DISTRIBUTION CODE MODIFICATION PROPOSAL FORM

Modification Proposal submitted By: Tony Hearne	DATE OF SUBMISSION OF PROPOSAL: 9th April 2013	Modification Proposal Number:*(to be assigned by Review Panel Secretary)* #24

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MODIFICATION PROPOSAL TITLE:	DS3 Ramp Rates

DISTRIBUTION CODE SECTION(S) AFFECTED BY PROPOSAL

1. DCC11.3.2.2
2. DCC11.3.2.3
3. DCC11.3.4.1
4. DCC11.3.4.2

MODIFICATION PROPOSAL DESCRIPTION *(Clearly state the desired amendment and all text changes. Attach further information if necessary)*

1. Replace the current content of DCC11.3.2.2 with the material shown in Appendix 1
2. Replace the current content of DCC11.3.2.3 with the material shown in Appendix 2
3. Replace the current content of DCC11.3.4.1 and DCC11.3.4.2 with the material shown in Appendix 3
4. Add the new definitions shown in Appendix 4

MODIFICATION PROPOSAL JUSTIFICATION *(Clearly state the reason for the modification. Attach further information if necessary)*

The purpose of the proposed modification is to clarify the requirements on Ramp Rates and frequency response for windfarms. There are currently 1-minute and 10-minute ramp rate settings defined, but they are subject to confusion and misinterpretation. The Ramp Rate definitions need to be clearer, particularly as significant amounts of wind generation are forecast to connect to the power system over the coming years. This will make it easier to determine how windfarms in aggregate respond to instructions.

This proposed modification also introduces a Ramp Rate specifically for frequency response, and a minimum expected time for provision of active power from WFPS for frequency response during frequency excursions. It also clarifies that the expected Active Power Response from the WFPS is based on Available Active Power.

It also specifies a settable frequency droop for WFPS, defaulting to 4%. This droop shall apply whenever frequency response is turned on.

IMPLICATIONS OF NOT IMPLEMENTING THIS MODIFICATION

Ramp Rates may be applied in an inconsistent manner by windfarm owners. Also the speed for providing frequency response from WFPS will be unknown, potentially affecting system security in the future.

PLEASE SUBMIT MODIFICATION PROPOSALS TO THE PANEL SECRETARY BY E-MAIL TO: DISTCODEPANEL@MAIL.ESB.IE

Appendix 1: Distribution Code body content: DCC11.3.2.2

DCC11.3.2.2   Active-Power Control

The **Wind Farm Control System** shall be capable of operating each **WTG** at a reduced level if the **Controllable WFPS's Active Power** output has been restricted by the **TSO or DSO**. In this **Active Power Dispatch Mode**, the **Wind Farm Control System** shall be capable of receiving an on-line **Active Power Control Set-point** sent by the **TSO or DSO** and shall commence implementation of the set-point within 10 seconds of receipt of the signal from the **TSO or DSO**.

The rate of change of output to achieve the **Active Power Control Set-point** should be ~~no less than the maximum ramp rate~~ the **Active Power Control Set-Point Ramp Rate** setting~~s~~ of the **Wind Farm Control System**, as advised by the TSO or DSO, as per DCC11.3.3. It is acknowledged that if the **Active Power** output of the **Controllable WFPS** is initially less than the **Design Minimum Operating Level**, and if the **Controllable WFPS** is expected to increase its **Active Power** output, then it may not be able to achieve the specified ramp rate at first, due to **WTG**s going through a start-up sequence. In such a case, **WTGs** shall start up as quickly as the technology allows, and in any case, not longer than three minutes from the time the **Active Power Control Set-point** was received.

Appendix 2: Distribution Code body content: DCC11.3.2.3

DCC11.3.2.3   Frequency Response

DCC11.3.2.3.1   In **Wind Following Mode**, the **Frequency Response System** shall have the capabilities as displayed in the *Power-Frequency Response Curve* in *Figures 10* where the power and frequency ranges required for points A, B, C, D, E are defined below in *Table 6 and Table 7.* The **Frequency Response System** shall adjust the **Active Power** output of the **Controllable WFPS** according to a **Governor Droop**, settable by the **TSO** in a range from 2% to 10% and defaulting to 4%, when operating in the ranges outside the deadband range F_B-F_C in the Power-Frequency Response Curve. **Controllable WFPS Frequency Response** and **Governor Droop** shall be calculated with respect to **Registered Capacity**. A **Controllable WFPS** can only give a low frequency response if the **Active Power Control Setpoint** is less than the **Available Active Power.**

DCC11.3.2.3.2   When in **Active Power Control Mode,** the **Controllable WFPS** shall always operate in **Frequency Sensitive Mode** with a **Governor Droop** as set out in DCC11.3.4 and with a deadband of +/-15mHz, or as otherwise agreed with the **TSO**
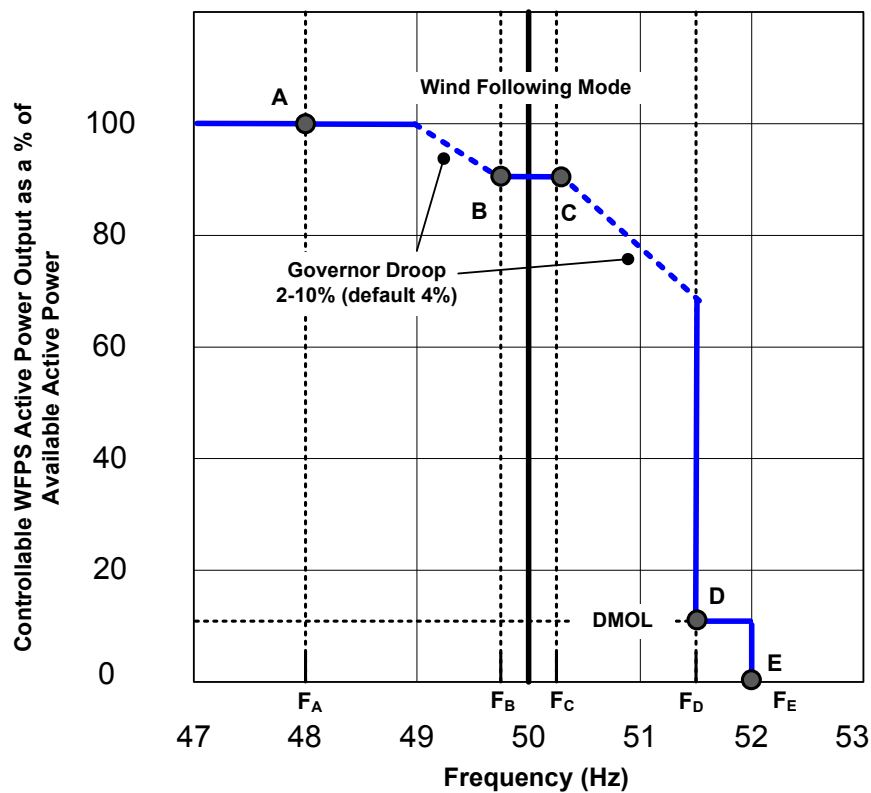

Figure 10 –*Example of Power-Frequency Response Curve for* ***Wind Following Mode***

DCC11.3.2.3.3   When acting to control **System Frequency**, the **Controllable WFPS** shall provide at least 60% of its expected additional **Active Power** response within 5 seconds, and 100% of its expected additional **Active Power** response within 15 seconds of the start of the **System Frequency** excursion outside the range F_B-F_C, or in the case of a **Controllable WFPS** in **Active Power Dispatch Mode**, when the **System Frequency** goes outside the deadband set out in DCC11.3.2.3.2.

DCC11.3.2.3.4   When the **System Frequency** is in the range F_C-F_D, the **Controllable WFPS** shall ensure that its **Active Power Output** does not increase beyond the **Active Power** value of the **Controllable WFPS** when the **System Frequency** first exceeded F_C, due to an increase in **Available Active Power** in that period.

DCC11.3.2.3.5   If the **Frequency** drops below F_A, then the **Frequency Response System** shall act to maximise the **Active Power** output of the **Controllable WFPS**, irrespective of the **Governor Droop Setting**. If the **Frequency** rises above F_D, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable WFPS** to its **DMOL** value. If the **Frequency** rises above F_E, then the **Frequency Response System** shall act to reduce the **Active Power** output of the **Controllable WFPS** to zero.   Any **WTG** which has disconnected shall be brought back on load as fast as technically feasible, provided the **System Frequency** has fallen below 50.2 Hz.

DCC11.3.2.3.6   Points 'A', 'B', 'C', 'D' and 'E' shall depend on a combination of the Frequency, Active Power and Active-Power Control Set-point settings,. These settings may be different for each Wind Farm Power Station depending on system conditions and Wind Farm Power Station location. These settings are defined in Table 6.

Point	Frequency (Hz)	Wind Farm Power Station Active Power Output (% of Available Active Power)
A	F_A	P_A
B	F_B	Minimum of : P_B or Active-Power Control Set-point (converted to a % of Available Active Power)
C	F_C	Minimum of: P_C or Active-Power Control Set-point (converted to a % of Available Active Power)
D	F_D	Minimum of: P_D or

		Active-Power Control Set-point (converted to a % of Available Active Power)
E	**F$_E$**	P$_E$ = 0 %

Table 6: Frequency and % Available Active Power Settings for the Points A, B, C, D and E illustrated in Figure 11

Two settings for each of *F$_A$, F$_B$, F$_C$, F$_D$, F$_E$, P$_A$, P$_B$, P$_C$, P$_D$* and *P$_E$* shall be specified by the TSO at least 120 business days prior to the **Contrllable Wind Farm Power** Station's scheduled Operational Date (refer to Table 7 below). . The Wind Farm Power Station shall be responsible for implementing the appropriate settings during Commissioning.

DCC11.3.2.3.7 The table below, Table 7, shows the Frequency and Active Power ranges for F$_A$, F$_B$, F$_C$, F$_D$, F$_E$, P$_A$, P$_B$, P$_C$, P$_D$ and P$_E$

	Transmission System Frequency *(Hz)*		*Available Active Power* (%)
			Registered Capacity ≥ 5 MW
F$_A$	47.0-~~51.0~~49.5	**P$_A$**	50-100
F$_B$	49.5-~~51~~50	**P$_B$**	~~50~~15-100
F$_C$	~~49.5~~50-50.5~~51~~	**P$_C$**	
F$_D$	50.5-52.0	**P$_D$**	~~20~~15-100 but not less than **DMOL**
F$_E$		**P$_E$**	0

Table 7: Frequency & Active Power ranges appropriate to Figure 9.

For the Frequency values in Table 7 above, F$_A$ ≤ F$_B$ ≤ F$_C$ ≤ F$_D$ = F$_E$.

DCC11.3.2.3.8 Alterations to the Wind Farm Power Station's Active Power output, triggered by Frequency changes, shall be achieved by proportionately altering the Active Power output of all available WTG as opposed to switching individual WTG on or off, insofar as possible.

DCC11.3.2.3.9 No time delays, such as moving average frequency filters, other than those necessarily inherent in the design of the **Frequency Response System** shall be introduced. ~~The response rate of each available online **WTG** shall be a minimum of 1 % of **WTG** rated capacity per second (MW/second).~~ The **Frequency Response System** shall continuously monitor the **System Frequency** in order to

continuously determine the **Controllable WFPS's** appropriate **Active Power** output by taking account of the **Controllable WFPS's Available Active Power** or **Controlled Active Power**.

DCC11.3.2.3.10 If the **System Frequency** rises to a level above F_E, as defined by the *Power-Frequency Response Curve in Figure 11*, it is accepted that **WTG**s may disconnect. Any **WTG** which has disconnected shall be brought back on load as fast as technically feasible (provided the **System Frequency** has fallen below 50.2 Hz).

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Appendix 3: Distribution Code body content: DCC11.3.4.1 and DCC11.3.4.2

DCC11.3.4.1   The **Wind Farm Control System** shall be capable of controlling the ramp rate of its **Active Power** output. ~~with a maximum MW per minute ramp rate set by the TSO. There shall be two maximum ramp rate settings. The first ramp rate setting shall apply to the MW ramp rate average over one (1) minute. The second ramp rate setting shall apply to the MW per minute ramp rate average over ten (10) minutes. These ramp rate settings shall be applicable for all ranges of operation including start up, normal operation and shut down. The TSO acknowledges that falling wind speed or Frequency Response may cause either of the maximum ramp rate settings to be exceeded.~~ There shall be three ramp rate capabilities, designated **Wind Following Ramp Rate**, **Active Power Control Set-Point Ramp Rate**, and **Frequency Response Ramp Rate**. The **Wind Farm 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**; **Wind Following Ramp Rate**. The **Wind Following Ramp Rate** shall be used during **Start-Up**, normal operation, and **Shutdown**. The **TSO** shall specify the **Wind Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** in percentage of **Registered Capacity** per minute. The **Frequency Response Ramp Rate** shall be the maximum possible ramp rate of the **Controllable WFPS** agreed with the **TSO** and with the characteristics as set out in WFPS1.5.2.2.2**.** It is acknowledged that rapidly changing wind speeds may cause temporary deviations from the ramp rate settings of the **Controllable WFPS**, but these deviations should not be allowed to exceed 3% of **Registered Capacity**.

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DCC11.3.4.2   It shall be possible to vary ~~each of these two maximum ramp rate settings~~ the **Wind Following Ramp Rate** and the **Active Power Control Set-Point Ramp Rate** each independently over a range between ~~1 and 30 MW~~ 1% and 100% of **Registered Capacity** per minute. ~~The **Wind Farm Control System** shall have the capability to set the ramp rate in MW per minute averaged over both one and ten minutes.~~

Appendix 4: New / Revised Definitions

Active Power Control Set-Point Ramp Rate: The rate of increase or decrease of **Active Power** output of a **Controllable WFPS** in response to an **Active Power Control Set-point** instruction

Design Minimum Operating Level (DMOL): The minimum **Active Power** output of **Controllable WFPS** where all **WTGs** are generating electricity and capable of ramping upwards at any of the specified ramp rates (given available wind), and shall not be greater than 12% of **Registered Capacity**.

Frequency Response Ramp Rate: The minimum rate of increase or decrease of **Active Power** output of a Controllable **WFPS** when acting to control System Frequency

Governor Droop: The percentage drop in the **Frequency** that would cause the **Generation Unit** under free governor action to change its output from zero to its full **Capacity**. In the case of a **Controllable WFPS**, it is the percentage drop in the **Frequency** that would cause the **Controllable WFPS** to increase its output from zero to its full **Registered Capacity.**

System Frequency The number of Alternating Current cycles per second, expressed in Hertz at which the System normally operates, i.e 50 Hertz.

Wind Following Mode:

A mode of operation of a **Controllable WFPS** where the system frequency is within normal range and the **Controllable WFPS** is not under **Active Power Control** by the **TSO**, allowing the **Controllable WFPS** to produce up to 100% of its **Available Active Power**, depending on the Power-Frequency Curve in operation**.** When operating on Power-Frequency Curve 2, the **Controllable WFPS** is required to maintain its **Active Power** output at a fixed percentage of its **Available Active Power** when **Transmission System Frequency** is within the range F_B-F_C**.**

Wind Following Ramp Rate:

The maximum rate of increase of **Active Power** output of a **Controllable WFPS** in response to an increase in wind speed.