Rate of Change of Frequency

Grid Code Modification

Report to NIAUR

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SONI Limited

Rate of Change of Frequency Modifications

Response to Consultation

21 December 2012

1. Introduction

1.1 The discussions in the 'Delivering a Secure and Sustainable Electricity System' (DS3) Joint Grid Code Working Group and the DS3 Joint Grid Code Working Group Position Paper, resulted in the publication in September 2012, of proposals to change the Rate of Change of Frequency (RoCoF) levels needed to manage the future operation of the All-Island Power System. Following the discussions held at the Joint Grid Code Review on 3 October 2012 in Belfast including a discussion about the RoCoF Modification Proposal – TSOs' Recommendations and at the Grid Code Review Panel on 3 October 2012 in Belfast, SONI prepared drafts of certain sections of the SONI Grid Code with proposed amendments to cover the issues raised regarding the RoCoF modifications. These drafts where sent for consultation on 17 October 2012 with responses to be received by close of business on 15 November 2012.

1.2 The proposed amended texts of the Grid Code, with both clean and redlined versions of each relevant section showing all the changes made to the existing version of the Grid Code, can be found in the "Grid Code Drafts" section of SONI's website. This consultation paper sets out a high-level summary of the proposed changes to the SONI Grid Code and SONI sought comments from Users on any aspect of the proposed amendments.

1.3 A total of five written responses where received to the consultation from the following consultees:

a) AES Kilroot Power Ltd and AES Ballylumford Ltd
b) PPB – Power NI
c) Ipower
d) NIE
e) Coolkeeragh ESB

1.4 This response addresses the points raised by respondents to the consultation and comments are made without prejudice to SONI's position in this matter.

2. Background and overview

2.1 SONI, as the Transmission System Operator (TSO) in Northern Ireland, is responsible for the operation of the Northern Ireland Transmission network in a secure, safe, and economic manner.

2.2 The TSOs, EirGrid and SONI, are jointly recommending that the proposed RoCoF modification be approved simultaneously in Ireland and Northern Ireland

by the respective regulators CER and NIAUR. While the modification itself is quite straightforward, the RoCoF issue is possibly the most contentious and complex to have come before the Regulatory Authorities in these jurisdictions. The ramifications of approving or not approving the modification are considerable, and will have an immediate impact on the viability of current and future wind projects in Ireland and Northern Ireland, and on the feasibility of the renewable energy targets. Moreover, a decision to approve will have an equally strong impact on the running regimes and operational costs of conventional plant. This is the formal recommendation from SONI TSO to the NIAUR to change the Northern Ireland Grid Code.

2.3 The Facilitation of Renewables (FOR) study, published in 2010, was a detailed technical study that considered levels of non-synchronous generation (wind and HVDC imports) up to 100% of system demand on the power system of Ireland and Northern Ireland. The study has shown that during times of high wind generation following the loss of the single largest infeed, RoCoF values of greater than 0.5 Hz/s but less than 1Hz/s could be experienced on the island power system. In addition there are issues associated with voltage dip induced power imbalance in a system with significant volumes of wind farms but these are to be addressed elsewhere.

2.4 Accordingly, the main outcome of the FOR study was that wind levels (Non-Synchronous generation) of up to about 75% of demand could be accommodated, but a series of mitigation measures would have to be carried out. One of the main mitigation measures was the need to address the issue of RoCoF. This issue is the current binding limitation on operating the power system past a System Non-Synchronous Penetration (SNSP) of 50%.

2.5 At present the SONI Grid Code does not define RoCoF or identify the required RoCoF capability. However, since 2001 SONI set out in a Minimum Function Specification a RoCoF requirement for Transmission connected CCGT plant at the connection offer stage of 1.5 Hz/s. The increasing penetration of wind generation and the outcome of the FOR study, make it necessary for SONI to take measures to address RoCoF issues.

2.6 The current position in relation to RoCoF levels that may be needed to be managed in the future operation of the All-Island Power System is set out in the DS3 Joint Grid Code Working Group Position Paper. Further, based on the information understood as at 4 September 2012, SONI and EirGrid have published RoCoF Modification Proposal – TSOs' Recommendations paper setting out the background and contextual information as well as their recommendations for modifications to the SONI and EirGrid Grid Codes which SONI and EirGrid believe are a necessary first step in enabling SONI and EirGrid to operate the system with higher levels of Non-Synchronous generation in their respective areas and which would assist Northern Ireland and Ireland with achieving their renewable energy targets.

3. Overview of the responses received by the TSOs

3.1 Included in the table below are the main issues, from a SONI perspective, that have arisen from the consultation process. Many of the issues raised have already been covered in the various TSO papers that have been presented on the subject of RoCoF as part of the DS3 discussions that have taken place over the last year. This process has fully involved all interested parties from the electricity industry and all the relevant data has been published on the EirGrid web site under the DS3 work stream. New issues that were raised have also been addressed in the table below, however the vast majority of the points raised had already been discussed as part of the DS3 working group that was setup to look at the requirement for Grid Code changes. SONI has provided a response to each item raised using the information available at the time. Some of the responses raised general concerns that although helpful where not pertinent to this consultation so SONI has not addressed these issues in the responses below.

Modification Issue	TSO Response
1. Are there any other changes in the pipeline that may affect the higher ROCOF effect on the unit? (e.g. AVR adjustment to drive down post-fault over voltage)	SONI are not aware of any other changes that will have an effect on the higher RoCoF requirement for a unit. However, SONI note that the issue with respect to voltage induced frequency deviations will need to be addressed separately.
2. At present, the Grid Code in Northern Ireland has no express RoCoF requirement for generators. The requirement is for all generators to stay connected between 47 and 52 Hz with no RoCoF requirement.	SONI accept that presently there is no express RoCoF requirement in the Northern Ireland Grid Code. However, since 2001 all Transmission connected CCGT plant had to meet a minimum functional specification (MFS) requirement of having a RoCoF capability of 1.5 Hz/s. This MFS was introduced in recognition of the fact that Northern Ireland can, based on a single contingency, become a small isolated electrical system. When the Grid Code was written RoCoF on the system was not seen as a major issue and as such was not included at that stage. With the subsequent introduction of large amounts of non-synchronous generation, it is now seen as prudent to have a defined RoCoF requirement in the Northern Ireland Grid Code. This modification is aimed at having a RoCoF requirement formally added to the Northern Ireland Grid Code that SONI as a prudent System Operator feel is required in order to meet its licence requirements to run the system in a safe, secure, and economic manner.
3. Technical information required to complete analysis of RoCoF.	SONI will provide any information that it can to assist in any analysis undertaken. As part of the DS3 process a significant amount of technical data has been made fully available to all interested parties and is freely available on the EirGrid web site. These include the “Facilitation Of Renewables Studies”, the “Ensuring a Secure Sustainable Power System” and the papers supporting the joint Grid Code working Group.
4. Testing and analysis needs completed before implementation.	SONI fully supports the requirement for all relevant analysis to be completed and full implementation of the recommendations

	associated with this work to be completed before materially operating the power system in a manner that could lead to these high RoCoF values. To date the most significant barrier to starting this analysis is the requirement for a clear cost recovery mechanism by generators which is a matter for the Northern Ireland utility regulator.
5. A higher RoCoF value than that proposed in Ireland creates a compliance requirement that is more onerous in Northern Ireland than in Ireland. Various issues have been raised: a. Generating plant with identical characteristics could be both compliant and non-compliant depending on part of the island it is based. b. Discrimination that could affect market scheduling and constraint dispatch. c. Cost to meet Grid Code requirements will be more expensive in Northern Ireland than in Ireland. d. Generators in Northern Ireland have suggested that a requirement to meet a RoCoF in excess of 1 Hz/s should be included as part of an Ancillary Services.	SONI acknowledge the concerns raised. While there are system reasons why there is distinction between jurisdictions SONI believe it appropriate to conduct more analysis on the need for 2 Hz/s. This will include commissioning independent consultants DNV Kema to explore the issues for generators operating through high RoCoF. Until this, and any other appropriate study, has been completed SONI will not seek the 2 Hz/s for Northern Ireland generators. Therefore SONI will remove the proposed modification CC5.3.4 which now means the proposal will be for a RoCoF requirement of 1 Hz/s in the Northern Ireland Grid Code.
6. DSO study of protection capabilities should be complete and consulted upon before making modifications. Potential issues are: a. Potential for islanding at 400V-11kV (most AGUs) is more likely than units connected at 33kV and above. LOM protection is more important at these lower voltages. b. Effect of higher RoCoF studies below 500ms.	Acting as a prudent System Operator SONI will proceed in small steps and monitor any changes carefully, and over a satisfactory period of time, to ensure system security is not adversely affected before moving any further forward. SONI are still waiting on the DSO final report and recommendations. Appendix 1 includes a possible implementation plan in which can be seen the importance of a decision by the regulatory authorities on the successful implementation of the plan.

7. Any material changes to the Supply Standards in Grid Code must only be made after a full technical assessment, including testing, of Users plant and apparatus to understand the potential implications of operating the system to a different standard.	Acting as a prudent System Operator SONI will ensure that all technical requirements are considered and taken into account before making any decisions. Appendix 1 includes a possible implementation plan in which it can be seen the importance of a decision by the regulatory authorities on the successful implementation of the plan.
8. Where is the proof from SONI that higher RoCoF (2 Hz/s) does not cause risk to plant?	SONI have been shown no evidence to date which indicates a risk to generating plant from higher RoCoF events. A review of historical events from the all-island system and internationally has shown that generating units have been able to withstand such events in the past. SONI has requested information from all the Northern Ireland generators and to date has received no firm evidence that their plant cannot withstand RoCoF events of 2Hz/s. SONI understands the Northern Ireland generators concerns with the 2 Hz/s figure and has commissioned DNV Kema to undertake a series of studies on system stability and plant capability. Until these studies have been completed SONI will remove the proposed modification CC5.3.4 which now means the proposal will be for a RoCoF requirement of 1 Hz/s in the Northern Ireland Grid Code SONI will, as a prudent System Operator, continue to operate the system as it does at present until evidence is provided that confirms that it is safe for the system, and all components of the system, to operate at the higher RoCoF values being discussed. The regulator has asked the generators for costs of performing tests and analysis on units.
9. The planned amount of non-synchronous generation in Ireland and Northern Ireland far exceeds that of other power systems and therefore the reliance on theory based on existing systems and/or models in the world is not sufficiently robust without undertaking considerable testing.	Acting as a prudent System Operator SONI will make small incremental changes and use live monitoring tools such as Wind Security Assessment Tool (WSAT) to ensure that any decisions that are made will not affect system security. This is the ethos behind the DS3 programme and is required in order to meet the 2020 renewable requirements.

10. We were informed on 14th November 2012 that SONI may have issued the wrong version of the Grid Code Modifications with the Consultation Paper. Limiting considerable rates of change of frequency, under CC5.3.4, to exceptional circumstances only would go some way to address this concern.	This was an oversight and SONI apologise for the mix-up. Section CC5.3.4 has now been removed as noted above. SONI appreciate the feedback.
11. The resource requirements to test AGU units are far greater than the conventional plant as there are multiple units to test.	SONI acknowledge your concerns; however, this is an issue that should be raised with the regulator.
12. Electricity, Safety, Quality & Continuity Regulations (effective: 31st Dec 2012) states a variation in frequency not exceeding 1% (0.5 Hz). A RoCoF figure of 2 Hz/s would contradict this rule.	This regulation which is also contained in the existing Electricity Supply Regulations refers to quality of supply at a consumer's terminals under normal conditions. These regulations are for 'normal' system conditions and SONI is of the opinion that they do not apply in the circumstances being considered.
13. Want a statement from TSO on retrospective application to existing plant as it is likely the TSOs will require existing plant to be compliant. a. Some plant is so old it would be uneconomic therefore a Grid Code derogation would be required. b. One option is for TSOs to pay for existing plant to be updated.	For this modification to be meaningful, all conventional generators existing and new must be capable of dealing with higher levels of RoCoF. This is based on the understanding that all wind farms have confirmed that they have this capability already. The regulator has asked the generators for costs of performing tests and analysis on units.
14. Changes to CC.S1.2.1 (d) and CC.S2.2.1 (e): **From:** '*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.'.* **To:** '*The DNO shall ensure that protection equipment applied to Generators, with an output of 5MW or more, in compliance with the requirements of Engineering*	The DSO should put this change through the normal Grid Code modification process as it is out of scope for this modification.

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 the DSO considers that such a configuration could result in an unacceptable risk to the safety or operation of the Distribution System.'.	
15. Affects on Costs and Pricing: a. Insurance premiums could rise based on risk survey of change to RoCoF capability. b. Delay modifications until utility regulator puts financial arrangements in place to allow generators to complete testing and analysis. c. Like a review to be completed on how this change will impact HAS, GP1 and other system charge arrangements.	The issues raised in these points are the remit of the Regulators. SONI would however point out that until such issues are addressed it would not be prudent to move from the existing system non-synchronous penetration levels on the island.

4. TSOs proposals

4.1. Following consultation with all the electricity undertakings likely to be affected by the proposals, SONI have listened to the concerns raised by the Northern Ireland generators and has removed section CC5.3.4; as such SONI would recommend that the Regulatory authorities approve the proposed modifications to the Grid Code. These modifications are required in order to enable SONI to meet both the current situation and the proposed 2020 renewable targets. Without them, the amount of renewable generation that can be safely accommodated on the Northern Ireland system will at times have to be curtailed. Any delay in the implementation of this proposal will have an adverse impact on the time lines for the program of Delivering a Secure and Sustainable Electricity System (DS3) and as stated above the 2020 renewable targets for Northern Ireland.

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21 December 2012

Appendix 1 Implementation plan for Higher Rate of change of frequency