# Guidance Notes for Network Operators
# Submission of Grid Code Data
# 2011 - 2012

(Incorporating changes for Grid Code B/07 Modifications)

Issue 3 (12th April 2011)

## Forward

The aim of these Guidance Notes is to make it as efficient as possible for Network Operators to meet their obligations to provide the Standard Planning and Operating Code data required by the Grid Code annually in week 28 each year.

The Guidance Notes do not form part of the Grid Code. In case of ambiguity the Code takes precedence over these Guidance Notes.

## Note on Grid Code B/07 Modifications

Grid Code PC.7.3 states: Grid Code amendment B/07 implemented changes to the Grid Code which included amendments to the datasets provided by both NGET and Users to inform the planning and development of the GB Transmission System. The Authority has determined that these changes are to have a phased implementation.

# Table of Contents

# Why does National Grid require this data?

National Grid requires the data to fulfil its transmission licence obligation to develop, maintain and operate an efficient, co-ordinated and economical transmission system. More specifically the Grid Code Standard Planning data is used to assess the security and safety of the transmission system at the interface with Network Operators for both operational and investment planning purposes. The results of the investment planning assessment are used within the Joint Technical Planning Liaison meetings (JTPLM) to investigate the need for transmission system reinforcement to meet the GB Security and Quality of Supply Standard.

## Basic principles of the data submission

There are some key basic principles of the data submission process:

- Network Operators are obliged to provide data to National Grid on a routine annual basis.
- The data represents each of the seven succeeding financial years.
- An up-to-date data bank is to be maintained.
- Standard Planning Data (as identified in the Data Registration Code) is to be supplied on a routine annual basis.
- Further Standard Planning Data is supplied only at National Grid's reasonable written request.
- The extent of the distribution network data to be supplied is defined in the definition of the Single Line Diagram.
- Much of the data needs to be supplied following a judgement by the Network Operator that the data is appropriate for exchange with National Grid. On this basis the Network Operator needs to be aware of how this data will be used in order to exercise adequate judgement.
- National Grid may estimate any data if a Network Operator fails to supply the data, or if data is believed to be erroneous. National Grid will need to inform a Network Operator in writing of any estimated data it intends to use.

## Provision of data to Network Operators by National Grid ("Week 42" data)

National Grid provides network equivalent data to Network Operators annually in week 42, for their fault level assessment processes, as defined in the **Planning Code Appendix A Part 3**. A separate Guidance Note is published for this data exchange.

# Phasing–in of B/07 Modifications

(Extract from agreed B/07 Project Plan PC.7.3)

**2009/10 Implementation Plan**

PC.7.3 - NGET agree implementation plan with each DNO.
PC.A.4.1.4.4 (b) - NGET inform DNOs of connection points in each Access Group.

**2010/11 Implementation Plan**

PC.A.4.1.4.4 (a) - NGET submit calendar weeks defining start & finish of each Access Period for each Transmission Interface Circuit (TIC).
PC.A.4.1.4.4 (b) - NGET submit Connection Points in each Access Group to User.
PC.A.4.1.4.5 - NGET inform User of any TICs that need to be considered out of service concurrently for overlapping Access Periods within the same Access Group.
PC.A.4.1.4.6 - NGET and User agree appropriate Access Groups prior to week 17.
PC.A.4.2.2 - NGET to inform each Network Operator of the relevant Access Period for each TIC for the current financial year and for the subsequent 7 financial years.
PC.A.4.2.2 - NGET inform each Network Operator of concurrent Access Periods of 2 or more TICs (if any) that are situated in the same Access Group for the current financial year and the subsequent 7 financial years.

**2011/12 Implementation Plan**

PC.A.4.1.4.4 (a) - NGET submit calendar weeks defining start & finish of each Access Period for each TIC.
PC.A.4.1.4.4 (b) - NGET submit Connection Points in each Access Group to User.
PC.A.4.1.4.5 - NGET inform User of any TICs that need to be considered out of service concurrently for overlapping Access Periods within the same Access Group.
PC.A.4.1.4.6 - NGET and User agree appropriate Access Groups prior to week 17.
PC.A.4.1.4.6 - NGET and User agree Access Periods for each TIC.
PC.A.4.2.2 - NGET inform each Network Operator of the relevant Access Period for each TIC for the current financial year and for the subsequent 7 financial years.
PC.A.4.2.2 - NGET inform each Network Operator of concurrent Access Periods of 2 or more TICs (if any) that are situated in the same Access Group for the current financial year and the subsequent 7 financial years.
PC.A.4.3.1 - User submits to NGET the forecast demand (active power) and power factor to be met at each Connection Point within each Access Group for the time of max demand (apparent power) at the Connection Point (as determined by the user) etc.

# How is the data exchange governed?

## The Grid Code

The Grid Code is the formal agreement referenced by all companies attaching to the National Grid transmission system. A copy is available on the Internet via …
**http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/**

"At privatisation and as required by the transmission licence, National Grid implemented the Grid Code, which is designed to permit the development, maintenance and operation of an efficient, co-ordinated and economical system for the transmission of electricity, to facilitate competition in the generation and supply of electricity and to promote the security and efficiency of the power system as a whole. National Grid and users of its transmission system are required to comply with the Grid Code.

The Grid Code is required to cover all material technical aspects relating to connections to and the operation and use of the transmission system or, in as far as relevant to the operation and use of the transmission system, the operation of the electric lines and electrical plant connected to it or to a distribution system.
The Grid Code also specifies data which system users are obliged to provide to National Grid for use in the planning and operation of the transmission system, including demand forecasts, availability of generating sets and intended dates of overhaul of large generating sets.
Any changes to the Grid Code are subject to the approval of the Authority".

…….(extract from the National Grid website)

## Grid Code Working Group

## Improved Planning Code Data Exchange for Compliance Assessments B/O7 Grid Code Changes

In 2006 a Working Group, comprising representatives from Network Operators, Ofgem and National Grid, was established by the Grid Code Review Panel to review the requirements for the exchange of Planning Data.

The terms of reference for the Group were:

i) Review scope of existing data exchange requirements of the Grid Code for determining the investment needs to meet their planning requirements e.g. assessment against security standards, P2/5 and GB SQSS

ii) Consider adequacy of existing requirements of the Grid Code, in particular, but not limited to, the treatment of the following areas:
- summer and seasonal peak load levels, and the appropriate statistical factors governing the forecasting of these quantities
- treatment of interconnected GSPs and format of data provision
- maintenance demand
- maintenance windows
- transfer capacity

iii) Determine what additional data exchange or process clarification is necessary to meet the Objectives.

Theses Guidance Notes now include guidance on the data submissions and process following the changes to the Grid Code as a result of the Working Group – please refer to
**Appendix 3 – Changes to the Grid Code Data Requirements from 2011**

The consultation documents are available at:
**http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/**

# How does National Grid request the data?

## Meetings

National Grid arranges at least two meetings per year with each Network Operator to discuss any issues and to assist in the understanding of the data exchange process.

## Data request letters

No later than week 17, National Grid notifies the Network Operator contacts of the agreed Access Periods, and details of the Great Britain Transmission System annual minimum and maximum demands **(PC.A.4.2.2)**. National Grid will endeavour to provide these values as soon as possible to maximise the time available for production of the demand returns. This information is required by the Network Operators to populate the demand data proforma tables 10b, 10c and 11.

National Grid also provides agreed proforma for the other data tables. **(D.R.C. 5.2.)**

A summary of requirements is given on Page 10.

# How do National Grid receive it?

## Who to send it to in National Grid

When a data submission has been prepared, it should be sent to the address given in Appendix 8 by calendar week 28.

## Data receipt by National Grid

Upon receipt, we will log the submission and it's contents into our record system. A receipt will be sent for each submission. The contents will be examined and used to update a databank. We will refer to you any queries we may have.

## Partial Submissions

If you are having difficulties preparing your submission, please keep us appraised of your situation. We are happy to discuss the situation with you, and may be able to receive partial submissions of data as it is prepared, with the rest to follow.

## Making a "No Change" Statement

The Grid Code provides for a Network Operator to make a statement that there are "No-Changes" to their data from the previous submission. The Network Operator should write and specify to which data items this refers. **(PC.A. 1.2(iii))**

## Managing Missing Data

Should any data not be provided, or is believed to be incorrect based on comparison with existing data, National Grid may estimate such data if we feel it is necessary to do so as per **DRC. 5.4.**

At calendar week 34, if any data has not been received, National Grid will formally write to the Network Operator reminding them of the data is missing, and inform the Network Operator under DRC 5.4 that estimated data will be used as necessary.

A further follow-up letter will be sent in week 40 if any data has still not been received.

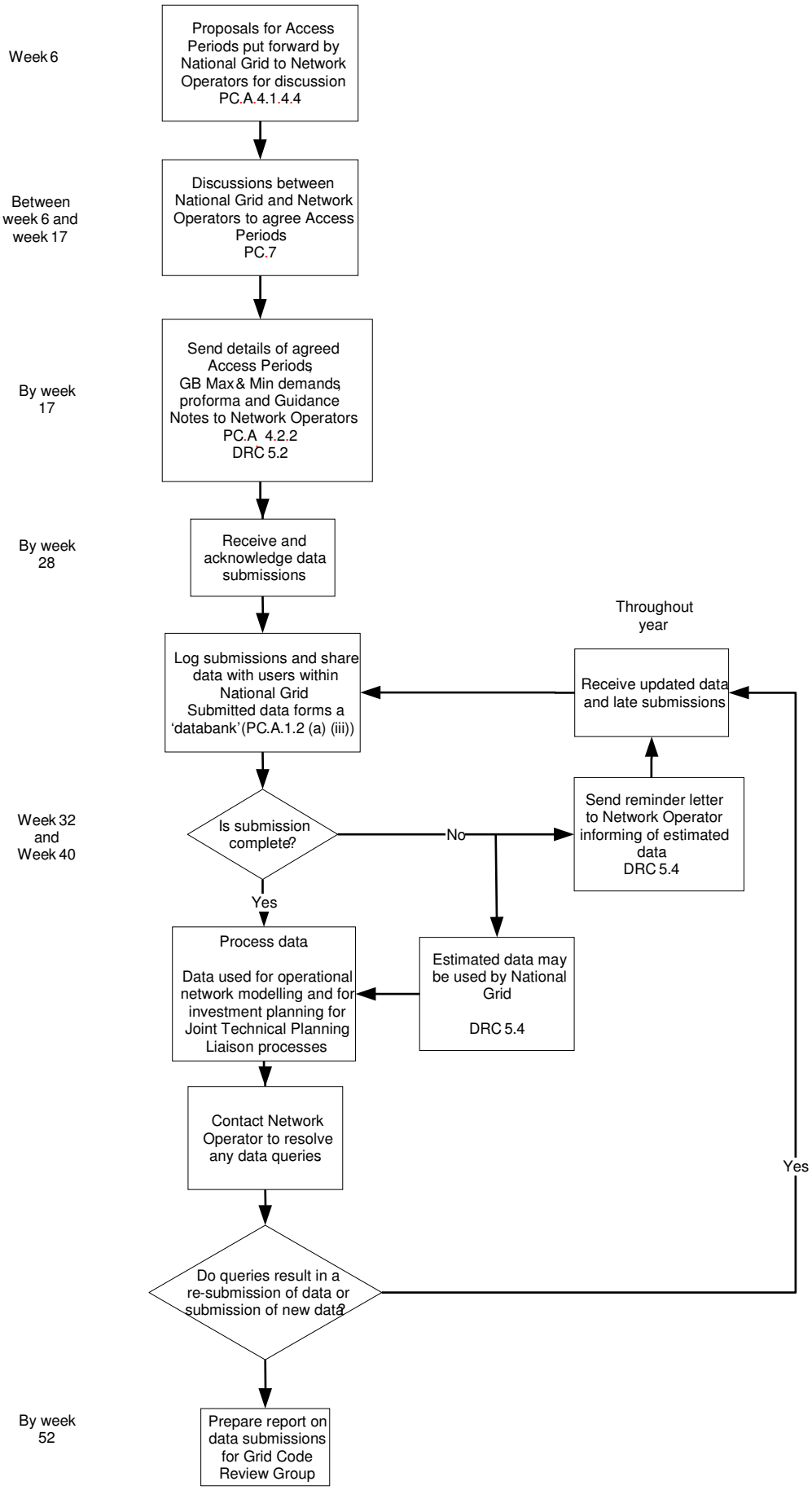
## Further Changes to data

During the course of the year, any further changes to the data should be notified to National Grid using the standard proforma. **(PC.A. 1.2 (b) and D.R.C. 5.3.1)**

## Reporting of Submission Timeliness and Quality

A report is prepared each year summarising the timeliness and quality of each Network Operator's week 24 submissions. This report is presented internally to National Grid's Grid Code Review Group. If significant issues are identified, details may be passed to the external Grid Code Review Panel.

# Data Submission Process Diagram



# What data is required?

National Grid requires the following information, as defined in the Grid Code, to be submitted using the agreed proforma supplied.

Please refer to the appropriate appendix for guidance on completing the table proforma.

| ***Proforma Table Name*** | ***Grid Code Reference*** | ***Data Registration Code (DRC) Reference*** | ***Description*** | ***Guidance Notes Appendix*** |
|---|---|---|---|---|
| **Demand and Energy data** | | General Principles | | **App. 1** |
| **10a** | PC.A.<br>4.2.1 (a) | Schedule 10<br>(Page 1 of 2) | Demand Profile for Day of User's Peak Demand based on Annual ACS conditions | **App. 2.1** |
| **10b** | PC.A.<br>4.2.1 (b) | Schedule 10<br>(Page 1 of 2) | Demand Profile for Day of GB Peak Demand based on Annual ACS conditions | **App. 2.2** |
| **10c** | PC.A.<br>4.2.1 (c) | Schedule 10<br>(Page 1 of 2) | Demand Profile for Day of GB Minimum Demand based on Annual Average conditions | **App. 2.3** |
| **17** | PC.A.4.1.4.4 | Schedule 17 | Access Period definitions | **App. 3.3** |
| **11** | PC.A.<br>4.3.1<br>4.3.2<br>4.3.5<br>4.5 | Schedule 11<br>(Page 1 of 2) | Connection Point Demand at GB Peak,<br>GB Minimum, Access Period Connection Point Peak, and other time specified. | **App. 3.4** |
| **11** | PC.A.<br>3.1.4(a)<br>3.2.2(c) | Schedule 11<br>(Page 2 of 2) | Connection Point embedded generation. (see also notes in DRC) | **App. 3.** |
| **11c** | PC.A.<br>4.2.3 | Schedule 10<br>(Page 2 of 2) | User's Active Energy Requirements by Customer Class.<br>(see also notes in DRC) | **App.3.** |
| **Emergency Demand Disconnection data** | | | | |
| **12a** | OC 6.6.2 | Schedule 12<br>(Page 2 of 2) | Automatic Low Frequency Demand Disconnection | **App. 4.1** |
| **12b** | OC 6.5.3(c) | Schedule 12<br>(Page 2 of 2) | Demand Reduction by voltage reduction or Demand Disconnection | **App. 4.2** |
| **12c** | OC6.7.2 | Schedule 12<br>(Page 2 of 2) | Percentage Emergency Manual Demand Disconnection | **App.4.3** |
| ***Table Name*** | ***Grid Code Reference*** | ***Data Registration*** | ***Description*** | ***Guidance Notes*** |

| | | *Code (DRC) Reference* | | *Appendix* |
|---|---|---|---|---|
| **Equipment data** | | | | |
| **14a** | PC.A. 2.2.6 (a) | Schedule 5 (Page 5 of 9) | LV Switchgear ratings at Connection Points | **App. 5.1** |
| **14b** | PC.A. 2.2.6 (b) | Schedule 5 (Page 2 of 9) | LV Substation Infrastructure ratings at Connection Points | **App. 5.2** |
| **14c** | PC.A. 2.4.1 | Schedule 5 (Page 2 of 9) | Reactive Compensation Plant | **App. 5.3** |
| **Network data** | | Overview | | **App. 6.1** |
| **Single Line Diagrams** | PC.A. 2.2.1, 2.2.2, 2.2.3 | Schedule 5 (Page 1 of 9) | Single Line Diagrams of User's system layout | **App. 6.2** |
| **Schedule 5 spreadsheet**<br><br>**Node data** | PC.A. 2.3<br><br>PC.A. 2.5.1, 2.5.4, 2.5.6<br><br>PC.A. 4.3.4 | <br><br>Schedule 13 | Lumped system susceptance<br><br>Fault infeeds<br><br>Node demands | **App. 6.3** |
| **Schedule 5 spreadsheet**<br><br>**Branch data** | PC.A. 2.2.4<br><br>PC.A. 2.2.5 | Schedule 5 (Page 3 of 9)<br><br>Schedule 5 (Page 4 of 9) | Circuit parameters<br><br>Transformer parameters | **App. 6.5** |

# What does National Grid do with the data?

## Who in National Grid uses the data and what they use it for?

All of the "Week 24" submission data is received by the Data and Analysis team at Wokingham. This data is logged into our receipts database and stored on a file server so it may be accessed by all Operations and Network Design staff within the National Grid electricity business.

The Data and Analysis team at Wokingham examines the "Schedule 5" network datasheets and updates the operational models for use by the Operations teams. This includes network connectivity, parameter changes, nodal demands, and modified fault infeeds[1].
In addition these updated values are made available in National Grid format, for use by the Network Design engineers at Warwick. It is made clear to the Network Design Engineers that this data is "Standard Planning Data" **(PC.4.4, PC.A.1.2.)**.

Under clause **PC.A. 2.1.4** National Grid may request clarification or further Standard Planning Data. This request may come via Wokingham or the Joint Technical Planning Liaison Meetings that are periodically held between National Grid Network Design Engineers and their counterparts in the Network Operators, and the data should then be submitted via the normal Standard Planning Data route.

If the Joint Technical Planning Liaison process identifies any inaccuracies or updates required to the Standard Planning Data, then the data must be resubmitted via the normal mechanism, thus ensuring the databank contains the most up-to-date information.

Additionally, more detailed information may be required to perform specialist studies, for example harmonic studies. The Network Design Engineers may request this information via the Joint Technical Planning Liaison Meetings. Such data is classed as "Detailed Planning Data". **(PC.4.4, PC.4.5, PC.A.1.2.)**

The Equipment data submissions (Tables 14) are also considered by both teams when studying the network for both design and operational purposes.

The Emergency Demand Control (Tables 12) information is used in the production of the National Grid internal document "The System Reference Document". This is primarily used by the Control Room for operating the network, but is also considered by the Network Design Engineers.

The Demand and Energy data submissions are primarily used by the Network Design Engineers to ensure the network systems are adequate to cope with future demand increases.

[1] Nodal demands and fault infeeds should correspond to nodes on the Single Line Diagrams.

# Appendix 1

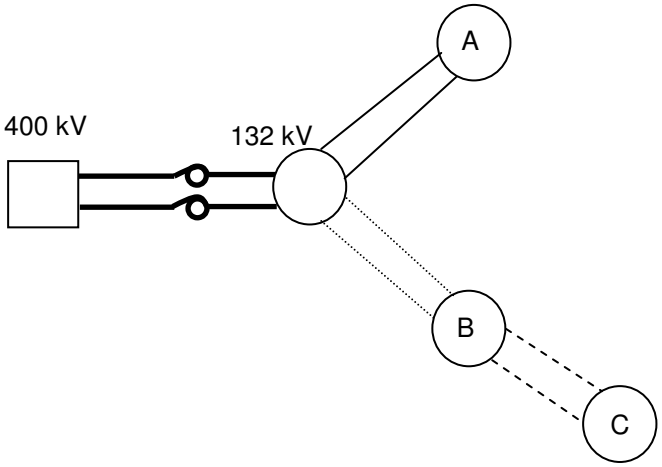
## 1.1 Demand Data - General Principles

In the Grid Code Glossary, **Demand** is defined as MW and MVAr (both active and reactive power), unless otherwise stated.

Demand data is provided in Tables 10a, 10b and 10c (Network Operator's total demand profiles), 11 (Connection Point demands and transfers used for security assessments), and 11c (a breakdown of demand types).

Demand figures should include the demands of any substations belonging to other Network Operators which are normally connected to the Distribution System of the host Network Operator and therefore take power from a Connection Point of the host Network Operator. Conversely, the other Network Operators should exclude the demands of any substations from their own demand profiles.

For example:



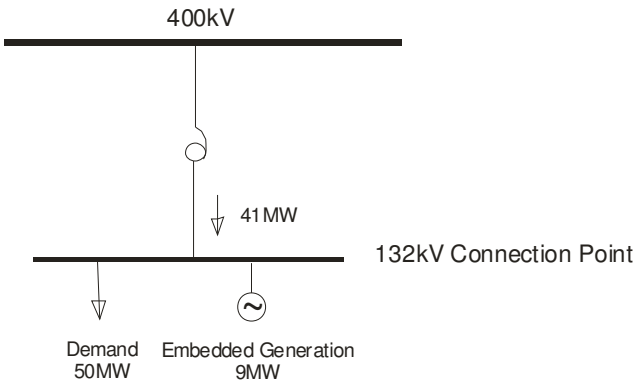

The Network Operator which owns substation A should include the demand for substation A.
The Network Operator which owns substation B should include the demand for substation B **and** the demand for substation C.
The Network Operator which owns substation C should not make a demand submission for substation C.

The data provided should include active power losses on the Network Operator's system.

The Network Operator should make whatever deduction from the demand profile it considers appropriate to allow for the running of embedded small and medium power stations and customer generating plant. No deduction is to be made to allow for the possible running of Large Power Stations. **(PC.A.4.2.4 (b) and PC.A. 4.3.2 (a))**

Example of netting off Embedded Medium and Small Power Stations

PC.A.4.2.4 (b) and PC.A. 4.3.2 (a)




In other words, Small and Medium power stations should be treated as negative demand, so that all Demand submissions should be net of the output of all embedded Medium and Small Power Stations.

According to the Grid Code, small, medium and large power stations are defined based upon their Registered Capacity:

| Transmission Area: | National Grid Company | Scottish Power Transmission Limited | Scottish Hydro Electric Transmission Limited |
|---|---|---|---|
| Large Power Station | >=100MW | >=30MW | >=10MW |
| Medium Power Station | >=50MW and <100MW | | |
| Small Power Station | <50MW | <30MW | <10MW |

The total embedded generation output which has been assumed should be provided in Table 11c **(PC.A.4.2.3)**, and the embedded generation output at each connection point should be provided in Table 11 **(DRC Schedule 11)**. The number of embedded small and medium power stations and their embedded capacity should be provided in Table 11 **(PC.A.3.1.4).**

Each Non-Embedded Customer is to supply the profile of its own demand directly to National Grid and therefore the Network Operator submission should exclude any non-embedded customer demand.

## 1.2 Treatment of Small and Medium Power Stations

The treatment of small and medium power stations is detailed in Engineering Recommendation P2/6: Security of Supply.

## 1.3 Future, Unplanned Embedded Generation

In a number of cases it may be that a Network Operator expects a certain amount of embedded generation to be commissioned, but is unable to identify exactly where this might be. For example a Network Operator may expect (say) 50MW to come on each year, but without being able to identify plant and/or location.

In such circumstances, the embedded generation should be included in Tables 10a, 10b and 10c but not in the appropriate Table 11. Thus, although normally, one would expect the sum of the demands in Table 11 at National Grid peak to equal the demand at National Grid peak in Table 10b, in the example described above the Table 10b value would be 50MW less than the sum of the Table 11 values in the first year; this difference would then increase by 50MW each year.

# Appendix 2 - Total Network Operator Demand Profiles

## 2.1 Table 10a - User's Total System Demand Profile - Day of User's Peak Demand

The demand profile for the day of the Network Operator's peak active demand should comprise the numerical value of the maximum demand that in the User's opinion could reasonably be imposed on the GB Transmission System. **(PC.A.4.2.1 (a))**
This demand profile is required for the current financial year and the following seven years.

## 2.2 Table 10b - User's Total System Demand Profile - Day of GB Peak Demand

The demand profile of the Network Operator's system for the day of the GB Transmission System peak demand should be provided in this table.

By calendar week 17 National Grid provides all Network Operators with date and time of the annual peak of the GB Transmission System Demand. This is provided for the current financial year and for the following seven financial years. **(PC.A.4.2.1 (b))**

National Grid dates provided are not true forecasts, but correspond to the dates when these demands would occur if average weather conditions pertained throughout the year. In reality, of course, the outturn peak demand is likely to be on a different date.

In addition to the forecast demand profiles, the Network Operator's total demand at GB Transmission System Peak for the current financial year, both outturn and weather corrected, is required.

## 2.3 Table 10c - User's Total System Demand Profile - Day of GB Minimum Demand

The demand profile of the Network Operator's system for the day of the GB Transmission System minimum demand should be provided in this table.

By calendar week 17 National Grid provides all Network Operators with date and time of the annual minimum of the GB Transmission System Demand. This is provided for the current financial year and for the following seven financial years. **(PC.A.4.2.1 (c))**

As for Table 10b, this is not a prediction of the day of minimum demand, but represents when National Grid would expect minimum demand to occur if average weather conditions pertained.

# Appendix 3 – Changes to the Grid Code Data Requirements from 2011

## 3.1 Background

Modifications to the Grid Code resulting from a Working Group on "Improved Planning Code Data Exchange for Compliance Assessments" come into effect on 1st January 2011. This new appendix has been written to assist Network Operators in meeting the requirements of the sections of the Planning Code which are new or have been modified as a result of this consultation.

This Guidance Document does not attempt to describe the detail of the consultation. The full consultation document explains the reasoning behind the changes and is available at:

**http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/**

As stated in the consultation documents, National Grid believes that the changes made to the Grid Code will:

- improve the clarity and scope of data transfer across the planning interface
- ensure that the relevant parties can access accurately their compliance against the applicable security standard
- facilitate the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity by reducing the ambiguity at the National Grid/DNO interface regarding roles and responsibilities.

The changes to the Grid Code involve modifications to the Planning Code, Glossary and Definitions and Data Registration Code sections.

In summary the changes:

a) introduce new Grid Code terms (Access Group, Access Period and Transmission Interface Circuit – see further explanation below), and associated provisions such that more robust data can be provided by Network Operators to National Grid that can then be used to demonstrate that assets are maintainable in accordance with the GB SQSS.

b) reinforce the fundamental principle behind the assessment of Transmission Interface Circuits against the Licence Standards is that the respective networks need to be coherently modelled. To facilitate this, the existing Single Line Diagram provisions within the Grid Code have been strengthened to ensure that National Grid is able to assess compliance using a Single Line Diagram that accurately represents the planned network configuration during each assessment period.

c) replace the existing Grid Code provisions that concern Demand Transfers (PC.A.4.5) with a process based around the Single Line Diagram that describes actions that would be taken by a Network Operator post fault to reconfigure their network.

d) include a new section which recognises that the data exchange and security assessment process is necessarily an iterative one that relies on a significant dialogue between the parties involved.

e) introduce new obligations to expand the data set National Grid can provide to a Network Operator in order to model the impact of the GB Transmission System upon its distribution system. (The process for the provision of this data by National Grid to Network Operators is covered in separate Guidance Notes.)

f) add provisions to the Data Registration Code to clarify the process following the submission of data believed to be erroneous.

## 3.2 Introduction

Fundamental to the understanding of the new requirements are the definitions of the new terms introduced into the Grid Code, specifically **Access Group, Transmission Interface Circuit**, and **Access Period**. Please refer to the Grid Code Glossary and Definitions section for the formal definitions, and to the Planning Code, in particular sections PC.A.4.1.4, 4.2.2, 4.3 and 4.5, for the data requirements.

## 3.3 Access Group

The concept of an Access Group has been developed to ensure that all relevant information is gathered at the same time to allow "maintainability" to be assessed. In it's simplest form, a single Connection Point in a radial network may constitute an Access Group on it's own.

In an interconnected network, an Access Group may contain many Connection Points. This allows, for example, when considering a maintenance outage, demand data to be provided for the same point in time for all interconnected Connection Points. A clear picture is needed of the interconnected network at the time of assessment.

A network is defined as "interconnected" either where:

a) the network is operated permanently interconnected, or
b) the Network Operator decides to interconnect Connection Points to transfer demand post fault and wishes this demand transfer to be taken into account for security assessment purposes.

All Connection Points within this section of network will then form an Access Group.

Interconnected networks they are by their nature more complex than simple radial networks and it is not surprising that are likely to require more data to assess "maintainability". However, the new Grid Code requirements are designed so that there is a lesser burden of data provision for simple radial networks.

Each Connection Point on the GB Transmission System must only reside in one, and only one Access Group. By definition, if a Connection Point were to be in two Access Groups then both Access Groups should be merged into a single larger Access Group, as they would be interconnected through the shared Connection Point.

## 3.4 Access Period

Having defined the Access Groups, the objective is to provide data to establish the "maintainability" of Transmission Interface Circuits (TICs) within each Access Group. A TIC (typically a supergrid transformer) is defined as a Transmission circuit which connects a system operating above 132kV to a system at 132kV or below (or, in Scotland, connects a system operating at 132kV or above to a system operating below 132kV). National Grid will need to carry out an assessment based on the data provided to determine whether each asset can be taken out of service for maintenance without breaching licence standards, ie the Great Britain Security and Quality of Supply Standard (GBSQSS). Network Operators have their own obligations to carry out security assessments for their system according to Engineering Recommendation P2/6.

It is important to note that this security assessment process for investment planning purposes is entirely separate from the actual placement of outages in operational timescales. The security compliance assessment is purely a theoretical evaluation of maintainability and does not relate to "real" outages. The placement of outages in operational timescales will continue to take place in accordance with the Operating Codes section of the Grid Code between National Grid and Network Operator operational staff. If operational teams find that in practice maintenance is proving extremely difficult at a site this will need to be fed into the planning discussions in the same manner as it is currently.

An Access Period must be established for each TIC. The Access Period must be a minimum of 8 weeks long and is required once over a 3-year period. (Note that the 3-year period does not relate to 3 specific

calendar years, as the process is designed to assess maintainability and not place actual outages over the next actual 3 years.) The Access Period must normally occur during the British Summer Time period of calendar weeks 13 to 43. Access periods may be allowed to overlap in the same Access Group and in the same maintenance year, however, wherever possible, Access Periods will be sought which do not overlap.

Note that in exceptional cases the Access Period may be reduced from 8 weeks to a minimum of 4 continuous weeks and/or be declared in the period from calendar weeks 10 to 43 (inclusive) which is an extension from calendar weeks 13 to 43 (inclusive). However, this must be agreed by both the Network Operator and National Grid [Revised PCA4.1.4.3 following consultation].

## 3.5 Connection Point Demands

For each Connection Point, demands should be provided for the following 5 assessment periods:

a) Time of local Connection Point peak
b) Time of GB Transmission System peak
c) Time of GB Transmission System minimum
**d) Time of Access Period peak**
e) Any other time specified by NGET or a User (which must be reasonably justified)

Note that only (d) is new to the Grid Code for 2011.

Where there is more than one Connection Point in an Access Group then demand data must be provided for each Connection Point in the Access Group at the time of the Access Period peak demand for the TIC being considered on maintenance outage. This allows a realistic assessment of security to be carried out as it ensures all the demand data relates to the same point in time.

Instead of providing demand data at the Connection Point, demands may, alternatively be provided at each node on the Single Line Diagram. The network data spreadsheet (known as the "schedule 5" spreadsheet) may be used to supply these demands. Demands at each node on the Single Line Diagram must in any case be provided for the time of the next winter GB Transmission System peak.

## 3.6 Single Line Diagram

The Single Line Diagram is a vitally important piece of information which lies at the heart of the data exchange and is fundamental in the demand submission for security assessment.

A Single Line Diagram representing the configuration of the Network Operator's network at the next GB Transmission System peak (ie: current financial year winter peak), and for the GB Transmission System peak for the next 7 years should always be provided (unless there is no change from the previous year in which case a statement as such should be made). The provision of these Single Line Diagrams is an existing Grid Code requirement and there is no change to this requirement from 2011.

From 2011, Single Line Diagrams are required to show the configuration of the Network Operator's network for each of the 5 assessment periods, not just the GB Transmission System peak. The Network Operator may choose either to submit revised Single Line Diagrams for each of the other time periods, or, alternatively, may provide a clear description of any changes to the Single Line Diagram from the "default" (GB Transmission System peak) version.

Whereas prior to 2011, the Grid Code schedules included provision to state demand transfers between Connection Points in terms of first and second circuit outage conditions, from 2009 there is now a reliance on the Single Line Diagram and the associated nodal demand data to indicate how demand transfers may be achieved. The post-fault network configuration must now be explained clearly with reference to a change to the Single Line Diagram. This allows National Grid to model the demand transfer through the Network Operator's network following post-fault actions.

Where demand data is provided at every node on the Single Line Diagram there must be a clear and precise correlation between the nodes listed on the spreadsheet containing the demand data and the Single Line Diagram.

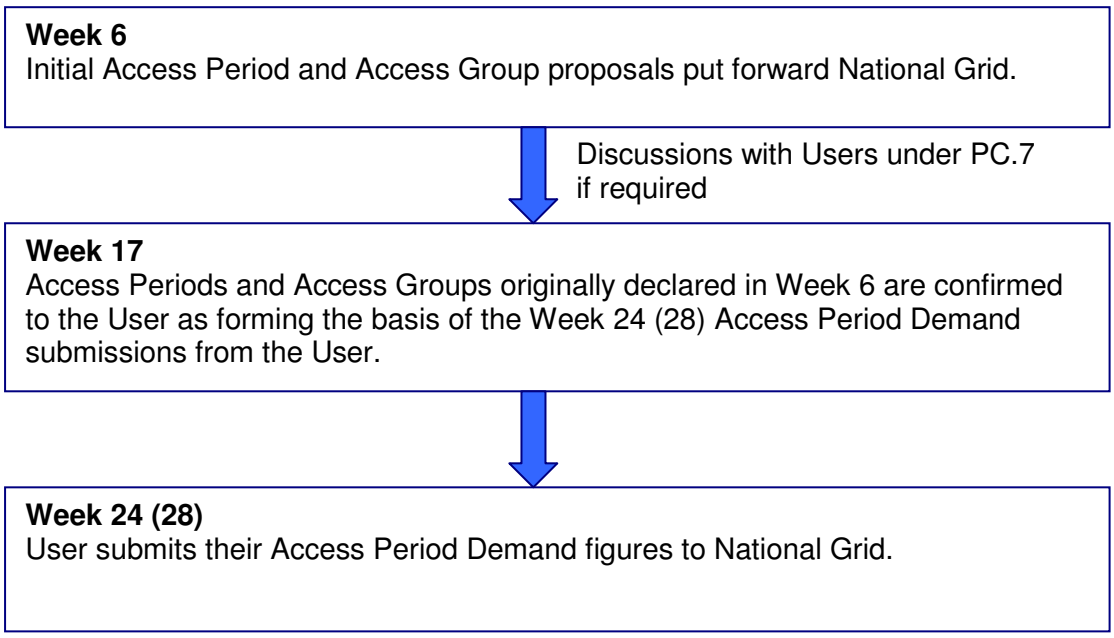
Demand transfers need only be offered where the Network Operator wishes them to be taken into account for the purposes of security assessment. Where demand transfers are offered they must be realistic and achievable.

## 3.7 Determination of Access Groups and Access Periods

The process for identifying Access Periods begins in week 6 when National Grid will put forward initial proposals to Network Operators. Following discussions between National Grid and Network Operators, the Access Period for each TIC will then be confirmed by week 17.

In the case of shared sites, National Grid will need to co-ordinate with the Network Operators concerned to establish the Access Group definitions, identify Access Periods and notify the Network Operators of the date and time of Connection Point and Access Period peak demands.

The Access Periods confirmed by week 17 will then be used as the basis for the data submission by week 28.



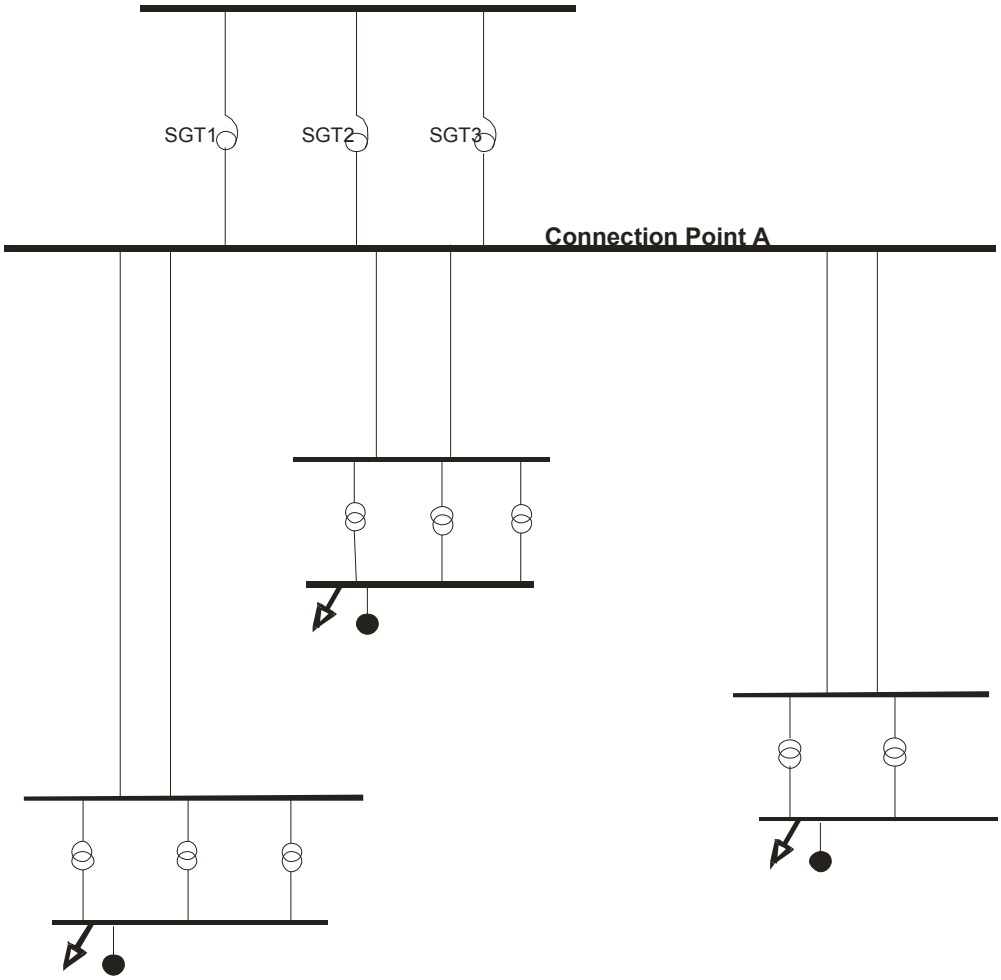

## 3.8 Schedule 17 – Access Period Data

A new Schedule 17 is provided in the Data Registration Code to define Access Groups and Access Periods. The electronic (Microsoft Excel) Schedule 17 provided by National Grid under the Data Registration Code (D.R.C.) gives a visual indication of the distribution of Access Periods automatically once the start and end week numbers are entered. (D.R.C 5.2.3 states that data can be submitted in an electronic format using a proforma to be supplied by National Grid, or other format agreed annually in advance with NGET.) The spreadsheet also includes guidance notes in the form of both an overview of the principle of an Access Group, and detailed instructions on completing the schedule. The Schedule includes a column which identifies potential concurrent outages. It is perfectly acceptable for the Access Periods relating to two or more TICs in an Access Group to overlap. However, the

“maintainability” of these TICs will need to be assessed taking into account the fact that the other TICs will also be out of service.

Examples of a typical Access Period schedule (Schedule 17) for a simple radial network and a more complex interconnected network are given below:

## 3.9 Example Schedule 17 – simple radial network




Data Registration Schedule 17

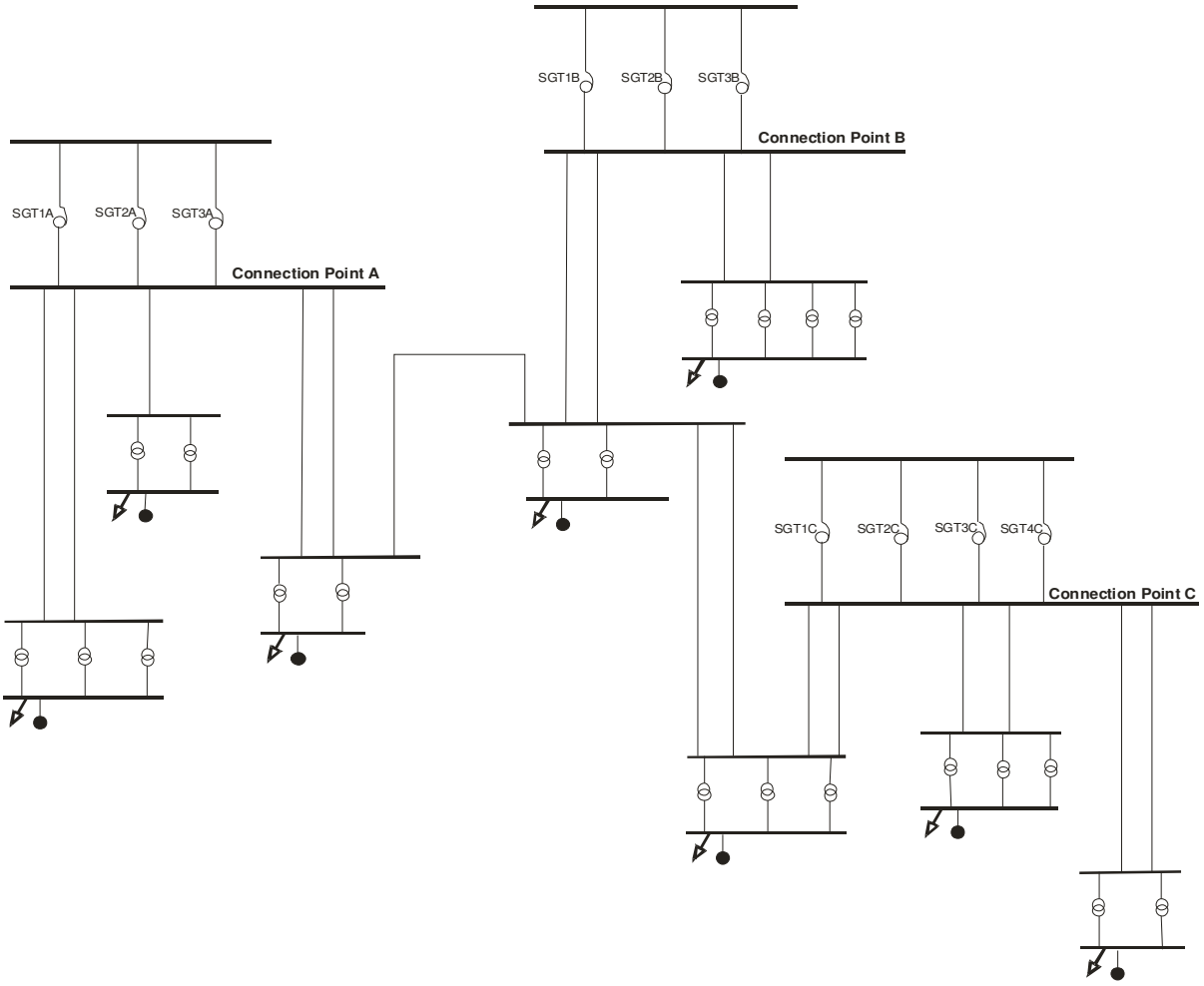
Overview | Process | **8 WEEK ACCESS PERIOD SCHEDULE**

ACCESS GROUP

| | Start Week | End Week | Maint Year | Duration | Potential Concurrent Outages |
|---|---|---|---|---|---|
| **Connection Point A** | | | | | |
| **SGT1** | 13 | 20 | 1 | 8 | |
| **SGT2** | 13 | 20 | 2 | 8 | |
| **SGT3** | 13 | 20 | 3 | 8 | |

Year 1 | Year 2 | Year 3

## 3.10 Example Schedule 17 – Interconnected network




Data Registration Schedule 17

**Overview** | **Process** | **8 WEEK ACCESS PERIOD SCHEDULE**

ACCESS GROUP

| | Start Week | End Week | Maint Year | Duration | Potential Concurrent Outages | Year 1 | Year 2 | Year 3 |
|---|---|---|---|---|---|---|---|---|
| **Connection Point D** | | | | | | | | |
| SGT1 | 13 | 20 | 1 | 8 | | | | |
| SGT2 | 22 | 29 | 1 | 8 | √ | | | |
| SGT3 | 31 | 38 | 1 | 8 | | | | |
| **Connection Point B** | | | | | | | | |
| SGT1A | 13 | 20 | 2 | 8 | | | | |
| SGT1B | 22 | 29 | 3 | 8 | | | | |
| SGT3 | 31 | 38 | 2 | 8 | | | | |
| **Connection Point C** | | | | | | | | |
| SGT1 | 13 | 20 | 3 | 8 | | | | |
| SGT2 | 22 | 29 | 1 | 8 | √ | | | |
| SGT3A | 22 | 29 | 2 | 8 | | | | |
| SGT3B | 31 | 38 | 3 | 8 | | | | |

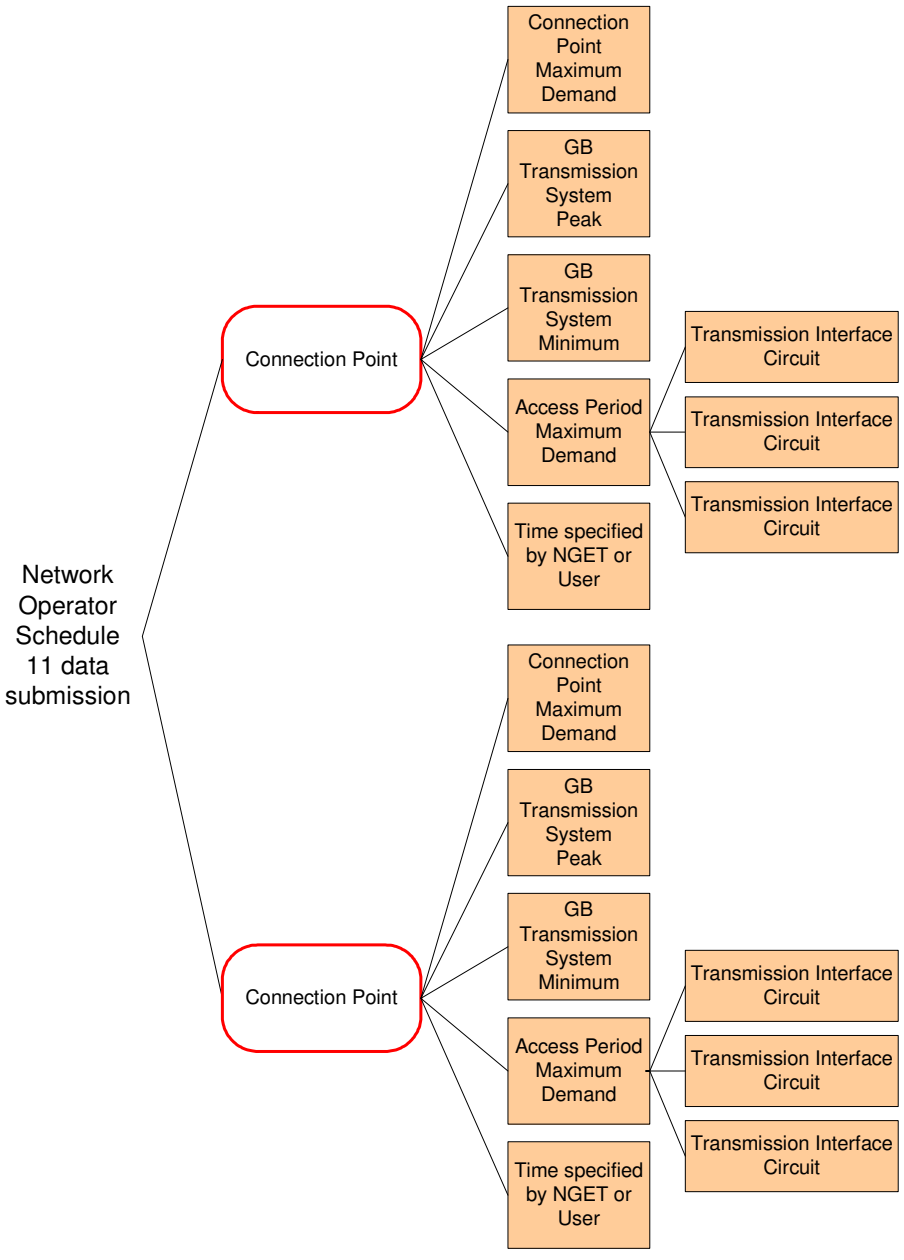
## 3.11 Completing Schedule 11 – Connection Point Demand Data

Having defined Access Groups and Access Periods in Schedule 17, the Connection Point Demand data is entered into Schedule 11. The format of the Schedule is given in the Data Registration Code. In practice, as for Schedule 17, it is anticipated that rather than completing a paper copy of the Schedule, most Network Operators would prefer to use the Microsoft Excel format provided by National Grid under D.R.C. 5.2.3.

Schedule 11 is designed to hold Connection Point Demand data and a copy of the Schedule is required for each Connection Point. For each Connection Point, 5 copies of the Schedule are required – one for each of the time periods for which security assessment may be carried out, ie:

a) Time of local Connection Point peak
b) Time of GB Transmission System peak
c) Time of GB Transmission System minimum
d) Time of Access Period peak
e) Any other time specified by NGET or a User

Additionally, in the case of (d), the time of Access Period peak, one schedule is required for each Transmission Interface Circuit at the Connection Point. For example:



A copy of the electronic Schedule representing the Connection Point Access Period is given below.

| | |
|---|---|
| **Network Operator:** | 1 |
| **Connection Point:** | 2 |
| **Access Group:** | 3 |

## Connection Point Access Period

| DATA DESCRIPTION | Outturn | Outturn Weathe 4 | F.Yr 1 | F.Yr 2 | F.Yr. 3 | F.Yr 4 | F.Yr 5 | F.Yr 6 | F.Yr 7 14 | DATA CAT |
|---|---|---|---|---|---|---|---|---|---|---|
| **Transmission Interface Circuit:** | | | | | | | | | | |
| Date of **Connection Point** Peak **Demand** during the **Access Period** 5 | | | | | | | | | | SPD PC.A.4.3.3 |
| Time of **Connection Point** Peak **Demand** during the **Access Period** | | | | | | | | | | SPD PC.A.4.3.3 |
| **Access Period Peak Demand** at **Connection Point** (MW) | | | | | | | | | | SPD PC.A.4.3.1 |
| **Access Period Peak Demand** at **Connection Point** (MVAr) 6 | | | | | | | | | | SPD PC.A.4.3.1 |
| Deduction made from **Access Period Demand** at **Connection Point** for **Small Power Stations**, **Medium Power Stations** and **Customer Generating Plant** (MW) 7 | | | | | | | | | | SPD PC.A.4.3.2 (a) |
| Reference to **Single Line Diagram** for time of **Access Period** 8 | | | | | | | | | | SPD PC.A.4.3.5 |
| Reference to node and branch data spreadsheet for time of **Access Period** 9 | | | | | | | | | | SPD PC.A.2.2 |
| Reference to post-fault revision of **Single Line Diagram** 10 | | | | | | | | | | SPD PC.A.4.5 |
| Reference to post-fault revision of the node and branch data associated with the **Single Line Diagram** 11 | | | | | | | | | | SPD PC.A.4.5 |
| Reference to the description of the actions and timescales involved in effecting the post-fault actions (e.g. auto-switching, manual, teleswitching, overload protection operation etc) 12 | | | | | | | | | | SPD PC.A.4.5 |
| Associated **Connection Point** within the same **Access Group:** 13 | | | | | | | | | | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MW) | | | | | | | | | | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MVAr) | | | | | | | | | | SPD PC.A.4.3.1 |
| Deduction made from **Access Period Demand** at associated **Connection Point** for **Small Power Stations**, **Medium Power Stations** and **Customer Generating Plant** (MW) | | | | | | | | | | SPD PC.A.4.3.2 (a) |

May be repeated if necessary to identify each post-fault action.

Repeat for each **Connection Point** within the same **Access Group**

The Schedule should be completed as follows:

**1** Name of the Network Operator for which the Connection Point is in the licence area.

**2** Connection Point name (normally the substation name).

**3** Name of the Access Group which contains this Connection Point. Every Connection Point must reside in one and only one Access Group. For a simple radial network, the Access Group may contain only one Connection Point. The naming convention for Access Groups may be determined by the Network Operator but should be clear and unique for each Access Group.

**4** The Transmission Interface Circuit(s) at the Connection Point whose Access Period is being considered by this copy of the Schedule.

**5** The date and time of the Access Period peak demand.

**6** The forecast Connection Point Access Period demand should be provided in terms of MW and MVAr for each of the 8 financial years indicated, ie the next summer minimum and the following 7 financial years. For the preceding financial year, both outurn and weather corrected outturn demands should be supplied. The "weather correction" should normalise outturn figures to Average Conditions.

Optionally, rather than providing the demands at the Connection Point, demand data may instead be provided at each node on the Single Line Diagram. In this case, the boxes referring to demand in Schedule 11 should contain a clear reference to the appropriate spreadsheet containing the nodal demands.

**7** The demand figures supplied in **6** should be net of any small or medium power stations (see Appendix 1 of this Guidance Note). The MW generation deducted representing these power stations should then be quoted here.

**8** Reference should be made to a valid Single Line Diagram, supplied as part of the current Grid Code data submission, which represents the configuration of the network for the Connection Point's Access Period. The "default" Single Line Diagram which must be provided is that representing the Network Operator's network at the next GB Transmission System peak. The reference to a Single Line Diagram made in the Access Period Schedule 11 table may either refer to an alternative Single Line Diagram representing the network at the time of the Access Period maximum demand, or alternatively may refer to a description which clearly describes the changes to the diagram from the GB Transmission System peak diagram submitted.

**9** The reference to branch and node data should refer to branch and node data spreadsheets which exactly match the Single Line Diagram referred to in the previous box.

**10** These boxes may be used to refer to post-fault configurations of the Network Operator's system where the Network Operator considers it appropriate for these to be taken into account by National Grid when assessing security. As for the previous boxes, reference should be made to a revised Single Line Diagram or to changes to the "default" Single Line Diagram. Note PC.A.4.5.1 states that post-fault actions must not be declared if there is no capability or intention to implement them during the specified assessment period.

**11** The reference to branch and node data should refer to branch and node data spreadsheets which exactly match the Single Line Diagram referred to in the previous box.

**12** This box should be used to provide a clear description of the post-fault actions which are proposed, including a description of how switching is achieved.

The post-fault action data block may be copied and repeated as necessary for each post-fault network configuration change.

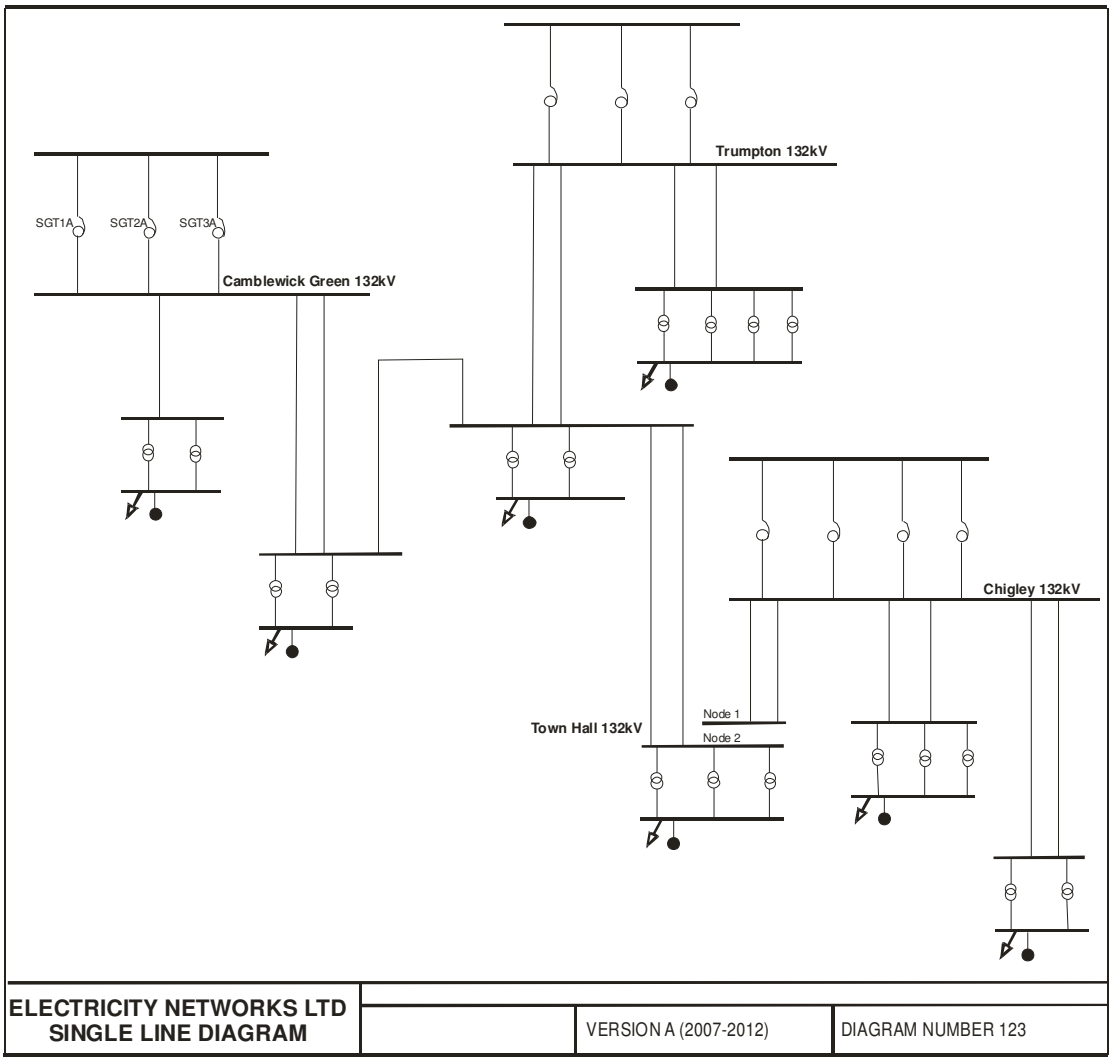
**13** The final block of the Schedule is used to provide demand data for Connection Points within the same Access Group at the time of the Access Period peak demand.

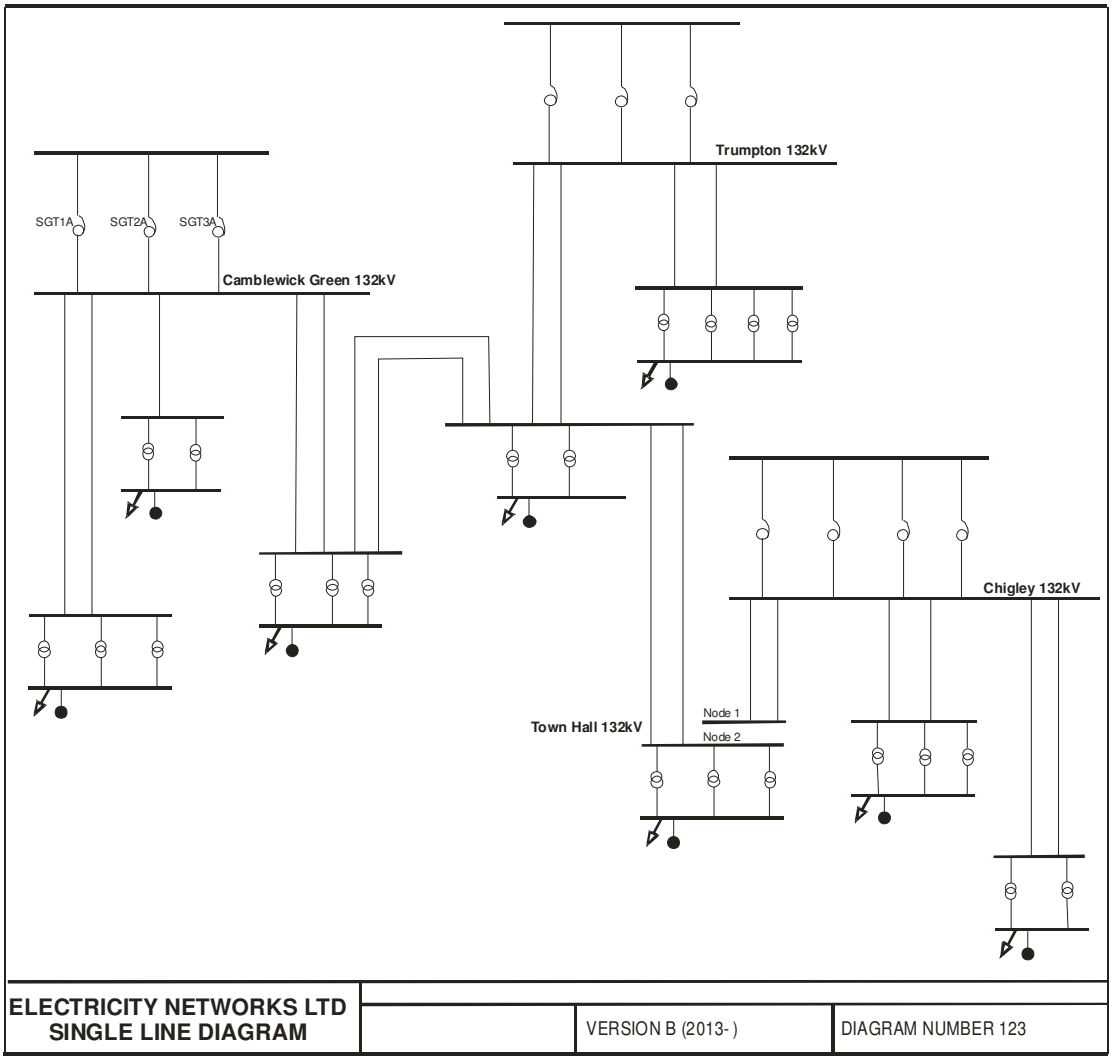
**14** All data should be provided for the next financial year and then for the following 7 financial years. Where there is no change to the data (for example, where the network configuration does not change from one year to the next so the reference to Single Line Diagram in unchanged) the cells may simply be copied across to the following years.

Note that in many cases it is likely that the same data is valid for more than one scenario, so that copies of the Schedule can be combined. For example, it may be that the Access Period may comprise the same weeks for more than one of the Transmission Interface Circuits at a Connection Point. In this case, the Transmission Interface Circuit can be quoted as, for example, "SGT1, SGT2 or SGT3" in box 4, and only one copy of the Schedule submitted. The Schedules are designed to allow for sufficient detail to be provided in the case of complex interconnected networks, but should not require excessive data and duplication in the case of simple radial networks.

## 3.12 Example Schedule 11

An example completed Schedule 11 follows, which gives the Connection Point Access Period demands relating to three TICs at a Connection Point. In this example, two versions of the Single Line Diagram have been provided:




Trumpton 132kV
SGT1A
SGT2A
SGT3A
Camblewick Green 132kV
Chigley 132kV
Town Hall 132kV
Node 1
Node 2
ELECTRICITY NETWORKS LTD
SINGLE LINE DIAGRAM
VERSION B (2013- )
DIAGRAM NUMBER 123

| Network Operator: | Electricity Networks Ltd |
|---|---|
| Connection Point: | Camblewick Green |

| Access Group: | North-East Group (Camblewick Green - Trumpton - Chigley) |
|---|---|

# Connection Point Access Period

| DATA DESCRIPTION | Outturn | Outturn Weather Corrected | F.Yr. 1 2008/9 | F.Yr. 2 2009/10 | F.Yr. 3 2010/11 | F.Yr. 4 2011/12 | F.Yr. 5 2012/13 | F.Yr. 6 2013/14 | F.Yr. 7 2014/15 | F.Yr. 8 2015/16 | DATA CAT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Transmission Interface Circuit:** | **SGT1A or SGT2A or SGT3A** | | | | | | | | | | |
| Date of **Connection Point** Peak **Demand** during the **Access Period** | 18/12/2007 | | 15/12/2008 | 14/12/2009 | 13/12/2010 | 19/12/2011 | 17/12/2012 | 16/12/2013 | 15/12/2014 | 14/12/2015 | SPD PC.A.4.3.3 |
| Time of **Connection Point** Peak **Demand** during the **Access Period** | 17:30 | | 17:30 | 17:30 | 17:30 | 17:30 | 17:30 | 17:30 | 17:30 | 17:30 | SPD PC.A.4.3.3 |
| **Access Period Peak Demand** at **Connection Point** (MW) | 230 | 228 | 230 | 233 | 235 | 238 | 240 | 246 | 250 | 260 | SPD PC.A.4.3.1 |
| **Access Period Peak Demand at Connection Point (MVAr)** | 65 | 62 | 65 | 67 | 70 | 73 | 74 | 75 | 76 | 81 | SPD PC.A.4.3.1 |
| Deduction made from **Access Period Demand** at **Connection Point** for **Small Power Stations**, **Medium Power Stations** and **Customer Generating Plant** (MW) | 22 | 20 | 23 | 23 | 24 | 25 | 26 | 30 | 33 | 40 | SPD PC.A.4.3.2 (a) |
| Reference to Single Line Diagram for time of **Access Period** | | | Diagram Number 123 Version A (2007-2012) | | | | | Diagram Number 123 Version B (2013-) | | | SPD PC.A.4.3.5 |
| Reference to node and branch data spreadsheet for time of **Access Period** | | | Network data spreadsheet 123 Version A (2007-2012) | | | | | Network data spreadsheet 123-Version B (2013-) | | | SPD PC.A.2.2 |
| Reference to post-fault revision of **Single Line Diagram** | | | Diagram Number 123 Version A (2007-2011): In the event of a fault outage of an SGT at Camblewick Green, nodes 1 and 2 at Town Hall 132kV to be merged | | | | | Diagram Number 123 Version B (2013-): In the event of a fault outage of an SGT at Camblewick Green, nodes 1 and 2 at Town Hall 132kV to be merged | | | SPD PC.A.4.5 |
| Reference to post-fault revision of the node and branch data associated with the **Single Line Diagram** | | | | | | | | | | | SPD PC.A.4.5 |
| Reference to the description of the actions and timescales involved in effecting the post-fault actions (e.g. auto-switching, manual, teleswitching, overload protection operation etc) | | | Switching at Town Hall 132kV to be carried out by telecontrol within 10 minutes | | | | | | | | SPD PC.A.4.5 |
| Associated **Connection Point** within the same **Access Group:** | **Trumpton** | | | | | | | | | | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MW) | 215 | 211 | 214 | 217 | 221 | 224 | 227 | 231 | 234 | 238 | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MVAr) | 63 | 62 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | SPD PC.A.4.3.1 |
| Deduction made from **Access Period Demand** at associated **Connection Point** for **Small Power Stations**, **Medium Power Stations** and **Customer Generating Plant** (MW) | 10 | 10 | 10 | 10 | 12 | 12 | 15 | 15 | 15 | 15 | SPD PC.A.4.3.2 (a) |
| Associated **Connection Point** within the same **Access Group:** | **Chigley** | | | | | | | | | | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MW) | 305 | 300 | 304 | 309 | 314 | 319 | 324 | 350 | 355 | 360 | SPD PC.A.4.3.1 |
| **Access Period Demand** at associated **Connection Point** (MVAr) | 89 | 88 | 89 | 90 | 92 | 93 | 95 | 96 | 97 | 99 | SPD PC.A.4.3.1 |
| Deduction made from **Access Period Demand** at associated **Connection Point** for **Small Power Stations**, **Medium Power Stations** and **Customer Generating Plant** (MW) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SPD PC.A.4.3.2 (a) |

## 3.13 Discussion and liaison with Network Operators

The purpose of the Grid Code is to define the formal data requirements and exchange process, however, it should be recognised that the overall process of compliance assessment to identify the need for future network investment is dependent upon collaboration and ongoing discussion between the parties concerned (National Grid, Network Operators or Non Embedded Customers). It is also realised that the determination of Access Periods is unlikely to be finalised in one attempt and in many cases there will be a number of iterations whilst the new process is being established. There will need to be ongoing dialogue throughout the planning process.

PC.7.3 places an obligation on National Grid to provide information to Network Operators or Non-Embedded Customers by week 6 of the following year regarding the results of their compliance assessments.

Furthermore, the new Planning Code section PC.7 recognises that it may be necessary to submit additional data or amend data if National Grid identifies possible future non-compliance with the GBSQSS, and so recognises the iterative nature of the process.

Note that GBSQSS "non-compliance" resulting from this security assessment process lies with National Grid and is distinct from any "non-compliance" with the Grid Code which may result from, for example, a User failing to submit data in a format specified in the Grid Code.

PC.7.8 also provides an opportunity for Users to request specified GB Transmission System network data from National Grid.

## 3.14 Substituted data

From 2011, a new clause in the Data Registration Code (D.R.C. 5.5) allows National Grid to estimate data if the data submitted by a Network Operator is inconsistent with existing data and therefore judged to be erroneous. This is intended to ensure that where necessary the security assessment process is not delayed whilst discussions take place to agree the correct data. National Grid must advise the Network Operator in writing of any estimated data it intends to use.

## 3.15 Connection Point Embedded Generation

There are no changes to the Grid Code requirements for this data for 2011.

## 3.3 Table 11c – User's Total System Active Energy Data

There are no changes to the Grid Code requirements for this data for 2011.

Table 11c should be completed in accordance with **PC.A.4.2.3** and be corrected to average weather conditions. **(PC.A.4.2.4 (c))**

The active energy data should:

a include the energy of the Customers of all suppliers using a Network Operator's Distribution System;

b exclude the energy taken by Non-Embedded Customers which will be provided to National Grid direct by those customers;

c contain no allowance for the output of Large Power Stations;

d contain no allowance for the output of Embedded Small and Medium Power Stations, the energy output of which is to be quoted separately in the space provided. This is the energy output from all embedded generating stations under 100MW connected to the Network Operator's system. (This information is required to enable the annual load factor to be calculated for the National Grid total "net" figures).

e exclude any energy transferred from one Network Operator to another resulting from interconnection between Connection points;

f exclude the energy taken by a substation of one Network Operator which is supplied from the Connection Point of a different Network Operator.

## 3.4 Reactive Demand

Several factors affect the reactive demand as seen at the Grid Supply Point. These include:

a Reactive demand inherent in the demand itself.
b Reactive demand due to $I^2X$ losses.
c Embedded generation.
d $BV^2$ gain due to the capacitive effect of the LV network.
e Effect of reactive compensation owned by National Grid
f Effect of reactive compensation not owned by National Grid.

Only the reactive demand represented by a, b and c should be included in the Network Operator's demand submission.

PC.A.4.3.2 (b) specifies that both reactive compensation equipment connected to the Network Operator's subtransmission system as listed in Table 14c (PC.A.2.4), and lumped system susceptance provided in the Network Data (PC.A.2.3) should NOT be included in the demand data tables.

# Appendix 4 - Demand Control

Operating Code 6 (OC6) requires certain information on demand control. This information consists of:

a low frequency relay tripping (OC6.6)

b demand disconnection in response to a "GB Transmission System Warning - High Risk of Demand" (OC6.5)

c emergency manual disconnection (OC6.7)

## 4.1 Table 12a - Low Frequency Relay Settings

The requirements for Network Operators to provide this data by calendar week 24 are specified in **OC.6.6.2 (d).**

National Grid will not specify any change to the low frequency settings of the relevant demand blocks **(OC.6.6.2 (b))** unless it is considered necessary for overall system reasons. Network Operators may therefore assume there is no change to the low frequency settings specified by National Grid from the previous year unless informed otherwise by calendar week 12.

A separate submission is required for each Grid Supply Point.

## 4.2 Table 12b – High Risk of Demand Reductions

OC6.5 requires all Network Operators to immediately institute uniform demand reduction if a "GB Transmission System Warning - High Risk of Demand Reduction" is issued. This demand reduction shall be in four tranches between 4 and 6%, e.g. 5%, 5%, 6% and 4%.

The requirements of the Network Operator week 24 data submission are specified in **(OC6.5.3 (c))**

## 4.3 Table 12c - Emergency Manual Disconnection

OC6.7 covers emergency manual disconnection, to be undertaken within 30 minutes.

The requirements of the Network Operator "week 24" data submission are specified in **(OC6.7.2 (a))**

A separate submission is required for each Grid Supply Point.

# Appendix 5 - Equipment Data

## 5.1 Table 14a - LV Switchgear data

Network Operators should provide data for circuit breakers installed at a Transmission Site in accordance with **PC.A.2.2.6 (a)** and in the format specified in **D.R.C. Schedule 5**. pg5

This data is provided to allow National Grid to carry out fault level assessments where National Grid is responsible for the safe operation of the site. The data is therefore required where National Grid controls the substation and is therefore responsible for managing fault levels.

## 5.2 Table 14b - LV Substation Infrastructure Data

Network Operators should provide data for substation infrastructure at a Transmission Site in accordance with **PC.A.2.2.6 (b)** and in the format specified in **D.R.C. Schedule 5**. **pg2**

As for Table 14a, this data is provided to allow National Grid to carry out fault level assessments where National Grid is responsible for the safe operation of the site. The data is therefore required where National Grid controls the substation and is therefore responsible for managing fault levels.

Where no LV substation infrastructure data is provided for a site for which National Grid is responsible for managing fault levels, it will be assumed that the switchgear data in Table 14a is the limiting factor.

## 5.3 Table 14c - Reactive Compensation Plant Data

Any reactive compensation plant, such as switched capacitors and reactors, which are not operated by National Grid, but are and connected to the Network Operator subtransmission network should be included in this table. **(PC.A.2.4.1 and D.R.C. Schedule 5 Page 2)**

If no such plant exists, a statement as such should be submitted.

# Appendix 6 - Network Data - Schedules 5 and 13.

## 6.1 Overview

Data relating to the Network Operator network comprises node and branch tables together with corresponding "Single Line Diagrams". The data requirements are specified in the Planning Code **PC.A.2** and the **DRC Schedules 5 and 13**.

In accordance with **DRC.5.2.3,** National Grid has devised a proforma in consultation with the Network Operators which includes the necessary fields to hold the data items required by the Grid Code. **DRC.5.2.3** states that this proforma should be provided by National Grid no later than calendar week 19.

The network data branch and node spreadsheets also fulfil the requirements of **PC.A.1.2 (a)(iii)** in providing a mechanism for Network Operators to maintain an up-to-date databank of this data.

## 6.2 Single Line Diagrams

The "Single Line Diagrams" **(PC.A.2.2) (D.R.C. Schedule 5 pg1)** are a vital part of the network data submission from the Network Operators, primarily because they show the extent of the network data provided by the Network Operator. There should therefore be an exact one-to-one relationship between each node and branch shown on the "Single Line Diagram" and the branch and node spreadsheets. For each node on the Diagram, demand data **(PC.A.4.3.4)** and fault infeed data **(PC.A.2.5)** must be provided **(PC.A.2.2.2)**.

The extent of the "Single Line Diagram", and therefore network data, which should be provided is specified in **(PC.A. 2.2.2.).** In summary, the network should include:

- the subtransmission system at any transmission site.
- the subtransmission system operating at >50kV (>30kV in Scotland) which:
    (a) interconnects separate Connection Points (or busbars which are normally split), or:
    (b) connects Embedded Large or Medium Power Stations connected to the Network Operator subtransmission system, to a Connection Point

- at the Network Operator's discretion, further details of the subtransmission system and transformers connecting the subtransmission system to a lower voltage (but see note below)

- with National Grid's agreement, details of the Network Operator system below the subtransmission system.

**PC.A.2.5.1(a)** requires that National Grid uses Good Industry Practice to calculate fault currents at sites where it is the controlling party. The extent of the data, provided in the "week 24" submission, has been devised to be sufficient for National Grid to carry out this assessment i.e. one voltage transformation below the substation being assessed.

In order to assist Network Operators in providing "Single Line Diagrams" which meet the requirements of the Grid Code, National Grid has offered to draft the "Single Line Diagrams" on behalf of the Network Operators. This considerably reduces the burden on Network Operators in drawing diagrams specifically for the Grid Code Standard Planning Data submission.

Each year National Grid will send copies of the relevant Diagrams to the Network Operator along with the other Table proforma and Network Data spreadsheets, prior to week 19 **(DRC.5.2.3)**. The "Single Line Diagrams" and Network Data spreadsheets will include any corrections or modifications that have be made during the year and agreed with the Network Operator the course of processing the data. The Network Operator is then able to simply mark the changes relevant to the new week 24 submission on

the diagrams and update the Network Data spreadsheets with the corresponding data changes. By highlighting only the network changes to both the Diagrams and Network Data, the obligation to maintain an up-to-date databank **(PC.A.1.2. (a)(iii))** can be met.

The week 24 submission data provided is used to represent the Network Operator's network in National Grid's winter peak model.

## 6.3 Future Years' Network Data

The Schedule 5 data should represent the network for the following 7 years. **(PC.A.1.2(a)(i))**

In practice, National Grid needs to be made aware of significant committed schemes, which may have an affect on the National Grid system, in particular changes to the topology of the subtransmission system.

National Grid have proposed that Network Operators provide marked up copies of the "Single Line Diagrams" indicating future years' changes. National Grid will then work with the Network Operator to obtain any data required relating to the changes. The corresponding data changes should then be added to a copy of the network data branch and node spreadsheets.

Rather than providing seven additional copies of each "Single Line Diagram", the changes for all future years can be drawn on one diagram and annotated with the estimated year of each change. National Grid will draw up these future diagrams in addition to the current year diagram on behalf of the Network Operator.

In the absence of future "Single Line Diagrams" being provided, National Grid will assume the Network Operator network will be substantially unchanged for the following seven years.

## 6.3 Network Data Spreadsheet: Node Data

| Network Operator - Schedule 5 Node data | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | PC.A.2.5.6(a)(i) |
| | | | | <--------- Demand Data (see note below) ----------> | | | | | <---------- Fault Infeed |
| Diagram Number | DNO Node Name | National Grid Node Name | Operating Voltage | National Grid Peak MW | National Grid Peak MVAr | or MVA | + pf | | Sub-transient I" |
| | | | KV | (These values are for setting study loadflows Table 11 demand growth information still required) | | | | | kA |
| | | (Supply points in bold) | | | | | | | |
| 380 | Sunny Street | **SUST11** | 132 | | | | | | |
| 380 | High Road | **HIRO31** | 33 | 33.450 | 20.450 | | | | 4.340 |
| 380 | Greendale | **GRDA51** | 11 | 61.232 | 45.320 | | | | 1.230 |
| 380 | Trumpton | **TRTO51** | 11 | 34.110 | 29.665 | | | | 0.856 |



Some columns in the spreadsheet have been added to assist in processing the information such as cross-referencing Network Operator and National Grid identifiers. These data items (#) are not referenced in the Grid Code.

Node Data spreadsheet column contents:

- (#) Single Line Diagram Number
- Network Operator node name / identifier **(PC.A.2.2.3(b))**
- (#) National Grid node name
- Nominal Operating Voltage of the Node. = rms pre-fault voltage at which the maximum fault currents were calculated) **(PC.A.2.2.3(b)) (PCA 2.5.6 9 (a)(iv))**

**Demand Data** is used for load flow assessment modelling:

- MW supplied by the node at time of National Grid peak. **(PCA 4.3.4).**
  **Note:** The demands provided for nodes must be consistent with those provided under **(PC.A.4.3.1(b))** ie: Table 11a.
- (#) MVar supplied by the Node at time of National Grid peak - derived
- (#) MVA supplied by the node at time of National Grid peak - derived
- Power factor for the node at time of National Grid peak. **(PCA 4.3.4)**
- (#) MVA correction factor - used by some Network Operators
- (#) MVA calculated infeed using Network Operator correction factors - used by some Network Operators

**Fault Infeed Data (PC.A.2.5.4 / PCA 2.5.6)** is used for fault level assessment modelling:

- Sub-transient Infeeds I" (total asynchronous + synchronous machine infeeds at time = 0 secs) in kA. **(PC.A.2.5.6 (a))**
  I" = rms of the symmetrical three-phase short circuit current infeed at the instant of fault. This should represent the **total** infeed to the node at the instant of fault, (time = 0) and should represent both fault contributions from Induction motors and Synchronous machines.
- Transient Infeeds I', (synchronous machine infeeds only. At time = 120mSec) in kA. **(PC.A.2.5.6 (a)(ii))**
  I' = rms of the symmetrical three-phase short circuit current due to synchronous machines only, after the contribution from induction motors has decayed away.

- A single positive phase sequence Combined X/R ratio at instant of fault.
  **(PC.A.2.5.6 (a)(v))**
  Note: National Grid represents infeeds as impedances. The X/R ratio is required to allow us to calculate correct decay rates

- (#) Used by National Grid to derive equivalent impedance's R, Xd' and Xd" for modelling purposes

**Minimum Zero Phase Sequence (ZPS) Impedance (PCA 2.5.6)** is used to assess ZPS fault levels on National Grid equipment:

- (#) National Grid ZPS impedance code number

- Ro value for those nodes where a ZPS infeed is present and a ZPS path exists to the National Grid site. **(PC.A.2.5.6 (a) (iii))**.

- Xo value for those nodes where a ZPS infeed is present and a ZPS path exists to the National Grid site. **(PC.A.2.5.6 (a) (iii))**

  The ZPS impedance represents the ZPS infeed from the Network Operator's system as seen from the node on the Single Line Diagram. This is required for those supply point nodes where there is a ZPS path from the supply point up to the National Grid system (via the Network Operator modelled branches). It is used to assess ZPS fault levels on National Grid equipment.

**Negative Phase Sequence Data (PC.A.2.5.6(a)(vi)):**

Please insert columns as required, if the NPS resistance and reactance is substantially different from the positive sequence resistance and reactance which would be derived from the data provided above. **(PC.A.2.5.6(a)(vi)).**

**LV Network Susceptance (PC.A 2.3):**

- (#) National Grid LVB code number.

- Value of summated susceptances ($B_1$) for those branches not explicitly listed in the branch data. **(PC.A.2.3.1)** For all parts of the Network Operator subtransmission system not included on the Single Line Diagram the equivalent lumped susceptance should be provided. This is used by National Grid to determine system MVAr requirements.

- (#) Comments may be added by either party.

## 6.4 Network Data Spreadsheet: Branch Data

| Network Operator Schedule 5 - Branch data | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (% 100MVA) | | | | | | | | |
| National Grid Line Code | Diagram Number | National Grid Node 1 | National Grid Node 2 | R1 PPS_R | X1 PPS_X | B1 PPS_B | Ro ZPS_R | Xo ZPS_X | Bo ZPS_B | Circuit coupled to: | Rm ZPS_Rm | Xr ZPS_ |
| C001 | 380 | SUST11 | HIRO11 | 2.800 | 6.060 | 1.794 | 6.100 | 16.939 | 0.000 | | | |
| C005 | 380 | SUST11 | GRDA11 | 0.611 | 2.408 | 4.377 | 1.326 | 5.602 | 0.000 | | | |
| C011 | 380 | GRDA11 | HIRO11 | 0.898 | 4.962 | 1.644 | 2.392 | 11.681 | 0.000 | | | |
| C003 | 380 | GRDA31 | HIRO31 | 1.208 | 6.543 | 6.666 | 3.155 | 15.360 | 0.000 | | | |
| T001 | 380 | GRDA51 | GRDA31 | 0.039 | 0.196 | 0.041 | 0.095 | 0.446 | 0.000 | | | |
| T004 | 380 | TRTO51 | TRTO31 | 0.033 | 0.181 | 0.037 | 0.088 | 0.433 | 0.000 | | | |



Some columns in the spreadsheet have been added to assist in processing the information such as cross-referencing Network Operator and National Grid identifiers. These data items (#) are not referenced in the Grid Code.

Branch spreadsheet <u>column</u> contents:

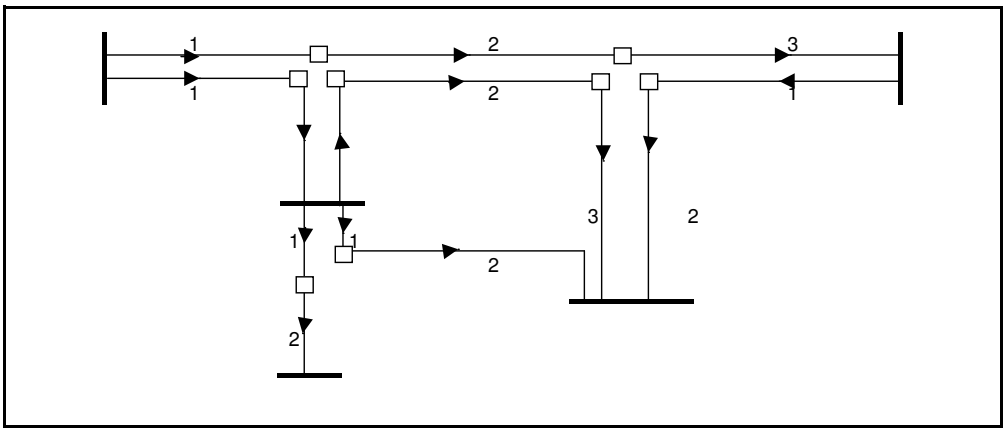
- (#) National Grid Line Code
- (#) Single Line Diagram Number
- Network Operator Node 1
- Network Operator Node 2
- (#) National Grid Node 1
- (#) National Grid Node 2

**PPS and ZPS data (where appropriate) for each branch** - units are "% on 100MVA" **(PCA 2.2.4):**

- $R_1$ Positive phase sequence resistance
- $X_1$ Positive phase sequence reactance
- $B_1$ Positive phase sequence susceptance
- $R_0$ Zero phase sequence resistance (self)
- $X_0$ Zero phase sequence reactance (self)
- $B_0$ Zero phase sequence susceptance (self)

**Mutual Coupling Data (PC.A.2.2.4):**

- To provide zero sequence self and mutual impedance data, each circuit between the nodes may be divided into one or more sections. For example, a double circuit line between two nodes (without any diversions to other different nodes) can be divided into one section - each circuit can be numbered to contain one section. For a complex configuration, there may be number of sections – in this case the sections in any two respective circuits will have self and mutual impedances.




- id of circuit coupled to
- Rm Zero phase sequence resistance (mutual)
- Xm Zero phase sequence reactance (mutual)
- Bm Zero phase sequence susceptance (mutual)
- (#) Coupling Sign ( + or - ) - for National Grid use.
- (#) Rating Winter
- (#) Rating Spring / Autumn
- (#) Rating Summer

Although historically provided by many Network Operators, the circuit ratings are not required by the Grid Code.

**Transformer Data (PC.A.2.2.5):**

- Rated MVA
- Voltage Ratio
- Winding Arrangement
- Positive phase sequence resistance (Max)
- Positive phase sequence resistance (Min)
- Positive phase sequence resistance (Nominal tap)
- Positive phase sequence reactance (Max)
- Positive phase sequence reactance (Min)
- Positive phase sequence reactance (Nominal tap)
- Zero phase sequence reactance
- Tap changer range **(PC.A.2.2.5.1)**
- Tap changer Step size **(PC.A.2.2.5.1)**
- Tap changer type: on or off circuit **(PC.A.2.2.5.1)**
- Earthing method: direct, resistance or reactance **(PC.A.2.2.5.1)**
- Earthing impedance (if not directly earthed) **(PC.A.2.2.5.1)**
- (#) Comments may be added by either party.

# Appendix 7: Annual Average Cold Spell (ACS) and Average Conditions

## 7.1 Definitions

The Grid Code gives the following definitions:

**a Average Conditions**

That combination of weather elements within a period of time which is the average of the observed values of those weather elements during equivalent periods over many years (sometimes referred to as normal weather).

**b Annual Average Cold Spell Conditions or ACS Conditions**

A particular combination of weather elements which gives rise to a level of peak demand within a financial year which has a 50% chance of being exceeded as a result of weather variation alone.

**c Weekly ACS (Average Cold Spell) Conditions**

Means that particular combination of weather elements that gives rise to a level of peak demand within a week, taken to commence on a Monday and end on a Sunday, which has a particular chance of being exceeded as a result of weather variation alone. This particular chance is determined such that the combined probabilities of demand in all weeks of the year exceeding the annual peak demand under Annual ACS Conditions is 50%, and in the week of maximum risk the weekly peak demand under Weekly ACS Conditions is equal to the annual peak demand under
Annual ACS Conditions.

## 7.2 Guidelines

The following points are for guidance on these two terms.

**a Average Conditions**

Observations of actual weather elements (ie, Temperature, Wind Speed, Cloud Cover, Precipitation etc) are made hourly at many Meteorological Office weather stations.

Records of these observations usually go back over several decades.

Hence for any individual weather stations or group of weather stations it is possible to calculate average values of these weather elements from the records of observations at particular times of the day, representative of each week or month of a standard year. These average values are often being referred to as being seasonal normal or normal weather conditions. Clearly these normal weather conditions will vary within the geographical location of the weather stations. A group of weather stations or an individual weather station may be selected as being representative of the weather affecting electricity demand in a particular location, region or entire supply area, and the normal weather conditions then evaluated for selected weather elements.

Using known relationships between electricity demand and selected weather elements it is possible to correct historic demand data to normal weather conditions and make forecasts of demand at normal weather conditions.

**b Annual Average Cold Spell Conditions or ACS Conditions**

Simulation studies carried out by the CEGB in the 1960's, using models of CEGB demand sensitivity to weather established a link between Winter Peak ACS Demand and Weekly Peak ACS Demand.

Winter Peak ACS Demand is that level of peak demand within a complete winter which would be exceeded in 50 winters out of 100, all other things being equal. This is clearly not the same thing as the demand that would arise under normal weather conditions, derived by averaging weather elements over the winter period.

The link that was established by the simulation studies was that for the weeks in which the Winter Peak ACS Demand occurred, the Weekly Peak ACS Demand was equal to the Winter Peak ACS Demand, when the Weekly Peak ACS Demand was defined according to the 12% risk criterion. It was thus established that the 50% risk criterion on a whole winter basis can be estimated using a 12% risk criterion on a weekly basis.

**c Weekly ACS (Average Cold Spell) Conditions**

Using the approximation of linearity of demand variation with individual weather elements it was possible to determine a weather base aligned to the 12% risk criterion for each week of a standard year. By weather correction of demand each week to this weekly ACS weather base, Weekly Peak ACS demands are determined. Additionally the peak value of these Weekly Peak ACS Demands is approximately equivalent to the Winter Peak ACS Demand or Annual ACS Demand.

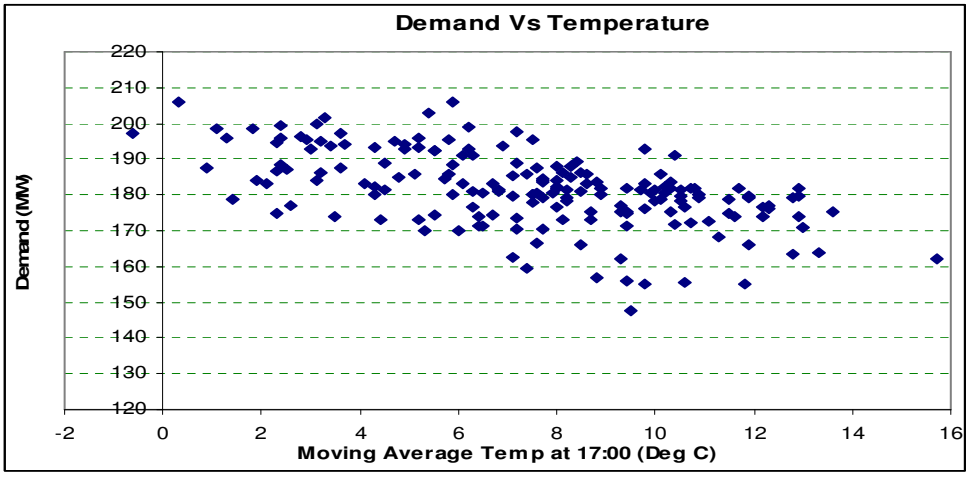
It should be noted that the 12% risk criterion associating Weekly Peak ACS Demand and Annual ACS Demand has been determined for the National Grid (previously CEGB) Demand and may not have the same value for other demand distributions. Nevertheless it would seem to be a way forward for all Users to adopt this criterion. This each User would be able to evaluate a Weekly ACS conditions weather base for his locality representative of his spatial distribution of weather sensitive demand at the 12% risk level. Aggregation of ACS demands, derived from these local weather bases, to a National Grid total would probably yield a reasonable approximation to the true position.

The average 12% risk temperature for winter peak demand weeks for different regions in GB based on the last 30 years weather records in National Grid's database indicated the following values:

| Region | Winter ACS Temperature ($^0$C) | Average Temperature at peak demand weeks |
|---|---|---|
| Scotland | 0.5 | 5.0 |
| North | 1.0 | 5.0 |
| South | 2.0 | 6.5 |

The following example shows how this 12% risk temperature may be used to evaluate an approximate Winter Peak ACS demand for a GSP in South West England:

Using 3 years of demand data of GSP at 17:30hrs when system peak most likely occurs, together with associated weather recorded in Bristol weather station, a linear relationship of -1.6MW/$^o$C between demand and moving hourly average temperature ending at 17:00hrs was established, i.e. an increase of 1$^o$C temperature would reduce demand by 1.6MW in this example.




Assuming a peak demand of 210MW at average temperature (6.5C) was forecasted, and since the GSP is in south England, then the forecast ACS demand would become:

Temperature correction (6.5-2.0)*1.6 = 7.2MW
210MW at 6.5C corrected to 2.0C would be 210MW + 7.2MW = 217MW

For the GB ACS demand calculation, National Grid has adopted a more vigorous approach. The method is described on the National Grid web site.
http://www.nationalgrid.com/uk/sys_07/default.asp?action=mnch2_15.htm&Node=SYS&Snode=2_15&Exp=Y#average_Cold_Spell_(acs)_Correction

# Appendix 8 - Contacting National Grid

In the first instance, please contact:

email DNOGridCodeData@uk.ngrid.com

or Grid Code Data Submissions
Data & Analysis
National Grid
St Catherine's Lodge
Bearwood Road
Sindlesham
Nr Wokingham
Berkshire
RG41 5BN

Fax 0118 9363127

Parry Batth (Data Management Team Manager) - Telephone 0118 9363140
email: parry.batth@uk.ngrid.com

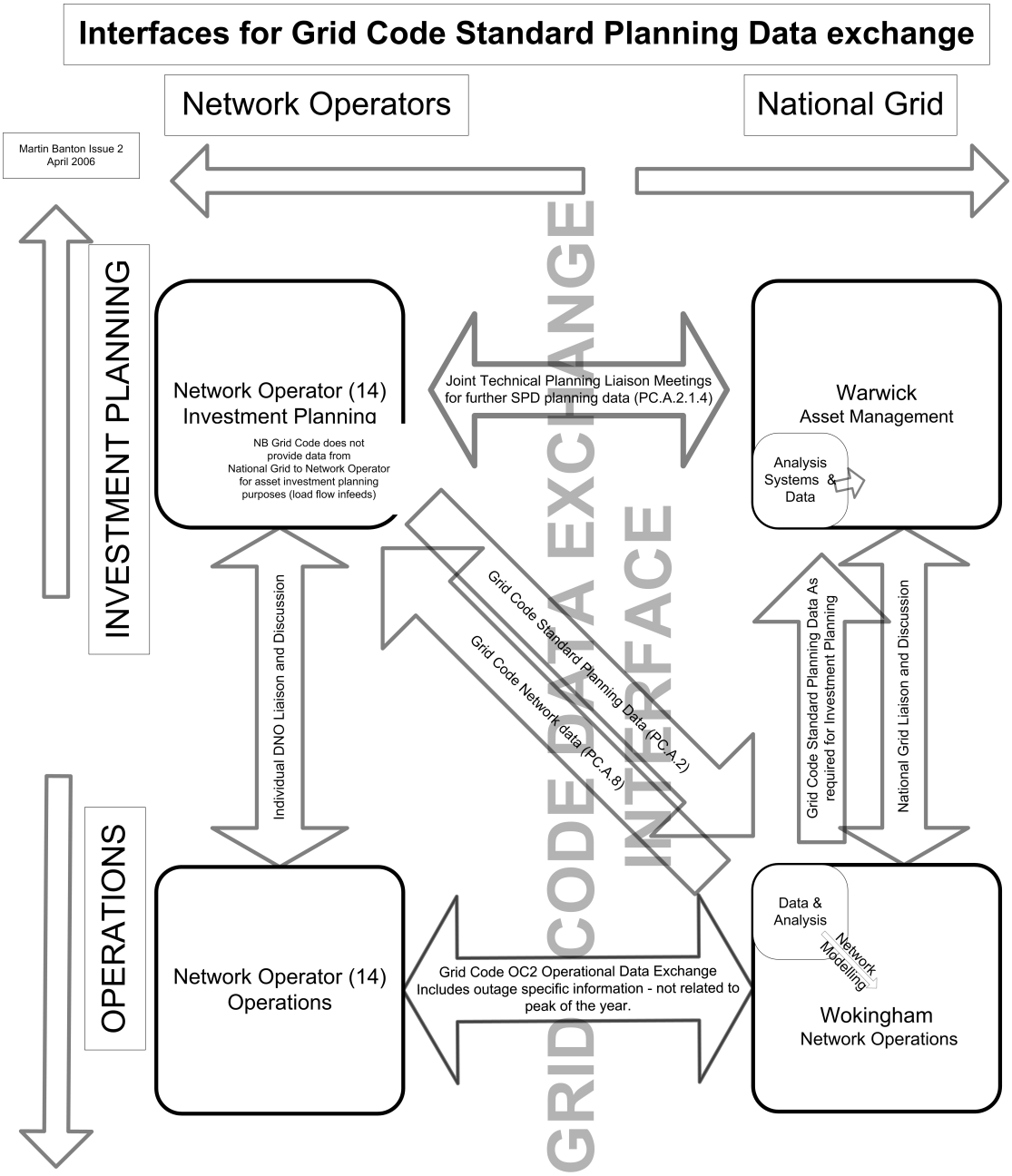
Joaquin Jimenez (Data Liaison & Management Engineer) – Telephone 0118 9363572
Email: joaquin.jimenez@uk.ngrid.com

Barry Lowis (Network Modelling Engineer) - Telephone 0118 9363892
email: barry.lowis@uk.ngrid.com

Charles Omondi (Network Modelling Engineer) – Telephone 0118 9363408
Email: charles.omondi@uk.ngrid.com

# Appendix 9 - Process Improvements

The diagram below has been developed to help improve understanding between the different parties in both Network Operators and National Grid who are involved in the exchange and use of Planning Code Data.



# Appendix 10 - Feedback Note

We look forward to receiving any comments you wish to make regarding these guidance notes. Please call us directly, or enter them below and send them to the address below and we will contact you to discuss them.

| To: Data Liaison & Management Engineer | From: |
|---|---|
| Data & Analysis Team<br>National Grid<br>St Catherine's Lodge<br>Bearwood Road<br>Sindlesham<br>Nr Wokingham<br>Berkshire<br>RG41 5BN | Company: |
| email: DNOGridCodeData@uk.ngrid.com | email: |
| Telephone: 0118 9363885 | Telephone: |
| | |