nationalgrid

~~GC0035 &~~ GC0079 Frequency Changes during Large Disturbances and their impact on the Total System.

TERMS OF REFERENCE

~~26 August 2015~~01 March 2016

Governance

1. The Frequency Changes during Large Disturbances and their impact on the Total System Workgroup was established by Grid Code Review Panel (GCRP) at the May 2012 GCRP meeting.

2. The Workgroup shall formally report to the GCRP and the DCRP.

Membership

3. The Workgroup shall comprise a suitable and appropriate cross-section of experience and expertise from across the industry, which shall include:

Name	Role	Representing
Mike Kay	Chair	Electricity North West
~~Scott Bannister~~Richard Woodward	Technical Secretary	National Grid
Graham Stein	Member	National Grid
Gareth Evans	Authority Representative	Ofgem
Adam Dyśko	Technical Expert	University of Strathclyde
~~Michael Walbank~~	~~Member~~	~~Northern Power Grid (DNO)~~
Sam Turner	Member	Northern Power Grid (DNO)
Martin Lee	Member	SSEPD (DNO)
Ioannis Koutsokeras	Member	SP Energy Networks (DNO)
Andrew Hood	Member	Western Power Distribution (DNO)
Miguel Bernardo	Member	UK Power Networks (DNO)
Campbell McDonald	Member	SSE (Generator)
Joe Duddy	Member	RES (Generator)
Jacob Allinson	Member	~~EON~~ RWE (Generator)
Greg Middleton	Member	Deep Sea Electronics
John Ruddock	Member	Deep Sea Electronics

Meeting Administration

4. The frequency of Workgroup meetings shall be defined as necessary by the Workgroup chair to meet the scope and objectives of the work being undertaken at that time.

5. National Grid will provide technical secretary resource to the Workgroup and handle administrative arrangements such as venue, agenda and minutes.

6. The Workgroup will have a dedicated section on the National Grid website to enable information such as minutes, papers and presentations to be available to a wider audience.

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Scope

7. The Workgroup will, as part of the first stage of work (Phase 1 under GC0035):
   a) Review the expected behaviour of Total System when subject to frequency changes during large disturbances, with particular focus on the rate of change of frequency. Take into account the output of the Frequency Response Technical Sub-group and also recent experience of disturbances on the Total System.

   b) Take account of relevant international practice and the approach taken in European Code development.

   c) Research details of the RoCoF based protection settings applied to embedded generators of 5MW and greater rated capacity.

   d) Investigate and quantify the risks to DNO networks and Users of desensitising RoCoF protection on embedded generators above 5MW and greater rated capacity. Develop proposals for consultation on any proposed changes drawing out the costs, benefits and risks of such a change to present to the GCRP and to DCRP members in July 2014. The proposed changes were approved by The Authority on 24th July 2014.

8. The Workgroup will undertake Phase 2 of the work. The context for Phase 2 includes the following considerations:

   a) There is a convergence of technical considerations when transmission system faults give rise to both voltage and frequency phenomena. GC0079 is concerned only with the frequency effects on the Total System, or on DNO power islands.

   b) It is recognized that National Grid will have to develop a formal operating standard in line with the European Codes defining the maximum rate of change of frequency that the total system is secured against. This is an expected consequential requirement of implementing the EU Network Code currently titled "Network Code on Operational Security" in the GB frameworks.

   c) There are a number of factors that will prevent generating plant riding through frequency changes. These include both the physical capabilities of electrical and mechanical components, the capability of control systems, and the effects of protection.

   d) Generating equipment connected to distribution networks will generally have protection that fulfils two discrete functions. The first is to protect the generating equipment and ancillaries. The second is to provide the required network interface protection, ie as required by G59 or G83.

   e) The focus of Phase 2 is to address the risks of unwanted tripping initiated by the network interface protection, but includes considering mitigation of any additional frequency resilience risks arising from generating equipment protection and control.

9. Phase 2 will therefore include the following activities:

   a) Monitoring the implementation of the protection changes recommended under phase 1.

   b) Researching the characteristics (numbers/types etc) of existing embedded generation of less than 5MW rated capacity including their likely RoCoF withstand capabilities;

   c) Investigating the characteristics of popular/likely inverter technology deployed, particularly in relation to RoCoF withstand capability and island stability;

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d) Assessing or modelling the interaction of multiple generators in a DNO power island;

e) Investigating and quantifying the risks to DNO networks and Users of desensitising RoCoF based protection on embedded generators of rated capacity of less than 5MW;

f) Analysing the merit of retrospective application of RoCoF criteria to existing embedded generation of less than 5MW (including comparison with similar programmes in Europe);

~~g) Development of RoCoF withstand criteria of new generating equipment for use in GB (as will be required by the EU Network Code Requirements for all Generators (ref RfG Art 13.1(b))) and will co-ordinate its efforts with GC0048 as necessary;~~

~~h)~~g) Considering any other relevant issues in relation to the resilience of the total system in respect of the operating characteristics of small generation;

~~i)~~h) Developing a view of the RoCoF operating standards for the purpose of the Workgroup's assessment which is consistent with the requirements of the European Network Code on Operational Security (Article 4 3(a));

~~j)~~i) Developing proposals for consultation on any proposed changes drawing out the costs, benefits and risk of such a change to present to the GCRP and DCRP. Proposals should include a recommendation of where implementation costs should fall and the most appropriate workgroup for this issue to sit with; and

~~k)~~j) Engaging with the Health and Safety Executive (HSE) and all affected parties considering the different stakeholders that will be affected by any proposed changes.

10. Proposals developed under Phase 2 will be presented in stages because of the complexity of the issues involved, the range of expert input required, and parties affected by the proposals under development. The first stage ("Phase 2(a)") will deliver proposals concerning RoCoF based protection on embedded generators of rated capacity of less than 5MW. The second stage ("Phase 2(b)") will deliver further proposals including RoCoF withstand criteria of new generating equipment as described in paragraph 9(g).

11. Phase 3 will include the following activities. Phase 2 completion will be prioritized ahead of Phase 3:

~~a) Recognize the likely trajectory of system inertia and other relevant parameters forecast by the System Operability Framework;~~

~~b)~~a) Consider the implications on existing generation plant of operating the system to higher RoCoF than it is currently secured to;

~~c)~~b) Consider the issues relating to the continuing use of Vector Shift techniques;

Comment [NG1]: NGET: To be moved to GC0087

Comment [NG2]: NGET: Merged with other TSOG point (d) below

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~~d)~~c) Liaise with any implementation group for managing the requirements of the European Code 'Transmission System Operation Guideline (TSOG)', GC0048 – Requirements for Generators, GC0087 – Requirements for Generators Frequency Provisions, to determine appropriate governance for system RoCoF operating limits and system inertia and determine how to assess impact on, and capability of, existing generation.~~Determine how to assess impact on and capability of existing generation;~~

~~e) Liaise with SQSS Panel to determine appropriate governance for system RoCoF operating limits which is consistent with the requirements of the European Network Code on Operational Security (Article 4 3(a)); and~~

~~f) Undertake necessary analysis to be able to recommend a RoCoF withstand criterion for existing generation appropriate for higher system operating RoCoF limits.~~

Comment [NG3]: NGET: Now to be considered within GC0087?

Deliverables

12. The Workgroup will provide updates and a Workgroup Report to the Grid Code Review Panel and Distribution Code Review Panel which will:

    a) Detail the findings of the Workgroup;

    b) Draft, prioritise and recommend changes to the Grid Code, Distribution Code and associated documents in order to implement the findings of the Workgroup; and

    c) Highlight any consequential changes which are or may be required,

Timescales

13. Workgroup timescales will be reviewed from time to time and agreed with the GCRP and DCRP.

14. If for any reason the Workgroup is in existence for more than one year, the Workgroup to produce a yearly update, including but not limited to; current progress, reasons for any delays, next steps and likely conclusion dates.

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