SONI Limited

WFPS Ramp Rate

Grid Code Amendments Consultation Paper

8th November 2011

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

WFPS Ramp Rate Applicable Point	Minimum **MW Output** a **Controllable WFPS** can maintain on a continuous basis, whilst providing **System Support Services**, without the need to switch out any **Generating Units**

CONNECTION CONDITIONS

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. 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 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 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 **Output** is to be initiated and the time interval over which the reduction 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 **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 site. For the avoidance of doubt nothing in this CC.S2.3.7(d) shall be construed as requiring a **Controllable WFPS** or **Dispatchable WFPS** to operate beyond its technical limits.

(e) 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 cannot be met solely due to the provision of **Frequency Control** or the **Generator's** compliance with the other provisions of the **Connection Conditions**.

(iii) When the **Controllable WFPS** or **Dispatchable WFPS** is operating at **Active Power** levels below its **WFPS Ramp Rate Applicable Point**, the rate of change of output to achieve the Set-point shall be at or below the maximum ramp rate setting of the Wind Farm Control System or as agreed with the **TSO**.

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. 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 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 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 **Output** is to be initiated and the time interval over which the reduction 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 **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**. For the avoidance of doubt nothing in this CC.S2.3.7(d) shall be construed as requiring a **Controllable WFPS** or **Dispatchable WFPS** to operate beyond its technical limits.

(e) 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 cannot be met solely due to the provision of Frequency Control or the Generator's compliance with the other provisions of the Connection Conditions.

(iii) When the **Controllable WFPS** or **Dispatchable WFPS** is operating at **Active Power** levels below its **WFPS Ramp Rate Applicable Point**, the rate of change of output to achieve the Set-point shall be at or below the maximum ramp rate setting of the Wind Farm Control System or as agreed with the **TSO**.

SCHEDULING AND DISPATCH CODE

SDC1 – APPENDIX A

Part 1. Technical Parameters

Technical Parameter	CDGU				Control WFPS	DSU		Agg. Gen		Pump Storage Demand
	Thermal	Hydr/ En Ltd	Disp. WFPS	Pump S Gen	-	Individual Demand Site	Aggregated Demand Sites			-
Block Load Cold	✓	✓	✓	✓	✓					
Block Load Hot	✓									
Block Load Warm	✓									
Demand Profile						✓	✓			
Deload Break Point	✓	✓	✓	✓	✓					
De-Loading Rate 1	✓	✓	✓	✓	✓					
De-Loading Rate 2	✓	✓	✓	✓	✓					
Dwell Time 1	✓	✓	✓	✓	✓					
Dwell Time 2	✓	✓	✓	✓	✓					
Dwell Time 3	✓	✓	✓	✓	✓					
Dwell Time Trigger Point 1	✓	✓	✓	✓	✓					
Dwell Time Trigger Point 2	✓	✓	✓	✓	✓					
Dwell Time Trigger Point 3	✓	✓	✓	✓	✓					
End Point of Start Up Period	✓	✓	✓	✓	✓					
Energy Limit		✓								
Energy Limit Factor		✓								
Energy Limit Start		✓								
Energy Limit Stop		✓								
Forecast Minimum				✓						✓

Technical Parameter	CDGU				Control WFPS	DSU		Agg. Gen		Pump Storage Demand
	Thermal	Hydr/ En Ltd	Disp. WFPS	Pump S Gen	-	Individual Demand Site	Aggregated Demand Sites			-
Output Profile										
Forecast Minimum Generation Profile	✓	✓	✓	✓		✓	✓			
Initial Demand Reduction Time						✓	✓			
Load Up Break Point Cold (1)	✓	✓	✓	✓	✓					
Load Up Break Point Cold (2)	✓	✓	✓	✓	✓					
Load Up Break Point Hot (1)	✓									
Load Up Break Point Hot (2)	✓									
Load Up Break Point Warm (1)	✓									
Load Up Break Point Warm (2)	✓									
Loading Rate Cold (1)	✓	✓	✓	✓	✓					
Loading Rate Cold (2)	✓	✓	✓	✓	✓					
Loading Rate Cold (3)	✓	✓	✓	✓	✓					
Loading Rate Hot (1)	✓									
Loading Rate Hot (2)	✓									
Loading Rate Hot (3)	✓									
Loading Rate Warm (1)	✓									
Loading Rate Warm (2)	✓									
Loading Rate Warm (3)	✓									
Max Ramp Down Rate (shall be a number greater than zero)						✓	✓			
Max Ramp Up Rate						✓	✓			

Technical Parameter	CDGU				Control WFPS	DSU		Agg. Gen		Pump Storage Demand
	Thermal	Hydr/ En Ltd	Disp. WFPS	Pump S Gen	-	Individual Demand Site	Aggregated Demand Sites			-
(shall be a number greater than zero)										
WFPS Ramp Rate Applicable Point					✓					
Maximum Down Time						✓	✓			
Maximum Generation / Registered Capacity	✓	✓	✓	✓	✓					
Maximum On Time	✓	✓	✓	✓	✓					
Maximum Storage Capacity				✓						
Minimum Down Time						✓	✓			
Minimum Generation	✓	✓	✓	✓	✓					
Minimum off time	✓	✓	✓	✓	✓					
Minimum on time	✓	✓	✓	✓	✓					
Minimum Storage Capacity				✓						✓✓
(Other relevant technical parameters)	✓	✓	✓	✓	✓			✓		
Pumping capacity				✓						✓
Ramp Down Break Point 1	✓	✓	✓	✓	✓			✓		
Ramp Down Break Point 2	✓	✓	✓	✓	✓			✓		
Ramp Down Break Point 3	✓	✓	✓	✓	✓			✓		
Ramp Down Break Point 4	✓	✓	✓	✓	✓			✓		
Ramp Down Rate 1	✓	✓	✓	✓	✓			✓		
Ramp Down Rate 2	✓	✓	✓	✓	✓			✓		
Ramp Down Rate 3		✓	✓	✓	✓			✓		

Technical Parameter	CDGU				Control WFPS	DSU		Agg. Gen		Pump Storage Demand
	Thermal	Hydr/ En Ltd	Disp. WFPS	Pump S Gen	-	Individual Demand Site	Aggregated Demand Sites			-
Ramp Down Rate 4	✓	✓	✓	✓	✓			✓		
Ramp Down Rate 5	✓	✓	✓	✓	✓			✓		
Ramp Up Break Point 1	✓	✓	✓	✓	✓			✓		
Ramp Up Break Point 2	✓	✓	✓	✓	✓			✓		
Ramp Up Break Point 3	✓	✓	✓	✓	✓			✓		
Ramp Up Break Point 4	✓	✓	✓	✓	✓			✓		
Ramp Up Rate 1	✓	✓	✓	✓	✓			✓		
Ramp Up Rate 2	✓	✓	✓	✓	✓			✓		
Ramp Up Rate 3	✓	✓	✓	✓	✓			✓		
Ramp Up Rate 4	✓	✓	✓	✓	✓			✓		
Ramp Up Rate 5	✓	✓	✓	✓	✓			✓		
Short Term Maximisation Capability	✓	✓	✓	✓	✓					
Soak Time Cold (1)	✓	✓	✓	✓	✓					
Soak Time Cold (2)	✓	✓	✓	✓	✓					
Soak Time Hot (1)	✓									
Soak Time Hot (2)	✓									
Soak Time Trigger Point Cold (1)	✓	✓	✓	✓	✓					
Soak Time Trigger Point Cold (2)	✓	✓	✓	✓	✓					
Soak Time Trigger Point Hot (1)	✓									
Soak Time Trigger Point Hot (2)	✓									
Soak Time Trigger Point Warm (1)	✓									
Soak Time Trigger Point	✓									

Technical Parameter	CDGU				Control WFPS	DSU		Agg. Gen		Pump Storage Demand
	Thermal	Hydr/ En Ltd	Disp. WFPS	Pump S Gen	-	Individual Demand Site	Aggregated Demand Sites			-
Warm (2)										
Soak Time Warm (1)	✓									
Soak Time Warm (2)	✓									
Synchronous Start-Up Time Cold	✓	✓	✓	✓	✓					
Synchronous Start-Up Time Hot	✓	✓	✓	✓	✓					
Synchronous Start-Up Time Warm	✓									
Target Reservoir Level Percentage				✓						✓
Start of Restricted Range 1	✓	✓	✓	✓	✓					
End of Restricted Range 1	✓	✓	✓	✓	✓					
Start of Restricted Range 2	✓	✓	✓	✓	✓					
End of Restricted Range 2	✓	✓	✓	✓	✓					