

Emergency and Restoration GB implementation

GC0127/GC0128

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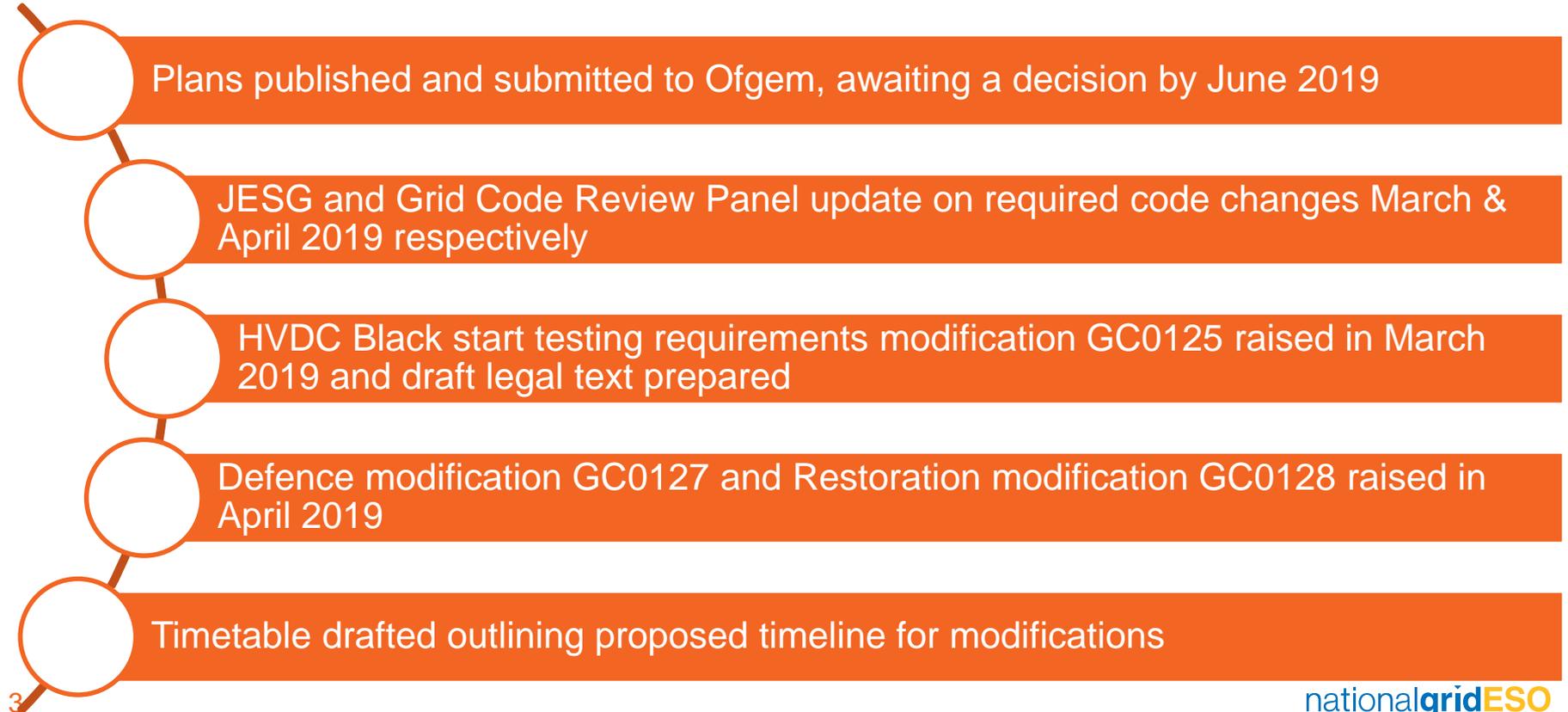
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Emergency and Restoration Code – The Wider Picture



Links to Related Documents

Plans and documents submitted to Ofgem on 18 December 2018:

<https://www.nationalgrideso.com/codes/european-network-codes?code-documents>

HVDC Black start testing GC0125, Defence plan GC0127 and Restoration plan GC0128 mods:

<https://www.nationalgrideso.com/codes/grid-code?mods>

Emergency and Restoration (E&R) code:

https://www.entsoe.eu/network_codes/er/

GC0127 and GC0128 - Overview

1. **GC0127 - Emergency and Restoration Requirements resulting from the System Defence Plan** (E&R Code:- Article 11 – Article 22)
2. **GC0128 - EU Code Emergency and Restoration: Requirements resulting from the System Restoration Plan** (E&R Code:- Article 23 – Article 39)
3. **Testing Requirements –** (E&R Code:- Article 43 – 51)
4. **Both modifications were raised and presented to the April Grid Code Review Panel**
5. **National Grid ESO System Defence Plan and National Grid ESO System Restoration Plan published December 2018**
6. **Validation of requirements to be demonstrated through a detailed mapping spread sheet.**

General Principles for Implementing GC0127 and GC0128

1. Requirements on the ESO will be specified in the System Defence Plan and System Restoration Plan as approved by Ofgem
2. The ESO is assumed to be the Frequency Leader – This is an update from previous thinking
3. Obligations on Transmission Licensees will be specified in the System Operator Transmission Owner Code (STC). Updates will need to be made where relevant to the STC and related STC Procedures to reflect any additional requirements which need to be implemented as a result of changes from the Emergency and Restoration Code.
4. Obligations on Users over and above those which already exist and which are required in the Emergency and Restoration Code will need to be incorporated into the Grid Code and Distribution Codes

EU Code SGU Criteria (GC0127 and GC0128)

Existing and New Type B, C or D Power Generating Modules

- In accordance with Article 5 of RfG
- Only SGUs with mandatory GB code obligations
- Note the System Restoration Plan excludes Type B Power Generating Modules

Transmission connected demand facilities

- Existing and new facilities providing services to the Transmission System Operator (TSO)

All transmission connected closed distribution systems

- Existing and new facilities providing services to the TSO

Aggregators

- Demand facilities by means of aggregation and providers of active power reserve in accordance with Title 8 of Part IV of the System Operation Guideline (SOGL)

Existing and new HVDC

- In accordance with Network Code HVDC where existing HVDC only comply with articles 26, 31, 33 and 50 unless they undergo substantial modification (includes Offshore Transmission)

SGUs responsible for implementing Defence measures (GC0127)

Defence measure	Responsible SGUs
Reduction in active power at frequencies above 50.5Hz	Only for power stations with a frequency response contract
Limited Frequency Sensitive Mode	New and Existing synchronised Gensets and HVDC converters required to satisfy Grid Code BC3.5.2 and ECC.6.3.3/CC.6.3.3.
Requirement not to exacerbate frequency excursion when system frequency is < 49.7Hz or > 50.3 Hz	Only for Balancing Mechanism (BM) participants that are required to satisfy Grid Code BC2.5.4
Reactive Power Instructions to generating units	Only for power stations with a mandatory services agreement
Emergency Instructions	Only for BM participants required to satisfy Grid Code BC2.9

Defence plan changes for December 2019 implementation (GC0127) (1)

1. Automatic under frequency control for storage providers (Article 15.3)

- Requirement on storage providers to switch from import to export at low frequencies before demand trips on Low Frequency (See next two slides)
- Under GC0096 this requirement has not been included in the drafting. There is also the unintended consequence on the sudden change from import to export and different technologies will have different cycle times.

2. Compliance testing of demand facilities (Article 45)

- Demand Side Response (DSR) providers required to execute a demand modification test, after two consecutive unsuccessful responses in real operation or at least every year
 - Only applies to transmission connected demand facilities or if you have a contract with National Grid ESO - Captured under Grid Code DRSC.11.5.1

Defence plan changes for December 2019 implementation (GC0127) (2)

1. Assistance for active power procedure (Article 21.1B)

- Any SGU (not a balancing service provider) to make available all active power
 - No Grid Code changes but work needed with Distribution Network Operators if Distribution Code change is required.

2. Compliance testing of low frequency demand disconnection relays (Art.47)

- Transmission System Operator (TSO) and Distribution System Operator (DSO) to execute testing on the low frequency demand disconnection relays implemented on its installations within a period to be defined at National Level.
- Under Grid Code it is not clear how this fits in with the Type Tests and Functional requirements for low frequency relays defined in Grid Code CC/ECC.A.5.4
- ENA Technical specification 48-6-5 Issue 1 dated 2005 “ENA Protection Assessment Functional Test Requirements – Voltage and Frequency Protection”.

Automatic under frequency control for Storage Providers (GC0127) (1)

- Emergency and Restoration Code Article 15.3 States:-
- Prior to the activation of the automatic low frequency demand disconnection scheme, each TSO and DSO identified pursuant to Article 11(4) shall foresee that energy storage units acting as load connected to its system:
 - (a) automatically switch to generation mode within the time limit and at an active power set-point established by the TSO in the system defence plan; or
 - (b) when the energy storage unit is not capable of switching within the time limit established by the TSO in the system defence plan, automatically disconnect the energy storage unit acting as load.
- As part of the GC0096 (Storage proposals) and also as part of the wider European Expert Group on Storage the proposal is for storage when operating in a mode analogous to demand to be tripped on low frequency. Pumped Storage plant is currently treated in the same way.

Automatic under frequency control for Storage Providers (GC0127) (2)

- There are concerns over the rapid switching of plant from import to export which include:-
 - Affect on the System
 - Control System Stability issues
 - Differences in cycle times between different storage technologies (eg a battery will have a very different cycle time than say a mechanical storage system such as a compressed air energy storage system)
 - Existing plant is likely to struggle with these requirements especially as Storage is not codified in the Connection Network Codes
- Under E&R Article 15.3 if the TSO set the time threshold from import to export to a very short time, then the requirement defaults to automatic tripping which is the preferred option. Would this approach be considered as an acceptable and pragmatic solution to the Workgroup.

SGUs responsible for implementing Restoration measures (GC0128)

Restoration Service Providers have contractual and codified obligations that they shall meet

Transmission connected SGUS that are required to comply with Grid Code BC2.9 on Emergency Circumstances

Distribution connected SGUs that are required to comply with Distribution Code DOC9.4 on Black Start
Further discussion required

Restoration Plan (GC0128)

- **Activation of the re-energisation procedure (Art.27(4))**
 - TSO to consult with DSOs on establishment and notification of the amount of netted demand to be reconnected on distribution networks.
- **Testing of communication systems (Art.48)**
 - Annual test of communication system defined in Article 41 (required by 2022)
 - Test backup power supply of communication systems at least every 5 years
 - Control Telephony (in GB) has a degree of robustness for operation under emergency conditions
- **Many of the requirements are already covered in OC9 although some additions will be required.**

Phase 2 Code changes

NCER Requirements	Implementation date
Automatic under frequency control scheme (Art.15(5) to15 (8))	18/12/2022
Communication systems (Art.41)	18/12/2022
Resilience tools and facilities (Art.42.1, 2 and 5)	18/12/2022
Testing and Communication Systems (Art.48)	18/12/2022
Inter-TSO test plan for testing of communication systems (Art.48)	18/12/2024

*Aim to start Phase 2 Code Changes September / October 2019

Next Steps

- **Detailed assessment of additional requirements**
- **Additional Legal text updates**
- **Preparation of mapping table**
- **SGU List**
 - Clarification of criteria for SGU list for industry participants (Defence & Restoration)
 - Industry engagement at relevant forums to raise awareness