DCRP_16_04_06a

nationalgrid

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

**TERMS OF REFERENCE**

**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 | Energy Networks Association |
| ~~Richard Woodward~~Ellen Bishop | Technical Secretary | National Grid |
| Graham Stein | Member | National Grid |
| ~~Gareth Evans~~Martin Queen | Authority Representative | Ofgem |
| Adam Dyśko | Technical Expert | University of Strathclyde |
| 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 | 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~~ primarily 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. Such an operating standard will not be developed within GC0079.

   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 currently 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.

   ~~e)~~f) Phase 2 will investigate the suitability of VS shift protection as an alternative to RoCoF, taking into account its possible unsuitability for transmission fault ride through requirements.

9. Phase 2 will therefore include the following activities:

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

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

c) Researching the characteristics of existing embedded generation of all sizes where the embedded generation is fitted with vector shift (VS) anti-islanding protection.

~~b)~~d) Investigate the likely effect of transmission faults on VS protection techniques, and determine the risk of wide spread DG tripping from VS protection being inappropriately sensitive to transmission faults.

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

~~c)~~f) Investigating the characteristics of popular/likely inverter technology deployed in relation to its behaviour in the presence of the voltage phenomena associated with transmission faults;

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

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

~~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));~~

**Commented [MK1]:** This is now GC0087??

k) Consider, if appropriate, revised VS protection settings, including any supporting risk assessment analysis;

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

~~i)~~m) Initiating consideration by DNOs of the future management of out-of-phase reclose risk; and

~~j)~~n) 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. Phase 2 will deliver proposals concerning RoCoF based protection on embedded generators of rated capacity of less than 5MW and concerning VS protection for all embedded generation..

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

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

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

~~c) Liaise with SQSS Panel plus any implementation group(s) 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~~

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

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## Deliverables

~~12.~~11. 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.~~12. Workgroup timescales will be reviewed from time to time and agreed with the GCRP and DCRP.

~~14.~~13. 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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