STC Amendment Proposal Form

CA021

1. Title of Amendment Proposal

Exchange of Certain Investment Planning Data

2. Description of the Proposed Amendment *(mandatory field)*

This amendment proposes changes to paragraph 2.4.3 (and 2.4.2) of Schedule 3 of the STC to allow Parties to disclose specific data to Transmission Owners on an enduring basis for the purposes of transmission investment planning, specifically stability studies.

3. Description of Issue or Defect that Proposed Amendment seeks to Address *(mandatory field)*

The current provisions of paragraph 2.4.3 of Schedule 3 will expire on 30 September 2006. However, there is a continuing need for this data to be provided to enable all Parties to meet their Licence obligations. It is therefore proposed that this data exchange is made permanent, but that the relevant sections of Schedule 3 are made more specific about the data that can be disclosed.

4. Impact on the STC *(information should be given where possible)*

Changes to paragraph 2.4.3 of Schedule 3 are required. Minor changes to paragraph 2.4.2 are also proposed.

There are no other changes required to the STC.

5. Impact on other frameworks e.g. CUSC, BSC *(information should be given where possible)*

None

6. Impact on Core Industry Documentation *(information should be given where possible)*

None

7. Impact on Computer Systems and Processes used by STC Parties *(information should be given where possible)*

None

8. Details of any Related Modifications to Other Industry Codes *(where known)*

None

9. Justification for Proposed Amendment with Reference to Applicable STC Objectives *(mandatory field)*

Amending the STC in this manner would mean that Transmission Owners would continue to be able to efficiently discharge the obligations imposed on them by transmission licences and the Act. It would also facilitate the development of an efficient, economical and coordinated system of electricity transmission.

Details of Proposer Organisation's Name	National Grid Electricity Transmission plc
Capacity in which the Amendment is being proposed (i.e. STC Party or other Party as designated by the Authority pursuant to STC section B7.2.2.1 (b))	STC Party
Details of Proposer's Representative Name Organisation Telephone Number Email Address	 Andrew Truswell National Grid Electricity Transmission plc 01926 656388 andrew.truswell@uk.ngrid.com
Details of Representative's Alternate Name Organisation Telephone Number Email Address	Ben Graff National Grid Electricity Transmission plc 01926 656312 ben.graff@uk.ngrid.com
Attachments (Yes/No): Yes If yes, title and number of pages of each attachment:	(i) Indicative Legal Text (2 pages) (ii) JPC Evaluation Paper (20 pages)

Notes:

1. Those wishing to propose an Amendment to the STC should do so by filling in this "Amendment Proposal Form" that is based on the provisions contained in Section 7.2 of the STC.

2. The Committee Secretary will check that the form has been completed, in accordance with the requirements of the STC, prior to submitting it to the Committee. If the Committee Secretary accepts the Amendment Proposal form as complete, then she/he will write back to the Proposer informing them of the reference number for the Amendment Proposal and the date on which the Committee will consider the Proposal. If, in the opinion of the Committee Secretary, the form fails to provide the information required in the STC, then he/she may reject the Proposal. The Committee Secretary will inform the Proposer of the rejection and report the matter to the Committee at their next meeting. The Committee can reverse the Committee Secretary's decision and if this happens the Committee Secretary will inform the Proposer.

   The completed form should be returned to:

   Shafiq Ullah
   STC Committee Secretary
   Commercial Frameworks
   National Grid Company plc
   National Grid House
   Warwick Technology Park
   Gallows Hill
   Warwick, CV34 6DA

   Or via e-mail to: STCTeam@uk.ngrid.com

CA021 Attachment 1 – Indicative Legal Text

Amend the following paragraphs in Schedule 3:

2.4.2 A Party may Disclose to a Transmission Owner:

(a) where the Disclosing Party is NGET:

(i) information submitted to or by NGET under Appendix A to the Planning Code or OC2.4.2.1(a) in respect of any Relevant Unit;

(ii) NGET's forecast(s) of which Users will be connected to the Receiving Transmission Owner's Transmission System or connected within the Boundary of Influence of such Transmission System at any time or times during the current or following six Financial Years;

(iii) NGET's forecast(s) of the Ranking Order for the GB Transmission System, specifying:

a. relevant individual Generation Units connected to the Receiving Party's Transmission System or connected within the Boundary of Influence of such Transmission System; and

b. relevant aggregations of Generation Units connected outside of the Boundary of Influence of such Transmission System,

at any time or times during the current or following six Financial Years;

(iv) the Ranking Order of all Generation Units which are Relevant Units and which NGET forecasts will be synchronised at the point in time when Demand on the GB Transmission System is at the forecast minimum in the current and following six Financial Years;

(v~~i~~) the high level results of any economic studies undertaken for the purpose of assessing options for investment planning or Construction Projects, in each case involving the Receiving Transmission Owner, but not including the detailed content or analysis in such studies; and

(b) ~~any Party may Disclose to a Transmission Owner~~ any changes which the Disclosing Party is planning to undertake to its Transmission System in the current or following six Financial Years and which will materially affect the planning or development of those parts of the Receiving Transmission Owner's Transmission System as are located within the Boundary of Influence of the Disclosing Party's Transmission System.

2.4.3 Without prejudice to sub-paragraph 2.4.2, ~~from the Code Effective Date to 30 September 2006 (inclusive), NGET~~ a Party may Disclose to a Transmission Owner:

(a) ~~information submitted to or by NGET under Appendix A to the Planning Code or OC2.4.2.1(a) in respect of any User; and~~where the Disclosing Party is NGET:

(i) information specified in Schedule Fourteen in respect of any User;

(ii) lists of all Generation Units which NGET forecasts will be synchronised to meet specified levels of Demand on the GB Transmission System in the current and following six Financial Years, including, but not limited to:

a. the forecast minimum Demand;

b. 60% of the forecast peak Demand;

c. the forecast peak Demand; and

(b) any changes which the Disclosing Party is planning to undertake to its Transmission System in the current or following six Financial Years and which will materially affect the planning or development of the Receiving Transmission Owner's Transmission System~~the Ranking Order of all Generation Units which NGET forecasts will be synchronised at the point in time when Demand on the GB Transmission System is at the forecast minimum in the current and following six Financial Years~~.

Insert Appendix 1 of Attachment 2 of this document as a new Schedule 14 of the STC.

CA021 Attachment 2 – JPC Evaluation

Schedule 3 Paragraph 2.4.3

Summary

1. This document concerns schedule 3 of the STC, and specifically paragraph 2.4.3, which is due to expire on 30th September 2006. The document summarises certain obligations placed on the Transmission Licensees and examines four approaches to fulfilling these obligations. A final recommendation is made which requires an amendment to paragraph 2.4.3 to allow for the enduring exchange of certain demand, generator and investment planning network data.

Introduction

2. Paragraph 2.4.3 in Schedule 3 of the STC is due to expire on 30th September 2006. The STC Committee has asked the Joint Planning Committee (JPC) to examine the impact of this clause. This document summarises the JPC's position on this clause.

Background to Paragraph 2.4.3

3. Schedule 3 of the STC sets out the information and data permitted to be disclosed by a Party to a Transmission Owner in accordance with Section F of the STC. During the drafting of the STC, Ofgem imposed a 'time limit' on the STC provisions, which allow Investment Planning Data to be provided by National Grid to a Transmission Owner[1]. The existing provisions of paragraph 2.4.3 of Schedule 3, which permit National Grid to provide certain data to Transmission Owners relating to Generation Units outside of their Boundary of Influence, have been hard coded to become obsolete on 30th September 2006. In the interim period, Ofgem expect National Grid and Transmission Owners to liase to develop a more enduring set of arrangements in this area.

4. The reason that a time limit was imposed on the provision of this information, was the fact that some Investment Planning information, whilst of great value in facilitating the efficient discharge of a Transmission Owner's License obligations, has the potential to theoretically prejudice the facilitation of competition in generation and supply, if that Transmission Licensee has associated generation and supply interests. Ofgem therefore suggested that the licensees consider further whether it may be more appropriate for National Grid to carry out system stability studies and/or whether the network model made available to Transmission Owners should, in relation to some parts of the system, be an equivalent model. However, Ofgem noted that the use of equivalence models may be highly problematic, and accepted that the result of the review may be that the process put in place from go-live is the most appropriate enduring process.

5. At the November Meeting of the JPC, it was agreed that such a review of Schedule 3 would commence in early 2006. The review would be conducted by an expert group, consisting of representatives from the TOs and National Grid. The STC Committee, 11th January 2006, issued a further guidance note on this process.

[1] Ofgem Conclusion Document – Information Exchange Under the STC (March 2005)

Obligations on the Transmission Owners (TOs)

6. Transmission Owners have various obligations to fulfil, including:

    a) Under the Electricity Act 1989, holders of a transmission licence have a duty to develop and maintain an efficient, co-ordinated and economical system of electricity transmission.

    b) Each Company's Transmission Licence further requires them to plan and develop their transmission systems in accordance with the GB Security and Quality of Supply Standards (GBSQSS) and STC.

    c) The GBSQSS (under paragraph 4.8) requires the transmission system to be planned such that there shall not be system instability for conditions on the GB transmission system which ought to be reasonably expected to arise in the course of a year of operation.

    d) In accordance with the STC each Transmission Owner shall develop and maintain a transmission investment plan in respect of the current and each of the following six financial years.

7. To undertake a stability study the following information is required for the entire system under consideration:

    a) Network topology and connectivity including branch parameters.

    b) Reactive compensation system parameters and relevant control system details.

    c) Demand

    d) Generation – connectivity, location and type.

    e) Generator dynamic parameters.

    f) Details of relevant generator control systems.

8. Therefore, in order to meet its obligations to plan in accordance with the GBSQSS, and assess system stability, each licensee requires information on conditions on the GB transmission system which ought to be reasonably expected to arise in the course of a year of operation, including:

    a) The system data described above in line with each transmission company's seven year investment plan. For stability studies each company will need an accurate representation of the whole GB network.

    b) Generation and demand patterns for a variety of demand conditions. In practice this may cover, for example, forecast summer minimum, 60% and 100% of forecast ACS peak demand levels for a specific year. (Traditionally, the GB power system stability problem is considered to be most onerous under minimum system demand conditions when fewer machines are running and the overall synchronising power is lower. Importantly, due to the higher network voltage profile seen under this condition, those machines that are running may be close to unity power factor or operating in the leading mode resulting in a lower stability margin. Additionally, past experience has indicated that the worst case for

stability on the Anglo – Scottish interconnector occurred at approximately 60% demand.)

c) Traditionally dynamic stability and transient stability are issues for synchronous generators whereas voltage stability becomes an increasing problem for wind farms due to their reliance on induction generator technology. In view of the growth in renewable generation, in particular wind generation and subsequent significant changes in the disposition of generation, it would be considered prudent to look at a range of demand conditions. A corresponding list of generators that would be running to meet this demand would also be required. A specific ranking order of these generators would not be required.

Stability Analysis pre- BETTA

9. Before the introduction of BETTA, the Scottish Transmission Licensees had to comply with their individual licence standards and the Scottish Grid Code. Joint system stability studies were carried out under the British Grid Systems Agreement (BGSA). The BGSA was an agreement between the three GB Transmission Licensees, NGC, SHETL and SPT. The main objective of the agreement was to manage the interconnection between the Licensees grid systems and to maintain the integrity of the whole GB Grid System.

10. BGSA Code 3 placed a requirement on the Parties to plan and develop their respective Grid Systems to sustain the Interconnection capability (both the Anglo-Scottish Interconnector and the SHETL-SPT Interconnector circuits). Code 3 also defined the data to be transferred between the Parties to undertake the necessary planning studies. A sub-committee, referred to as the Joint Interconnector Planning Group (JIPG), was established to advise the British Grid System Committee (BGSC) on the co-ordinated planning and development of the Interconnector circuits.

11. Each year the JIPG undertook benchmark thermal, voltage and transient stability studies to track the Interconnector capacity as new developments were introduced to each of the grid networks. The studies were carried out at various demand levels (typically 40%, 60%, 80% and 100% of system maximum demand) and over a number of study years. These co-ordinated studies involved the exchange of transmission data for the whole GB system and considerable time was invested in making sure the dynamic representation of plant and controllers were accurately modelled in each company's computer system. This co-ordinated approach allowed verification of data and permitted the Parties to investigate the cause of any differences in the study results. The studies carried out by each party were compared and where agreement was obtained this gave a high degree of confidence in the study results. Through this process it became evident that modelling the whole GB system was important to the outcome of transient stability studies. One example was the representation of the SVCs in the south of England, which proved to have a significant impact on the stability of generators in Scotland for critical flows on the Anglo-Scottish Interconnector.

12. Confidentiality of data was dealt with under various sections of the Transmission Licence, Public Electricity Supply Licences, Grid Codes, Distribution Codes and the BGSA itself. The BGSA had an extensive clause, defining how NGC, SHETL and SPT could use any information or data supplied to and acquired from the other Parties in performing the permitted activities. This allowed for the exchange of complete network, demand and generation data and the use of this information was covered under a confidentiality agreement.

Approaches to developing paragraph 2.4.3 of Schedule 3 of the STC.

13. The following four alternatives to the existing paragraph 2.4.3 have been considered and are discussed in detail below:

    a) Take no action (let the clause lapse).
    b) Use dynamic equivalents for stability studies.
    c) Use SYS networks instead of Investment Planning networks.
    d) Revise paragraph 2.4.3 to allow the exchange of specific information needed for stability studies.

Option a - Do nothing (i.e. let the clause lapse):

14. If the clause were to lapse, then NGET would no longer be able to pass the specified data to the Scottish TOs. If this data were no longer transferred, then the TOs would no longer be able to fulfil their licence obligations to carry out stability studies, and they would need to be relieved of their obligations to carry out stability studies under the GBSQSS. This would require a change to the Scottish TOs' Transmission Licences.

15. Further, if stability studies are not completed at all as part of the Investment Planning process, then any stability problems would have to be addressed in operational timescales, which has potentially severe constraint cost implications. For example, in an extreme case, a new generator may have to be permanently constrained off due to stability concerns. The impact of this would be more severe if there was a shortage of generation in the future, putting the system under even greater stress.

16. An alternative approach to this would be for NGET to carry out stability studies and plan appropriate investments for the whole of GB. This would, however, undermine the prime obligation of the TOs to ensure compliance with GBSQSS and plan and develop their system in an efficient, co-ordinated and economical manner. For example, investment solutions often cover several non-compliance issues, however, investments may no longer be co-ordinated if different companies had responsibility for different aspects of compliance (e.g. an SVC can address both voltage and stability issues).

17. Therefore, letting paragraph 2.4.3 lapse is not an acceptable option, because the Scottish Transmission Licensees would no longer be able to meet their license conditions.

Option b - Use of dynamic equivalents

18. Compared to carrying out a detailed stability study on a full network, the use of equivalents has the following disadvantages and problems:

    a) Dynamic equivalents are less accurate because of the very large number of non-linear variables involved (leading to potential over or under investment).

    b) With equivalents, it is difficult to determine the exact nature and cause of an instability condition and therefore potential reinforcement solutions may be ill judged. Such an approach could lead to either over or under investment.

    c) The use of equivalents assumes that there are only network solutions to stability problems, whereas in reality these could be rectified using alternative control

system solutions employed on generating plant, which may provide a cheaper solution.

d) An equivalent is specific to one single scenario and does not allow for sensitivity analysis related to variations in the generation and demand pattern.

e) The skills required to produce equivalents are specialised and the process is very resource intensive. Equivalents would need to be set up to cover a wide range of scenarios and these would each need to be fully validated against a range of detailed stability studies.

19. To summarise, the use of dynamic equivalents carries a high risk of inefficient (or even non-compliant) network investments, planned by using system models in which the Transmission Owners would have reduced confidence. Therefore, the use of dynamic equivalents is not considered an acceptable alternative.

Option c - Use of SYS networks instead of Investment Planning networks

20. As currently written, STCP 22-1 assumes the creation of hybrid networks for all Investment Planning studies other than the summer minimum. These hybrid networks are created by joining an Investment Planning network to a SYS network outside the Boundary of Influence.

21. Generally, a Transmission Owner's Investment Planning network differs considerably from the SYS networks for the next seven years. For example, SYS networks may contain reinforcements that have an impact on stability, but would not be contained in an Investment Planning network. A specific example of this is the fourth England-Scotland interconnector circuit, which has a significant impact on stability. This reinforcement would be included in a SYS dataset but not an Investment Planning network. In particular, there is considerable risk that non-optimal solutions to stability problems could be proposed or that potential stability issues are not assessed and corrected adequately.

22. Previous studies to determine the Anglo-Scottish Interconnector capacity, carried out under the BGSA, did use SYS networks. However, it should be noted that pre-Betta the Interconnector capability was governed under a contractual/commercial relationship between the three Transmission Licensees rather than a requirement to satisfy the GB security and quality of supply standard as is now required. The purpose of past benchmarking studies was **not** therefore to identify necessary investments based on GB power flows, rather it was to monitor known stability, voltage and thermal limits for the system over the next year or two to ensure no erosion of capability was likely to occur due to developments in each Licensee's area. For this purpose it was adequate to study the Interconnector capability a couple of years out using the SYS networks where there was little divergence between the SYS networks and the Investment Planning view. However, it was recognised that the SYS networks would not be adequate for the full planning cycle.

23. It should also be noted that as currently written, STCP 22-1 assumes the use of Investment Planning networks, without the use of hybrids, for the study of the summer minimum condition, and is therefore not workable under the current drafting of Schedule 3.

24. Finally, the current processes for the exchange of SYS networks do not allow for the inclusion of generator dynamic data or any control system models, so these networks would not be adequate for stability studies.

25. In summary, the use of SYS networks for stability studies in planning time-scales is not considered an acceptable alternative.

Option d - Revise paragraph 2.4.3 to include only the specific information and data needed for stability studies

26. Based on the above information, the preferred approach would be to amend paragraph 2.4.3 of the STC to specifically target the minimum data required for the Transmission Licensees to be able to undertake stability studies. The following revisions are proposed:

    a) List out specific information and data from Appendix A of the GB Grid Code Planning Code that is specifically required for stability studies. This will take out reference to any demand, user data and generator data that is not required specifically for stability studies. In terms of data requirements, the Data Registration Code summarises all data requirements under the Grid Code. It is therefore considered appropriate to quote those data items required from the Data Registration Code and include them as an Appendix to the STC rather than list large sections of Appendix A of the Planning Code. See Appendix 1 for proposed information list. The advantage of this approach is that the exchange of many of the potentially commercially sensitive data items will no longer be required (in its existing form, paragraph 2.4.3 allows the disclosure of all data items listed in appendix A to the Planning Code and in OC2.4.2.1(a)).

    b) Change the term ranking order, to become a list, in no particular order, of generation units which NGET forecasts to be synchronised to meet a specified demand. These demand levels will include the minimum, 60% of peak demand and ACS peak demand on the GB Transmission System. The TOs should also be able to request sensitivities on the lists provided.

    c) Add the exchange of Investment Planning network data at the time of minimum, 60% and ACS peak demand on the GB Transmission System (this is additional to what is currently allowed under schedule 3).

    d) Take out reference to the information referred to in OC2.4.2.1(a) as this is not required.

27. This is the preferred approach as it allows all the Transmission Licensees to carry out detailed stability studies as required by their transmission licenses. Further, the information that would be exchanged is significantly reduced and excludes most of the information that could be considered commercially sensitive.

Recommendations

28. The JPC recommends that paragraph 2.4.3 of Schedule 3 is amended to allow for the enduring exchange of certain demand, generator and investment planning network data, as detailed in Option d above.

Appendix 1 – user data required to be transferred for stability studies

The Data Registration Code comprises of 15 Schedules and is a summary of all data required under the Grid Code. In order for the TOs to fulfil their obligation under the Transmission Licence and GBSQSS to carry out stability studies, only a subset of this data will be required from Schedule 1 of the DRC. No data items are required from Schedules 2 to 15 of the DRC.

The following tables are extracted from DRC Schedule 1. None of the data required is believed to be commercially confidential in respect of generation market conditions. There may however be an issue with respect to providing Users data, which is seen as intellectual property, especially amongst wind turbine manufacturers.

DATA REGISTRATION CODE SCHEDULE 1

GENERATING UNIT (OR CCGT MODULE) TECHNICAL DATA

DATA DESCRIPTION	UNITS	DATA CAT.	**GENERATING UNIT** (OR CCGT MODULE, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
Rated MVA	MVA	**SPD+**							
Rated MW	MW	**SPD+**							
Rated terminal voltage	kV	**DPD**							
Turbo-Generator inertia constant (for synchronous machines)	MW secs /MVA	**SPD+**							
Normal auxiliary load supplied by the **Generating Unit** at rated MW output	MW	**DPD**							
	Mvar	**DPD**							
Rated field current at rated MW and Mvar output and at rated terminal voltage	A	**DPD**							
Field current open circuit saturation curve (as derived from appropriate manufacturers' test certificates):									
120% rated terminal volts	A	**DPD**							
110% rated terminal volts	A	**DPD**							
100% rated terminal volts	A	**DPD**							
90% rated terminal volts	A	**DPD**							
80% rated terminal volts	A	**DPD**							
70% rated terminal volts	A	**DPD**							
60% rated terminal volts	A	**DPD**							
50% rated terminal volts	A	**DPD**							
IMPEDANCES: (Unsaturated)									
Direct axis synchronous reactance	% on MVA	**DPD**							
Direct axis transient reactance	% on MVA	**SPD+**							
Direct axis sub-transient reactance	% on MVA	**DPD**							
Quad axis synch reactance	% on MVA	**DPD**							
Quad axis sub-transient reactance	% on MVA	**DPD**							
Stator leakage reactance	% on MVA	**DPD**							
Armature winding direct current Resistance.	% on MVA	**DPD**							
In Scotland, negative sequence resistance	% on	**DPD**							

	MVA								

Note: - the above data item relating to armature winding direct-current resistance need only be provided by **Generators** in relation to **Generating Units** commissioned after 1st March 1996 and in cases where, for whatever reason, the **Generator** is aware of the value of the data item.

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**GENERATING UNIT** OR STATION DATA						
			G1	G2	G3	G4	G5	G6	STN
TIME CONSTANTS (Short-circuit and Unsaturated)									
Direct axis transient time constant	S	**DPD**							
Direct axis sub-transient time Constant	S	**SPD**							
Quadrature axis sub-transient time Constant	S	**DPD**							
Stator time constant	S	**DPD**							
GENERATING UNIT STEP-UP TRANSFORMER									
Rated MVA	MVA	**SPD+**							
Voltage Ratio	-	**DPD**							
Positive sequence reactance:									
Max tap	% on MVA	**SPD+**							
Min tap	% on MVA	**SPD+**							
Nominal tap	% on MVA	**SPD+**							
Positive sequence resistance:									
Max tap	% on MVA	**DPD**							
Min tap	% on MVA	**DPD**							
Nominal tap	% on MVA	**DPD**							
Tap change range	+% / -%	**DPD**							
Tap change step size	%	**DPD**							
Tap changer type, on-load or off-circuit	On/Off	**DPD**							
EXCITATION:									
Note: The data items requested under Option 1 below may continue to be provided by									

Generators in relation to **Generating Units** on the **System** at 9 January 1995 (in this paragraph, the "relevant date") or they may provide the new data items set out under Option 2. **Generators** must supply the data as set out under Option 2 (and not those under Option 1) for **Generating Unit** excitation control systems commissioned after the relevant date, those **Generating Unit** excitation control systems recommissioned for any reason such as refurbishment after the relevant date and **Generating Unit** excitation control systems where, as a result of testing or other process, the **Generator** is aware of the data items listed under Option 2 in relation to that **Generating Unit**.

Option 1								
DC gain of **Excitation Loop**		**DPD**						
Max field voltage	V	**DPD**						
Min field voltage	V	**DPD**						
Rated field voltage	V	**DPD**						
Max rate of change of field volts:								
Rising	V/Sec	**DPD**						
Falling	V/Sec	**DPD**						
Details of **Excitation Loop** Described in block diagram form showing transfer functions of individual elements	Diagram	**DPD**	(please attach)					

SCHEDULE 1

DATA DESCRIPTION		UNITS	DATA CAT.	**GENERATING UNIT** OR STATION DATA						
				G1	G2	G3	G4	G5	G6	STN
Option 2										
Exciter category, e.g. **Rotating Exciter**, or **Static Exciter** etc		Text	**SPD**							
Excitation System Nominal Response	V_E	sec^{-1}	**DPD**							
Rated Field Voltage	U_{fN}	V	**DPD**							
No-load Field Voltage U_{fO}		V	**DPD**							
Excitation System On-Load Positive Ceiling Voltage	U_{pL+}	V	**DPD**							
Excitation System No-Load Positive Ceiling Voltage	U_{pO+}	V	**DPD**							
Excitation System No-Load Negative Ceiling Voltage	U_{pO-}	V	**DPD**							
Power System Stabiliser (PSS) Fitted		Yes/No	**SPD**							
Details of **Excitation System**										

(including **PSS** if fitted) described in block diagram form showing transfer functions of individual elements.	Diagram	**DPD**								

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**GENERATING UNIT** OR STATION DATA						
			G1	G2	G3	G4	G5	G6	STN
GOVERNOR AND ASSOCIATED PRIME MOVER PARAMETERS									
Note: The data items requested under Option 1 below may continue to be provided by **Generators** in relation to **Generating Units** on the **System** at 9 January 1995 (in this paragraph, the "relevant date") or they may provide the new data items set out under Option 2. **Generators** must supply the data as set out under Option 2 (and not those under Option 1) for **Generating Unit** governor control systems commissioned after the relevant date, those **Generating Unit** governor control systems recommissioned for any reason such as refurbishment after the relevant date and **Generating Unit** governor control systems where, as a result of testing or other process, the **Generator** is aware of the data items listed under Option 2 in relation to that **Generating Unit**.										
Option 1									
GOVERNOR PARAMETERS (REHEAT UNITS)									
HP Governor average gain	MW/Hz	**DPD**							
Speeder motor setting range	Hz	**DPD**							
HP governor valve time constant	S	**DPD**							
HP governor valve opening limits		**DPD**							
HP governor valve rate limits		**DPD**							
Re-heat time constant (stored **Active Energy** in reheater)	S	**DPD**							
IP governor average gain	MW/Hz	**DPD**							
IP governor setting range	Hz	**DPD**							
IP governor time constant	S	**DPD**							
IP governor valve opening limits		**DPD**							
IP governor valve rate limits		**DPD**							
Details of acceleration sensitive elements HP & IP in governor loop		**DPD**	(please attach)						
Governor block diagram showing transfer functions of individual elements		**DPD**	(please attach)						
GOVERNOR (Non-reheat steam and Gas Turbines)									
Governor average gain	MW/Hz	**DPD**							
Speeder motor setting range		**DPD**							

Time constant of steam or fuel governor valve	S	**DPD**							
Governor valve opening limits		**DPD**							
Governor valve rate limits		**DPD**							
Time constant of turbine	S	**DPD**							
Governor block diagram		**DPD**	(please attach)						

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**GENERATING UNIT** OR STATION DATA						
			G1	G2	G3	G4	G5	G6	STN
End of Option 1									
Option 2									
All **Generating Units**									
Governor Block Diagram showing transfer function of individual elements including acceleration sensitive elements		**DPD**							
Governor Time Constant	Sec	**DPD**							
Speeder Motor Setting Range	%	**DPD**							
Average Gain	MW/Hz	**DPD**							
Steam Units									
HP Valve Time Constant	sec	**DPD**							
HP Valve Opening Limits	%	**DPD**							
HP Valve Opening Rate Limits	%/sec	**DPD**							
HP Valve Closing Rate Limits	%/sec	**DPD**							
HP Turbine Time Constant	sec	**DPD**							
IP Valve Time Constant	sec	**DPD**							
IP Valve Opening Limits	%	**DPD**							
IP Valve Opening Rate Limits	%/sec	**DPD**							
IP Valve Closing Rate Limits	%/sec	**DPD**							
IP Turbine Time Constant	sec	**DPD**							
LP Valve Time Constant	sec	**DPD**							
LP Valve Opening Limits	%	**DPD**							
LP Valve Opening Rate Limits	%/sec	**DPD**							
LP Valve Closing Rate Limits	%/sec	**DPD**							
LP Turbine Time Constant	sec	**DPD**							
Reheater Time Constant	sec	**DPD**							

Where the generating unit governor does not have a selectable deadband facility, then the actual value of the deadband need only be provided.

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**GENERATING UNIT** OR STATION DATA						
			G1	G2	G3	G4	G5	G6	STN
Gas Turbine Units									
Inlet Guide Vane Time Constant	sec	**DPD**							
Inlet Guide Vane Opening Limits	%	**DPD**							
Inlet Guide Vane Opening Rate Limits	%/sec	**DPD**							
Inlet Guide Vane Closing Rate Limits	%/sec	**DPD**							
Fuel Valve Time Constant	sec	**DPD**							
Fuel Valve Opening Limits	%	**DPD**							
Fuel Valve Opening Rate Limits	%/sec	**DPD**							
Fuel Valve Closing Rate Limits	%/sec	**DPD**							
Hydro **Generating Units**									
Guide Vane Actuator Time Constant	sec	**DPD**							
Guide Vane Opening Limits	%	**DPD**							
Guide Vane Opening Rate Limits	%/sec	**DPD**							
Guide Vane Closing Rate Limits	%/sec	**DPD**							
Water Time Constant	sec	**DPD**							
	End of Option 2								
UNIT CONTROL OPTIONS*									
Normal droop	%	**DPD**							

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
Power Park Module Rated MVA	MVA	**SPD+**							
Power Park Module Rated MW	MW	**SPD+**							
Number & Type of **Power Park Units** within each **Power Park Module**									
Power Park Unit Model - A validated	Transfer	**DPD**							

DATA DESCRIPTION	UNITS	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
mathematical model in accordance with PC.5.4.2 (a)	function block diagram and algebraic equations, simulation and measured test results								
Power Park Unit Data (where applicable)									
Rated MVA	MVA	**SPD+**							
Rated MW	MW	**SPD+**							
Rated terminal voltage	V	**SPD+**							
Inertia constant at synchronous speed	MW secs /MVA	**SPD+**							
Stator Resistance.	% on MVA	**DPD**							
Stator Reactance.	% on MVA	**SPD+**							
Magnetising Reactance	% on MVA	**SPD+**							
Rotor Resistance (at starting).	% on MVA	**DPD**							
Rotor Resistance (at rated running)	% on MVA	**SPD+**							
Rotor Reactance (at starting).	% on MVA	**DPD**							
Rotor Reactance (at rated running)	% on MVA	**SPD**							
Inertia constant of the wind turbine rotor	MW secs /MVA	**DPD**							
Inertia constant of the generator rotor	MW secs /MVA	**DPD**							
Shaft stiffness	Nm / electrical radian	**DPD**							

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
Minimum generator rotor speed (Doubly Fed Induction Generators)	RPM	**SPD+**							
Maximum generator rotor speed (Doubly Fed Induction Generators)	RPM	**SPD+**							
The optimum generator rotor speed versus wind speed	tabular format	**DPD**							
Power Converter Rating (Doubly Fed Induction	MVA	**SPD+**							

DATA DESCRIPTION	UNITS	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
Generators)									
The rotor power coefficient (C_p) versus tip speed ratio (λ) curves for a range of blade angles (where applicable)	Diagram + tabular format	**DPD**							
*The electrical power output versus generator rotor speed for a range of wind speeds over the entire operating range of the **Power Park Unit**.*	Diagram + tabular format	**DPD**							
The blade angle versus wind speed curve	Diagram + tabular format	**DPD**							
The electrical power output versus wind speed over the entire operating range of **the Power Park Unit**.	Diagram + tabular format	**DPD**							
Transfer function block diagram, parameters and description of the operation of the power electronic converter (where applicable).	Diagram	**DPD**							
For a **Power Park Unit** consisting of a synchronous machine in combination with a back to back **DC Converter,** or for a **Power Park Unit** not driven by a wind turbine, the data to be supplied shall be agreed with **NGET** in accordance with PC.A.7.									

SCHEDULE 1

DATA DESCRIPTION	UNITS	DATA CAT.	**POWER PARK UNIT** (OR **POWER PARK MODULE**, AS THE CASE MAY BE)						
			G1	G2	G3	G4	G5	G6	STN
Torque / Speed and blade angle control systems and parameters For the **Power Park Unit**, details of the torque / speed controller and blade angle controller in the case of a wind turbine and power limitation functions (where applicable) described in block diagram form showing transfer functions and parameters of individual elements	Diagram	**DPD**							

Voltage/**Reactive Power**/**Power Factor** control system parameters For the **Power Park Unit** and **Power Park Module** details of **Voltage/Reactive Power**/**Power Factor** controller (and **PSS** if fitted) described in block diagram form including parameters showing transfer functions of individual elements.	Diagram	**DPD**							
Frequency control system parameters For the **Power Park Unit** and **Power Park Module** details of the **F~~f~~requency** controller described in block diagram form showing transfer functions and parameters of individual elements.	Diagram	**DPD**							
As an alternative to PC.A.5.4.2 (a), (b), (c), (d), (e) and (f), is the submission of a single complete model that consists of the full information required under PC.A.5.4.2 (a), (b), (c), (d) (e) and (f) provided that all the information required under PC.A.5.4.2 (a), b), (c), (d), (e) and (f) individually is clearly identifiable.	Diagram	**DPD**							

SCHEDULE 1

DC CONVERTER STATION TECHNICAL DATA

Data Description	Units	Data Category	**DC Converter Station** Data
DC CONVERTER STATION DATA			
Number of poles, i.e. number of **DC Converters**	Text		
Pole arrangement (e.g. monopole or bipole)	Text	**SPD+**	
Details of each viable operating configuration	Diagra	**SPD+**	

Configuration 1 Configuration 2 Configuration 3 Configuration 4 Configuration 5 Configuration 6 Remote ac connection arrangement	m Diagra m Diagra m Diagra m Diagra m Diagra m Diagra m	**SPD+** **SPD**	

SCHEDULE 1

Data Description	Units	Data Category	Operating Configuration					
			1	2	3	4	5	6
DC CONVERTER STATION DATA								
DC Converter Type (e.g. current or Voltage source)	Text	**SPD**						
Rated MW import per pole **[PC.A.3.3.1]**	MW	**SPD+**						
Rated MW export per pole **[PC.A.3.3.1]**	MW	**SPD+**						
DC CONVERTER TRANSFORMER **[PC.A.5.4.3.1**		**DPD**						
Rated MVA	MVA	**DPD**						
Winding arrangement	KV	**DPD**						
Nominal primary voltage	KV							
Nominal secondary (converter-side) voltage(s)		**DPD**						
Positive sequence reactance	% on	**DPD**						
Maximum tap	MVA	**DPD**						
Nominal tap	% on							
Minimum tap	MVA	**DPD**						
Positive sequence resistance	% on	**DPD**						
Maximum tap	MVA	**DPD**						
Nominal tap		**DPD**						
Minimum tap	% on							
	MVA	**DPD**						
Tap change range	% on							

Number of steps	MVA % on MVA +% / -%							

SCHEDULE 1

Data Description	Units	Data Category	Operating configuration					
			1	2	3	4	5	6
DC NETWORK [PC.A.5.4.3.1 (c)]								
Rated DC voltage per pole	KV	**DPD**						
Rated DC current per pole	A	**DPD**						
Details of the **DC Network** described in diagram form including resistance, inductance and capacitance of all DC cables and/or DC lines. Details of any line reactors (including line reactor resistance), line capacitors, DC filters, earthing electrodes and other conductors that form part of the **DC Network** should be shown.	Diagram	**DPD**						
DC CONVERTER STATION AC HARMONIC FILTER AND REACTIVE COMPENSATION EQUIPMENT **[PC.A.5.4.3.1 (d)]**								
For all switched reactive compensation equipment	Diagram	**SPD**						
		SPD						
	Text	**SPD**						
Total number of AC filter banks	Diagram	**SPD**						
Diagram of filter connections		**DPD**						
Type of equipment (e.g. fixed or variable)	Text	**DPD**						
Capacitive rating; or	Mvar	**DPD**						
Inductive rating; or	Mvar							
Operating range		**DPD**						
Reactive Power capability as a function of various MW transfer levels	Table							

SCHEDULE 1

Data Description	Units	Data Category	Operating configuration					
			1	2	3	4	5	6
CONTROL SYSTEMS **[PC.A.5.4.3.2]**								
Static V_{DC} – P_{DC} (DC voltage – DC power) or Static V_{DC} – I_{DC} (DC voltage – DC current) characteristic (as appropriate) when operating as		**DPD**						
–Rectifier	Diagram	**DPD**						
–Inverter	Diagram	**DPD**						
Details of rectifier mode control system, in block diagram form together with parameters showing transfer functions of individual elements.	Diagram	**DPD**						
Details of inverter mode control system, in block diagram form showing transfer functions of individual elements including parameters.	Diagram	**DPD**						
Details of converter transformer tap changer control system in block diagram form showing transfer functions of individual elements including parameters. (Only required for DC converters connected to the **GB Transmission System**.)	Diagram	**DPD**						
Details of AC filter and reactive compensation equipment control systems in block diagram form showing transfer functions of individual elements including parameters. (Only required for DC converters connected to the **GB Transmission System**.)	Diagram	**DPD** **DPD**						
Details of any frequency and/or load control systems in block diagram form showing transfer functions of individual elements including parameters.	Diagram	**DPD**						
Details of any large or small signal modulating controls, such as power oscillation damping controls or sub-synchronous oscillation damping controls, that have not been submitted as part of the above control system data.	Diagram							
Transfer block diagram representation of the reactive power control at converter ends for a voltage source converter.	Diagram							

NOTE:

Users are referred to Schedules 5 & 14 which set down data required for all **Users** directly connected to the **GB Transmission System**, including **Power Stations**