td>DPD II</td>
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<td>- Normal Setting ±Hz</td>
<td>DPD II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Minimum Setting ±Hz</td>
<td>DPD II</td>
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<tr>
<td>(Note Generators who are not required to satisfy the requirements of the European Connection Conditions do not need to supply Governor Insensitivity data).</td>
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<tr>
<td>Part of PC.A.5.3.2 (d) Option 2 (ii)</td>
<td>Steam Units</td>
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<td>Reheater Time Constant sec</td>
<td>DPD II</td>
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<td>Boiler Time Constant sec</td>
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<td>HP Power Fraction %</td>
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<td>DATA DESCRIPTION</td>
<td>UNITS</td>
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<td>IP Power Fraction</td>
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<td>Part of PC.A.5.3.2 (d) Option 2 (iii)</td>
<td>Gas Turbine Units</td>
<td>Waste Heat Recovery Boiler Time Constant</td>
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<td>Part of PC.A.5.3.2 (e)</td>
<td>UNIT CONTROL OPTIONS</td>
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<td>Maximum droop</td>
<td>%</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Minimum droop</td>
<td>%</td>
<td>DPD II</td>
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<td></td>
<td>Maximum frequency Governor Deadband and Governor Insensitivity*</td>
<td>±Hz</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Normal frequency Governor Deadband and Governor Insensitivity*</td>
<td>±Hz</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Minimum frequency Governor Deadband and Governor Insensitivity*</td>
<td>±Hz</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Maximum Output Governor Deadband and Governor Insensitivity*</td>
<td>±MW</td>
<td>DPD II</td>
</tr>
<tr>
<td></td>
<td>Normal Output Governor Deadband and Governor Insensitivity*</td>
<td>±MW</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Minimum Output Governor Deadband and Governor Insensitivity*</td>
<td>±MW</td>
<td>DPD II</td>
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<td></td>
<td>(Note Generators who are not required to satisfy the requirements of the European Connection Conditions do not need to supply Governor Insensitivity data).</td>
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<td>Frequency settings between which Unit Load Controller droop applies:</td>
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<tr>
<td></td>
<td>Maximum</td>
<td>Hz</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Normal</td>
<td>Hz</td>
<td>DPD II</td>
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<tr>
<td></td>
<td>Minimum</td>
<td>Hz</td>
<td>DPD II</td>
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<td>Sustained response normally selected</td>
<td>Yes/No</td>
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<tr>
<td>PC.A.3.2.2 (f) (ii)</td>
<td>Performance Chart of a Power Park Modules (including DC Connected Power Park Modules) at the connection point</td>
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<td>SPD</td>
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<td>PC.A.3.2.2 (b)</td>
<td>Output Usable (on a monthly basis)</td>
<td>MW</td>
<td>SPD</td>
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<td>PC.A.3.2.2 (e) and (j)</td>
<td>DC CONVERTER STATION AND HVDC SYSTEM DATA</td>
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<td>ACTIVE POWER TRANSFER CAPABILITY (PC.A.3.2.2)</td>
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<td>Import MW available in excess of Registered Import Capacity.</td>
<td>MW</td>
<td>SPD</td>
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<tr>
<td></td>
<td>Time duration for which MW in excess of Registered Import Capacity is available</td>
<td>Min</td>
<td>SPD</td>
</tr>
<tr>
<td></td>
<td>Export MW available in excess of Registered Capacity.</td>
<td>MW</td>
<td>SPD</td>
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<td>PC REFERENCE</td>
<td>DATA DESCRIPTION</td>
<td>UNITS</td>
<td>DATA CATEGORY</td>
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<td>---------------</td>
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</tr>
<tr>
<td></td>
<td>Time duration for which MW in excess of Registered Capacity is available</td>
<td>Min</td>
<td>SPD</td>
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<tr>
<td>Part of PC.A.5.4.3.3</td>
<td>LOADING PARAMETERS</td>
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<td>MW Export</td>
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<tr>
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<td>Nominal loading rate</td>
<td>MW/s</td>
<td>DPD I</td>
</tr>
<tr>
<td></td>
<td>Maximum (emergency) loading rate</td>
<td>MW/s</td>
<td>DPD I</td>
</tr>
<tr>
<td></td>
<td>MW Import</td>
<td></td>
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<tr>
<td></td>
<td>Nominal loading rate</td>
<td>MW/s</td>
<td>DPD I</td>
</tr>
<tr>
<td></td>
<td>Maximum (emergency) loading rate</td>
<td>MW/s</td>
<td>DPD I</td>
</tr>
</tbody>
</table>

APPENDIX E - OFFSHORE TRANSMISSION SYSTEM AND OTSDUW PLANT AND APPARATUS TECHNICAL AND DESIGN CRITERIA

PC.E.1 In the absence of any relevant Electrical Standards, Offshore Transmission Licensees and Generators undertaking OTSDUW are required to ensure that all equipment used in the construction of their network is:

(i) Fully compliant and suitably designed to any relevant Technical Specification;

(ii) Suitable for use and operation in an Offshore environment, where such parts of the Offshore Transmission System and OTSDUW Plant and Apparatus are located in Offshore Waters and are not installed in an area that is protected from that Offshore environment, and

(iii) Compatible with any relevant Electrical Standards or Technical Specifications at the Offshore Grid Entry Point and Interface Point.

PC.E.2 The table below identifies the technical and design criteria that will be used in the design and development of an Offshore Transmission System and OTSDUW Plant and Apparatus.

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>DOCUMENT</th>
<th>REFERENCE No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National Electricity Transmission System Security and Quality of Supply Standard</td>
<td>Version [ ]</td>
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<tr>
<td>2*</td>
<td>Planning Limits for Voltage Fluctuations Caused by Industrial, Commercial and Domestic Equipment in the United Kingdom</td>
<td>ER P28</td>
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<tr>
<td>3*</td>
<td>Planning Levels for Harmonic Voltage Distortion and the Connection of Non-Linear Loads to Transmission Systems and Public Electricity Supply Systems in the United Kingdom</td>
<td>ER G5/4</td>
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<tr>
<td>4*</td>
<td>Planning Limits for Voltage Unbalance in the United Kingdom</td>
<td>ER P29</td>
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</tbody>
</table>

* Note:- Items 2, 3 and 4 above shall only apply at the Interface Point.
APPENDIX F - OTSDUW DATA AND INFORMATION AND OTSDUW NETWORK DATA AND INFORMATION

PC.F.1 Introduction

PC.F.1.1 Appendix F specifies data requirements to be submitted to The Company by Users and Users by The Company in respect of OTSDUW.

PC.F.1.2 Such User submissions shall be in accordance with the OTSDUW Development and Data Timetable in a Construction Agreement.

PC.F.1.3 Such The Company submissions shall be issued with the offer of a CUSC Contract in the case of the data in Part 1 and otherwise in accordance with the OTSDUW Development and Data Timetable in a Construction Agreement.

PC.F.2 OTSDUW Network Data and Information

PC.F.2.1 With the offer of a CUSC Contract under the OTSDUW Arrangements The Company shall provide:

(a) the site specific technical design and operational criteria for the Connection Site;
(b) the site specific technical design and operational criteria for the Interface Point, and
(c) details of The Company's preliminary identification and consideration of the options available for the Interface Point in the context of the User's application for connection or modification, the preliminary costs used by The Company in assessing such options and the Offshore Works Assumptions including the assumed Interface Point identified during these preliminary considerations.

PC.F.2.2 In accordance with the OTSDUW Development and Data Timetable in a Construction Agreement The Company shall provide the following information and data to a User:

(a) equivalent of the fault infeed or fault level ratings at the Interface Point (as identified in the Offshore Works Assumptions)
(b) notification of numbering and nomenclature of the HV Apparatus comprised in the OTSDUW;
   (i) past or present physical properties, including both actual and designed physical properties, of Plant and Apparatus forming part of the National Electricity Transmission System at the Interface Point at which the OTSUA will be connected to the extent it is required for the design and construction of the OTSDUW, including but not limited to:
   (ii) the voltage of any part of such Plant and Apparatus;
   (iii) the electrical current flowing in or over such Plant and Apparatus;
   (iv) the configuration of any part of such Plant and Apparatus
   (v) the temperature of any part of such Plant and Apparatus;
   (vi) the pressure of any fluid forming part of such Plant and Apparatus;
   (vii) the electromagnetic properties of such Plant and Apparatus; and
   (viii) the technical specifications, settings or operation of any Protection Systems forming part of such Plant and Apparatus.
(c) information necessary to enable the User to harmonise the OTSDUW with construction works elsewhere on the National Electricity Transmission System that could affect the OTSDUW
(d) information related to the current or future configuration of any circuits of the Onshore Transmission System with which the OTSUA are to connect;
(e) any changes which are planned on the National Electricity Transmission System in the current or following six Financial Years and which will materially affect the planning or development of the OTSDUW.
PC.F.2.3  At the User's reasonable request additional information and data in respect of the National Electricity Transmission System shall be provided.

PC.F.2.4  OTSDUW Data And Information

PC.F.2.4.1  In accordance with the OTSDUW Development and Data Timetable in a Construction Agreement the User shall provide to The Company the following information and data relating to the OTSDUW Plant and Apparatus in accordance with Appendix A of the Planning Code.

< END OF PLANNING CODE >