

Review of Grid Code Connection Conditions for Frequency and Voltage Operating Ranges

Paper by National Grid

Introduction

It has been noted that existing GB Grid Code requirements for frequency operating ranges that synchronous generating units must remain connected continuously to the transmission system appear more stringent than those required internationally. This is against a background where statistically large frequency perturbations have rarely occurred on the GB transmission system and have been transitory in nature.

Similarly voltage range is specified in combination with frequency capability with specific limited time operation at more extremes.

At the GCRP meeting of 21 May 2009 it was agreed (minute 1228) that a review of the GC requirements should be added to the Outstanding Issues list of the GCRP for subsequent review. This paper proposes to initiate such a review via a GC Working Group to ensure timely consideration based on the amount of new synchronous generating plant expected to be connected in the next ten years.

Performance of Transmission

Frequency

CC.6.1.2 specifies that the frequency range of the National Electricity Transmission System shall be controlled within the limits of 49.5-50.5Hz unless exceptional circumstances prevail.

CC.6.1.3 states system frequency could rise to 52Hz or fall to 47Hz in exceptional circumstances and that users plant must be capable of operating within the range as follows:-

47.5Hz – 52 Hz	Continuous operation
47 Hz – 47.5 Hz	At least 20 seconds operation

Since 1990 the frequency has fallen below 49.5 Hz on 12 occasions and fallen below 49.0 Hz once in this period and not risen above 50.5 Hz since a system split in 1981^{2,3}. On all these occasions frequency was quickly restored to within the normal limits and hence only existed transiently.

The international standard⁴ relevant to synchronous generating plant IEC 60034-3:2007 paragraph 4.6 recognises the differences between continuous operation at maximum output and frequencies where time limited operation is more appropriate. Individual transmission system operators may use the IEC standard as a basis for defining the time periods for operation in exceptional circumstances, for example see RTE specifications⁵ or Nordic Grid Code⁶.

Voltage

CC.6.1.4 states that at 400 kV the voltage limits are normally maintained within $\pm 5\%$ of nominal value unless abnormal conditions prevail. In addition the minimum and maximum voltages are $\pm 10\%$ unless abnormal conditions prevail, but voltages beyond $+5\%$ and $+10\%$ will not persist for more than 15 minutes unless abnormal conditions prevail.

Since 1990 abnormal voltage outside $\pm 10\%$ has occurred six times in England and Wales and such instances are limited in geographic scope.

Recommendation

It is recommended that a GC Working Group is convened based on the draft terms of reference and based on this commence a review of the frequency and voltage range defined in the Grid Code.

Impact on Other Documents

There is a potential interaction with the BSSG working group on frequency response, the Relevant Electrical Standards and SQSS.

References

1. The Grid Code Issue 4
2. Review of Studies Assessing frequency and Duration of Loss of Off-Site Power at Nuclear Power Stations NGC/MASD/19.2.4/028/A:May 2001
3. A Review of the Performance of Connections to Nuclear Power Stations owned by BE and NDA, Annual Report 2009, NG/AM/ENI/15.68/117/P
4. IEC 60034-3 Requirements for synchronous generators driven by steam turbines or combustion gas turbines
5. Nordic Grid Code 2007 Part 4 Connection Code
6. RTE Gestionnaire du reseau de transport d'electricite – Documentation technique de reference V2
7. UCTE Requirements
8. European Utility Requirements for LWR nuclear power plants.