

SONI Limited

Grid Code Amendments Consultation Paper: Rate of Change of Frequency (RoCoF)

APPENDIX: Proposed Grid Code Modifications

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

GLOSSARY AND DEFINITIONS (GD)

Rate of Change of Frequency

The rate of increase or decrease of **Frequency** as measured at the **User's Connection Point** over the time period as set out in CC.5.3.3

CONNECTION CONDITIONS

CC5 SUPPLY STANDARDS

CC5.3 Frequency Variations

CC5.3.1 The **Frequency** of the **NI System** shall be nominally 50 Hz and shall normally be controlled within the limits of 49.5 Hz to 50.5 Hz and in accordance with the Electricity Supply Regulations (N.I.) 1991.

CC5.3.2 In exceptional circumstances, **System Frequency** will rise to 52 Hz or fall to 47 Hz but sustained operation outside the range specified in the Electricity Supply Regulations (N.I.) 1991(as amended, updated or superseded) is not envisaged. **Users** should take these factors into account in the design of **Plant** and **Apparatus**.

CC5.3.3 In exceptional circumstances, **System Frequency** will vary causing a considerable **Rate of Change of Frequency**. Under such conditions, **Users** must ensure that their **Plant** and **Apparatus** remains **synchronised** to the **NI System** for a **Rate of Change of Frequency** up to and including 1 Hz per second as measured over a rolling 500 milliseconds period within the frequency range mentioned in CC5.3.2. For the avoidance of doubt, this requirement relates to the capabilities of **Generating Units** only and does not impose the need for **Rate of Change of Frequency** protection nor does it impose a specific setting for anti-islanding or loss-of-mains protection relays. Severe voltage dips may cause localised **Rate of Change of Frequency** values in excess of 1 Hz per second for short periods, and in these cases, the relevant condition for each type of generation contained in the schedule of these **Connection Conditions** supersedes this CC5.3.3 (the relevant conditions being: CC.S1.1.5.6 for any **User** other than a **WFPS** connected to the **Transmission System**; CC.S2.1.3.6 for a **WFPS** connected to the **Transmission System**; CC.S2.2.3.3 for a **WFPS** connected to the **Distribution System** and CC.S1.2.4.4 for any **User** other than a **WFPS** connected to the **Distribution System**).

CC5.3.4 Notwithstanding CC5.3.3, until such time as a notification given by the **TSO** pursuant to this CC5.3.4 that there is additional system re-enforcement, **Users** must ensure that their **Plant** and **Apparatus** remains **synchronised** to the **NI System** for a **Rate of Change of Frequency** up to and including 2 Hz per second as measured over a rolling

500 milliseconds period within the frequency range mentioned in CC5.3.2. For the avoidance of doubt, this requirement relates to the capabilities of **Generating Units** only and does not impose the need for **Rate of Change of Frequency** protection nor does it impose a specific setting for anti-islanding protection relays.

In exceptional circumstances, **System Frequency** will vary causing a considerable **Rate of Change of Frequency**. Voltage dips may cause localised **Rate of Change of Frequency** values in excess of 2 Hz per second for short periods, and in these cases, the relevant condition for each type of generation contained in the schedule of these **Connection Conditions** supersedes this CC5.3.4 (the relevant conditions being: CC.S1.1.5.6 for any **User** other than a **WFPS** connected to the **Transmission System**; CC.S2.1.3.6 for a **WFPS** connected to the **Transmission System**; CC.S2.2.3.3 for a **WFPS** connected to the **Distribution System** and CC.S1.2.4.4 for any **User** other than a **WFPS** connected to the **Distribution System**.)

CC5.4 Voltage Variations

CC5.4.1 The voltage variation on the **Transmission System** shall comply with the Electricity Supply Regulations (N.I.) 1991 (as amended, updated or superseded), that is, will normally remain within the limits $\pm 10\%$ of the nominal value or as otherwise agree.

CC8 TECHNICAL CRITERIA:-

CC8.8 Obligations on the DNO

CC8.8.4 The requirements of CC8.8.3 do not apply where:

- (a) the islanding protection has operated correctly, consistent with the settings agreed with the **DNO**; or
- (b) there is manual intervention by the **Generator**.

CONNECTION CONDITIONS SCHEDULE 1

Part I

TECHNICAL CRITERIA FOR GENERATING UNITS CONNECTED TO THE TRANSMISSION SYSTEM OTHER THAN THOSE COMPRISED WITHIN WFPSs

CC.S1.1.5 **Generating Unit** Control Arrangements

CC.S1.1.5.6 During the connection process, the **TSO** may require the completion of technical analysis to identify the fault ride performance with which a **Generating Unit** must comply. This analysis will be completed in accordance with the methodology described in the NI Security and Planning Standards.

Part II

TECHNICAL CRITERIA FOR GENERATING UNITS CONNECTED TO THE DISTRIBUTION SYSTEM OTHER THAN THOSE COMPRISED WITHIN WFPSs

CC.S1.2.1 Applicability of Technical Design and Operational Criteria

- (a) In this Schedule 1, Part II all references to **Generating Units** shall be read and construed as references only to **CDGUs** connected to the **Distribution System** other than **WFPSs**. Such references shall not be read or construed as references to **Generating Units** connected to the **Distribution System** that form part of a **WFPS**.
- (b) At the point of connection to the **Distribution System**, all **Generating Units** with an **Output** of 10 **MW** or more shall meet the following technical design and operational criteria.
- (c) **Generating Units** with an **Output** of 10 **MW** or more shall, as a minimum requirement comply with all relevant Engineering Recommendations and relevant regulations and the particular requirements of the **TSO** which will take account of the conditions prevailing on the **Transmission System** at the closest electric **Bulk Supply Point** at the relevant time. The **TSO** will notify its particular requirements to the **Generator** during the course of the **Generator's** submission of information under CC11.
- (d) The **DNO** shall ensure that protection equipment applied to **Generators**, with an output of 5**MW** or more, in compliance with the requirements of Engineering Recommendation G59/1/NI, (as amended, updated or superseded), are configured such that the **Generators** remain connected to the **NI System** whilst the frequency remains within the limits given in these **Connection Conditions** unless alternative arrangements have been agreed with the **TSO**.

CC.S1.2.4 **Generating Unit** Control Arrangements

- CC.S1.2.4.1 Each **Generating Unit** must be capable, in accordance with CC.S1.2.4.2, of contributing appropriately, as reasonably specified by the **TSO**, to **Frequency** control by continuous modulation of **Active Power** supplied to the **NI System**.
- CC.S1.2.4.2 Each **Generating Unit** which is a **CDGU**, with a **Registered Capacity** of 10 **MW** or more must be fitted with a fast acting proportional turbine speed governor to provide **Frequency Control** under normal operational conditions as specified by the **TSO** from time to time. For steam turbine **Generating Units** the governor must be designed and operated to the relevant requirements of BS132. For gas turbine **Generating Units** the governor must be capable of operating with a nominal droop characteristic of 4%.
- CC.S1.2.4.3 For **Generating Units** with a **Registered Capacity** of 10 **MW** or more, the **TSO** shall specify that a **Generating Unit** must be fitted with a **Unit Load Controller**. Where so specified, the **Generator** must ensure that the **Unit Load Controller** is in operation at all times and in accordance with the settings for **Frequency** trigger and reset point, time delay and droop as specified by the **TSO**.
- CC.S1.2.4.4 During the connection process, the **TSO** may require the completion of technical analysis to identify the fault ride performance with which a **Generating Unit** must comply. This analysis will be completed in accordance with the methodology described in the NI Security and Planning Standards. The scope of this analysis will be agreed in conjunction with the **DNO**.

CONNECTION CONDITIONS SCHEDULE 2

Part I

TECHNICAL CRITERIA FOR WFPSs CONNECTED TO THE TRANSMISSION SYSTEM

CC.S2.1.9 Automatic Load Shedding Devices

CC.S2.1.9.1 There is an expectation that **WFPSs** will continue to operate outside statutory **Frequency** limits. However, it is likely that this could mean connection within an **Automatic Load Shedding** zone as detailed in OC4. Consequently, **Users** shall ensure that **Protection** on **WFPSs** shall have settings to co-ordinate with the settings on the **Automatic Load Shedding** equipment as detailed by the **TSO** on request by the **User**.

CC.S2.1.9.2 (a) Each **WFPS** shall be capable of satisfactory operation at any **Frequency** within the range of 47.0 Hz to 52.0 Hz for the minimum time periods specified below unless the **TSO** has agreed to the use of any **Frequency** level relays which will trip the **WFPS** within this **Frequency** range.

Minimum time periods:

Frequency Range	Time requirement, minimum
50.5 Hz – 52.0 Hz	60 minutes
49.5 Hz – 50.5 Hz	Continuous operation
47.5 Hz – 49.5 Hz	60 minutes
47.0 Hz – 47.5 Hz	20 seconds

(b) Where **WFPSs** are equipped with **Rate of Change of Frequency** relays or other devices which measure and operate in relation to a **Rate of Change of Frequency** (e.g. a governor) the setting must comply with CC.5.3.3.

Part II

TECHNICAL CRITERIA FOR WFPSs CONNECTED TO THE DISTRIBUTION SYSTEM

CC.S2.2.1 Applicability of Technical Design and Operational Criteria

- (a) In this Schedule 2, Part II all references to **Generating Units** shall be read and construed as references only to **Generating Units** connected to the **Distribution System** that form part of a **WFPS**. It shall not be deemed to refer to **CCGT Modules, Steam Turbine Units** and/or **Gas Turbine Units**.
- (b) In this Schedule 2, Part II unless otherwise specified all references to measurements shall be deemed to be applicable at the connection to the **Distribution System** of the **WFPS**.

- (c) This Schedule 2, Part II contains technical, design and operational requirements for **WFPSs**. Detailed information relating to a particular connection will, where indicated below, be made available by the **TSO** on request by the **Generator**. A number of the requirements in this Schedule 2 and the **WFPS Settings Schedule** are applicable only to **Controllable WFPSs** or **Dispatchable WFPSs**. Such requirements are not, by definition, applicable to a **WFPS** first connected to the **Distribution System** before 1 April 2005 whose wind turbines comprise a **Registered Capacity** of 5 MW or more, unless that **WFPS** is subject to material modification, whereupon such a **WFPS** shall, for the purposes of this Schedule 2 and the **WFPS Settings Schedule**, be treated as a **Controllable WFPS** or **Dispatchable WFPS**.
- (d) A **Controllable WFPS** or a **Dispatchable WFPS** shall, as a minimum requirement comply with all relevant Engineering Recommendations and relevant regulations and the particular requirements of the **TSO** which will take account of the conditions prevailing on the **Transmission System** at the closest electric **Bulk Supply Point** at the relevant time. The **TSO** will notify its particular requirements to the **Generator** during the course of the **Generator's** submission of information under CC11.
- (e) The **DNO** shall ensure that protection equipment applied to **Generators**, with an output of 5MW or more, in compliance with the requirements of Engineering Recommendation G59/1/NI, (as amended, updated or superseded), are configured such that the **Generators** remain connected to the **NI System** whilst the frequency remains within the limits given in these **Connection Conditions** unless alternative arrangements have been agreed with the **TSO**.