

Grid Code Review Panel

Frequency Resilience of the Total System

**A paper by National Grid
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Summary of Issue

1. The work carried out by the Frequency and Voltage Operating Range Working Group (FaVOR) has concluded with a Grid Code modification proposal as set out in the D/10 Report to the Authority dated 27th May 2011. The report contains an assessment of the proposed changes to the frequency and voltage criteria within the Grid Code. In respect of the frequency range change, the report concludes that the changes do not materially impact on the security of the Transmission System because of a range of frequency resilience related provisions within the Transmission and Distribution frameworks.
2. Specifically, the report highlights the importance of a robust and well managed approach to:
 - Automatic Low Frequency Demand Disconnection;
 - Manual Demand Control; and
 - Resilience of transmission and distribution connected generation.
3. This paper summarises the latest industry position on each of these topics and recommends further work.

Background

4. The Frequency and Voltage Operating Range Working Group has proposed a change to the Frequency Operating Range criteria within the Grid Code. One aspect of the change, namely the adoption of 49.0Hz as the value for the lower threshold of the continuous operating range attracted keen debate.
5. National Grid gave its support to this proposal given in the context of a range of existing frequency resilience features, and particularly the two mechanisms in place which protect the integrity of the Total System in the event that frequency falls below 49.0Hz, namely Low Frequency Demand Disconnection (LFDD) and Manual Demand Control. Provisions relating to LFDD and Manual Demand Control are set out within Grid Code OC6.
6. The report also highlights the importance of generator resilience to frequency deviations, as any loss of generation during a frequency deviation will exacerbate the initial problem. There are a number of facets to this, ranging from an ability to stay connected through to the interaction of protection and control equipment (Rate of Change of Frequency or "ROCOF" based protection is one such example).

7. Generation within the scope of the transmission frameworks is obliged to comply with the frequency operating range criteria of CC.6.1.3 (as potentially modified by the FaVOR Working Group's recommendations). Other Grid Code Criteria such as CC.6.3.15 (Fault Ride Through) and CC.6.3.3 (Falling Power with Falling Frequency) also enhance frequency resilience. Generation within the scope of the distribution frameworks falls under the scope of the Distribution Code and the relevant Engineering Recommendations (ER G59/2¹ and ER G83/1²).

Assessment

Low Frequency Demand Disconnection

8. A review of the Low Frequency Demand Disconnection arrangements was completed in 2009 by the OC6.6 Working Group. The working group made a number of recommendations which have been acted upon.

Manual Demand Control

9. Manual Demand control is currently under discussion by the GCRP. There is therefore no need to initiate new work in this area at this time.

Generator Resilience

10. Generation connecting under the transmission frameworks have to comply with a number of frequency related criteria, including any associated over or under-frequency protection settings if fitted, and are required to demonstrate this through well established procedures. There is some uncertainty however over the frequency resilience of generation connected prior to the establishment of current compliance processes.
11. The Distribution Code and the associated Engineering Recommendations G59 and G75³ were recently reviewed taking into account frequency resilience issues. Work to implement recommendations fully is ongoing. Engineering Recommendation G83 ("Recommendations for the Connection of Small-scale Embedded Generators (up to 16A per Phase) in parallel with Public Low-Voltage Distribution Networks") is currently under review. National Grid is represented on this working group and expects frequency resilience requirements to be fully incorporated into this document.
12. Subsequent to the review of the Distribution Code and ER G59 however, the Security and Quality of Supply Standard (NETS SQSS) has been amended to allow larger infeed loss risks to be catered for. The change to a larger infeed loss impacts on the rate at which frequency can fall for a secured event which could be high enough to cause a significant loss of small embedded generation as a result of the ROCOF based protection being triggered. The Panel asked the FaVOR Working Group to add this issue to its terms of reference in the 4th February 2010 meeting, but the Working Group did not feel it had the appropriate membership to do this work at that time.

¹ ER G59/2: "Recommendations For The Connection Of Generating Plant To The Distribution Systems Of Licensed Distribution Network Operators"

² ER G83/1: "Recommendations for the Connection of Small-scale Embedded Generators (Up to 16A per Phase) in Parallel with Public Low-voltage Distribution Networks."

³ ER G75/1: "Recommendations for the connection of embedded generating plant to Public distribution systems above 20kV or with outputs over 5MW", superseded by G59/2

13. There is therefore an outstanding need to assess the ROCOF issue in light of the SQSS change. Also, the Frequency Response Working Group is currently evaluating future frequency response requirements which will provide new information on possible future frequency characteristics. Terms of reference for a working group on ROCOF incorporating transmission, distribution and generation representatives will be brought to the September GCRP.

GCRP Recommendation

14. The Panel is asked to note the range of frequency resilience issues against which the FaVOR recommendations were assessed and the recent progress in these areas.
15. The Panel is asked to note National Grid's intention to bring forward Terms of Reference for a working group on ROCOF to the September GCRP.