nationalgrid

Meeting Note

Meeting name	GC0062: Fault-ride-through
Meeting number	2
Date of meeting	6 February 2014
Time	10:00 – 14:00
Location	National Grid House, Warwick.

Attendees

Name	Initials	Company
Graham Stein	GS	National Grid (Chair)
Tony Johnson	AJ	National Grid
Duraisingam Balasingam	DB	National Grid
Paul Wakeley	PW	National Grid (Technical Secretary)
Herve Meljac	HM	EDF Energy
Dave Draper	DD	Horizon Nuclear Power
Phil Jenner	PJ	RWE
Campbell McDonald	CM	SSE Generation
Philip Belben	PB	Horizon Nuclear Power

Apologies

Name	Company
John Morris	EDF Energy
Rui Rui	Iberdrola

In addition to this Meeting note, please refer to the slides for the meeting which have been published to the Grid Code Workgroup webpage:
http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0062/

1 Introductions/Apologies for Absence

1. GS welcomed representatives to the meeting and thanked them for joining the meeting. The purpose of the workgroup meeting was outlined as defining the scope of the study work that National Grid needs to undertake to support future discussions for fault-ride-through for Large synchronous plant connected at Supergrid voltages (> 200kV) and to ensure consistency with the ENTSO-E Requirements for Generators (RfG) Network Code.

2. The meeting note from the previous meeting was agreed, and can be found on the Grid Code website:
http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/GC0062/

2 Resume of Previous Meeting

3. AJ summarised the situation from the previous meeting and what the workgroup was now expected to do. The expectation is to work with the broad requirements in the Grid Code for fault-ride-through for Large synchronous plant connected at Supergrid voltages, but to consider amendments the voltage characteristic applicable for faults longer than 140ms (Mode B). It is these types of faults, when issues such as pole slipping become a problem. A key challenge will be determining a voltage characteristic that is acceptable for the overall security of the system, but that are achievable by the Generators. It was noted that such a requirement would need to be consistent with the ENTSO-E RfG.

4. The concern with respect to system security is that during a fault on the network, a large voltage depression will occur across large parts of the Network due to the low impedance of the Supergrid. National Grid's primary aim is to ensure that the Generation connected to healthy circuits remains connected and stable so as to protect the overall System. AJ noted that National Grid as System Operator currently secure a maximum infrequent infeed loss risk of 1320MW (to be increased to 1800MW in April 2014). He noted that if 1800MW where to be lost due to a Transmission System fault and neighbouring generation connected to healthy circuits also tripped, the frequency could not be secured to 49.2Hz resulting in potential operation of the low frequency demand disconnection scheme which in the worst case could lead to total frequency collapse. For longer duration faults (Mode B) for example where both main protections failed or a circuit breaker were to stick, it was acknowledged that the system frequency could not be controlled to above 49.2Hz but the Transmission System and Generation connected to it should be sufficiently robust to prevent total system shut down.

5. AJ advised that the current requirements in the Grid Code were created based on the research and study work undertaken by National Grid as part of Grid Code Consultation H/04 (See Appendix 2 of the consultation document on the National Grid Website[1]). It was also noted that the type of plant connected to the system has evolved since 2004. AJ noted that a fundamental part of this process was to ensure that Power Station auxiliaries could continue to operate under the fault-ride-through conditions. Although this issue had been investigated in 2004 this issue may require further assessment.

6. Several points of note were raised which will need considering as part of any output from this workgroup.

   - The presentation of the requirements in the current GB Grid Code (Mode A: CC.6.3.15.1(a) for Faults up to 140ms in duration and Mode B: CC.6.3.15.1(b) for Voltage Dips in excess of 140ms in duration) is different from the requirements in the RFG:
     - RFG presents a voltage-against-time profile at the connection point, where generators experiencing any voltage profile above that curve must remain connected. In the Grid Code for Mode A faults, Generators must remain connected and stable for any balanced or unbalanced supergrid fault which may last up to140ms in duration. For Mode B faults, Generators must remain connected and stable for any Supergrid voltage dip on or above the heavy black line of Figure 5 in the Grid Code Connection Conditions.
     - The RFG refers to the Voltage at the Connection Point, whereas the Grid Code refers to Supergrid Voltage (ie any voltage of 200Kv or greater).

[1] http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/Grid-code/Modifications/Concluded/2004/

- The development and approval of the RFG Network Code continues. In January 2014 the European Commission issued a revised informal draft of the Network Code. Although there were no material changes to the fault-ride-through requirements for Type D synchronous plant[2] an error has been noted in the drafting. This has been flagged to DECC by National Grid. Clarity in the RFG requirements should be gained as the Code progresses through the Cross-Border Committee[3], with formal voting on the text expected in April 2014– although all timelines are provisional.
- One workgroup member cautioned against any early adoption of requirements from RFG, as it may inadvertently set a precedent to application to the broader Type D Generation at a later stage. It was noted that RFG is just being used an example of how changes could be made to the Grid Code (equivalently requirements from another country could have been used). As RFG only applies to new generators, the requirements for new Type D generators do not necessarily map directly from the work of this workgroup and will need further consideration. It was noted that such issues (which are outside the remit of this Workgroup) would need to be considered as part of the combined Grid Code / Distribution Code RFG Implementation Working Group.
- It was noted that based on the RFG fault-ride-through requirements, it is still unclear what studies / simulations would need to prepared by a Generator to demonstrate their compliance to the requirements. Further guidance will be required.
- Workgroup members noted that the pre-fault system conditions have a significant impact on the outcome of any simulations to demonstrate compliance, most notably the minimum system fault level, both pre and post fault. This can vary greatly between sites and lead to a 'post-code lottery' type of scenario for developers. It was suggested that greater visibility of these fault levels would provide developers with a lot more clarity when performing initial design stage studies.

3 Scope of Study Work and Parameter Determination

7. It was noted that RFG allows a time range (140ms to 250ms) for sustaining a 0pu fault. Under the Grid Code it is presently 140ms for a 0pu voltage at Supergrid voltage levels (ie above 200kV). At this stage NGET does not perceive a requirement to move away from 140ms due to the operating times of our protection equipment.

8. National Grid will undertake system studies to investigate the likely voltage levels observed across the Network after system faults and, a secondary outime, to outline typical minimum fault levels.. It was noted that Secured Events are defined in the NETS SQSS[4]. Workgroup members expressed concerns that Fault-Ride-Through requirements were trying to secure against a multi-fault scenario as the voltage dip duration times used are for backup protection following failure of the main protection during a network fault. It was noted that a balance had to be struck between the need to protect electricity consumers from unnecessary supply interruptions and the inherent capability of a Generator.

9. It was noted that the voltage-time profile after a fault will be a function of the local network topology, the location of the fault, and the local post-fault short circuit current which would be a function of the connected adjacent Generation. Therefore the studies need to consider the variation across the system rather than based on one specific scenario.

10. The initial system studies will be prepared using the summer minimum demand and future expected generation based on National Grid's slow progression and Gone green Future Energy Scenarios[5]. Using future scenarios helps to examine a scenario when there are more, Interconnectors, wind generation and new nuclear. Using summer minimum demand captures the situation when we expect to have the lowest percentage of generation connected (meaning overall lower system inertia and synchronising torque). It was also noted that under minimum demand conditions the voltage tends to be higher; therefore generators tend to operate either

2 Type D plant in GB is any power generating module connected above 110kV or with a capacity greater than 30MW.

3 Officially "Committee on the implementation of legislation on conditions of access to the network for border exchanges in electricity". A committee composing of representatives from member states (in the case of UK, the Department of Energy and Climate Change).

4 http://www2.nationalgrid.com/UK/Industry-information/Electricity-codes/System-Security-and-Quality-of-Supply-Standards/

5 http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Future-Energy-Scenarios/

at unity power factor or in the underexcited mode of operation and hence and closer to their stability margin.

11. The studies will be complied using the full England and Wales multi-machine study in Digsilent Power Factory and will inform the impact on Auxiliaries.

12. The other aspect of this work, after the system studies, will be to ascertain the technical capability of new and future generators. This is likely to include engagement with manufacturers.

4 Other topics of discussion

13. The benefit of carrying out asymmetric fault scenario was questioned, recognising the a three-phase fault scenario would always be worst case for FRT compliance. It was determined that asymmetric faults were out of scope for this study at present.

14. A discussion was held on whether the fault-ride-through requirements should apply on a site specific basis or as currently on a national basis. It was noted that bilateral agreements are less transparent that Grid Code requirements, however, the original Grid Code paper (GCRP Paper Reference6 PP12/04) has proposed that there be a national standard with local variations if appropriate. It was noted that although there is a national fault-ride-through requirement, the local pre and post-fault short-circuit current infeed will have to be defined on a site specific basis. Generators would like greater clarity on this locational short-circuit current rather than the ranges specified in the Electricity Ten Year Statement[7].

5 Actions

15. The workgroup is due to the report to the Grid Code Review Panel by January 2015, however, it is welcome to report earlier if the work of the workgroup is concluded sooner.

16. The next meeting is proposed to be held in late April / early May (date to follow). At this stage it is expected there will be some output from the system studies for the group to consider.

ID	Actions	Captured	Owner	Status
1	Circulate Grid Code Panel Paper pp12/14 on fault-ride-through	WG 1	NGET	Complete
2	Setup meetings for 2014 (Next meeting in early February, then at 8 to 10 week intervals)	WG 1	NGET	Closed See section 5 above.
3	Prepare an initial review of fault ride through compliance in GB	WG 1	NGET	Open
4	Prepare preliminary analysis of voltage recovery profiles and a proposal for analysis required to demonstrate the need case.	WG 1	NGET	Closed. Defined to take place as part of study work.

[6] Included in papers for January 2012 GCRP at: http://www.nationalgrid.com/NR/rdonlyres/75FA2248-B3DA-4823-A1DA-2ABCEEC7C016/51220/January12GCRPpapers2.zip

[7] http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Electricity-ten-year-statement/