

SONI Consultation Paper: Incorporation of Approved Grid Code Modification Establishing 1 Hz/s RoCoF

Consultation Paper
July 1st, 2022



1. Introduction

- 1.1 A Modification establishing a 1 Hz/s RoCoF standard into the Grid Code was consulted upon in 2012.
- 1.2 This Modification was approved in principle in 2014, with implementation dependent on comprehensive testing of the NI conventional fleet, changes to relay settings for priority dispatch and embedded generation.
- 1.3 Testing of the conventional fleet and changes to RoCoF settings for priority dispatch and embedded generation have since been completed by SONI and NIEN respectively.
- 1.4 Other Modifications to the Grid Code have also been implemented in the interim, most notably for RfG, necessitating housekeeping changes to the original RoCoF Modification
- 1.5 SONI therefore presented and discussed the Modification approved in principle in 2014 at the Grid Code Review Panel on 14th June 2022, noting the changes to that Modification to the Grid Code in the years since the 2014 RoCoF Modification.
- 1.6 This consultation paper sets out the proposed changes to the Modification agreed in principle in 2014 and seeks comments from relevant parties on the proposed changes to the approved in principle Modification.
- 1.7 This consultation period is proposed to be eight weeks; the deadline for submission of comments is close of business on 26th August 2022. SONI will submit a copy of all responses to the Utility Regulator alongside a report on this consultation. If a response is required to remain confidential this should clearly be stated. The intention is to publish all non-confidential responses. Please note that, in any event, all responses will be shared with the Regulatory Authority.

2. Background and Overview

- 2.1 As outlined in a position paper¹ produced by the DS3 Joint Grid Code Working Group in 2012, increasing levels of non-synchronous generation were shown in studies to lead to high RoCoF values in credible contingency scenarios. Establishing a RoCoF standard was deemed, along with other measures, to be critical to the avoidance of excessive curtailment of priority dispatch generation.

¹ <https://www.soni.ltd.uk/media/documents/Archive/IGCWG%20RoCoF%20Position%20Paper.pdf>

- 2.2 There then followed a consultation², on the Grid Code amendments necessary to establish a RoCoF standard, and working groups were formed to facilitate the implementation of same.
- 2.3 The Regulatory Authority approved³ a Grid Code Modification in principle in 2014 , to be implemented at such time as conventional and renewable generation portfolio could be deemed compliant with the new standard, and SONI operational policy and tools had been updated.

3. Changes to the Grid Code – Incorporating RoCoF Modification and Housekeeping following Interim Modifications

3.1 Glossary and Definitions

This definition was already introduced as part of the RFG Modifications. No further Modifications are required.

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

3.2 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.

This following Modification to CC5.3.2 has already been implemented and hence no further Modifications are required:

CC5.3.2 In exceptional circumstances, **System Frequency** could 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**.

² <https://www.soni.ltd.uk/media/documents/Operations/Grid-Code/RoCoF%20Modifications-consultation%20paper.pdf>

³ <https://www.uregni.gov.uk/publications/decision-paper-rate-change-frequency-grid-code-modification>

The following Modification to CC5.3.3 needs a housekeeping alteration. The paragraph below needs to be renumbered from CC5.3.3 to CC5.3.3 (i). References to WFPS have been updated to PPM. The reference to CC.S2.1.3.6 in the original Modification needs to be renumbered to CC.S2.1.3.9

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CC5.3.3 (i) In exceptional circumstances, **System Frequency** could 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. 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(i) (the relevant conditions being: CC.S1.1.5.6 for any **User** other than a **PPM** connected to the **Transmission System**; CC.S2.1.3.6⁹ or a **PPM** connected to the **Transmission System**; CC.S2.2.3.3 for a **PPM** connected to the **Distribution System** and CC.S1.2.4.4 for any **User** other than a **PPM** connected to the **Distribution System**.)

Note the existing CC5.3.3 in a box as introduced with the RfG Modifications needs to have the paragraph alignment of the text within the box realigned correctly and be renumbered as CC5.3.3 (ii). The reference to CC5.3.3 within the text needs to be updated to CC5.3.3 (ii). CC.S2.1.4 and CC.S2.2.3.4 are applicable for RfG units.

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CC5.3.3 (ii) In exceptional circumstances, **System Frequency** could 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. 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 (ii) (the relevant conditions being: CC.S1.1.5.6 for any **User** other than a **PPM** connected to the

Transmission System; CC.S2.1.4 for a PPM connected to the Transmission System; CC.S2.2.3.4 for a PPM connected to the Distribution System and CC.S1.2.4.4 for any User other than a PPM connected to the Distribution System.)

The Modification below to CC5.4 to the effect that the Electricity Supply Regulations (N.I.) 1991 may be updated, amended or superseded has already been implemented and hence no further action is required

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.

The following clause needs a housekeeping alteration to ensure correct numbering. CC8.8.3 is now CC8.8.4.1 and CC8.8.4 is now CC8.8.5.

CC8 TECHNICAL CRITERIA:

CC8.8 Obligations on the DNO

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CC8.8.45 The requirements of ~~CC8.8.34.1~~ do not apply where:

- (a) the islanding protection has operated correctly, consistent with the settings agreed with the **DNO**; or
- (b) ~~the System Frequency has changed at a rate greater than 0.5Hz/s; or~~
- (c) 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 PPMs

This Modification was brought in as part of the RFG Modifications and appears in a box with a plain circle in the corner. This is now applicable to all generation, so a housekeeping alteration is required. The updated Modification is to remove the box around CC.S1.1.5.6 to ensure that this clause now applies to generation both pre- and post-RFG.

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

CC.S1.1.5.6 The TSO may specify in the relevant **Connection Agreement** that a **Generating Unit** must remain synchronised during and following any fault which could result in voltage dips at the **Connection Point** of no greater than 95% (5% retained).

Part II

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

The Modification below to CC.S1.2.1(d) to the effect that the Electricity Supply Regulations (N. I.) 1991 may be updated, amended or superseded has already been implemented and hence no further action is required. Note that the change to these clauses to update WFPSs to PPMs has also already been implemented.

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 **PPMs**. Such references shall not be read or construed as references to **Generating Units** connected to the **Distribution System** that form part of a **PPM**.
- (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**.

- (e) A **Generating Unit** with a **Registered Capacity** greater than the **MEC** at the **Connection Point**, as agreed in the relevant **Connection Agreement**, shall demonstrate Grid Code compliance with the technical design and operational requirements of the Generating Unit set out in Grid Code CC5, CC6, CC7 and CC8. Under such circumstances Grid Code compliance shall be demonstrated at the **MEC** rather than at the **Generating Unit Registered Capacity** to ensure the safe operation of the **Generators Plant and Apparatus** and the **DNO's Plant and Apparatus**. A **Generator** shall be issued with **Agreed compliance Testing and Monitoring Procedures** throughout the connection and commissioning programme of the **Generators** connection.

The Modification below was brought in as part of the RFG Modifications and appears in a box with a plain circle in the corner. This is now applicable to all generation, so a housekeeping alteration is required. The updated Modification is to remove the box around CC.S1.2.4.4 to ensure that this clause now applies to generation both pre- and post-RFG.

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 **The TSO may specify in the relevant Transmission Use of System Agreement or Grid Code Compliance Agreement that a Generating Unit must remain synchronised during and following any fault which could result in voltage dips at the Connection Point. The magnitude and duration of such fault ride through capability will need to be agreed with the User and the DNO.**

What was CC.S2.1.9 has been re-numbered CC.S2.1.11. This Modification has been superseded by previous Modifications and hence no further action is required – similarly Rate of Change of Frequency as a defined term has been incorporated prior to this Modification.

CONNECTION CONDITIONS SCHEDULE 2

Part I

TECHNICAL CRITERIA FOR PPMs CONNECTED TO THE TRANSMISSION SYSTEM

CC.S2.1.11 Automatic Load Shedding Devices

CC.S2.1.11.1 There is an expectation that **PPMs** 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 **PPMs** 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**.

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CC.S2.1.11.2 (a) Each **PPM** 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 **PPM** 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 **PPMs** 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 procedure in CC.S2.9.2(c) below will be followed to ensure satisfactory operation of the **PPMs**.
- (c) (i) At a reasonable time prior to a **PPM** being connected to the **Transmission System**, and prior to any relevant Modification to a **PPM** or any relevant **Power Station Equipment**, the **Generator** shall contact

- the **TSO** with details of the proposed rate-of-change-of-Frequency setting.
- (ii) The **TSO** shall, within a reasonable period and in any case no more than 28 days, discuss with the **Generator** whether the proposed settings are satisfactory. The agreed settings shall be specified in the **Connection Agreement**.
- (iii) In relation to any **Generator** which has agreed the settings with the **TSO** under these provisions, the **TSO** shall notify that **Generator** of any change of which it is aware in the expected rate-of-change-of-Frequency on the **NI System** which may require new settings to be agreed

Part II

TECHNICAL CRITERIA FOR PPMs CONNECTED TO THE DISTRIBUTION SYSTEM

CC.S2.2.1(e) below has since been renumbered CC.S2.2.1(f) and the Modification has already been implemented, and hence no further action is required

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 **PPM**. 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 **PPM**.
- (c) This Schedule 2, Part II contains technical, design and operational requirements for **PPMs**. 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 specifically for **WFPS** the **WFPS Settings Schedule** and **PPMS** the **PPM Settings Schedule**) are applicable only to **Controllable PPMs** or **Dispatchable PPMs**. Such requirements are not, by definition, applicable to a **PPM** first connected to the **Distribution System** before 1 April 2005 whose wind turbines comprise a **Registered Capacity** of 5 MW or more, unless that **PPM** is subject to material Modification, whereupon such a **PPM** shall, for the purposes of this Schedule 2 (and specifically for **WFPS** the **WFPS Settings Schedule** and **PPMS** the **PPM Settings Schedule**), be treated as a **Controllable PPM** or **Dispatchable PPM**.

- (d) A **Controllable PPM** or a **Dispatchable PPM** 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) A **PPM** with a **Registered Capacity** greater than the **MEC** at the **Connection Point**, as agreed in the relevant **Connection Agreement**, shall demonstrate Grid Code compliance with the technical design and operational requirements of the **Generating Unit** set out in Grid Code CC5, CC6, CC7 and CC8. Under such circumstances Grid Code compliance shall be demonstrated at the **MEC** rather than at the **PPM Registered Capacity** to ensure the safe operation of the **Generators Plant** and **Apparatus** and the **DNO's Plant** and **Apparatus**. The **Generator** shall demonstrate Grid Code compliance in accordance with the **WFPS Setting Schedule** or **PPM Setting Schedule** which may be reviewed from time to time by the **TSO**.
- (f) 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**.

4. Next steps

- 4.1 The consultation period will run for 8 weeks. Users are invited to send their comments to SONI via email to gridcode@soni.ltd.uk by close of business on Friday 26th August 2022. In the meantime, should any Users have any queries they should contact SONI via gridcode@soni.ltd.uk.
- 4.2 Following receipt of comments in relation to this Consultation Paper and the expiration of the period for making comments, SONI will, in accordance with Condition 16 of its Licence, send to the Utility Regulator a report on the outcome of this review.
- 4.3 If you require your response to remain confidential you should clearly state this on the coversheet of the response. We intend to publish all non-confidential responses. Please note that, in any event, all responses will be shared with the Utility Regulator.
- 4.4 Following the end of the consultation period and subject to discussions to be held with the Utility Regulator, the previously approved Modification to the Grid Code (with

amendments as described in this consultation paper) will be incorporated into the code.