

SONI Limited

WFPS Settings Schedule

Grid Code Amendments Consultation Paper

APPENDIX: Proposed Grid Code Modifications

It is proposed to amend the Grid Code by adding in the text in blue and by deleting the text in red strikethrough.

GLOSSARY AND DEFINITIONS (GD)

<u>Normal Wind Following Ramp Rate</u>	<p>The maximum rate of increase of Output of a WFPS in response to an increase in wind speed or removal of any TSO action via SCADA which limits Output of the WFPS, as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time).</p>
<u>Active Power Control Set-Point Ramp Rate</u>	<p>The maximum rate of increase or decrease of Output of a WFPS in response to an Active Power Dispatch Instruction sent by the TSO via SCADA when the WFPS is operating in an Active Power control mode. This ramp rate will be calculated by the Generator each time an Active Power Dispatch Instruction is sent by the TSO via SCADA based on the change in Active Power required and the curtailment time interval set point.</p> <p>The Active Power Dispatch Instruction shall be any MW value in the range 0MW to Registered Capacity of the WFPS. The curtailment time interval set point shall be any value in the range 1 to 30 minutes, as specified by the TSO via SCADA.</p>
<u>Frequency Response Ramp Rate</u>	<p>The maximum rate of increase or decrease of Output of a WFPS when providing Frequency Control, as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time).</p>
<u>Fast Acting</u>	<p>As specified in the relevant section of the WFPS Settings Schedule</p>

PLANNING CODE

APPENDIX A

PLANNING DATA REQUIREMENTS FOR USERS (OTHER THAN THE DNO) CONNECTED TO THE TRANSMISSION SYSTEM ONLY

PART 1

PC.A2 STANDARD PLANNING DATA

PC.A2.1 CONNECTION SITE AND USER SYSTEM DATA

PC.A2.1.1 General

All **Users** shall provide the **TSO** with the details as specified in sub sections ~~A2.1.2 and A2.1.3~~ [PC.A2.1.2](#) to [PC.A2.1.4](#) relating to their **User System**.

[PC.A2.1.4 Modelling Data](#)

The **Generator** in respect of its **Controllable WFPS** or **Dispatchable WFPS** must submit modelling data to the **TSO** as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time).

The modelling data submitted to the **TSO** is for **System** planning purposes and is not intended to constrain any **Ancillary Service** agreements.

APPENDIX B

PLANNING DATA REQUIREMENTS FOR USERS CONNECTED TO THE DISTRIBUTION SYSTEM

PART 1

PC.B.2 STANDARD PLANNING DATA

PC.B.2.1 CONNECTION SITE AND USER SYSTEM DATA

PC.B.2.1.1 General

All **Users** shall provide the **TSO** with the details as specified in sub ~~section B2.1.2~~ sections [PC.B.2.1.2](#) and [PC.B.2.1.3](#) relating relating to their **User System**.

[PC.B.2.1.3 Modelling Data](#)

The **Generator** in respect of its **Controllable WFPS** or **Dispatchable WFPS** must submit modelling data to the **TSO** as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time).

The modelling data submitted to the **TSO** is for **System** planning purposes and is not intended to constrain any **Ancillary Service** agreements.

CONNECTION CONDITIONS

CC7 TECHNICAL CRITERIA:

Technical Criteria for **WFPSs** and **Generating Units** other than those comprised within **WFPSs**.

CC7.1 The Schedules to these **Connection Conditions** contain certain technical requirements for **Users**, divided into type of **Plant** or **User** connection. Schedule 1 sets out technical criteria that **Generators** must comply with in respect of their **CCGT Modules, Steam Turbine Units** and **Gas Turbine Units**. Schedule 2 sets out technical criteria that **Generators** must comply with in respect of their **WFPSs**.

CC7.2 The detail of such technical criteria for **WFPSs** is in some cases as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time), for the reasons set out in the introduction to the **WFPS Settings Schedule**. The version of the **WFPS Settings Schedule** at any time current is therefore deemed to form part of the **Grid Code ~~Connection Conditions~~**. Changes to the **WFPS Settings Schedule** shall be the subject of consultation undertaken by the **TSO** except to the extent that those changes do not alter the setting for a technical criterion specified in the **WFPS Settings Schedule** so that it ceases to be within the range prescribed for that criterion in the **Grid Code Connection Conditions**.

CC7.3 ~~Both CC8-The Grid Code and the WFPS Settings Schedule set out technical criteria in relation to communications, control and telemetry that Generators must comply with in respect of their WFPSs. In the event of any inconsistency between the provisions of CC8 and the current version of the WFPS Settings Schedule, the provisions of the current version of the WFPS Settings Schedule shall prevail.~~

CONNECTION CONDITIONS SCHEDULE 2

Part I

TECHNICAL CRITERIA FOR WFPSs CONNECTED TO THE TRANSMISSION SYSTEM

CC.S2.1.3 WFPS Performance Requirements

CC.S2.1.3.2 ~~For WFPSs—A WFPS shall continuously control voltage at the Connection Point within its Reactive Power capability shall as a minimum be: (i) —rated power factor (absorbing)—0.95;~~

limits. For WFPSs, the minimum Reactive Power capability is defined in the characteristic below.
~~(ii) —rated power factor (generating)—0.95;~~

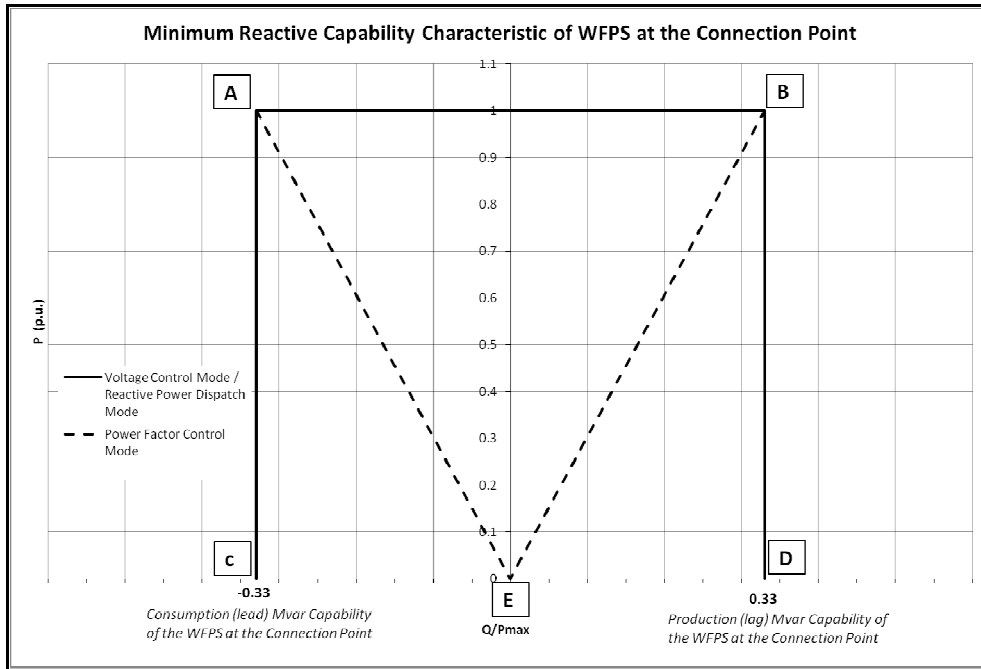
within the voltage limits specified under ~~CC5.4~~CC.5.4.

There are three Voltage Control modes:

- (i) Voltage Control mode
- (ii) power factor control mode
- (iii) Reactive Power Dispatch

Whilst the WFPS is operating in Voltage Control mode the minimum reactive capability is defined by the envelope ABCD in the Voltage Control characteristic shown below. Whilst the WFPS is operating in power factor control mode the reactive capability is defined by the envelope AEB in the power factor control mode characteristic shown below. Whilst the WFPS is operating in Reactive Power Dispatch control mode, the WFPS, as a minimum, must be capable of exporting or importing Mvars within the envelope ABCD.

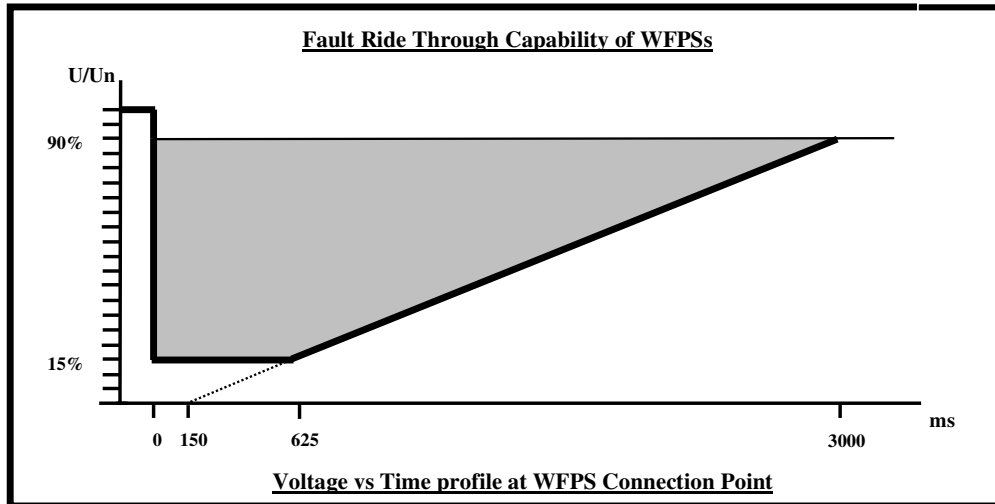
For the avoidance of doubt, all ~~power factor~~ measurements refer to the **Connection Point**.



Point A	Mvar consumption (lead) capability of the WFPS at Registered Capacity at the Connection Point
Point B	Mvar production (lag) capability of the WFPS at Registered Capacity at the Connection Point
Point C	Mvar consumption (lead) capability at cut-in speed of the WFPS at the Connection Point
Point D	Mvar generation (lag) capability at cut-in speed of the WFPS at the Connection Point

WFPSs must be capable of responding to variations in the voltage of the NI System in accordance with ~~the following diagram~~ [CC5.4](#).

- CC.S2.1.3.6 (a) In the event of a step change in voltage each **WFPS** first connected to the **Transmission System** on or after 1 April 2005 shall remain connected to the **Transmission System** as specified in the following diagram and the remainder of this CC.S2.3.6:



- (b) **WFPSs** first connected to the **Transmission System** prior to 1 April 2005 shall not be required to comply with the requirements in the above diagram save where the **WFPS** is subject to material modification involving the installation of additional ~~wind turbines~~ **Generating Units** in which case the requirements in the above diagram shall apply in respect of the performance of those ~~turbines~~ **Generating Units**.
- (c) ~~A **WFPS** shall continuously control voltage at the **Connection Point** within its reactive power capability limits.~~ The speed of response of the **WFPS** control system should be such that following a step change in voltage and recovery to the normal operating range the **WFPS** should achieve and maintain on average at least 90% of its steady state active power response, measured by **Output**, at the **Connection Point** within ~~1 second~~ **500ms** of the voltage recovery to the normal range.
- (d) **WFPSs** shall not consume on average more reactive power in the 10 seconds following a disturbance on the **Transmission System** than they did on average in the 10 minutes before the occurrence of the disturbance. Where a **WFPS** is supporting the **Transmission System** voltage through reactive power export, it shall not draw reactive power during or immediately following the disturbance.
- (e) In order to ensure the continued performance of each **WFPS** the **Generator** shall meet the reasonable costs of the **TSO** in providing and maintaining a **Monitoring, recording and transmitting device**.

- (f) Each **WFPS** shall be capable of satisfactory operation at any voltage within the range 0% - 120% for the minimum time periods specified below. Other voltage thresholds may be possible but agreement between the **Generator** and the **TSO** must be reached about their suitability at the application stage for connection.

Minimum time periods:

<u>Voltage Range (U/Un)</u>	<u>Time requirement, minimum</u>
<u>115% - 120%</u>	<u>2 seconds</u>
<u>110% - 115%</u>	<u>10 seconds</u>
<u>90% - 110%</u>	<u>Continuous operation</u>
<u>0% - 90%</u>	<u>As per Fault Ride Through Capability of WFPSs chart (CC.S2.1.3.6(a))</u>

CC.S2.1.3.7 Start-Up and Ramp Rates

- (a) The ~~Generator shall ensure that a WFPS shall not start up more frequently than once in any 10 minute period. A WFPS shall have a positive ramp rate controller capable of being set within a range from 1 MW per minute to 10 MW per minute to control the ramp rate under normal operating conditions and including a zero ramp rate setting, which shall automatically take effect during a time period when a ramp blocking signal is present.~~ **WFPS** control system shall be capable of controlling the ramp rate of its **Output**. There shall be three ramp rate capabilities designated, **Normal Wind Following Ramp Rate**, **Active Power Control Set-Point Ramp Rate** and **Frequency Response Ramp Rate**. The **WFPS** control system shall operate the ramp rates with the following order of priority (high to low): **Frequency Response Ramp Rate**; **Active Power Control Set-Point Ramp Rate**; **Normal Wind Following Ramp Rate**. It shall be possible to vary the **Normal Wind Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** each independently over a range between 1% and 100% of **Registered Capacity per minute**. Unless notified otherwise by the **TSO**, the **Generator** will set the controller to the setting as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time). The ramp rate is the average rate of change in **Output** measured over any 10 minute period. The ramp rate averaged over 1 minute should not exceed 3 times the average ramp rate over 10 minutes.
- (b) A **Controllable WFPS** or a **Dispatchable WFPS** shall have a ramp **Frequency** controller, which on **Start-Up** and during normal operation of any **Controllable WFPS** or **Dispatchable WFPS** shall only allow ~~ramping an increase in Output~~ when the **System Frequency** is below a set value ~~and~~. This set value in the ~~absence of a ramp blocking signal~~. ~~The~~ ramp **Frequency** controller should be capable of being set in the range ~~50.2-50.0~~ Hz to 52.0 Hz in steps of 0.1 Hz. Unless notified otherwise by the **TSO**, the **Generator** will set the controller to the setting as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time).

- (c) During operation the **TSO** may send to the **Generator** a positive ramp blocking signal if the **NI System** would otherwise be at risk from excess **Frequency** movements. This signal is designed to restrain **WFPSs** from ramping above the previous 10 minute average level at the time of receiving the signal. The **WFPS** may continue to supply **Output** up to this level until the signal is removed. The **TSO** will remove the ramp blocking signal as soon as stable conditions on the **NI System** are restored, as determined by the **TSO**.
- (d) ~~If wind speeds or potential wind speeds equal to or faster than the manufacturer's cut out speed for the wind turbines in a **Controllable WFPS** or **Dispatchable WFPS** as specified within the **Connection Agreement** for the particular site are deemed by the **TSO**, acting reasonably, to require a reduction in the **Output** of a **Controllable WFPS** or **Dispatchable WFPS**, then the **TSO** may instruct the **Controllable WFPS** or **Dispatchable WFPS** as to the maximum **Output** from that **Controllable WFPS** or **Dispatchable WFPS** allowable under the prevailing conditions. To assist the **TSO** in determining that a reduction in **Output** is required, each **Controllable WFPS** or **Dispatchable WFPS** shall send SCADA signals to the **TSO Control Centre** to the extent necessary to keep the **TSO** accurately informed as to how many turbines have been shut down on account of wind speeds equal to or faster than the manufacturer's cut out speed. Unless the **Controllable WFPS** or **Dispatchable WFPS** has a continually manned control point, the **TSO** shall send a SCADA signal indicating that a process of ~~reducing maximum~~ increasing/decreasing **Output** is to be initiated and the time interval over which the ~~reduction~~ increase/decrease of **Output** is to be achieved. A **Controllable WFPS** or **Dispatchable WFPS** receiving such a signal shall send a SCADA signal in response confirming that it has received the SCADA signal from the **TSO**. ~~For a~~ The increase/decrease in **Output** of the **Controllable WFPS** or **Dispatchable WFPS** whose wind turbines comprise a **Registered Capacity** of less than 50 MW no one increment of **Output** reduction shall exceed 5 MW and for all **Controllable WFPSs** or **Dispatchable WFPSs** the pattern(s) of **Output** reduction shall be set out in the **Connection Agreement** for the particular sites shall be at the **Active Power Control Set-Point Ramp Rate**. For the avoidance of doubt nothing in this ~~CC.S2.3.7(d)~~ CC.S2.1.3.7(d) shall be construed as requiring a **Controllable WFPS** or **Dispatchable WFPS** to operate beyond its technical limits.~~
- (e) Upon removal of an **Active Power Dispatch Instruction** sent by the **TSO** via SCADA when the **WFPS** is operating in an **Active Power control mode** and under normal operational conditions, the **WFPS** shall ramp at the **Normal Wind Following Ramp Rate**.
- (e)(f) The ramp rate requirements for **WFPSs** need not be met in the case of: (i) wind speed falling at a greater rate than that which would be required to control the **Output** to be within the ramp rate; (ii) ~~a **Frequency** deviation on the **NI System** from 50 Hz below the lower deadband setting or above the upper deadband setting (both as specified by the **TSO** in accordance with CC.S2.5.2 (a)) where the **WFPS** is (at the **TSO's** request) providing **Frequency Control**, to the extent that the ramp rate requirements can not be met solely due to the provision of~~

~~Frequency Control or the Generator's compliance with the other provisions of the Connection Conditions.~~

- (g) In the absence of a TSO Dispatch Instruction, each Generating Unit comprising a Controllable WFPS or Dispatchable WFPS must operate as per the power curve submitted to the TSO and remain connected to the NI System between the Generating Unit cut-in speed and cut-out speed.

CC.S2.1.5 WFPS Control Arrangements

- CC.S2.1.5.1 Each **Controllable WFPS** or **Dispatchable WFPS** must be capable, in accordance with CC.S2.1.5.2 and CC.S2.1.5.3, of contributing appropriately, as reasonably specified by the **TSO**, to **Frequency** and voltage by continuous modulation of **Active** and **Reactive Power** supplied to the **Transmission System**.
- CC.S2.1.5.2 (a) Each **Controllable WFPS** or **Dispatchable WFPS** must be fitted with a ~~fast acting~~ **Fast Acting** (as specified in Section 7.5 of the **WFPS Settings Schedule**) proportional wind power governor to provide **Frequency Control** under normal operational conditions. This ~~fast acting~~ **Fast Acting** (as specified in Section 7.5 of the **WFPS Settings Schedule**) proportional governor should be equipped with controls which allow the droop to be set independently in the range 2% to 20% ~~below 50.0 Hz and from 2% to 20% at 50.0 Hz and above, each setting being capable of being set independently~~ above and below 50.0 Hz. A deadband within which no control will be exercised must be capable of being set with a lower limit between 49.0 Hz and 50.0 Hz in steps of 0.05 Hz and an upper limit between 50.0 Hz and 51.0 Hz in steps of 0.05 Hz. Whilst responding to Frequency excursions on the System the change in Output of the Controllable WFPS or Dispatchable WFPS shall be at the Frequency Response Ramp Rate. In addition a high **Frequency** trip facility must be provided capable of being set in the range 51.0 Hz to 52.0 Hz in steps of 0.1 Hz. Unless the **Generator** is notified otherwise by the **TSO**, the **Governor Droop**, deadband and high **Frequency** trip settings shall be as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time). Where a **Controllable WFPS** or **Dispatchable WFPS** becomes isolated from the rest of the **Transmission System** the **Controllable WFPS** or **Dispatchable WFPS** must immediately detect the condition and shut itself down.
- (b) Under certain **System** conditions the **TSO** may require a **Controllable WFPS** or a **Dispatchable WFPS** to operate below its maximum instantaneous **Output** ~~and in a manner where the droop setting will come into operation should the System Frequency fall below the lower deadband setting (as specified by the TSO in accordance with CC.S2.5.2(a))~~ on a droop setting to be set in the range 2% to 20%. In this mode of operation the **Controllable WFPS** or **Dispatchable WFPS** will be providing some of the **System** reserve. ~~The use of this constrained operating mode shall be kept to a minimum and is most likely to occur during summer night operation. The Controllable WFPS or Dispatchable WFPS controller must be capable of being set to operate in a constrained manner within the range of at least 50% to 100% of maximum instantaneous Output. Unless the Generator is notified otherwise by the TSO, the setting of the controller shall be as specified by the TSO from time to time in the WFPS Settings Schedule~~

~~published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time).~~

CC.S2.1.5.3

- (a) Each **Controllable WFPS** or **Dispatchable WFPS** must be fitted with a ~~fast acting~~ **Fast Acting** (as specified in Section 7.7 of the **WFPS Settings Schedule**) control system capable of being switched to control the **Controllable WFPS** or **Dispatchable WFPS** ~~Output voltage or the Controllable WFPS or Dispatchable WFPS Output power factor~~ voltage; power factor or the **Reactive Power** output at the **Connection Point**. These control modes must maintain the ~~voltage at the Connection Point~~ within a voltage band as specified within the **Connection Agreement** for the particular site, and in any case within statutory limits as specified under CC5.4. A WFPS shall continuously control voltage at the Connection Point within its Reactive Power capability limits. If the voltage exceeds the specified band, the power factor ~~control or Reactive Power~~ control must revert to voltage control. The control of voltage ~~and~~, power factor ~~and~~ **Reactive Power Dispatch** must ensure stable operation over the entire operating range of the **Controllable WFPS** or **Dispatchable WFPS**. In the event that action by the **Controllable WFPS** or **Dispatchable WFPS** active and reactive power control functions is unable to achieve a sustained voltage within the statutory limits, the **Controllable WFPS** or **Dispatchable WFPS** must detect this and immediately shut down.
- (b) Other voltage control schemes may be possible but agreement between the **Generator** and the **TSO** must be reached at the application stage for connection about their suitability. If voltage control is implemented for the **Controllable WFPS** or **Dispatchable WFPS**, rather than on individual ~~wind turbines~~ **Generating Units**, then the range of power factor available should not be less than that which would have been available if voltage control had been on individual ~~wind turbines~~ **Generating Units**. Voltage control schemes based upon equipment located on the **TSO's** side of the connection may be possible, but such schemes are considered special, and the details, responsibilities and cost schedule must be agreed between the **Generator** and the **TSO** in the **Connection Agreement**.
- (c) In order to deal with **Controllable WFPSs** or **Dispatchable WFPSs** inducing power fluctuations, an additional control loop must be provided by the **Generator** to ensure that the ~~wind turbine~~ **Generating Unit** control system, wind turbulence or other factors in the **Controllable WFPS** or **Dispatchable WFPS** cannot produce power oscillations between 0.25 Hz and 1.75 Hz. It should be designed and operated to ensure that the total peak-to-peak MW oscillation within this **Frequency** range is less than 1% of the **Registered Capacity** of the **Controllable WFPS** or **Dispatchable WFPS**.

CC.S2.1.10 Additional information

- CC.S2.1.10.1 Each **Generator** shall provide the calculated **Output** for the **WFPS** as part of the application for connection of that **WFPS** to the **Transmission System**. This will take the form of a diagram showing wind speed and direction against electrical output in **MW**, in "rose" format. Following connection, the **WFPS** shall be monitored for a period to confirm the validity of the calculations, which may be used for future **Output** predictions. This **Monitoring** shall be completed before a final ~~Grid Code~~ compliance certificate is issued. Each **Generator** requires a ~~Grid Code~~ temporary compliance certificate in respect of each of its **WFPSs** before being allowed to operate it.

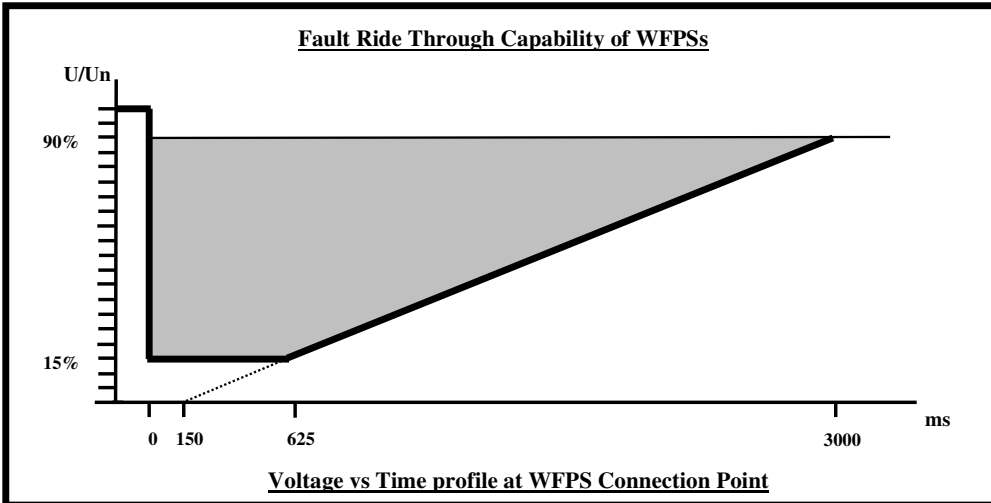
CC.S2.1.10.2 A temporary ~~Grid Code~~-compliance certificate may be issued to allow tests or **Monitoring** that can only be performed on energised and/or loaded **Plant**. After a period of time not exceeding one year from the date on which a temporary ~~Grid Code~~ compliance certificate takes effect (unless the **TSO** in its absolute discretion agrees to extend the validity of a temporary ~~Grid Code~~-compliance certificate), the **TSO** shall issue a final ~~Grid Code~~-compliance certificate or indicate the reason why a final compliance certificate cannot be issued. The final ~~Grid Code~~-compliance certificate may be issued with or without conditions depending upon the result of compliance tests, ~~and~~. A temporary or final compliance certificate may be subsequently withdrawn for the non-compliance of the **Generator** or a **Generator's WFPS** with the **Grid Code** by the **TSO** ~~giving such notice of the withdrawal (which notice and replaced with a restricted compliance certificate. A restricted compliance certificate shall be issued to the Generator which shall set out the matters in respect of which there is non-compliance) as is reasonable in the circumstances. If the final Grid Code compliance certificate is not issued or is withdrawn the Generator must cease to operate its WFPS until such time as a temporary or final Grid Code~~ a non compliance; the MVA rating at the Connection Point to which the WFPS is restricted; the timescales for resolution of the non compliance. Upon resolution of the non compliance the TSO in its absolute discretion, may re-issue a temporary or final compliance certificate ~~is issued or re-issued in respect of the WFPS.~~

Part II

TECHNICAL CRITERIA FOR WFPSs CONNECTED TO THE DISTRIBUTION SYSTEM

CC.S2.2.3 WFPS Performance Requirements

- CC.S2.2.3.3 (a) In the event of a step change in voltage each **WFPS** first connected to the **Distribution System** on or after 1 April 2005 shall remain connected to the **Distribution System** as specified in the following diagram and the remainder of this CC.S2.2.3.3.



- (b) **WFPSs** first connected to the **Distribution System** prior to 1 April 2005 shall not be required to comply with the requirements in the above diagram save where the **WFPS** is subject to material modification involving the installation of additional ~~wind turbines~~ **Generating Units** in which case the requirements in the above diagram shall apply in respect of the performance of those ~~turbines~~ **Generating Units**.
- (c) The speed of response of the **WFPS** control system should be such that following a step change in voltage and recovery to the normal operating range the **WFPS** should achieve and maintain on average at least 90% of its steady state active power response, measured by **Output**, at the point of connection to the **Distribution System** within ~~1 second~~ **500ms** of the voltage recovery to the normal range.
- (d) Each **WFPS** shall be capable of satisfactory operation at any voltage within the range 0% - 120% for the minimum time periods specified below. Other voltage thresholds may be possible but agreement between the **Generator** and the **TSO** about their suitability must be reached at the application stage for connection.
Minimum time periods:

<u>Voltage Range (U/Un)</u>	<u>Time requirement, minimum</u>
<u>115% - 120%</u>	<u>2 seconds</u>
<u>110% - 115%</u>	<u>10 seconds</u>
<u>90% - 110%</u>	<u>Continuous operation</u>
<u>0% - 90%</u>	<u>As per Fault Ride Through Capability of WFPSs chart (CC.S2.2.3.3(a))</u>

CC.S2.2.3.4 Start-Up and Ramp Rates

- (a) The **Generator** shall ensure that a **WFPS** shall not start up more frequently than once in any 10 minute period. ~~A WFPS shall have a positive ramp rate controller capable of being set within a range from 1 MW per minute to 10 MW per minute to control the ramp rate under normal operating conditions and including a zero ramp rate setting, which shall automatically take effect during a time period when a ramp blocking signal is present~~ **WFPS** control system shall be capable of controlling the ramp rate of its **Output**. There shall be three ramp rate capabilities designated, **Normal Wind Following Ramp Rate**, **Active Power Control Set-Point Ramp Rate** and **Frequency Response Ramp Rate**. The **WFPS** control system shall operate the ramp rates with the following order of priority (high to low): **Frequency Response Ramp Rate**; **Active Power Control Set-Point Ramp Rate**; **Normal Wind Following Ramp Rate**. It shall be possible to vary the **Normal Wind Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** each independently over a range between 1% and 100% of **Registered Capacity per minute**. Unless notified otherwise by the **TSO**, the **Generator** will set the controller to the setting as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time). The ramp rate is the average rate of change in **Output** measured over any 10 minute period. The ramp rate averaged over 1 minute should not exceed 3 times the average ramp rate over 10 minutes.
- (b) A **Controllable WFPS** or a **Dispatchable WFPS** shall have a ramp **Frequency** controller, which on **Start-Up** and during normal operation of any **Controllable WFPS** or **Dispatchable WFPS** shall only allow ~~ramping an increase in Output~~ when the **System Frequency** is below a set value ~~and in the absence of a ramp blocking signal~~. The ramp **Frequency** controller should be capable of being set in the range ~~50.2~~ **50.0** Hz to 52.0 Hz in steps of 0.1 Hz. Unless notified otherwise by the **TSO**, the **Generator** will set the controller to the setting as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time).
- (c) During operation the **TSO** may send to the **Generator** a positive ramp blocking signal if the **NI System** would otherwise be at risk from excess

Frequency movements. This signal is designed to restrain **WFPSs** from ramping above the previous 10 minute average level at the time of receiving the signal. The **WFPS** may continue to supply **Output** up to this level until the signal is removed. The **TSO** will remove the ramp blocking signal as soon as stable conditions on the **NI System** are restored, as determined by the **TSO**.

- (d) ~~If wind speeds or potential wind speeds equal to or faster than the manufacturer's cut out speed for the wind turbines in a **Controllable WFPS** or **Dispatchable WFPS** are deemed by the **TSO**, acting reasonably, to require a reduction in the **Output** of a **Controllable WFPS** or **Dispatchable WFPS**, then the **TSO** may instruct the **Controllable WFPS** or **Dispatchable WFPS** as to the maximum **Output** from that **Controllable WFPS** or **Dispatchable WFPS** allowable under the prevailing conditions. To assist the **TSO** in determining that a reduction in **Output** is required, each **Controllable WFPS** or **Dispatchable WFPS** shall send SCADA signals to the **TSO Control Centre** to the extent necessary to keep the **TSO** accurately informed as to how many turbines have been shut down on account of wind speeds equal to or faster than the manufacturer's cut out speed. Unless the **Controllable WFPS** or **Dispatchable WFPS** has a continually manned control point the **TSO** shall send a SCADA signal indicating that a process of ~~reducing maximum~~ increasing/decreasing **Output** is to be initiated and the time interval over which the ~~reduction~~ increase/decrease of **Output** is to be achieved. A **Controllable WFPS** or **Dispatchable WFPS** receiving such a signal shall send a SCADA signal in response confirming that it has received the SCADA signal from the **TSO**. ~~For a~~ The increase/decrease in **Output** of the **Controllable WFPS** or **Dispatchable WFPS** whose wind turbines comprise a **Registered Capacity** of less than 50 MW no one increment of **Output** reduction shall exceed 5 MW shall be as per the **Active Power Control Set-Point Ramp Rate**. For the avoidance of doubt nothing in this ~~CC.S2.3.7~~ CC.S2.2.3.4 (d) shall be construed as requiring a **Controllable WFPS** or **Dispatchable WFPS** to operate beyond its technical limits.~~

- (e) Upon removal of an **Active Power Dispatch Instruction** sent by the **TSO** via SCADA when the **WFPS** is operating in an **Active Power** control mode and under normal operational conditions, the **WFPS** shall ramp at the **Normal Wind Following Ramp Rate**.

- (e)(f) The ramp rate requirements for **WFPSs** need not be met in the case of: (i) wind speed falling at a greater rate than that which would be required to control the **Output** to be within the ramp rate; (ii) ~~a **Frequency** deviation on the **NI System** from 50 Hz below the lower deadband setting or above the upper deadband setting (both as specified by the **TSO** in accordance with CC.S2.5.2 (a)) where the **WFPS** is (at the **TSO's** request) providing **Frequency Control**, to the extent that the ramp rate requirements can not be met solely due to the provision of **Frequency Control** or the **Generator's** compliance with the other provisions of the **Connection Conditions**.~~

- (g) In the absence of a **TSO Dispatch Instruction**, each **Generating Unit** comprising a **Controllable WFPS** or **Dispatchable WFPS** must operate as per the power curve submitted to the **TSO** and remain connected to the **NI System** between the **Generating Unit** cut-in speed and cut-out speed.

CC.S2.2.5 **WFPS Control Arrangements**

CC.S2.2.5.1 Each **Controllable WFPS** or **Dispatchable WFPS** must be capable, in accordance with CC.S2.2.5.2 and CC.S2.5.3, of contributing appropriately, as reasonably specified by the **TSO**, to **Frequency** by continuous modulation of **Active Power** supplied to the ~~NISystem~~**NI System**.

CC.S2.2.5.2 (a) Each **Controllable WFPS** or **Dispatchable WFPS** must be fitted with a ~~fast acting~~**Fast Acting** (as specified in Section 7.5 of the **WFPS Settings Schedule**)proportional wind power governor to provide **Frequency Control** under normal operational conditions. This ~~fast acting~~**Fast Acting** (as specified in Section 7.5 of the **WFPS Settings Schedule**) proportional governor should be equipped with controls which allow the droop to be set independently in the range 2% to 20% above and below 50.0 Hz ~~and from 2% to 20% at 50.0 Hz and above, each setting being capable of being set independently above and below 50.0 Hz.~~ A deadband within which no control will be exercised must be capable of being set with a lower limit between 49.0 Hz and 50.0 Hz in steps of 0.05 Hz and an upper limit between 50.0 Hz and 51.0 Hz in steps of 0.05 Hz. Whilst responding to **Frequency** excursions on the **System** the change in **Output** of the **Controllable WFPS** or **Dispatchable WFPS** shall be as per the **Frequency Response Ramp Rate**. In addition a high **Frequency** trip facility must be provided capable of being set in the range 51.0 Hz to 52.0 Hz in steps of 0.1 Hz. Unless the **Generator** is notified otherwise by the **TSO**, the **Governor Droop**, deadband and high **Frequency** trip settings shall be as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time). Where a **Controllable WFPS** or **Dispatchable WFPS** becomes isolated from the rest of the **Transmission System** the **Controllable WFPS** or **Dispatchable WFPS** must immediately detect the condition and shut itself down.

(b) Under certain **System** conditions the **TSO** may require a **Controllable WFPS** or a **Dispatchable WFPS** to operate below its maximum instantaneous **Output** ~~and in a manner where the droop setting will come into operation should the **System Frequency** fall below the lower deadband setting (as specified by the **TSO** in accordance with CC.S2.2.5.2(a))~~on a droop setting to be set in the range 2% to 20%. In this mode of operation the **Controllable WFPS** or **Dispatchable WFPS** will be providing some of the **System** reserve. ~~The use of this constrained operating mode shall be kept to a minimum and is most likely to occur during summer night operation.~~ The **Controllable WFPS** or **Dispatchable WFPS** controller must be capable of being set to operate in a constrained manner within the range of at least 50% to 100% of maximum instantaneous **Output**. ~~Unless the **Generator** is notified otherwise by the **TSO**, the setting of the controller shall be as specified by the **TSO** from time to time in the **WFPS Settings Schedule** published on the SONI website (or such other place or by such other means as may be notified to the **Generator** from time to time).~~

CC.S2.2.7 Additional information

CC.S2.2.7.1 Each **Generator** shall provide the calculated **Output** for the **Controllable** or **Dispatchable WFPS** as part of the submission of information under CC11. This will take the form of a diagram showing wind speed and direction against electrical output in MW, in “rose” format. Following connection, the **Controllable** or **Dispatchable WFPS** shall be monitored for a period to confirm the validity of the calculations, which

may be used for future **Output** predictions. This **Monitoring** shall be completed before a final ~~Grid Code~~-compliance certificate is issued. Each **Generator** requires a ~~Grid Code~~-temporary compliance certificate in respect of each of its **Controllable** or **Dispatchable WFPSs** before being allowed to operate it.

CC.S2.2.7.2 A temporary ~~Grid Code~~-compliance certificate may be issued to allow tests or **Monitoring** that can only be performed on energised and/or loaded **Plant**. After a period of time not exceeding one year from the date on which a temporary ~~Grid Code~~ compliance certificate takes effect (unless the **TSO** in its absolute discretion agrees to extend the validity of a temporary ~~Grid Code~~-compliance certificate), the **TSO** shall issue a final ~~Grid Code~~-compliance certificate or indicate the reason why a certificate cannot be issued. The final ~~Grid Code~~-compliance certificate may be issued with or without conditions depending upon the result of compliance tests, ~~and~~. A temporary or final compliance certificate may be subsequently withdrawn for the non-compliance of the **Generator** or a **Generator's Controllable or Dispatchable WFPS** with the **Grid Code** by the **TSO** giving such notice of the withdrawal (which notice and replaced with a restricted compliance certificate. A restricted compliance certificate shall be issued to the Generator which shall set out the matters in respect of which there is ~~non-compliance) as is reasonable in the circumstances. If the final Grid Code compliance certificate is not issued or is withdrawn the Generator must cease to operate its Controllable or Dispatchable WFPS until such time as a temporary or final Grid Code~~ a non compliance; the MVA rating at the **Connection Point** to which the **WFPS** is restricted; the timescales for resolution of the non compliance. Upon resolution of the non compliance the **TSO** in its absolute discretion, may re-issue a temporary or final compliance certificate ~~is issued or re-issued in respect of the Controllable or Dispatchable WFPS.~~