Examples of Generic BCA Templates

A number of Users have requested if National Grid could provide some examples of the generic templates used to populate the Technical Appendix (Appendix F's) of Bilateral Connection Agreements. With this in mind, National Grid has provided two examples of the generic templates which are attached in Appendix A and B of this paper.

- An Onshore Generator Template
- An Onshore Demand Template

In providing these examples, Users should be aware that the Technical Appendices detail the site specific requirements in relation to a connection and are also designed to be consistent with the requirements of the Grid Code and other industry codes. The above examples therefore simply provide a base from which each individual connection offer is tailored to suit the site specific requirements of that connection and the variations that may occur.

National Grid is publishing these examples in good faith to provide the Industry with an illustration of the type of technical requirements necessary. It should however be noted that the Power System and Commercial environment is evolving on a continuous basis and these templates are subject to regular review to ensure they remain fit for purpose.

In addition, the Technical Appendices are the only method in which National Grid can ensure appropriate technical requirements are placed on a User in a time frame which is consistent with the Connection Application Process. Naturally, any significant technical requirement would need to be subject to wider review amongst the Grid Code Review Panel and associated Working Groups.

It must be remembered that the Connection Agreements are Bilateral and hence require the agreement of both parties before signature. A User will have 90 days to sign an offer hence providing ample opportunity for discussion, clarification and amendment of the technical appendices. National Grid is receptive to comments from Users in respect of these agreements as it sees such feedback as an important tool in updating, refining and improving them. There have been numerous examples in the past where comments received from User's following a specific connection application have then been included within the Generic Template. Notwithstanding this however, National Grid equally needs to balance Customers expectations against the requirements of security of supply.

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TEMPLATE FOR AN ONSHORE LARGE POWER STATION WITH A STANDARD CONNECTION BOUNDARY (AIS) AT THE BUSBAR CLAMPS. IF THE CONNECTION IS TO A GIS SUBSTATION CONSULT POLICY FOR ADVICE

(NOTES – ALL SECTIONS IN [RED] TO BE SELECTED AS REQUIRED)

ALL SECTIONS IN YELLOW HIGHLIGHTED RED TEXT ARE WHERE A DECISION SHOULD BE MADE DEPENDING ON THE TYPE OF AGREEMENT

ALL SECTIONS IN YELLOW HIGHLIGHTED BLACK ITALLIC TEXT ARE FOR GUIDANCE AND SHOULD BE DELETED BEFORE COMPLETION

NOTE:- WHERE REFERENCE HAS BEEN MADE TO STAGE 1, THIS ONLY NEEDS TO BE INCLUDED WHERE THE DEVELOPMENT IS STAGED. IF THERE IS NO REFERENCE TO STAGING THIS REFERENCE CAN BE DELETED

AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Authors	Approved by (including Job Title)
1	January 2015	Update and revision from comments received in 2014	A Johnson N Martin	G Stein Technical Policy Manager
1.1	5 March 2015	Removal of Breaker status from Dynamic System Monitoring – Schedule 4 – Appendix F5	A Johnson	G Stein Technical Policy Manager
1.2	3 February 2016	Addition of operational metering signals to facilitate GC0028 Constant terminal voltage	A Johnson	G Stein Technical Policy Manager
2	**1 August 2016**	**Update to wind farm voltage control requirements**	**D Beaumont**	**Xiaoyao Zhou Technical Policy Manager**
3	**24 Oct 2016**	**ASM minimum sampling rate reduced to 1Hz**	**Phil Tonkin**	**Xiaoyao Zhou Technical Policy Manager**
4	**17 Nov 2016**	**Operational Metering sampling rate change to 1s or 1Hz following customer feedback**	**A Johnson**	**Xiaoyao Zhou**
5	**28 Mar 2017**	**Addition of "trip relay" column in protection schedule of F4**	**Gihan Abeyawardene**	**Xiaoyao Zhou**
6	**28 Mar 2017**	**Addition of item 33 &34 in F5 re tidal connections**	**A Johnson**	**Xiaoyao Zhou**
7	**28 Mar 2017**	**Addition of operational metering signal for tidal connections in Appendix f5 schedule 2**	**A Johnson**	**Xiaoyao Zhou**
8	**28 Mar 2017**	**Appendix F5 schedule 1, cross-site wiring obligation clarified**	**A Johnson**	**Xiaoyao Zhou**
9	**30 Mar 2018**	**Appendix F5, more clearly defined obligations relating to**	**A Johnson**	**Xiaoyao Zhou**

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		control points and emergency instructions		
10	**27Apr 2017**	**Following completion of GSR18 and GC77, SSR text added to F5**	**B Awad**	**Xiaoyao Zhou**

TO	NG/SPT/SHET
MWs	
Direct/Embedded	
Generation or Demand	
Synchronous or asynchronous	
If Offshore, HVDC or AC connected	
If interconnector, CS or VS	

(this whole page to be deleted after the appendices have been checked by Techical Policy)

APPENDIX F

SITE SPECIFIC TECHNICAL CONDITIONS
CONTENTS

(NOTES – ALL SECTIONS IN [RED] TO BE COMPLETED/DELETED WHERE APPROPRIATE)

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] ***for direct connect wind farm only***

Contents

Delete the Electrical Standard paragraphs if embedded, if direct connect select the appropriate one and delete the other.

Electrical Standards *(E&W)*

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These appendices contain references to The Company's Relevant Electrical Standards (RES) throughout. The User shall ensure that all User equipment contained within The Company's busbar protection zone at the User/The Company Connection Point (see Grid Code CC 6.2.1.2) complies with the RES. The User can access the RES from The Company's website at which is available at:-

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

The RES is updated periodically. If the RES is updated in the period between issuing the Connection Offer and the User completing the connection to The Company Transmission System then The Company will seek agreement with the User to use the updated RES as the standard for plant and apparatus at the Connection Point.

Electrical Standards *(Scotland)*

These appendices contain references to The Company's Relevant Electrical Standards (RES) and /or [The Scottish Electrical Standards for SPT's Transmission System (SPTS)/ Scottish Electrical Standards for SHET's Transmission System (SHETS)] throughout. The User shall ensure that all User equipment contained within Relevant Transmission Licensee's busbar protection zone at the User /National Transmission Connection Point (see Grid Code CC 6.2.1.2) complies with the RES/SPTS/SHETS. The User can access these standards from The Company's website at:-

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

The SPTS/SHETS and RES are updated periodically. If the SPTS / SHETS or RES is updated in the period between issuing the Connection Offer and the User completing the connection to the National Transmission System then The Company will seek agreement with the User to use the updated RES and SPTS/SHETS as the standard for plant and apparatus at the Connection Point.

(following paragraph for tidal agreements only, otherwise delete)

In so far as the Grid Code is concerned, the User will be considered as a Power Park Module, in which the Power Park Module includes the tidal generating units. In addition to supplying all data associated with each Power Park Module (as appropriate) under the Grid Code, it is also recognised that this application contains new generation technology. As further information becomes available, and the User's design becomes more clearly established, The Company may need to revise and update the technical requirements and parameters specified in this Technical Appendix (Appendix F) in collaboration with the User and the Construction Programme timeframe specified in the Appendix J of the Construction Agreement.

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APPENDIX F1

SITE SPECIFIC TECHNICAL CONDITIONS
AGREED ANCILLARY SERVICES

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] *(for direct connect wind farms only)*

Agreed Ancillary Services

The Connection and Use of System Code (CUSC) and the Grid Code detail The Company's requirements for provision of Mandatory Ancillary Services (CUSC Clause 1.3.3, Section 4 and Schedule 2 - Exhibit 4 and Grid Code CC.8)

The User may wish to consider, prior to the construction phase of its project, whether it intends to negotiate the provision of additional Balancing Services (Agreed Ancillary Services) in order that it can install the necessary hardware to allow monitoring of such services.

Details of the types of Balancing Service and methods of securing them are contained in The Company's Procurement Guidelines and Balancing Principles.

NOTE at the initial application stage, Commercial Intertripping requirements are NOT usually specified until post offer negotiation. If this is the case delete the text in Red below up to the heading "General". If this is not the case and specific Commercial Intertripping is required, the following text in red should be used.

Commercial Transmission System to Generator Operational Intertripping Schemes

Based on the Generation background at the time of this offer, The Company may need to negotiate a bilateral payment arrangement for certain outage combinations. The outage combinations will be specified as part of any Commercial Bilateral Agreement.

The User agrees to arm or have armed this intertripping scheme in accordance with the terms of the Commercial Bilateral Agreement at the Instruction of The Company.

The User, shall as soon as reasonably practicable, notify The Company of the availability of the Commercial Intertripping Scheme in accordance with the terms of the Commercial Bilateral Agreement.

The User shall ensure that each Generating Unit is fully robust and able to withstand total disconnection from the National Electricity Transmission System in a controlled and safe manner.

Substation	Grid Code Ref	CUSC ref	Trip within (ms) from receipt of the trip signal	Additional info
	BC2.10.2(a)	CUSC4.2A CUSC2.9.3		

Technical Requirements and Obligations relating to Commercial and Operational Intertripping Schemes

Refer to F3.

General

The Company may wish to approach the User to establish a valid bilateral payment arrangement for the establishment of a Commercial Transmission System to Generator Operational Intertripping

Scheme in the future. This approach would be made at such time that The Company has established certainty in the local generation background. *(Delete if intertrip specified above)*

The User shall co-operate with The Company in enhancing/amending these facilities and will not unreasonably withhold its agreement to any such proposals should The Company require this at a later date.

Any changes to this Appendix F1 and/or to The Company's and/or User's obligations shall be subject to the provisions of Paragraph 2.9.3 of the CUSC which states that if either party wishes to modify, alter or change the site specific technical conditions it shall be deemed to be a Modification for the purposes of the CUSC unless CUSC 4.2B.3 (Agreed Ancillary Services) applies. CUSC 4.2B.3 states that if both parties have failed to reach agreement within a reasonable period then The Company is entitled to initiate the procedure for resolution as an "Other Dispute". This does not apply in the case of Max Generation or System to Generator Operational Intertripping.

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APPENDIX F2

SITE SPECIFIC TECHNICAL CONDITIONS
DEROGATED PLANT

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] *(for direct connect wind farms only)*

Derogated Plant

Not applicable.

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APPENDIX F3

SITE SPECIFIC TECHNICAL CONDITIONS
SPECIAL AUTOMATIC FACILITIES

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] *(for direct connect wind farms only)*

Special Automatic Facilities

Note System Design must ensure that any requirements for Operational Intertripping are consistent with the Design Specification Investment proposal and checked by Construction/Alliances.

If intertrip is specified, use the text in red below

1. Transmission System to Generating Unit Intertripping Schemes

Category/Substation	Grid Code Ref	CUSC ref	Trip within (ms) from receipt of the trip signal	Obligation
	BC2.10.2(a)	CUSC4.2A CUSC2.9.3	Usually 100ms	See schedule 1 for associated trips/outage combinations

This Transmission System to Generating Unit(s) intertrip is classified as a category [XXXX] intertripping scheme, as defined in the Grid Code.

Where the User is required to provide a generator intertrip facility, the User shall include all information in accordance to those provisions within Appendix F4 and include all relevant information within Schedule 1 of Appendix F4.

The User agrees that The Company shall, in operational timescales issue an Ancillary Services instruction for the arming of the intertrip facility pursuant to the Grid Code BC2.10.2(a) and CUSC 4.2A. The Company shall issue an instruction to arm the intertripping scheme for one or more of the outage combinations as specified in Schedule 1 of Appendix F3.

In the event that the intertrip is not healthy The Company shall issue an instruction to the User with the course of action to be taken. *(Use only this first sentence for Category 2 or 4 Intertripping Schemes).* In the worst case, the User may be required to reduce its Maximum Export Limit (MEL) (or Maximum Import Limit (MIL) for importing Generators eg Pumped Storage) as required by The Company *(Use the whole paragraph for Category 1 or Category 3 Schemes only).*

General

If no intertrip specified, use the following text in red

None identified at this time however the User shall co-operate with The Company in enhancing/amending these facilities, should The Company require this at a later date, and will not unreasonably withhold its agreement to any such proposals.

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For the avoidance of doubt, except where CUSC 4.2A.6 applies, any such changes of this Appendix F3 and/or to The Company's and/or the User's obligations in respect therefore shall be subject to the provisions of Paragraph 2.9.3 of the CUSC.

Technical Requirements and Obligations Relating to Commercial and Operational Intertripping

The User is required to install and maintain an intertripping facility such that on receipt of an appropriate signal (s) from The Company/National Electricity Transmission System, the Generating Unit(s) will trip (by opening the Generating Unit(s) circuit breaker(s)). This shall form part of the User System.

The Company/Relevant Transmission Licensee will provide the required signals to facilitate this intertripping facility to a marshalling cubicle located within [XXXX] kV Substation. The User shall be responsible for the installation and maintenance of duplicated communications routes and the cabling between the marshalling cubicle and the Power Station.

The intertripping scheme will be monitored by the User to ensure it is healthy at all times and provide indications to The Company for all selections (for F3 intertrips this is as specified in schedule 1).

The functionality, performance, availability, accuracy, dependability, security, protocol and repair times of the communications links, trip facilities and monitoring facilities provided by the User from The Company's/Relevant Transmission Licensee's marshalling cubicles located at [XXXX] kV Substation to the User's circuit breakers shall be agreed with The Company and Relevant Transmission Licensee as soon as reasonably practicable and at least 24 months before the Completion Date (Stage 1).

The System shall be fail safe such that no single hardware, software, system, communication, interface or power supply failure or depletion of facility shall result in failure to trip within the specified time or an incorrect control action.

The User shall install isolation facilities to locally switch the intertrip facility out of service. The User shall not isolate the intertripping facility unless otherwise agreed with The Company.

(Delete this section if not required in F3 and move to F1 if there is a commercial intertrip requirement)

Special Automated Facilites

Requirement	
Disconnection from the Transmission System with or without User Demand	N/A unless specified
Transmission System to Demand Intertripping Scheme	N/A unless specified
Transmission System to Directly Connected Customers Intertripping Schemes	N/A unless specified
Restricted Entry Capacity	N/A unless specified

Other Facilities

Requirement	
Automatic Open/ Closure Schemes	N/A unless specified
System Splitting/Islanding Schemes	N/A unless specified

2. Synchronising & Voltage Selection

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The User will be required to interface with the National Electricity Transmission System substation synchronising system in accordance with the TS.3.24.60_RES /SPTS/SHETS. In circumstances where the User does not synchronise at the Grid Entry Point the User is required to participate in The Company's/Relevant Transmission Licensee's voltage selection scheme.

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Appendix F3 - Schedule 1
Site Specific Technical Conditions – Circuits to be selected for Operational Intertripping

Selection	System Maintenance Condition	Trip Condition	Overload Condition
1	[XXXX]	[XXXX]	[XXXX]
2			
3			
4			
5			
6			

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SITE SPECIFIC TECHNICAL CONDITIONS
RELAY SETTINGS & PROTECTION

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] *(for direct connect wind farms only)*

If Embedded (eg BEGAs, BELLAs, LEEMPs etc) use this red text and delete the text headed « Relay Settings & Protection » :

Relay settings and Generating Unit Power Station Protection Arrangements to be agreed between the User and the host Distribution Network Operator.

Relay Settings & Protection

For direct connect only, delete this section if embedded, all red unhighlighted text should only be included if in Scotland

1. Relay Settings
(CC.6.2.2.5)

The User shall complete the attached blank protection schedule pro-forma (Schedule 1 of this Appendix). The User shall submit the protection settings on its plant for agreement with The Company and the Relevant Transmission Licensee. This shall include details of the following:

a. Circuit diagrams of both ac connections and tripping for the purposes of interpreting the schedule
b. Proposed back-up protection grading curves to allow The Company and the Relevant Transmission Licensee to assess adequacy of co-ordination
c. Details of the Protection Dependability Index per protected zone (CC 6.2.2.2.2 d).

Not less than 3 months before the Commissioning Programme Commencement Date for the agreed works, the User shall have agreed the protection settings on the User's equipment with The Company and the Relevant Transmission Licensee. The Company and the Relevant Transmission Licensee shall then finalise the protection settings on The Company's own/ Transmission System equipment, complete the protection schedule with supporting details where necessary, and supply it to the User.

Any subsequent alterations to the protection settings (whether by the User or The Company or the Relevant Transmission Licensee) shall be agreed between The Company and the User in accordance with the Grid Code (CC.6.2.2.5).

No User equipment shall be energised until the protection settings have been finalised. The User shall agree with The Company, and carry out a combined commissioning programme for the protection systems, and generally, to a minimum standard as specified in The Company Transmission Procedure (TP) 106 which is available from The Company's Extranet. Access to The Company's Extranet can be requested via E-Mail to:- transmission .documentcontrol@nationalgrid.com. / by the Relevant Transmission Licensee.

2. Generating Unit and Power Station/Power Park Module Protection Arrangements
(CC 6.2.2.2)

The fault clearance time (from fault inception to circuit breaker arc extinction) for faults on all the User's equipment directly connected to The Company Transmission System shall meet the following minimum requirement(s): -

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[400kV within 80ms or 275kV within 100ms or 132kV and below within 120ms]

For faults on transformers the clearance time is specified for the HV side (e.g. for a fault on a [400/21(33 if wind farm)]kV interconnecting transformer the maximum clearance time is [80]ms. Where intertripping is required to open circuit breakers, the overall fault clearance time shall not be extended by more than [60]ms (total [140]ms in this example) to allow such intertripping to operate.

(Scotland only)
Backup clearance time should be as specified in the TOCA or if not, use the following text with the appropriate values for the voltage required.
The corresponding backup clearance time at 400kV where there is only one main protection shall be less than 300ms

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APPENDIX F4 - Schedule 1

PROTECTION AND INTERTRIPPING DETAILS AT THE COMPANY / USER INTERFACE

SITE NAME:

CIRCUIT NAME*:
* where a feeder exists between two sites, a separate schedule will be required for each end.

CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See F4 Item 2)	MOST PROBABLE CLEARANCE TIME					FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		$PROT^N$	Trip relay	CB	INTER TRIP	TOTAL	PHASE-PHASE	PHASE-EARTH		

User Representative Name: Date: Signature:

The Company Representative Name: Date: Signature:

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SITE SPECIFIC TECHNICAL CONDITIONS
OTHER TECHNICAL REQUIREMENTS

User: [XXXX]

Connection Site: [XXXX]

Point of Common Coupling [XXXX] *(for direct connect wind farms only)*

Other Technical Requirements

The User can gain access to the technical specifications from The Company's Extranet website. Access to The Company's Extranet website can be requested via E-Mail to:- transmission.documentcontrol@nationalgrid.com.

	Criteria	***Applies to? Delete this column when finished***	**Grid Code Ref – User to comply with:**	**Obligations**
1.	Protection of interconnecting connections	*Direct Connect only. Only applies for double busbar substation connection, if it is a single busbar check with policy*	CC 6.2.2.3.1 CC.6.2.2.2.2	Defined as connections between current transfomers on the Generator circuit side of the circuit breaker to the Grid Entry Point at the busbar clamps on the busbar side of the busbar selector disconnectors. The Company/Relevant Transmission Licensee: Shall design the protection scheme for the Interconnection Connections at the site once the Construction Programme has commenced. The User: Shall install auxiliary components on its circuits which are compatible with The Company's/Relevant Transmission Licensee's to provide required dependability and setting for the protection. Shall provide two current transformers type PX-B/X-B *(PX-B E&W, X-B Scotland)* cores in each of the User's bays in accordance with TS 3.02.04_RES /SPTS/SHETS exclusively for use by The Company/Relevant Transmission Licensee for the protection of the Interconnecting Connections. This will ensure compatibility with The Company's/Relevant Transmission Licensee's interconnecting connections protection system. All protection equipment capable of tripping the interconnecting circuit breaker shall comply with CC.6.2.2.2.2 of the Grid Code.

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				(Use text below only if User connects to any equipment within The Company's busbar protection zone which is GIS): User shall provide all necessary alarms and indications with respect to any gas zones that straddle the ownership boundary.
2.	Circuit Breaker Fail Protection	*E&W only (except 132kV connections delete if it is a 132kV connection)*	CC.6.2.2.3.2	The User: To install circuit breaker fail protection equipment on all User circuit breakers operating at Supergrid Voltage that interface directly with The Company. The User shall provide Circuit breaker fail back trip facilities to integrate with the Company's back tripping scheme. Alarms and Indications associated with the Circuit Breaker Fail Scheme must be provided to The Company to indicate operation of circuit breaker fail protection. In the event that the Circuit Breaker Fail is an integral function of The Company's busbar protection scheme, the User shall provide CT signals, plant status and initiation contacts from their bay (s) to The Company. The User shall accept tripping commands from The Company's Busbar Protection/Ciricuit Breaker Fail scheme to the User's circuit breaker trip systems. All provisions are to be in accordance with TS.3.24.39_RES.
3.	Pole Slipping	*Only synchronous plant and compulsory for embedded*	CC.6.2.2.3.4	Not required by The Company but may be installed if generator wishes to install such protection. The User: To provide protection type, settings and selection policy to The Company/Relevant Transmission Licensee for approval only if The User wishes to install Pole Slipping Protection..
4.	Fault Disconnection Facilities	*Direct Connect only*		The User: To make provision for tripping of the generator/transmission transformer circuit breakers by The Company/Transmission protection systems.
5.	Reactive capability	*Where the Grid Entry Point is not at the same location as the High Voltage Terminals of the Generator Transformer, use the text in red Not applicable to*	CC.6.3.2 (a) *(synchronous only)* CC.6.3.2 (c) *(for power park modules)*	The User: Required to meet the requirements of CC.6.3.2(a)/(c) of the Grid Code. May be required to install Reactive Compensation equipment at the Grid Entry Point (or User System Entry Point if embedded) to ensure that under all operating conditions, the reactive power can be controlled to ensure that the voltage at the Grid Entry Point (or User System Entry Point if embedded) can be maintained between the limits specified in CC.6.1.4 of the Grid Code.The requirements for any additional reactive compensation equipment at the Grid Entry Point (or User System Entry Point if embedded) shall be discussed and agreed between the User and The Company during the detailed design phase following assessment by The Company of the User's data as submitted under Schedule 5 of the Data Registration Code. (this red text is for synchronous plant only) In addition, with all plant in service, each Power Park Module shall be required to be capable of full

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		small BEGAs		Leading Power factor from 100% to 20% of Rated MW output. For the avoidance of doubt, operation of each Power Park Module is required in the triangular shaded region between 50% and 20% of Figure 1 of CC.6.3.2.*(this para, power park modules only)*
6.	Black Start Capability	*User choice Synchronous Plant only*	CC.6.3.5	*The User:* *May wish to notify The Company of their ability to provide a Black Start facility and the cost of the service. The Company will then consider whether it wishes to contract with the User for the provision of a Black Start service.*
7.	Excitation Performance Control Requirements	*Synchronous only*	CC.6.3.8 CC.6.A.6	The User: Is required to install a continuously acting automatic excitation control system for each Generating Unit as detailed in CC.6.3.8 and Appendix 6 of the Grid Code Connection conditions. The User is also required to ensure that the settings as specified in Schedule 4 (Excitation System Parameters) of this Appendix are implemented. In satisfying the requirements of CC.6.3.2, CC.6.3.4 and CC.6.3.8, Generators are permitted to control the terminal voltage of the Onshore Synchronous Generating Unit above 1.0p.u of rated terminal voltage. If the Generator chooses to operate its Generating Unit in excess of 1.0p.u, they should notify The Company of the maximum terminal voltage set point and the terminal voltage set point resolution (if not continuous) in accordance with PC.A.5.3.2(a).
8.	Fault Ride Through	*All except small BEGAs*	CC.6.3.15	The User: To meet the requirement of CC.6.3.15. The total fault clearance time on the National Electricity Transmission System shall be 140ms.
9.	Sub-Synchronous Resonance	*Synchronous plant only*	PC.A.5.3.2(g)	The User: To supply each Generating Unit's mechanical parameters and mechanical frequencies in accordance with PC.A.5.3.2(g) of the Grid Code. To assess the risk of Sub-Synchronous Resonance and related conditions to ensure that no existing or new modes of interaction are present, or ensure where such modes occur they are positively damped. To agree the details with The Company of this assessment during the detailed design phase. The Company reserves the right to review the nature of any mitigation measures presented and will require models to be provided to represent the effect of any applicable design measures to mitigate the risk.
10.	Trading Point Electronic Data Transfer (EDT), Control Points, Control Telephony and Control Point	*All except small BEGAs*	CC.6.5.8(a) CC.7.9 OC.7 BC.2 CC.6.5.2 to CC.6.5.5 CC.6.5.8, CC.6.5.9 and BC.1.4.1 CC.6.5.8(b)	The User: To fulfil the obligations defined in schedule 1 of this appendix.

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	Electronic Dispatch and Logging (EDL)			
11.	Control Point	*All directly connected and those with a BEGA or BELLA also*	CC.7.9	The User: As required under BC2.9 of the Grid Code, the User will be required to respond to Emergency Instructions, some examples of which are described in BC.2.9.1. In order to fulfill these requirements, it is envisaged that the User has the ability to de-energise all their electrical equipment by ensuring it can open circuit breakers remotely and safely from their Control Point without delay and, where applicable, has the ability to open/close its busbar disconnectors at the Grid Entry Point (or User System Entry Point *(if Embedded))* remotely and safely from their Control Point without delay. For the avoidance of doubt, this functionality is generally required to enable timely restoration of the Transmission System and prevent delays to the return to service of User's Plant and Apparatus following receipt of such an instruction.
12.	Operational Metering	*All*	CC.6.5.6	The User: To fulfil the obligations defined in schedule 2 of this appendix.
13.	Dynamic System Monitoring	*If required, generally if generator is greater than 5X large*	CC.6.6	The User: To fulfil the obligations defined in schedule 3 of this appendix.
14.	Ancillary Services monitoring	*Only if generator has an MSA (ie usually greater than 50MW)*		The User: To install Ancillary Services Monitoring equipment and provide communication facilities allowing remote access of the data to The Company. The Ancillary Services Monitoring equipment shall be capable of recording values of Active Power output, Reactive Power output and frequency with a minimum sampling rate of 1Hz derived from Settlement Metering as specified in Schedule 2. The Ancillary Services Monitoring requirements are detailed in TS 3.24.95_RES (Ancillary Services Monitoring). In the event that any part of the User's equipment fails (including the communications routes) up to The Company's interface, then the User shall be required to repair the equipment within 5 days of the fault unless otherwise agreed.
15.	Voltage Unbalance	*Direct Connect only Scottish TOs will specify in TOCA*	CC6.1.5(b) CC6.1.6	The User: To provide Voltage Unbalance Assessment information as specified in PC.4.4.1, PC.4.4.2, PC.4.5, PC.A.4.7 and DRC.6.1.5 Schedule 5, of the Grid Code. The Company: To carry out voltage unbalance assessment in accordance with CC.6.1.5(b) and CC.6.1.6. Following the assessment, The Company will (where applicable) specify to the User (by written notice), the negative phase sequence current limits to which The User will comply.

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16.	Electromagnetic Transients, Voltage Fluctuations and Transformer Energisation	*Direct Connect only Scottish TOs will specify in TOCA*	CC.6.1.7(a) CC.6.1.7(b)	The User: To minimise the probability and severity of electromagnetic voltage transients or transformer inrush at the Grid Entry Point which may occur when the User's Plant and Apparatus, Generating Unit or any material subsystem is connected to or disconnected from the National Electricity Transmission System. The User shall provide the Company with details of such measures and an assessment of the predicted probability and severity of such transients or transformer inrush. In the event that The Company needs to undertake transient overvoltage assessments or voltage assessment studies, The User will be required to provide the data required under PC.A.6.2.1 or PC.A.6.5 of the Grid Code.
17.	Harmonic Performance	*Direct connect only, if required. Only if it is a variable speed drive machine should you check with Quality of Supply the text for windfarms is in the section below*	CC.6.1.5	The User: To provide The Company with a harmonic performance assessment in accordance with Engineering Recommendation G5/4-1 which relates to the impact of variable speed drives within the User's auxiliary systems. Should harmonic mitigation measures be required, the User shall cooperate with The Company in providing such measures.
18.	Power Quality Monitoring	*For Direct connect synchronous only. To be arranged with NO in Scotland*		The Company: To provide three phase voltage transducers of suitable accuracy and these shall be appropriately sited at [XXXX] kV substation to enable continuous power quality voltage monitoring to be undertaken whether or not the User's System is energised. To also provide three phase current transducers of suitable accuracy at the [XXXX] kV substation to enable continuous power quality current monitoring to be undertaken. [A current transducer would be suitable for power quality monitoring if it is also compliant with International Standard IEC 60044-6 "Requirements for protective current transformers for transient performance".] To install permanent, Class A power quality monitors as defined in IEC 61000-4-30 at the Grid Entry Point in order to check compliance against the Grid Code.

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19.	Paralleling	*Direct Connect only*		The User: To ensure there is no paralleling of The National Electricity Transmission System through the User's System.
20.	Safety and Operational Interlocking	*Direct Connect only*		The User: Electrical and mechanical interlocking to be provided by the User in accordance with TS.3.01.01_RES/SPTS/SHETS.
21.	Earthing Facility	*Direct Connect only. To be arranged with NO in Scotland.*		The Company/Relevant Transmission Licensee: All earth mats on the User site(s) and The Company's/ the Relevant Transmission Licensee's site(s) where these are adjacent may be bonded together. The Company's/ Relevant Transmission Licensee's site earth mats can be bonded to the User's site earth mat. The User: To carry out an earthing survey of their sites prior to construction of the User's Plant and Apparatus. The earthing system is to be designed to withstand a short circuit current of [XX kA for YY seconds] *(63 kA for 1 second at 400 kV substations, 40kA for 1 second at 275 kV substations and 40kA for 3 seconds at 132 kV substations) (Note this will depend on connection voltage)*. The User shall ensure that it's Plant and Apparatus is designed and installed such that the rise of earth potential (ROEP) at [XXXX] kV substation conforms to the touch, step and transfer voltage limits which are defined in ENA TS 41 – 24. Where intertripping (second main protection) is required to open circuit breakers, the overall fault clearance time shall not be more than [XXXX] ms at [XXXX] kV substations. *140ms at 400kV substations, 160ms at 275kV substations and 180ms at 132kV substations (Note this will depend on connection voltage)*. The User's earthing system design review shall take The Company's/Relevant Transmission Licensee's earthing system design into account and the User shall collaborate with The Company/Relevant Transmission Licensee to ensure that compliance has been demonstrated at the Grid Entry Point which also mitigates 3rd party impact as required. The earthing system at [XXXX] kV substation shall be designed to comply with ESQCR 2002 and BS EN50522.
22.	Compliance Testing	*All*		The User: To demonstrate compliance with the requirements of the Grid Code.
23.	Settlement Metering	*Only if participating in BM if the User is connecting to a GIS*	CC.6.2.2.3.5	The User: To provide CTs/VTs that comply with the relevant metering Code of Practice required for Settlement. To provide the Settlement Meters and register compliant items of Metering Equipment for Settlement purposes. All of the above to be completed prior to energisation and in accordance with the Balancing and Settlement Code (BSC).

		substation then speak to Policy team		
24.	Loss of Mains Protection	*Embedded only*		The User: If required by the host Distribution Network Operator, loss of mains protection to be provided by a means not susceptible to spurious or nuisance tripping. The User to discuss and agree with The Company, the type, settings and philosophy used in any protection scheme.
25.	Site Specific HV equipment requirements	*Only to be included if circuit breaker ratings at site are close to the limit, In Scottish agreements this should only be included if specified in the TOCA.*		The User In view of the operating time assumptions and the generation concentrations around the connection site, an atypical circuit breaker capability specification may be required to ensure the User's equipment operates within its proven capability. All User's bay HV equipment needs to continue to conform to the RES noting that the studied DC component of fault duty upon the switchgear is such that a DC time constant of [XXXX] ms is observed at time of break, with fault levels at the connection site busbar now standing at [XXXX] kA RMS break for a single phase-ground fault. Any equipment installed needs to be rated to withstand levels observed in the planning studies. As a minimum the User's HV bay equipment shall be rated to match The Company's existing (*if there are known plans to uprate the substation or planned asset replacement works on site which will increase switchgear ratings include National Grid's planned CB rating information*) HV substation circuit breaker ratings. The Company's existing substation equipment is rated to *(SD Engineer to add the existing nominal substation switch gear ratings here -)* [XXXX] kA RMS break for a three phase fault and - [XXXX] kA RMS single phase-ground break at a DC time constant of some [XXXX]ms.
26.	Sub-synchronous Resonance	*All synchronous generation*		The Company may specify to the User a set of characteristics depicting the electrical damping the User's Generating Unit(s) are expected to experience over the sub-synchronous frequency range. The User shall inform The Company of any Sub-Synchronous Oscillations that it believes to be insufficiently damped ("Unacceptable Sub-Synchronous Oscillations"). Where a risk of Unacceptable Sub-Synchronous Oscillations has been identified, the User and The Company shall agree the site specific requirements and the works, including any Transmission Reinforcement Works and/or User Works, required to ensure that all Sub-Synchronous Oscillations are sufficiently damped. Neither the User nor The Company shall unreasonably withhold their agreement to these works. The Company shall provide the User with an updated set of electrical damping characteristics reflecting the effect

				of the agreed Transmission Reinforcement Works. The Company reserves the rights to review the designs and request the models of any measures the User implements in order to prevent Unacceptable Sub-Synchronous Oscillations. Where necessary, The Company may also require that the User installs Sub-Synchronous Oscillations monitoring equipment. There is no requirement on the User to install any Sub-Synchronous Oscillations protection.
27.	Sub-synchronous Resonance	*All power park modules*		The Company may specify to the User a set of characteristics depicting the network resistance and reactance as seen by the User's Power Park Module(s) over the sub-synchronous frequency range. The User shall inform The Company of any Sub-Synchronous Oscillations that it believes to be insufficiently damped ("Unacceptable Sub-Synchronous Oscillations"). Where a risk of Unacceptable Sub-Synchronous Oscillations has been identified, the User and The Company shall agree the site specific requirements and the works, including any Transmission Reinforcement Works and/or User Works, required to ensure that all Sub-Synchronous Oscillations are sufficiently damped. Neither the User nor The Company shall unreasonably withhold their agreement to these works. The Company shall provide the User with an updated set of network resistance and reactance characteristics reflecting the effect of the agreed Transmission Reinforcement Works. The Company reserves the rights to review the designs and request the models of any measures the User implements in order to prevent Unacceptable Sub-Synchronous Oscillations. Where necessary, The Company may also require that the User installs Sub-Synchronous Oscillations monitoring equipment. There is no requirement on the User to install any Sub-Synchronous Oscillations protection.
28.	Frequency and Time Recording	*Critical sites in Scotland only*		<u>The User:</u> To provide and install Frequency and Time Recording Equipment to monitor the frequency at the User's site and provide communication facilities of the signals to [XXXX] kV Transmission Substation. <u>The Company:</u> To install the communications channels to [XXXX] kV Transmission Substation to access the Frequency and Time recording signals provided by the User. The functionality, performance, availability, accuracy, dependability, security, configuration, delivery point, interfacing arrangements, protocol and repair times of the equipment generating and supplying the Frequency

				and Time Measurement signals (ie the monitors and communication links), to the Transmission Site at [XXXX] kV substation shall be agreed with The Company and Relevant Transmission Licensee at least 12 months before the Completion Date [Stage 1].
29.	All of the below	*Wind farm only*		
30.	MW output profile submissions	*BELLAs only*	CC.6.5.8(a) BC1	The User: Required to submit Physical Notifications (PNs) and Maximum Export Limits (MEL). This can be via EDT or the web based MPSI system.
31.	Voltage Control Performance Requirements	*All wind farms except small BEGAs*	CC.6.3.8	The User: To install a continuously acting automatic control system to provide control of the voltage at the Grid Entry Point (or User System Entry Point if embedded) as detailed in CC.6.3.8 of the Grid Code. The performance requirements of this control system are detailed in Appendix 7 of the Grid Code Connection Conditions. To declare to The Company, the ability of each Power Park Module to contribute to voltage control below 20% of Rated MW output. As a minimum and as specified in CC.6.3.8(a)(iii) of the Grid Code, if voltage control is not being provided below 20% of Rated MW output, the User shall ensure that the control system of each Power Park Module shall be designed to ensure a smooth transition between the shaded area bound by CD and the non shaded area bound by AB in Figure 1 of CC.6.3.2 (c) of the Grid Code.
32.	Power Oscillation Damping	*PSS Not required - Customer choice*	BC.2.11.2	The User: There is no requirement for the voltage control system to be fitted with a Power System Stabiliser (PSS). However if the Generator chooses to install a PSS within the Power Park Module voltage control system, its settings and performance shall be agreed with The Company and commissioned in accordance with BC.2.11.2 of the Grid Code.
33.	Reactive Power Limiters	*Only if required and specified in the TOCA*		
34.	Power Quality Monitoring	*Direct connect only Check with the Scheme Team Rep to see if Quality of Supply Monitoring is required. In Scotland the TO will specify in*		The User: To provide three phase voltage transducers of suitable accuracy which are appropriately sited at the Point of Common Coupling to enable continuous power quality voltage monitoring whether or not the Power Park Module is energised. Examples of suitable voltage transducers are detailed in TS 3.02.05 “Voltage Transformers” (with particular reference to Section 1.3) or, alternatively, in TS 3.02.12 “Voltage Dividers”. To provide three phase current transducers of suitable accuracy on the User’s feeders at The Company’s [XXXX] kV substation at the Grid Entry Point to enable continuous power quality current monitoring. The current transducers on the User’s feeders shall be sited such that the monitored currents include any contribution from reactive power compensation and / or harmonic mitigation equipment.

		the TOCA if required.		The transducer is required to meet TS 3.02.04_RES (Current Transformers for Protection and General Use). A current transducer is suitable for power quality monitoring if it is also compliant with International Standard IEC 60044-6 "Requirements for protective current transformers for transient performance". The User to provide the output signal of these voltage and current transducers to The Company. The Company: To install permanent, Class A power quality monitors as defined in IEC 61000-4-30 at the Grid Entry Point in order to check compliance against the specified limits. To undertake a four week period (unless otherwise agreed) of continuous power quality voltage measurements using the above facilities immediately prior to the energisation of the User's feeders to establish a baseline for compliance with the Grid Code. Continuous power quality monitoring shall then be performed during and after commissioning.
35.	Voltage Waveform Quality	*Direct connect E&W wind farms only*	CC.6.1.5(b) CC.6.1.6	The User: To provide The Company with Harmonic Assessment information as specified in PC.4.4.1, PC.4.4.2, PC4.5, PC.A.5.42(h), DRC.6.1.1 Schedule 1 and DRC.6.1.5 Schedule 5 of the Grid Code so that The Company can carry out harmonic voltage distortion and fluctuation assessments in accordance with Grid Code conditions CC.6.1.5(a) and CC.6.1.7 respectively. The Company: Following the above assessments, The Company to specify to the User (by written notice), the harmonic voltage distortion or harmonic current emission limits (as appropriate) and to specify voltage fluctuation limits. The User shall comply with the above limits. The specification of the above limits will normally be calculated using the data provided by the User. If the User subsequently notifies The Company of any changes to such data, The Company reserves the right to amend the limits and to issue revised limits to the User following any revised Voltage Waveform Quality Assessment.
36.	Switching Groups	*All wind farms*	PC.A.3.2.2(k) PC.A.3.2.4 OC2.4.2.1(f)	The User: To notify The Company of any change to the number, type or configuration of Power Park Units within each Power Park Module. To ensure that each Power Park Module is capable of meeting the full requirements of the Grid Code and this Bilateral Agreement (including but not limited to matters of quality of supply requirements, fault infeed and reactive capability) irrespective of the connection configuration of each Power Park Unit within each Power Park Module.

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37.	Additional data for new types of Power Stations and configurations	*Tidal only*	PC.A.7	The User: Should be aware that The Company may reasonably require additional data to correctly represent the performance of the User's Plant and Apparatus where the present data submisisons would prove insufficient for the purpose of producing meaningful studies.
38.	Power Export	*Tidal only*		The User: Shall ensure that the total output from each Power Park Module does not exceed its Transmission Entry Capacity (TEC) and Connection Entry Capacity (CEC) to prevent unacceptable overloads on the National Electricity Transmission System. The standard deviation of generation output over a 30 minute period must not exceed 2.5 percent of the power park module's registered capacity.

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Appendix F5 - Schedule 1
Site Specific Technical Conditions - Communications Plant (CC.6.5)

Description	Location	Source	Provided By	Comments
Control Telephone CC.6.5.2 to CC.6.5.5, CC.6.5.8, CC.6.5.9 and BC.1.4.1	Control Point	The Company /Transmission Substation Exchange.	The User to provide and install wiring from the User's Control Point to The Company substation exchange, and install free issue handset The Company/Relevant Transmission Licensee to provide communications path to the User's Control Point site (Great Britain only) in conjunction with the User. *Delete this paragraph if a BELLA* The Company to provide handset only The relevant Transmission Licensee to provide Red handset only *(Scotland only)*	Control Telephony provides secure point to point telephony for routine Control Calls, priority Control Calls and emergency Control Calls. If the User intends to have a nominated Trading Point/Control Point outside of GB, The Company will provide the communication routes and Control Telephony facilities to the User's Control point but will charge the User for the overseas element of this work including any ongoing regular maintenance. Any subsequent relocation of Control Point will be charged to the User by The Company.
PSTN (or other off-site communications circuits) for Telephony. (CC.6.5.2 to CC.6.5.5 and CC.7.9, OC.7 and BC.2)	Trading Point, Control Point	Public Telephone Operator (PTO).	The User to provide a Control Point in accordance with CC.7.9 of the Grid Code. Wiring to the Public Telecommunications Exchange including handset to be provided by The User.	Data and speech services required by The Company shall be cabled from the User site to the Public Telecommunications Exchange. The User shall only use the PSTN facilities for voice communcations with The Company as detailed in CC.6.5.4.5 and CC.6.5.5.2 of the Grid Code. The User's control point must be immediately and directly contactable by The Company at all times and operators should be able to communicate in clear plain English.

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Trading Point Data Transfer (EDT) (CC.6.5.8(a) and BC.1.4.1) *If a BELLA* : MW Output Profile Submission (CC.6.5.8(a) and BC.1.4.1) also	Trading Point	The Company Substation Exchange	User to provide and install EDT terminal The User to provide communications path to the EDT terminal in conjunction with The Company in order to submit the data required by the Grid Code. *If a BELLA and choose not to install EDT:* The Company to provide a web based platform. The User to provide terminal in conjunction with The Company with the requirements defined in the detailed design phase.	The Company to include site in instructor database and commission. Facility provided via Control Telephone and/or Facsimile machine. The User will provide the communications path for the EDT terminal from the User's Trading Point and can elect to send this to two locations (Warwick or Wokingham). The Company will provide the necessary connection and interfacing equipment at both locations. it the User intends to have a nominated Trading Point outside Great Britain, the responsibilities, functionality, dependability, security, procurement, configuration, delivery points, protocol and repair times of the communication links to be agreed with The Company 6 months prior to Completion Date[Stage 1]. *For BELLAs only:* If MPSI is selected the functionality interfacing, connection arrangements, delivery point, protocol, communications links, performance, security and dependability of the MW Output Profile Submissions will be agreed with The Company in the Detailed Design Phase.
Data Entry Terminals (Electronic Despatch & Logging (EDL)) (CC.6.5.8(b)) *(Required only if the User is required to provide all Part 1 System Ancillary Services and wishes to participate in the Balancing Mechanism)*	Control Point	Public Telephone Operator	User to provide and install EDL terminal approved by The Company which will permit submission and acceptance of Grid Code data between the User's Control Point and The Company continuously. The Company to provide communications path to the EDL terminal (Great Britain only) in conjunction with the User.	The Company will only provide the communications path to the EDL terminal where the Users Control Point is located in Great Britain. If the User intends to have a nominated Trading Point/Control Point outside of GB, The Company will provide the communication routes and Control Point Electronic Dispatch and Logging facilities to the User's Control point but will charge the User for the overseas element of this work including any ongoing regular maintenance. Any subsequent relocation of Control Point will be charged to the User by The Company.
Facsimile Machine (CC.6.5.9)	Trading Point and Control Point	Public Telephone Operator.	User to provide and install facsimile machine and wiring to PTO.	

NB The specifications for Control Telephony, EDT and EDL are defined in the Annex to the General Conditions of the Grid Code which is available on The Company's website at:-
http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

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Appendix F5 - Schedule 2
Site Specific Technical Conditions - Operational Metering Requirements in respect of The Company and Relevant Transmission Licensee *(Scotland only)* (CC.6.5.6)

Description	Units	Type	Provided by	Notes
MW and MVAr for each Balancing Mechanism Unit and Station Supplies derived from Boundary Point Settlement Metering System.	MW MVAr	Signals to have a 1Hz update rate or better and provide input to the Ancillary Services Monitoring equipment	User.	The User is required to install a Remote Terminal Unit (RTU) and supply the signals defined in this schedule. The Company will install the communications channels to {XXXX] substation in order to interface with the User's Operational Metering signals. *(delete this paragraph if in Scotland)* The functional performance, availability, accuracy, dependability, security, delivery point, protocol and repair times of the equipment generating and supplying the signals (ie the meters and communication links) shall be agreed with The Company at least 12 months before the Completion Date. In the event that any part of the User's Operational Metering equipment, including the communications links to The Company's/Relevant Transmission Licensee's [XXXX] kV substation fails, then the User will be required to repair such equipment within 5 working days of notification of the fault unless otherwise agreed. In the worst case, The User may be required to reduce its Maximum Export Limit (MEL) *or (Maximum Import Limit (MIL) for Generators which import power such as pumped storage stations)* as required by The Company. User to provide Single Line Diagram showing location of CT/VT equipment and nomenclature of HV Apparatus. The Company will use this information to notify the User of which HV circuit breaker and disconnector positions (ie status indications) are required. The nomenclature of Users equipment should be in accordance with OC11 of the Grid Code.
Individual alternator MW and MVAr *(applicable to multi-shaft CCGT Generators)*	MW MVAr	Signals to have a 1Hz update rate or better	User	
Individual unit transformer HV MW and MVAr. *(synchronous only)*	MW MVAr	Signals to have a 1Hz update rate or better	User.	
Voltage for each generator bay connection to The Company [XXXX] kV substation derived from single phase VT (usually a CVT).	kV	Signals to have a 1Hz second update rate or better	User. Note the User shall also make this signal available at its own Control Point for responding to Voltage Control Instructions from The Company	
Terminal Voltage of each Onshore Synchronous Generating Unit *(applicable only to Generators who wish to satisfy the requirements of CC.6.3.2, CC.6.3.4 and CC.6.3.8 by adjusting the Onshore Synchronous Generating Unit terminal voltage).*	kV	Signals to have a 1 second update rate or better	User.	
Frequency	Hz	Signals to have a 1Hz update rate or better and provide input to the Ancillary Services Monitoring equipment	User.	
Generator circuit(s) HV and LV circuit breaker(s) and disconnector(s) as agreed with The Company	Open / Closed Indication	Double point off dedicated auxiliary contacts (1 n/o and 1 n/c)	User.	
Each generator transformer Tap Position Indication (TPI)	TPI	Tap Position Indication	User.	

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Representative wind speed and direction of each Power Park Module *(wind farm only)*	m/s Degrees from North in a clockwise direction	Signals to have a 0.2 Hz update rate or better	User	
Representative tidal flow speed/tidal current and direction of each Power Park Module *(tidal only)*	m/s Degrees from North in a clockwise direction	Signals to have 1Hz update rate or better	User	
Power Available *(wind farms only)*	MW	Signals to have 0.2 Hz update rate or better	User	Power Available is defined in the Grid Code and is used by The Company to determine the Headroom available for the purposes of calculating Frequency response volumes and net System Reserve.

Note: The term 'Boundary Point Metering System' is defined in the Balancing and Settlement Code. In the event that any part of the User's Operational Metering equipment, including the communications links to [XXXX] kV substation fails, then the User will be required to repair such equipment within 5 working days of notification of the fault from The Company or Relevant Transmission Licensee unless otherwise agreed. The User shall also provide facilities to allow The Company/Relevant Transmission Licensee to monitor the health of the Operational Metering equipment up to the Grid Entry Point (or User System Entry Point if embedded).

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Appendix F5 - Schedule 3 *(only if required ie > 5X large, if not required delete table and text and replace with N/A)*
Site Specific Technical Conditions – Dynamic System Monitoring (CC.6.6.1)
The User is required to provide the dynamic system monitoring facilties on the User's circuits and provide communication facilities allowing remote access of data to the Company.

Description	**Type**	**Provided by**	**Notes**
Balancing Mechanism Unit 3 phase voltage and current at [[XXXX] kV substation derived from Settlement metering.	AC Waveforms	User	The functionality, performance, availability, accuracy, dependability, security, configuration, delivery point, protocol and repair times of the equipment generating and supplying the signals (ie the inputs, monitors and communication links) shall be agreed with The Company/Relevant Transmission Licensee at least 12 months before the Completion Date[Stage 1].
Dynamic System Monitoring and remote communications and interfacing on User Circuits at The Company's [XXXX] kV substation.	Monitors	User	Connection to enable data to be retrieved from Dynamic System Monitoring equipment. Connection to The Company/Relevant Transmission Licensee with connection, monitoring and security arrangements to be agreed with The Company/Relevant Transmission Licensee at least 12 months before the Completion Date[Stage 1].
	Communications Channels	User to provide signals and interface at The Company's [XXXX] kV substation	

In the event that any part of the User's equipment fails to deliver the information required at [XXXX] kV substation (including the communications routes) then the User shall be required to repair the equipment within 5 working days of notification of the fault from The Company/Relevant Transmission Licensee unless otherwise agreed. The User shall also provide facilities to allow The Company to monitor the health of the Dynamic System Monitoring equipment up to the Grid Entry Point.

Note:- The specification and performance requirements for Dynamic System Monitoring is detailed in Technical Specification TS 3.24.70-RES (Dynamic System Monitoring (DSM)).

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Appendix F5 - Schedule 4 *(synchronous plant only)*
Site Specific Technical Conditions – Excitation System Performance (CC.6.3.8, CC.6.A.6)

Note System Design must run stability studies to ensure the excitation system parameters selected are appropriate for the connection application (ie The Excitation Control System parameters quoted below should reflect the parameters used in the Excitation System model used in stability studies).

Grid Code CC.A.6 Clause	**Parameter**	**Setting**
CC.A.6.2.4.2	Upper and lower ceiling voltages to the Generating Unit field to be provided in a time not exceeding [50ms or 300ms]	Not exceeding [50ms or 300ms] *Note use 50ms for Static Excitation Systems and 300ms for rotating/ brushless excitation systems*
CC.A.6.2.4.3	The Exciter shall be capable of attaining an Excitation System On Load Positive Ceiling Voltage of not less than [2 p.u] of Rated Field Voltage when responding to a sudden drop in voltage of 10% or more at the Generating Unit terminals.	Not less than [2 p.u] *(Adjust depending on system design studies)*
CC.A.6.2.4.4 (i)	The field voltage should be capable of attaining a negative ceiling level of not less than [1.6 p.u] of Rated Field Voltage after the removal of the step disturbance as described in CC.A.6.2.4.3.	Not less than [1.6 p.u] *(Only applicable to static excitation systems – delete entire row if a rotating/brushless exciter)*

NOTE for embedded connections:- If the DNO has network restrictions that limit the steady state reactive output of the Generator, alternative steady state limits should be specified here. For all Mod Apps with a Completion Date before 1 January please see Policy.

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USEFUL LINKS

The Grid Code:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/The-Grid-code/

Electrical Standards:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

Extranet (ID and password required, email transmission .documentcontrol@nationalgrid.com to request access):

https://www.nationalgrid.com/uk/Engineering/default.asp

Connection Policies and Guidance:

http://www2.nationalgrid.com/uk/services/electricity-connections/policies-and-guidance/

Procurement Guidelines and Balancing Principles:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Balancing-framework/Transmission-license-C16-statements/

APPENDIX B

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APPENDIX F

TEMPLATE FOR A DEMAND CONNECTION WITH A STANDARD CONNECTION BOUNDARY (AIS) AT THE BUSBAR CLAMPS. IF THE CONNECTION IS TO A GIS SUBSTATION CONSULT POLICY FOR ADVICE

(NOTES – ALL SECTIONS IN [RED] TO BE SELECTED AS REQUIRED)

ALL SECTIONS IN YELLOW HIGHLIGHTED RED TEXT ARE WHERE A DECISION SHOULD BE MADE DEPENDING ON THE TYPE OF AGREEMENT

ALL SECTIONS IN YELLOW HIGHLIGHTED BLACK ITALLIC TEXT ARE FOR GUIDANCE AND SHOULD BE DELETED BEFORE COMPLETION

NOTE:- WHERE REFERENCE HAS BEEN MADE TO STAGE 1, THIS ONLY NEEDS TO BE INCLUDED WHERE THE DEVELOPMENT IS STAGED. IF THERE IS NO REFERENCE TO STAGING THIS REFERENCE CAN BE DELETED

AMENDMENTS RECORD

Issue	Date	Summary of Changes / Reasons	Authors	Approved by (including Job Title)
1	April 2015	Update and revision from comments received in 2014	A Johnson N Martin	G Stein Technical Policy Manager
2	May 2015	Updated to include Embedded Generation Issues	A Johnson A Minton	G Stein Technical Policy Manager
3	January 2016	Word “record” included in section 8.2 to correct typographical error	A Johnson	G Stein Technical Policy Manager
4	January 2016	Additional updates to include Active Network Management and SGT Reverse Power Flow	A Johnson A Minton	G Stein Technical Policy Manager
5	**17 Nov 2016**	**Operational Metering sampling rate change to 1s or 1Hz following customer feedback**	**A Johnson**	**Xiaoyao Zhou**
6	**28 Mar 2017**	**Addition of “trip relay” column in protection schedule of F4**	**Gihan Abeyawardene**	**Xiaoyao Zhou**
7	**28 Mar 2017**	**Update of F3 schedule 1 to reflect Active network management schemes**	**Dan Clarke**	**Xiaoyao Zhou**
8	**28 Mar 2017**	**Appendix F5 schedule 1, cross-site wiring obligation clarified**	**A Johnson**	**Xiaoyao Zhou**

TO	NG/SPT/SHET
MWs	
Direct/Embedded	
Generation or Demand	
Synchronous or asynchronous	
If Offshore, HVDC or AC connected	
If interconnector, CS or VS	

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(Please delete this page once it has been checked)

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APPENDIX F

SITE SPECIFIC TECHNICAL CONDITIONS
CONTENTS

(NOTES – ALL SECTIONS IN [RED] TO BE COMPLETED/DELETED WHERE APPROPRIATE)

User: [XXXX]

Connection Site: [XXXX]

Contents

Delete the Electrical Standard paragraph which does not apply

Electrical Standards *(E&W)*

These appendices contain references to The Company's Relevant Electrical Standards (RES) throughout. It is recognised by the User and The Company that the equipment installed at the date of this Agreement may not meet the requirements of the latest RES but were installed to the standards applicable at the time of design. Accordingly, unless a permanent alteration is made in the manner contemplated below then, the User shall not be required to make the equipment compliant with the RES and this Appendix F. (*Note this paragraph only applies to Existing Connection Sites.)*

These appendices contain references to The Company's Relevant Electrical Standards (RES) throughout. The User shall ensure that all User equipment contained within The Company's busbar protection zone at the User/The Company Connection Point (see Grid Code CC 6.2.1.2) complies with the RES. The User shall ensure that subject to the provisions of Grid Code CC.6.2.1.2 following this agreement, any permanent alterations to all User equipment contained within the Company busbar protection zone at the User/Company connection point are agreed between the User and The Company. The User can access the RES from The Company's website at which is available at:-

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

The RES is updated periodically. If the RES is updated in the period between issuing the Connection Offer and the User completing the connection to The Company Transmission System then The Company will seek agreement with the User to use the updated RES as the standard for plant and apparatus at the Connection Point.

Electrical Standards *(Scotland)*

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These appendices contain references to The Scottish Electrical Standards for SPT's Transmission System (SPTS)/ Scottish Electrical Standards for SHET's Transmission System (SHETS) or The Company's Relevant Electrical Standards (RES) throughout. The User shall ensure that all User equipment contained within Relevant Transmission Licensee's busbar protection zone at the User /National Transmission Connection Point (see Grid Code CC 6.2.1.2) complies with the SPTS/SHETS. The User can access the RES from The Company's website which is available at:-

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

It is recognised by the User, the Relevant Transmission Licensee and The Company that the equipment installed at the date of this Agreement may not meet the requirements of the latest SPTS/SHETS or RES but were installed to the standards applicable at the time of design. Accordingly, unless a permanent alteration is made in the manner contemplated below then, the User shall not be required to make the equipment compliant with the SPTS/SHETS or RES and this Appendix F. *(this paragraph applies only to existing sites)*

The SPTS/SHETS and RES are updated periodically. If the SPTS / SHETS or RES is updated in the period between issuing the Connection Offer and the User completing the connection to the National Transmission System then The Company will seek agreement with the User to use the updated RES and SPTS/SHETS as the standard for plant and apparatus at the Connection Point.

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APPENDIX F1

SITE SPECIFIC TECHNICAL CONDITIONS
AGREED ANCILLARY SERVICES

User: [XXXX]

Connection Site: [XXXX]

Agreed Ancillary Services

[not applicable] *(use this text for DNO or traction agreements but delete if it is DSB)*

If a Demand Side Bidder include the following text, if not delete it

There is no requirement for the User to provide Mandatory Ancillary Services. However the User may wish to declare to The Company their ability to provide Commercial Ancillary Services (Agreed Ancillary Services) and the cost of providing such facilities.

There is no obligation to provide these facilities however The Company would recommend that the User contacts The Company prior to the construction phase of its project to i) discuss the provision of any such services which can be provided and ii) install the necessary hardware (if such additional services are agreed) to allow monitoring facilities to be installed.

Details of the types of Balancing Service and methods of securing them are contained in The Company's Procurement Guidelines and Balancing Principles.

NOTE there is no requirement for Demand Customers to provide Ancillary Services, however should they wish to do so it may be worth including these paragraphs. CHECK WITH CONTRACT SERVICES.

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APPENDIX F2

SITE SPECIFIC TECHNICAL CONDITIONS
DEROGATED PLANT

User: [XXXX]

Connection Site: [XXXX]

Derogated Plant

Not applicable.

APPENDIX A

APPENDIX F3

SITE SPECIFIC TECHNICAL CONDITIONS
SPECIAL AUTOMATIC FACILITIES

User: [XXXX]

Connection Site: [XXXX]

Special Automatic Facilities

2. Transmission System to Generating Unit Intertripping Schemes

Not applicable – *unless specified by the TO*

But, if a BELLA GSP in Scotland, include the following paragraphs

These requirements will largely be dictated by SPT or SHET as defined in the TOCA. When the template has been populated it should be sent to SPT or SHET for checking.

Category/Substation	Grid Code Ref	CUSC ref	Trip within (ms)	Obligation
	BC2.10.2(a)	CUSC4.2A CUSC2.9.3		See schedule 1 for associated trips/outage combinations

This Transmission System to Generating Unit(s) intertrip is classified as a category '[XXXX]' intertripping scheme, as defined in the Grid Code.

Where the User is required to facilitate a generator intertrip function on plant belonging to an Embedded Generator, the User shall include all information in accordance with those provisions within Appendix F4 and include all relevant information within Schedule 1 of Appendix F4.

The User shall install and maintain the interface to the intertripping facility such that, on receipt of an appropriate signal(s) from the Transmission System, the selected Embedded Power Station will trip within 200ms by opening the appropriate User's circuit breakers to ensure the Active Power Output of the Embedded Generator is reduced to sero MW.

The User shall install selection facilities to switch the intertrip scheme into and out of service.

The User agrees that The Company shall, in operational timescales, issue an Ancillary Services instruction to the Embedded Generator for the arming of the intertrip facility in respect of the [XXXX*] (name of power station)* pursuant to the Grid Code BC2.8 and CUSC 4.2A. The Embedded Generator [XXXX] shall then instruct theUser to switch the intertrip into service. *(amend this paragraph if alternative arrangements have been specified in the TOCA.)*

Upon instruction from the Embedded Generator [XXXX] (following an instruction from The Company), The User is required to switch the intertrip into service for the scenarios defined in Schedule 1.

General

The User shall co-operate with The Company in enhancing/amending these facilities, should The Company require this at a later date, and will not unreasonably withhold its agreement to any such proposals.

Except where CUSC 4.2A.6 applies, any such changes of this Appendix F3 and/or to The Company's and/or the User's obligations in respect therefore shall be subject to the provisions of Paragraph 2.9.3 of the CUSC.

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Special Automated Facilites

Requirement	
Transmission System to Demand Intertripping Scheme	N/A unless specified
Transmission System to Directly Connected Customers Intertripping Schemes	N/A unless specified

Other Facilities

Requirement	
Automatic Open/ Closure Schemes	N/A unless specified
System Splitting/Islanding Schemes	N/A unless specified

Note: these are generally not applicable but may be required for example to manage fault level restrictions or to enable automatic post fault switching.

Active Network Management Scheme

(Note- This requirement may or may not be required depending on the connection topology. For further advice contact the SO Network Capability - GB System Operability Team)

This Active Network Management Scheme (ANM) is required to limit the real and reactive power flow at [XXXX]kV substation following faults on the National Electricity Transmission System.

Where the User is required to provide an ANM facility, the User shall include all information in accordance to those provisions within Appendix F4 and include all relevant information within Schedule 1 of Appendix F4.

The User agrees that The Company shall, in operational timescales issue an instruction for the arming of the ANM facility. The Company shall arm the ANM scheme for one or more of the outage combinations as specified in Schedule 1 of Appendix F3.

The User shall install equipment that will accept signals from The Company's marshalling cubicles at [XXXX]kV substation such that upon receipt of a signal by The Company, the total MW and MVAr export at [XXXX]kV substation shall be reduced to a defined export value. This defined export value will be notified by The Company to the User either when the scheme is armed or as Transmission System conditions change. In any event, the defined export value will be notified to the User during pre-fault conditions.

The User shall install and maintain an ANM facility such that, on receipt of an appropriate signal(s) from The Company, the User shall reduce the total MW and MVAr export at [XXXX]kV substation within 10s. This shall form part of the User System.

The ANM scheme will be monitored to ensure it is healthy at all times and provide indications to The Company. The functionality, performance, availability, accuracy, dependability, security and repair times of the communications links, trip facilities and monitoring facilities provided by the User from The Company's marshalling cubicles located in [XXXX]kV substation to the User's interface shall be agreed with The Company at least 24 months before the Completion Date.

In the event that the ANM is not healthy, The Company shall instruct the course of action to be taken. In the worst case, the User may be required to reduce the MW and MVAr export capacity at [XXXX]kV substation as required by The Company.

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No single hardware, software, system, communication, interface or power supply failure or depletion of facility shall result in failure to trip within the specified time or an incorrect control action.

The User shall install isolation facilities to locally switch the ANM facility out of service. The User shall not isolate the intertripping facility unless otherwise agreed with the Company.

For the avoidance of doubt, The Company will provide the necessary signals at the marshalling cubicle within [XXXX]kV substation. The User is responsible for the installation and maintenance of the cabling between the marshalling cubicle and the User's interface equipment.

General

The User shall co-operate with The Company in enhancing/amending these facilities, should The Company require this at a later date, and will not unreasonably withhold its agreement to any such proposals.

SGT Reverse Power Flow Control Scheme

In order to protect The Company's Supergrid Transformers (SGT's) from the risk of trip as a result of excessive overloads from the Embedded Generation installed within the [XXXX] group, the User is required to design, own, operate and install an SGT Reverse Power Flow Control Scheme (referred to in this technical appendix as "the Scheme"). The Scheme will be required to control the pre-fault loading on the Grid Supply Point as well as provide the means in effect to intertrip embedded generation in the case of an SGT fault.

It is the User's responsibility to design the SGT Reverse Power Flow Control Scheme to manage the embedded generation levels such that the total export limit at [XXXX]kV Substation is limited to the values defined in Schedule 2 of Appendix F3 under both intact and planned outage conditions. The scheme must be permanently armed and meet the following requirements.

The User shall ensure that the Scheme is capable of maintaining the prefault loading on each of the SGT's at [XXXX]kV substation within the limits specified by The Company as detailed in Schedule 2 of Appendix F3. In addition, the User's scheme shall ensure that the post fault export across each of the SGT's at [XXXX] kV substation are reduced to the values specified in Schedule 2 of Appendix F3 within 5s. This shall form part of the User System.

The Scheme will be monitored to ensure it is healthy at all times. The User shall inform The Company of any issues related to the scheme that impact on the operation of the Transmission System. In the event that the scheme is not healthy, the User will take measures to ensure the Connection Asset Reverse Power Limit defined in Appendix G Schedule 1 part 5 is met.

The Company will provide the necessary SGT signals (CT, VT and plant status) at a marshalling cubicle within [XXXX] kV substation (ie the Grid Entry Point).

The User shall be responsible for taking these signals from the Grid Entry Point to the User's Scheme. Any additional equipment required to adapt the above signals to the User's scheme requirements shall be supplied, installed, commissioned and maintained by the User.

The scheme and associated interface engineering shall be jointly agreed between The Company and the User at least [XXXX] months before the Completion Date [Stage 1].

The User shall demonstrate the suitability of the scheme to The Company through engagement at the detailed design phase, factory tests and on site performance validation tests. The requirements shall be agreed with The Company at least [XXXX] months before the Completion Date [Stage 1]. In addition, the User is also required to supply the additional information as detailed in Schedule 3 of Appendix F3 for agreement with The Company at least [XXXX] months before the Completion Date [Stage 1].

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The User shall be responsible for the installation, maintenance and overall costs of the Scheme.

For the avoidance of doubt this scheme does not and will not replace the existing SGT Transformer protection.

General

The User shall co-operate with The Company in enhancing/amending these facilities, should The Company require this at a later date, and will not unreasonably withhold its agreement to any such proposals.

Synchronising

(England and Wales)
NOTE:- Where National Grid owns the LV busbars, use the following paragraph and delete all others.

The User will be required to provide measurement of the voltage on the User's incoming feeders (on circuits where there is a possibility of back feed) to the Company's voltage selection scheme in accordance with TS.3.24.60_RES.

NOTE:- Where National Grid does not own the LV busbars, delete other paragraphs and use the following:

The User will be required to provide measurement of the busbar voltage references in accordance with TS.3.24.60_RES via a voltage selection scheme to enable The Company to carry out synchronising of The Company's circuits. The Company will also contribute to the User's voltage selection scheme.

(Scotland)
NOTE:- for all Scottish demand agreements use the following paragraph.

The User will be required to provide measurement of the busbar voltage in accordance with the SPTS/SHETS as part of the synchronising facility, and for use as part of the Automatic Control Scheme employed on the transformer circuits (where such a facility is installed).

There is no requirement for a synchronising facility between the Embedded Generator and the Transmission System. *(this para for BELLAs only)*

For traction agreements use the following paragraph and delete all others, if there is a possibility of a back feed further information should be sought from Asset Engineering/Core Construction:

There is no requirement for a synchronising facility, however the User shall ensure that an interlocking scheme is provided to prevent the risk of back feeding the National Electricity Transmission System.

NOTE:- For a DSB, delete the above paragraphs and use the following (this assumes the User owns the busbar):

The User will be required to provide measurement of the busbar voltage in accordance with TS.3.24.60_RES as part of the synchronising facility. The details of such an arrangement will be discussed and agreed in the detailed design phase. This will be no longer than 12 months before the Completion Date [Stage 1]

Automatic Voltage Control

Not applicable for BELLAs, and for traction agreements, in most traction agreements it is likely that a HV ATCC will be specified and no User requirement will be necessary. The exception to

this rule would be in the event of a non standard ownership or connection agreement (eg where the owner owns the Transformer). This should be advised by the relevant TO.

Not less than 3 months before the Commissioning Programme Commencement Date for the agreed works, the User will agree settings for the Automatic Tap Change Control (ATCC) with The Company and Relevant Transmission Licensee. Any subsequent alterations to the ATCC settings shall be agreed between The Company, the Relevant Transmission Licensee and the User.

It is envisaged that the new SGT(s) will be integrated into the existing SGT Automatic Voltage Control System. *(this para where applicable)*

The User must also provide switchgear status relevant to busbar topology and voltage references to The Company to enable The Company to implement ATCC to control the 132kV busbar voltage. *(this para E&W DNO only)*

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Appendix F3 - Schedule 1 *(delete if not required)*

Site Specific Technical Conditions – Circuits to be selected for the Active Network Management Scheme

Selection	**Circuit Name**
1	
2	

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Appendix F3 – Schedule 2 - SGT Reverse Power Flow Control – GSP Limits
Current GSP limits at [XXXX] kV substation

Insert as many combinations as required to cater for all eventualities. For further advice consult the SO Network Capability - GB System Operability Team

System Conditions	Allowed Export Limits	
	Intact Prefault loading Conditions (MVA)	Maximum Post fault loading Conditions (MVA)

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Appendix F3 – Schedule 3 - SGT Reverse Power Flow Control
SGT Reverse Power Flow Control Design Settings

As part of the design of the SGT Reverse Power Flow Control Scheme the User is required to provide The Company with details of the following:-

- SGT overload response profiles
- Automatic response times
- Deload / trip Settings
- Failure detection times
- Number of preselected de-load settings
- Additional information as may reasonably be required by The Company during the detailed design phase.

The above information is required to be submitted by the User and supplied to The Company as part of the Compliance Process at least [XXXX] months before the Completion Date [Stage 1].

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APPENDIX F4

SITE SPECIFIC TECHNICAL CONDITIONS
RELAY SETTINGS & PROTECTION

User: [XXXX]

Connection Site: [XXXX]

Relay Settings & Protection

System Design must ensure that any requirements for protection are consistent with the Design Specification Investment Proposal and checked by construction or the relevant TO.

1. Relay Settings
(CC.6.2.3.4)

The User shall complete the attached blank protection schedule pro-forma (Schedule 1 of this Appendix). The User shall submit the protection settings on its plant for agreement with The Company and the Relevant Transmission Licensee. This shall include details of the following:

a. Circuit diagrams of both ac connections and tripping for the purposes of interpreting the schedule.
b. Proposed back-up protection grading curves to allow The Company and the Relevant Transmission Licensee to assess adequacy of co-ordination.
c. Details of the Protection Dependability Index per protected zone.

Not less than 3 months before the Commissioning Programme Commencement Date (as defined in the CUSC) for the agreed works, the User shall have agreed the protection settings on the User's equipment with The Company and the Relevant Transmission Licensee. The Company and the Relevant Transmission Licensee shall then finalise the protection settings on The Company's own/ Transmission System equipment, complete the protection schedule with supporting details where necessary, and supply it to the User.

Any subsequent alterations to the protection settings (whether by the User or The Company or the Relevant Transmission Licensee) shall be agreed between The Company and the User in accordance with the Grid Code (CC.6.2.3.4).

No User equipment shall be energised until the protection settings have been finalised. The User shall agree with The Company, and carry out a combined commissioning programme for the protection systems, and generally, to a minimum standard as specified in The Company Transmission Procedure (TP) 106 which is available from The Company's Extranet. Access to The Company's Extranet can be requested via E-Mail to:- transmission .documentcontrol@nationalgrid.com. / by the Relevant Transmission Licensee.*(delete as appropriate)*

2. Grid Supply Point Protection Arrangements
(CC 6.2.3.1)

For main protection systems, the fault clearance time (from fault inception to circuit breaker arc extinction) for faults on all the User's equipment directly connected to The Company Transmission System shall meet the following minimum requirement(s): -

[400kV within 80ms or 275kV within 100ms or 132kV and below within 120ms] *(will vary depending on connection voltage)*

Where intertripping is required to open circuit breakers, the overall fault clearance time shall not be extended by more than 60ms to allow such intrtripping to operate.

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The maximum backup fault clearance time at 132kV and below is 1.5s. *(will vary depending on connection voltage for 400kV should be less than 300ms)*

3. Engineering Recommendation P24 (*for traction agreements only)*

It is proposed that the protection arrangements for the supply point will be generally in accordance with The Company's application and settings policy PS(T) 063 and *(E&W only)* Engineering Recommendation P24 "AC Traction Supplies for Network Rail".

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APPENDIX F4 - Schedule 1

PROTECTION AND INTERTRIPPING DETAILS AT THE COMPANY/ USER INTERFACE

SITE NAME:

CIRCUIT NAME*:
* where a feeder exists between two sites, a separate schedule will be required for each end.

CIRCUIT BREAKER TO BE OPERATED	PROTECTION					SPECIFIED CLEARANCE TIME (See F4 Item 2)	MOST PROBABLE CLEARANCE TIME					FAULT SETTING		RELAY SETTINGS PLUS COMPONENT VALUES	CT RATIO
	PROTECTED ZONE	FUNCTION	MAKE	TYPE/ RATING	DEPENDABILITY INDEX		PROT^N	Trip relay	CB	INTER TRIP	TOTAL	PHASE-PHASE	PHASE-EARTH		

User Representative Name: Date: Signature:

The Company Representative Name: Date: Signature:

APPENDIX F5

SITE SPECIFIC TECHNICAL CONDITIONS
OTHER TECHNICAL REQUIREMENTS

User: [XXXX]

Connection Site: [XXXX]

Other Technical Requirements

The User can gain access to the technical specifications from The Company's Extranet website. Access to The Company's Extranet website can be requested via E-Mail to:- transmission.documentcontrol@nationalgrid.com.

	Criteria	***Applies to? Delete this column when finished***	**Grid Code Ref – User to comply with:**	**Obligations**
39.	Protection of interconnection connections	*Only applies for double busbar substation connection, if it is a single busbar check with policy* *There are two sides of the circuit breaker, the circuit side, and the Connection Point side. This definition ensures that*	CC 6.2.2.3.1	Defined as as the primary conductors from the current transformer accommodation on the circuit side of the circuit breaker to the Connecting Point. *(England and Wales – DNO/DSB)* *If National Grid owns the LV busbars, use the following paragraph:-* The Company: The Company will provide the common and per zone equipment. The Company will design the protection scheme for the Interconnecting Connections at the new Connection Site once the Construction Programme has commenced. The User: The User shall provide two Current Transformer Type 'PX-B' cores (unless otherwise agreed), in each of the User's bays in accordance with TS 3.02.04_RES. The current transformer accommodation referred to above is exclusively for use by The Company for the protection of the Interconnecting Connections. In order to provide the required dependability and setting for the protection, the User will be required to install relays and auxiliary components on its circuits that are compatible with those used by The Company. *If National Grid does not own the LV busbars, use the following paragraph and delete the paragraph above.* The Company: The Company shall provide two current transformers which shall be compatible with those specified by the User in

		the CT position "overlaps" the circuit breaker to the Connecting Point.		the current transformer accommodation referred to above exclusively for use by the User for the protection of the Interconnecting Connections. The type and specification of the current transformers provided by The Company shall be discussed with the User in the detailed design phase. The Company acknowledges that the requirements and specifications for CT's in respect of the protection systems other than in respect of the Protection of Interconnecting Connections shall be discussed and agreed with the User in the detailed design phase. *(Use text below only if User connects to any equipment within The Company's busbar protection zone which is GIS):* User shall provide all necessary alarms and indications with respect to any gas zones that straddle the ownership boundary. *For Scottish Agreements (DNO and DSB) delete the paragraphs above and use these ones:* The Relevant Transmission Licensee: Will design the protection scheme for the Interconnecting Connections at the new Connection Site once the Construction Programme has commenced. The User: The User will be required to install auxiliary components on its circuits, which are compatible with those used by The Relevant Transmission Licensee In order to provide the required dependability and setting for the protection. Shall provide two Current Transformer Type 'XB' cores or otherwise agreed, in accordance with the SPTS/ SHETS, in the current transformer accommodation referred to above, exclusively for use by the Relevant Transmission Licensee for the protection of the Interconnecting Connections. *For traction agreements and If the connection arrangements are unusual and not clearly defined at the application stage delete the above paragraphs and use the paragraph below as a last resort.* The protection of the interconnecting connections is to be agreed with The Company in the detailed design phase. This shall be agreed at least 12 months before the Completion Date [Stage 1].
40.	Fault Disconnection Facilities	*Delete as appropriate*	CC.6.2.3.2	*For DNO and DSB, and where National Grid owns the LV busbars, use the following paragraph:-* The User*:* To make provision for the tripping of circuit breakers connected at the Connection Point by The Company protection systems.

APPENDIX B

				Where National Grid does not own the LV busbars, use the following paragraph and delete the paragraph above. The User*:* To make provision for tripping of The Company/National Electricity Transmission System transformer LV circuit breaker by the User Protection systems. *NOTE:- Where no National Grid circuit breaker is provided at the User's connection voltage the requirements of CC.6.2.3.2 shall apply. Details of the tripping arrangements will however need to be specified in this Bilateral Agreement. It is recommended that further advice is sought from Construction.* *For traction agreements and If the connection arrangements are unusual and not clearly defined at the application stage delete the above paragraphs and use the paragraph below as a last resort.* The requirements for fault disconnection facilities are to be agreed with The Company in the detailed design phase. This shall be agreed at least 12 months before the Completion Date [Stage 1].
41.	Automatic Switching Equipment	*Where automatic re-closure of circuit breakers is required following faults on the User's system, specify here*	CC.6.2.3.3	The User: Not applicable
42.	Control Telephony	*All, but if DSB intends to submit bids and offers to the market, delete this item and use row 6 instead.*	CC.6.5.2 CC.6.5.5	*(E&W)* *Where National Grid owns the LV busbars, use the following sentence:-* Not applicable – Control Telephony will be supplied by The Company. *Where National Grid does not own the LV busbars, delete the sentence above and use the paragraph below.* The User shall install either: a) A free issue telephone handset supplied by The Company (each on dedicated cores). b) A PSTN telephone. *Scotland:* *If alternative requirements are specified these will be included in the TOCA and need to be included in this section.* *In some cases this may not be required as Control Telephony facilities may already be installed at site.*

				The User shall provide accommodation for either:- (a) A free issue Transmission Control Telephone and Extension Bell (each on designated cores) (b) A PSTN Telephone, or (c) Other free issue Control Telephony as agreed
43.	Additional Communication Facilities: Trading Point Electronic Data Transfer (EDT), Control Points and Control Point Electronic Dispatch and Logging (EDL)	*Only DSB*	CC.6.5.8(a) CC.7.9 OC.7 BC.2 CC.6.5.8, CC.6.5.9 and BC.1.4.1 CC.6.5.8(b) CC.6.5.2	The User: To fulfil the obligations defined in schedule 2 of this appendix.
44.	Operational Metering	*All*	CC.6.5.6	*NOTE:- National Grid will supply the CT's and VT's for operational metering purposes. The cost of this equipment will however need to be included in the overall cost of the scheme. The Scheme Team will need to determine the specification of this equipment.* *(DNO England and Wales use this para)* The Company shall supply Voltage Transformers, Current Transformers and Supergrid LV feed equipment sufficient to accomplish the measurement of MWs, MVArs, Voltage, Current, Frequency, Circuit Breaker and Disconnector status. *(DNO Scotland use this para)* The User shall continue to provide the present space and location allocated within the User's substation to house the SCADA equipment and provide reasonable access to the facility to allow transmission cable connections into this equipment. The User shall continue to provide voltage and current measurement outputs and plant status indications and alarms to the Transmission SCADA interface equipment. The User's substation circuit breaker and disconnector positions are required for the bus section circuit. *For DSB and traction agreements delete the above and use the below* The User: To fulfil the obligations defined in schedule 1 of this appendix.
45.	Voltage Phase Unbalance	*Traction and DSB agreements*	CC6.1.5(b) CC6.1.6	*(For DSB)* The User: To provide Voltage Unbalance Assessment information as specified in PC.4.4.1, PC.4.4.2, PC.4.5, PC.A.4.7 and

		only for Scottish agreements the information will be provided but the Scottish TO in the TOCA		DRC.6.1.5 Schedule 5, of the Grid Code. The Company: To carry out voltage unbalance assessment in accordance with CC.6.1.5(b) and CC.6.1.6. Following the assessment, The Company will (where applicable) specify to the User (by written notice), the negative phase sequence current limits and phase allocations (as appropriate) to which The User will comply. *(For traction agreements, delete above paras and use this)* The User: To contain the voltage phase unbalance /(tony??)NPS voltage level at XXXX kV Substation to within the limits specified in sections CC.6.1.5 and CC.6.1.6 of the Grid Code (and the NPS voltage limits set out in the Addendum to Engineering Recommendation P24 – *Scotland only*), the traction demand connected to XXXX kV Substation shall be limited to: Feeder F1 1-minute average: [XXXX] MVA 30-minute average: [XXXX] MVA 24-hour average: [XXXX] MVA Feeder F2 1-minute average: [XXXX] MVA 30-minute average: [XXXX] MVA 24-hour average: [XXXX] MVA *(in E&W check these numbers with quality of supply)* The Company (upon advice from the Relevant Transmission Licensee): To specify which phases are to be used If the supply is to be taken from a single phase or from a phase-to-phase connection.
46.	Voltage Waveform Quality	*DSB and Traction agreements only*	CC.6.1.5 CC.6.1.6 CC.6.1.7	*Check with Quality of Supply in England and Wales and TO in Scotland*
47.	Demand Reduction	*All*	OC.6.6 CC.6.4.3	The User: Is required to make arrangements (specified in OC.6.6 and CC.6.4.3(delete if traction or DSB)) that will enable automatic low frequency demand disconnection to limit the consequences of a major loss of generation or an event which leaves part of the system with a generation defecit. To discuss and agree (as applicable) the arrangements and settings with The Company in the detailed design phase which shall be at least 18 months before the Completion Date unless otherwise agreed. *(use this para for E&W traction and DSB only)*
48.	Power Quality Monitoring	*For DSB and traction agreements*		The Company/User *(depending on who owns the transducer)*: To provide three phase voltage transducers of suitable accuracy and these shall be appropriately sited at [XXXX] kV substation to enable continuous power quality voltage monitoring to be undertaken whether or not the User's

		only. NB Scottish TOs will define any need for PQM in the TOCA, if none then put Not applicable		System is energised. Examples of suitable voltage traducers are detailed in TS 3.02.05_RES "Voltage Transformers" 9with particular reference to section 1.3) or, alternatively, in TS 3.02.12_RES "Votlage Dividers". To also provide three phase current transducers of suitable accuracy on the higher voltage side of the [400/25-0-25kV] transformers*(traction only)* at the [XXXX] kV substation to enable continuous power quality current monitoring to be undertaken. [A current transducer would be suitable for power quality monitoring if it is also compliant with International Standard IEC 60044-6 "Requirements for protective current transformers for transient performance".] The tranducers would be required to meet TS 3.02.04_RES "Current Transformers for Protection and General Use". The output signal of these voltage and current tranducers shall be provided to The Company. *(only if User owned)* To provide cubicle space, power supplies and associated ancillary equipment and install permanent, Class A power quality monitors as defined in IEC 61000-4-30 at the Grid Entry Point in order to check compliance against specific limits. The User To provide signals from the voltage and current tranducers (as specified above) to a suitable termination point within the cubicle. For information, The Company will undertake a minimum of four weeks of continuous power quality voltage measurements using the above facilities immediately prior to the energisation of the User's feeders to establish a baseline for compliance with the Grid Code. Continuous power quality monitoring will then be performed during and after commissioning. The current transducers in each User's feeder shall be sited such that the monitored currents include any contribution from reactive power compensation and/or harmonic mitigation equipment. *(traction only)*
49.	Harmonic Content	*For DSB and Traction Agreements only*	CC.6.1.5(a)	<u>The User:</u> Shall provide The Company and Relevant Transmission Licensee with Harmonic Assessment information (as specified in PC.4.4.1, PC.4.4.2, PC.4.5, PC.A.4.7, DRC.6.1.5 Schedule 5, DRC.6.1.7 Schedule 7 of the Grid Code) so that The Company/the Relevant Transmission Licensee can carry out an harmonic voltage distortion assessment in accordance with Grid Code Conditions CC.6.1.5(a). If regenerative braking is to be employed, this shall be explicitly stated in the Harmonic Assessment information and the effect of it shall be included in the data provided to The Company and Relevant Transmission Licensee. *(this para for traction agreements only)*

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				The Company (upon advice from the Relevant Transmission Licensee): Following the above assessment, will specify to the User (by written notice), the harmonic voltage distortion or harmonic current emission limits (as appropriate). The User shall comply with the above limits. The specification of the above limits will normally be calculated using the data provided by the User. If the User subsequently notifies The Company of any changes to this data, The Company reserves the right to amend the limits and to issue revised limits to the User following any revised Voltage Waveform Quality Assessment. (delete this para if it is a Scottish agreement)
50.	Load Characteristics at the Grid Supply Point	*DNO agreements only*		The Relevant Transmission Licensee in coordination withThe Company: Reserves the right to conduct detailed demand assessments on the [XXXX] kV substation load and offer advice on any special measures required. The Company/Relevant Transmission Licensee does not envisage the need to undertake such an assessment but will monitor the connection point load characteristics through Technical Planning Meetings and any other means available. *(for E&W DNO agreements only, use the following para)* Power Factor: To ensure the network can be operated within statutory voltage limits, The Company will from time to time compare historic MW and MVAr flow data at the GSP interface across a year of operation with the User's week 24 submission. Where a discrepancy exists the User will co-operate with The Company to satisfactory resolve any resulting operational compliance issues.
51.	Reactive Capability Limits	*Scottish DNO agreements only*		In order to prevent the risk of high or low voltages occurring at [XXXX]kV substation and on adjacent [XXXX]kV Transmission circuits, the User shall be required to ensure that the connection of any Embedded Generation within the Network Operator's System does not increase the current levels of reactive power exported or imported to [XXXX]kV substation beyond a maximum of +/-[XXXX]MVArs. *(only to be used if there is a risk of high or low system volts as a result of the uncontrolled spill of MVArs from a DNO connection point*
52.	Safety and Operational Interlocking	*All*		The User: Electrical and mechanical interlocking to be provided by the User in accordance with TS.3.01.01_RES/SPTS/SHETS. *Scottish TOs will define in the TOCA, if not use this text*
53.	Earthing Facility	*All*		*(For DNO and DSB)* The Company/Relevant Transmission Licensee*: (DNO and DSB,delete this para if a traction agreement)* Will provide at least two points within its substation(s) to facilitate any bonding with the User's site if required.

				All earth mats on the User site(s) and The Company's/ the Relevant Transmission Licensee's site(s) where these are adjacent may be bonded together. The Company's/ Relevant Transmission Licensee's site earth mats can be bonded to the User's site earth mat. *(next 3 paras for traction agreements only)* At this stage the earthing system appropriate to The Company/the Relevant Transmission Licensee and the User sites has not been fully established. The Company's/Relevant Transmission Licensee's site earth mat would be expected in this instance to be bonded to the User's site earth mat, excepting any equipment that the User installs at The Company's/the Relevant Transmission Licensee's site at [XXXX] kV substation. The Company/Relevant Transmission Licensee can provide at least two points within its substation(s) to facilitate any bonding should this be required. Should the User's site not be bonded to The Compnay's/the Relevant Transmission Licensee's Earthing mat, then the Earthing requirements will need to be discussed and agreed with The Company and Relevant Transmission Licensee in the detailed design phase. The earthing arrangements of the User's [XXXX] kV Substation shall comply with ENA ER P24 (section 11) and an agreement of the connections between The Company's/the Relevant Transmission Licensee's substation earthing system and the supply return conductor side of the 25kV winding of the 400/25kV transformers shall also be finalised and agreed in the detailed design phase. (*All)* The User: To carry out an earthing survey of their sites prior to construction of the User's Plant and Apparatus. The earthing system is to be designed to withstand a short circuit current of [XX kA for YY seconds] The User shall ensure that it's Plant and Apparatus is designed and installed such that the rise of earth potential (ROEP) at [XXXX] kV substation conforms to the touch, step and transfer voltage limits which are defined in ENA TS 41 – 24. Where intertripping (second main protection) is required to open circuit breakers, the overall fault clearance time shall not be more than [XX]ms at [XXX]kV substations. The User's earthing system design review shall take The Company's/Relevant Transmission Licensee's earthing system design into account and the User shall collaborate with The Company/Relevant Transmission Licensee to ensure that compliance has been demonstrated at the Grid Entry Point which also mitigates 3rd party impact as required. The earthing system at [XXXX] kV substation shall be designed to comply with ESQCR 2002 and BS EN50522.
54.	Settlement Metering	*For DNO new templates*	CC.6.2.2.3.5	The User: To provide CTs/VTs that comply with the relevant metering Code of Practice required for Settlement. To provide the Settlement Meters and register compliant items of Metering Equipment for Settlement purposes.

		only and DSB or traction agreement, if connected to GIS check with TP		All of the above to be completed prior to energisation and in accordance with the Balancing and Settlement Code (BSC).
55.	Voltage Regulation at the Grid Supply Point	*Only for DNO agreements with Embedded generation where a statement of works process has been instigated*		The User should be aware that Embedded Large and Embedded Medium Power Stations are required to satisfy the reactive capability and voltage control requirements of CC.6.3.2, CC.6.3.8 Grid Code. For Small Embedded Power Stations as defined in Appendix G Parts 2, 3 and 4 of this Connection Agreement, the User shall ensure that each Generating Unit or Power Park Module within each Embedded Small Power Station shall have a reactive capability of between 0.95 Power Factor Lead to 0.95 Power Factor Lag at Rated MW Output at the User System Entry Point. Subject to the provisions of 11.2.2 of this Connection Agreement, during the operational timeframe, the User shall instruct each Generating Unit or Power Park Module within each Embedded Small Power Station of its required operating Power Factor which shall be within the capability range of each Embedded Small Power Station defined in Appendix G Parts 2, 3 and 4 of this Connection Agreement. There is no restriction on the User if they wish to employ an alternative method to manage MVAr transfers at the Grid Supply Point, for example through the installation of reactive compensation equipment, intertripping Embedded Generation or the application of other suitable control schemes.
56.	Emergency Instructions	*Only for DNO agreements with Embedded generation where a statement of works process has been instigated*		In accordance with the requirements of BC2.9.1.4, using the principles set out in OC6.7.1 the User shall maintain a facility such that under emergency conditions on the National Electricity Transmission System, the User shall have the ability to de-energise the Embedded Generation detailed in section 11.3 and Appendix G Parts 2, 3 and 4 of this Connection Agreement, upon instruction from The Company.

APPENDIX B

Appendix F5 - Schedule 1 *(DSB and traction only, delete if not)*
Site Specific Technical Conditions - Operational Metering (CC.6.5.6)

Description	**Units**	**Type**	**Provided by**	**Notes**
Voltage and Current measurements to be agreed with The Company.	MW MVAr	Signals to have 1 second update rate or better	User.	The functionality, performance, availability, accuracy, reliability, delivery point, protocol measurement point and repair times of the equipment generating and supplying the signals (ie the meters and communication links) shall be agreed with The Company at least 12 months before the Completion Date [Stage1]. User to provide Single Line Diagram showing location of CT/VT equipment and nomenclature of HV Apparatus. The Company will use this information to notify the User of which HV circuit breaker and disconnector positions (ie status indications) and measurement points are required .
All Users circuit HV circuit breaker(s) and disconnector(s). *(where relevant)*	Open / Closed Indication	Status Indication	User.	

Note: In the event that any part of the User's Operational Metering equipment, including the communications links to [XXXX]kV substation fails, then the User will be required to repair such equipment within 5 working days of notification of the fault from The Company or Relevant Transmission Licensee unless otherwise agreed.

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Schedule 2
Site Specific Technical Conditions – Additional Communications Facilities (CC.6.5)
DELETE THIS TABLE IF ADDITIONAL COMUNICATIONS FACILITIES ARE NOT REQUIRED – DSB agreements only

Description	Location	Source	Provided By	Comments
Control Telephone CC.6.5.2 to CC.6.5.5, CC.6.5.8, CC.6.5.9 and BC.1.4.1	Control Point	The Company /Transmission Substation Exchange.	The User to provide and install wiring from the User's Control Point to The Company substation exchange, and install free issue handset . The Company/Relevant Transmission Licensee to provide communications path to the User's Control Point site (Great Britain only) in conjunction with the User. The Company to provide handset only	Control Telephony provides secure point to point telephony for routine Control Calls, priority Control Calls and emergency Control Calls. If the User intends to have a nominated Trading Point/Control Point outside of GB, The Company will provide the communication routes and Control Telephony facilities to the User's Control point but will charge the User for the overseas element of this work including any ongoing regular maintenance. Any subsequent relocation of Control Point will be charged to the User by The Company.
PSTN (or other off-site communications circuits) for Telephony. (CC.6.5.2 to CC.6.5.5 and CC.7.9, OC.7 and BC.2)	Trading Point, Control Point	Public Telephone Operator (PTO).	Wiring to the Public Telecommunications Exchange including handset to be provided by The User.	Data and speech services required by The Company shall be cabled from the User site to the Public Telecommunications Exchange. The User shall only use the PSTN facilities for voice communcations with The Company as detailed in CC.6.5.4.5 and CC.6.5.5.2 of the Grid Code. The User's control point must be immediately and directly contactable by The Company at all times and operators should be able to communicate in clear plain English.
Trading Point Data Transfer (EDT) (CC.6.5.8(a) and BC.1.4.1)	Trading Point	The Company Substation Exchange	User to provide and install EDT terminal The User to provide communications path to the EDT terminal in conjunction with The Company in order to submit the data required by the Grid Code.	The Company to include site in instructor database and commission. Facility provided via Control Telephone and/or Facsimile machine. The User will provide the communications path for the EDT terminal from the User's Trading Point and can elect to send this to two locations (Warwick or Wokingham). The Company will provide the necessary connection and interfacing equipment at both locations. it the User intends to have a nominated Trading Point outside Great Britain, the responsibilities, functionality, dependability, security, procurement, configuration, delivery points, protocol and repair times of the communication links to be agreed with The Company 6 months prior to Completion Date[Stage 1].

APPENDIX B

Data Entry Terminals (Electronic Despatch & Logging (EDL)) (CC.6.5.8(b)) *(Required only if the User is required to provide all Part 1 System Ancillary Services and wishes to participate in the Balancing Mechanism)*	Control Point	Public Telephone Operator	User to provide and install EDL terminal approved by The Company which will permit submission and acceptance of Grid Code data between the User's Control Point and The Company continuously. The Company to provide communications path to the EDL terminal (Great Britain only) in conjunction with the User.	The Company will only provide the communications path to the EDL terminal where the Users Control Point is located in Great Britain. If the User intends to have a nominated Trading Point/Control Point outside of GB, The Company will provide the communication routes and Control Point Electronic Dispatch and Logging facilities to the User's Control point but will charge the User for the overseas element of this work including any ongoing regular maintenance. Any subsequent relocation of Control Point will be charged to the User by The Company.
Facsimile Machine (CC.6.5.9)	Trading Point and Control Point	Public Telephone Operator.	User to provide and install facsimile machine and wiring to PTO.	

NB The specifications for Control Telephony, EDT and EDL are defined in the Annex to the General Conditions of the Grid Code which is available on The Company's website at:-
http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

USEFUL LINKS

The Grid Code:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/The-Grid-code/

Electrical Standards:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Electrical-Standards-Documents/

Extranet (ID and password required, email transmission .documentcontrol@nationalgrid.com to request access):

https://www.nationalgrid.com/uk/Engineering/default.asp

Connection Policies and Guidance:

http://www2.nationalgrid.com/uk/services/electricity-connections/policies-and-guidance/

Procurement Guidelines and Balancing Principles:

http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Balancing-framework/Transmission-license-C16-statements/