

Guidance Notes for Network Operators - Submission of Grid Code Data 2007/2008

Issue 18 April 2007

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.

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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. 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.

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 (P2/5 Working Group)

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.*

The Working Group published its recommendations in a consultation document issued on 15th March 2007. It has identified a series of Grid Code changes which it believes will improve the clarity and scope of the data transfer across the planning interface.

Copies of the notes from the Working Group meetings are available at:
<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/workinggroups/p25wg/>

The full consultation document is available at:
<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/>
or via the following link:
<http://www.nationalgrid.com/NR/rdonlyres/ADB837E-417B-4D9E-904C-DB156F10FE1F/15785/B07ConsultationIssued.pdf>

Following industry consultation, if the changes to the Grid Code are approved by Ofgem, it is anticipated that the new Planning Data requirements would formally be in place for 1st January 2008, in time for the 2008/9 data exchange process.

Should any User wish to submit any trial data via the new schedules for the 2007/8 data submissions, they should contact National Grid for electronic copies of the latest schedules.

How does National Grid request the data?

Meetings

Between weeks 1 to 17 each year National Grid arranges a meeting 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 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 11a.

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

A summary of requirements is given on Page 9.

How we receive it

Who to send it to in National Grid

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

Data receipt by National Grid

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

Partial Submissions

If you are having difficulties preparing your submission, please keep us apprised 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, National Grid may estimate such data if we feel it is necessary to do so as per **DRC. 5.4 - Data not supplied.**

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.

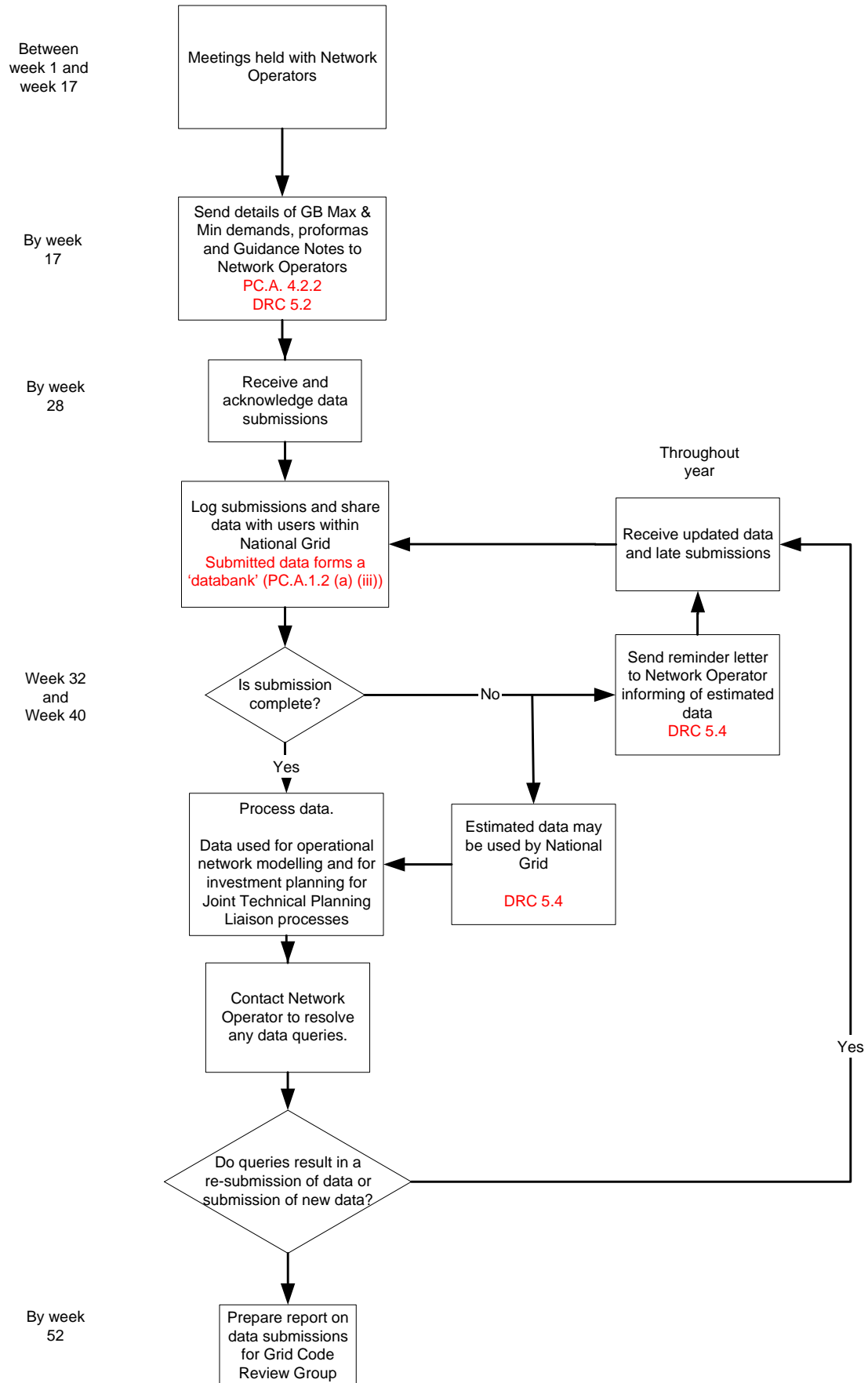
Further Changes to data

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's 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. 4.2.1 (a)	Schedule 10 (Page 1 of 2)	Demand Profile for Day of User's Peak Demand based on Annual ACS conditions	App. 2.1
10b	PC.A. 4.2.1 (b)	Schedule 10 (Page 1 of 2)	Demand Profile for Day of National Grid's Peak Demand based on Annual ACS conditions	App. 2.2
10c	PC.A. 4.2.1 (c)	Schedule 10 (Page 1 of 2)	Demand Profile for Day of National Grid's Minimum Demand based on Annual Average conditions	App. 2.3
11a	PC.A. 4.3.1 4.3.2	Schedule 11 (Page 1 of 4)	Connection Point Demand at National Grid's Peak, National Grid's Minimum, and Connection Point Peak	App. 3.1
11b	PC.A. 4.5(a) 4.5(b) 3.1.4(a) 3.2.2(c)	Schedule 11 (Page 2 of 4) (Page 3 of 4)	Connection Point Demand Transfer Capability and embedded generation. (see also notes in DRC)	App. 3.2
11c	PC.A. 4.2.3	Schedule 10 (Page 2 of 2)	User's Active Energy Requirements by Customer Class. (see also notes in DRC)	App.3.3
Emergency Demand Disconnection data				
12a	OC 6.6.2	Schedule 12 (Page 2 of 2)	Automatic Low Frequency Demand Disconnection	App. 4.1
12b	OC 6.5.3(c)	Schedule 12 (Page 2 of 2)	Demand Reduction by voltage reduction or Demand Disconnection	App. 4.2
12c	OC6.7.2	Schedule 12 (Page 2 of 2)	Percentage Emergency Manual Demand Disconnection	App.4.3

Table Name	Grid Code Reference	Data Registration Code (DRC) Reference	Description	Guidance Notes 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	PC.A. 2.3	Schedule 13	Lumped system susceptance	App. 6.3
Node data	PC.A. 2.5.1, 2.5.4, 2.5.6 PC.A. 4.3.4		Fault infeeds Node demands	
Schedule 5 spreadsheet	PC.A. 2.2.4	Schedule 5 (Page 3 of 9)	Circuit parameters	App. 6.5
Branch data	PC.A. 2.2.5	Schedule 5 (Page 4 of 9)	Transformer parameters	

What we do with it

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 infeeds¹. 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

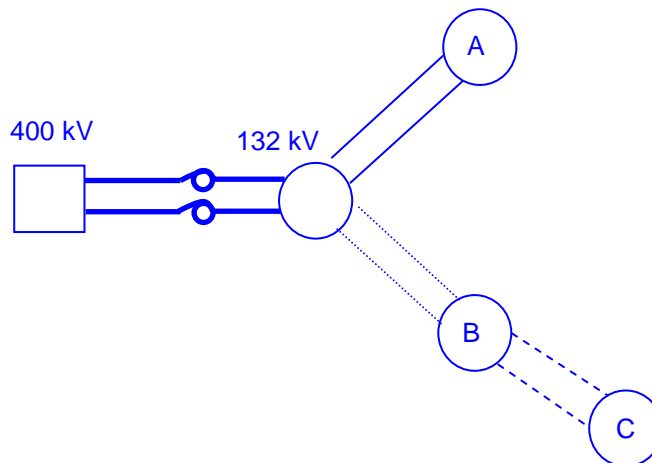
1.1 Demand Data - General Principles

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), 11a and 11b (Connection Point demands and transfers used for security assessments), 11c (a breakdown of demand types), and Schedule 5 nodal demands (used for network modelling).

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))**

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 11a (**PC.A.4.3.2(a)** and **DRC Schedule 11**). The number of embedded small and medium power stations and their embedded capacity should be provided in Table 11b (**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

Some Network Operators have requested additional advice on dealing with embedded generation. National Grid would like to stress that the decision on the treatment of such plant ultimately lies with the Network Operator. **PC.A.4.3.2** states that the forecast demand shall be that remaining after any "deductions reasonably considered by the user" have been removed. The process below is National Grid's view of a possible method.

The process can be considered to consist of the following:

- a Identify the size, location, fuel and likely running arrangements of embedded generation. Likely running arrangements can generally be split into four categories:
 - i) Base Load (most CHP plants may fall into this category)
 - ii) Mid Merit (e.g. OCGT's running on gas)
 - iii) Peaking plant (e.g. OCGT running on distillate)
 - iv) Fuel Limited (i.e. it will only run if fuel is available: wind power being a prime example)

Refuse or other waste burners are likely to be Base-Load or Mid-Merit, depending on the volume of fuel available.

- b Identify the underlying demand. This would be the demand if no embedded generation was operating. It may be appropriate to examine historical metered data, and subtract off contributions from generation operating at that time.
- c The underlying demand will alter from year to year according to demand growth/reduction, transfer to other GSP's etc.
- d Generation contribution is evaluated.
- e The evaluated contribution from generation is then included in the Table 11a submission. The demands quoted in Table 11a should be the underlying demands less the generation contribution.

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 10 a, b and c but not in the appropriate Table 11a. Thus, although normally, one would expect the sum of the demands in Table 11a 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 11a 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 - Connection Point Demand Data.

3.1 Table 11a - Connection Point Demand Data

The data relating to the peak demand at the Connection Point should give the maximum Demand (Active Power) that in the Network Operator's opinion could reasonably be imposed on the National Grid Transmission System.

If the Network Operator considers that the day and time of the Connection Point peak demand is expected to coincide with the day and time of National Grid peak demand and there are no Small Power Stations or Medium Power Stations, then the submissions for the two days will be identical.

3.2 Table 11b - Connection Point Demand Transfer and Generation

The data should be consistent, where appropriate, with the corresponding Table 11(a) data.

The demand transfer information is required to assist with assessing compliance with Security Standards at the interface. Accordingly this should NOT include demand transferred to another node at the same site, nor to another transformer at the same site, unless the Network Operator has agreed with National Grid that the groups are treated separately for compliance purposes.

The Security Standard includes an assumption that demand during the maintenance period is always below 67%. This was true for to the majority of GSP's in the 1970's, but it is no longer valid for a large number of Grid Supply Points.

Accordingly, although not a strict Grid Code Requirement, a place on the form is included for Network Operators to give their estimate of the maximum demand level during the maintenance period. Similarly, although not a formal definition, it is normally assumed that the Maintenance Period runs from April to October inclusive.

Demand transfer can be via 4 mechanisms. It can be:-

- a manual (involving re-switching the network)
- b automatic (involving automatic re-switching the network)
- c interconnected (where two or more GSP's are run in parallel)
- d pre-fault (only for maintenance period)

Where demand transfer is quoted for security assessment, the appropriate parts of Table 11b should be completed. If demand transfer is manual or automatic, then the time taken to undertake the transfer should be provided.

The Grid Code states that Demand Transfers should be expressed in terms of both Active and Reactive Power (MW and MVar). In previous years, however, MVA has been used in the Table 11b proforma. To avoid confusion the proforma has not been modified this year as the format is likely to change as a result of the P2/5 Working Group (see page 5).

Suppose BSP XYZ can be transferred from one GSP to a second GSP, and XYZ has a demand of 60MW at peak and the maintenance period demand level is 75%. Then the maintenance period demand transfer capability would be 45MW.

When the demand is to be transferred to more than one other Connection Point, details of both connection points and demand to be transferred should be given.

Where two GSP's run normally interconnected, the "demand transfer" quoted should represent the demand which is "picked up" by the other GSP without the Network Operator system itself overloading. Thus, for example, if there are 2 interconnected GSP's each taking 150MW (intact system), and after the first circuit outage the two GSP's take 130MW and 170MW respectively, then the demand transfer capability will be 20MW.

The number of Small and Medium Embedded Power Stations and the associated number of generating units at a Connection Point are required **(PC.A.3.1.4(a))**. Should National Grid require to know further details of such Power Stations then this will be requested separately in accordance with **PC.A.3.1.4 (b)**.

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

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

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														
National Grid	Diagram	National Grid	National Grid	(% 100MVA)			R ₀	X ₀	B ₀	Circuit	R _m	X _r		
Line Code	Number	Node 1	Node 2	PPS_R	PPS_X	PPS_B	ZPS_R	ZPS_X	ZPS_B	coupled to	ZPS-R _m	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 column contents:

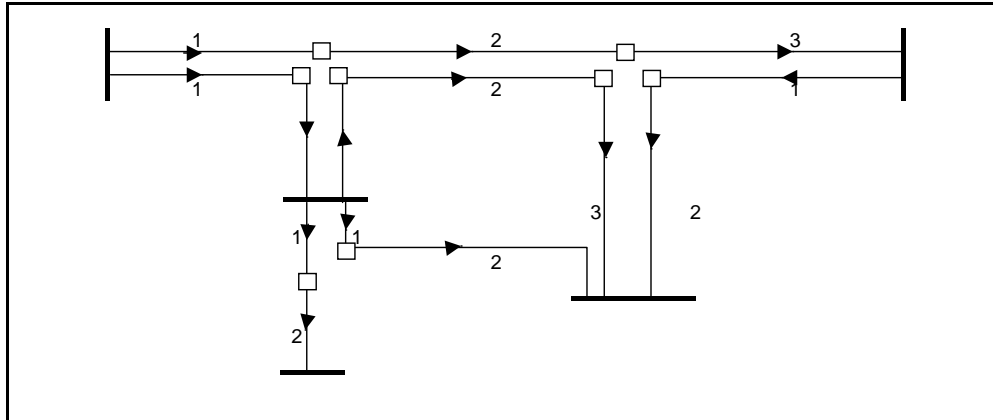
- (#) National Grid Line Code
- (#) Single Line Diagram Number
- Network Operator Node 1
- Network Operator Node 2
- (#) National Grid Node 1
- (#) National Grid Node 2

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

- R₁ Positive phase sequence resistance
- X₁ Positive phase sequence reactance
- B₁ Positive phase sequence susceptance
- R₀ Zero phase sequence resistance (self)
- X₀ Zero phase sequence reactance (self)
- B₀ 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 (ACS) Conditions

A particular combination of weather elements which gives rise to a level of Peak Demand within an National Grid Financial Year which has a 50% chance of being exceeded as a result of weather variation alone.

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

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 week 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 was equivalent to a 12% risk criterion on a weekly basis. Weekly Peak ACS Demands could then be calculated for all other weeks of the year using the 12% risk level.

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 of course 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.

Appendix 8 - Contacting National Grid

In the first instance, please contact:

email DNORGridCodeData@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

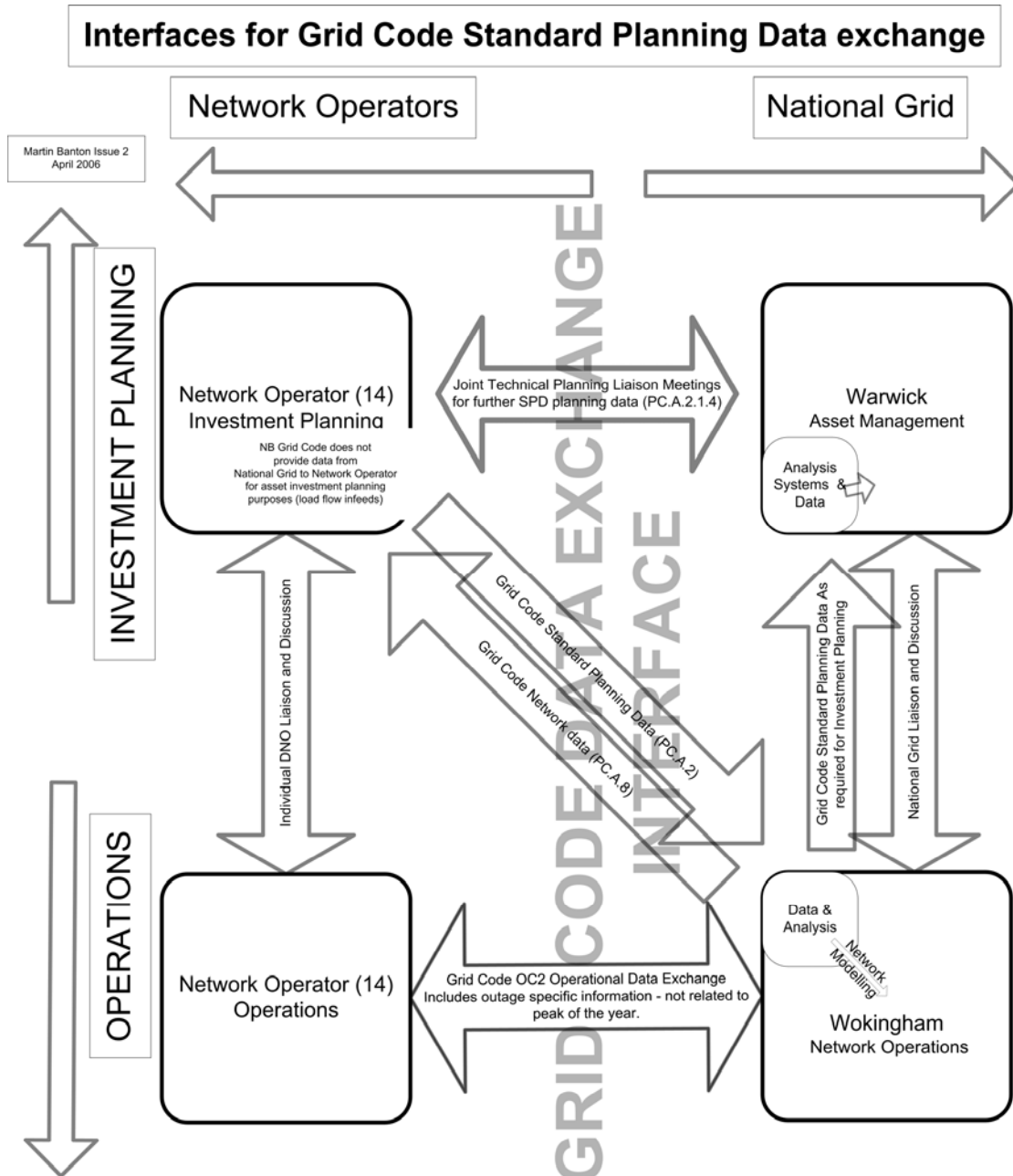
Parry Batth (Data Management Team Manager) - Telephone 0118 9363140
email: Parry.Batth@uk.ngrid.com

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

Joaquin Jimenez (Network Modelling Engineer) – Telephone 0118 9363572
Email: Joaquin.Jimenez@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: DNO Liaison Engineer	From:
Data & Analysis Team National Grid St Catherine's Lodge Bearwood Road Sindlesham Nr Wokingham Berkshire RG41 5BN	Company:
email: DNOGridCodeData@uk.ngrid.com	email:
Telephone: 0118 9363140	Telephone: