GB Grid Forming (GBGF) - capability mandate, clarity on definitions, changes to performance requirements and changes to compliance tests and simulations

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Background

- Grid Code Modification GC0137 was implemented into the Grid Code in Feb 2022 which provides the Minimum Specification Required for the Provision of a GB Grid Forming (GBGF) Capability.

- An Expert Group, which comprised a wide range of Stakeholders, was established to develop a GB Grid Forming Best Practice Guide, which was subsequently published in April 2023.

- Grid Code Modification GC0163 was implemented into the Grid Code in July 2024 and permits the use of a real, virtual or real / virtual impedance between the internal voltage source of a Grid Forming Converter and Connection Point which provides flexibility and cost reductions

- During the last few years, significant experience has been gained by the ESO (in particular Generator Compliance and through the Stability Pathfinder work) on the capability and performance of Grid Forming Inverter units (GBGF-I).

- We are also observing the European developments of Grid Forming following the consultation of RfG 2.0 and HVDC 2.0.

- We propose to take this industrial experience forward to update the Grid Code, initially this will be via an Expert Group ahead of a formal code change.

Scope / Terms of Reference

- Develop an Expert Group (ahead of a formal Code Change) to consider
  - The recommendations of the GB Grid Forming Best Practice Guide
  - Comments raised from Stakeholders
  - The industrial experience gained through the Stability Pathfinder work and projects which have been through the Generator Compliance Process
  - European Developments
  - Consider the appropriateness or otherwise of mandating Grid Forming on specific types and sizes of plant
- Grid Code Implementation target date: by the end of 2025.

What's the proposal (1)?

1- From the end of 2025, mandating a Grid Forming Capability on:-

Type D Power Generating Modules (50 MW and above and/or connected at 110 kV or above) and:-

HVDC Systems (including Interconnectors)

With compliance required by the end of 2028

This would not be retrospective on pre 31 December 2025 plant

2- The modification proposal builds on the experience and comments received to date and includes the following further topics for consideration,

A. Inverter Based Resources (IBRs) with a pre-defined Grid Forming Mode should operate as long as possible to provide natural responses rather than operate in a Grid Following Mode for the provision of fast fault current injection.
B. Different operational modes should be clearly specified: To avoid confusion, Normal & Withstand Modes instead of "Linear" and "Non-Linear" Modes will be considered to reflect the operational conditions of GBGF Plants.
C. A Phase Jump Angle Withstand of 60 degrees should be further evaluated for further roll-out of GB Grid Forming applications.

What's the proposal (2)?

3- The modification proposal further builds on the ESO's experience of the compliance process for the first GC0137-compliant Grid Forming units and Stability Pathfinder units. Various suggestions are being proposed by the ESO to modify and clarify various clauses, tests and definitions based on the experience gained.

4- The ESO has received a few suggestions from the wider industry to provide further clarity on the expected performance and monitoring of GBGF-I units. Provided that the group has sufficient time and the workload permits, some or all the following points will be brought up for discussion:

A. Update the definition of Active Phase Jump Power to avoid fast acting controls from delivering this response and ensure that this power is delivered by a slow acting, natural response.
B. Review ECC.6.6.1.9 - ECC.6.6.1.10 in respect of monitoring, especially phase jumps.
C. Define a limit on the Allowed Phase Jump Angle step in the Grid.
D. Differentiate between GBGF-I and standard frequency control requirements.
E. Examining how the "handshake" between initial inertial action and frequency response informs the energy density requirements of the energy store behind the grid forming plant.
F. Optimal deployment of secondary damping controls to support both frequency stabilisation and elimination of inter-area modes.
G. Consider the difference between Grid Following and Grid Forming requirements for Fast Fault Current Injection

Next Steps

- Seek nominations for an Expert Group (aim to start first meeting in September)
- Develop Terms of Reference and Proposal documents
- Prepare recommended Code Changes and ensure these are scrutinised by the Expert Group
- Prepare a report summarising the findings and recommendations with suggested legal text
- Raise the issue as a formal Code Modification
- If you are interested in joining the Grid Forming Expert Group please contact the ESO if you have not been previously involved in the previous Expert Group.

Questions