

Electricity System Restoration Standard

GC0156 Industry Webinar – Please [click here](#)
for the recording

7 December 2022

Summary

- Background
- The Defect
- Facilitation of the Electricity System Restoration Standard
- Tools available to support System Restoration
- How have the current defects been identified
- Key features of the GC0156 drafting
- Distributed Re-Start
- Transmission Demand
- Other Factors
- Proposed High Level Grid Code Changes
- Other Documents Affected
- Summary

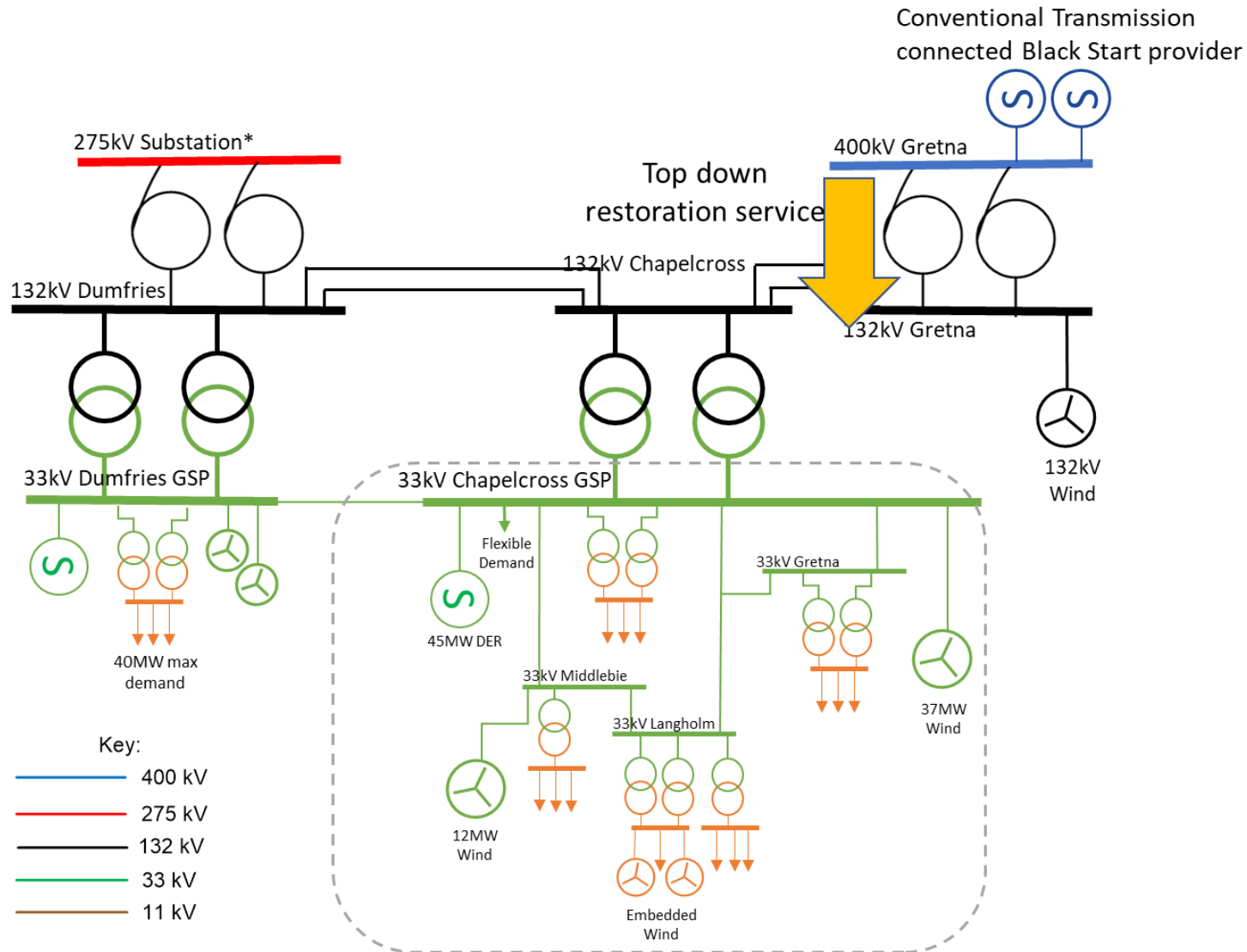
Total and Partial System Shutdown - Causes

Potential causes include:

- Physical damage to network at multiple points e.g. extreme weather event
- Inadvertent configuration of system (e.g. system malfunction, human error)
- Malicious attack (e.g. insider threat, cyber attack, terrorist attack)



Traditional Restoration Procedure



Restoration Service Providers will start without external power supplies and energise the transmission network

The distribution networks will be energised in pre-segregated blocks of demand to stabilise the Restoration Service Providers Plant

The transmission network will be grown to restore supplies to other transmission connected energy resources

This process is repeated until the power system is restored with multiple power islands being grown in parallel across GB

The Defect

- National Grid ESO has had Restoration (Black Start) Policies in place for many years using the processes highlighted on the previous slide
- Going forward these practices require review for the following reasons:-
 - Restoration Service Providers (traditionally Coal and Gas fired Power Stations connected at Transmission are retiring)
 - Significant changes in Generation type, Network topology, demand profiles and Demand habits
 - Significant growth in Embedded Generation
 - Introduction of the Electricity System Restoration Standard
 - Increased frequency of extreme weather events
 - Net Zero goals

Facilitation of the Electricity System Restoration Standard (ESRS)

- Special Condition 2.2 of National Grid's Electricity System Operator's Transmission Licence, the Electricity System Restoration Standard (ESRS) was introduced in October 2021 and requires
 - a. 60% of electricity demand being restored within 24 hours in all regions;
and
 - b. 100% of electricity demand being restored within 5 days nationally.
- The purpose of this direction is to require that the ESO
 - a) Ensures and maintains an electricity restoration capability; and
 - b) Ensures and maintains the restoration timeframe.
 - c) Replace the definition of "Black Start" with "Electricity System Restoration"
- The aim is to restore the system and supplies as quickly as possible in the most economic manner

Tools to support Restoration

Tool	Purpose	Function
GC0137 Modification	Grid Forming	Enables Converter and Renewable based Generation to provide Restoration Services – Approved by Ofgem in January 2022
Implementation of the EU Emergency and Restoration Code (Grid Code Mods GC0125, GC0127, GC0128, GC0148)	Improved Communications resilience	72 hours communication resilience
	Participation from Non – CUSC Parties	More Parties are able to provide Restoration Services
	Critical Tools and Facilities and Governance	Provides requirements for Critical Tools and Facilities during a Total or Partial System Shutdown
New measures being introduced through Grid Code Modification GC0156 to implement the Electricity System Restoration Standard	Changes to the Industry Codes (Grid Code, STC, CUSC and BSC) to facilitate the introduction of the Electricity System Restoration Standard	This modification is only associated with the Grid Code changes which itself is subject to a Governance Process. The Grid Code is taking the lead and the other Industry Codes will then follow which again also have their own Governance process.

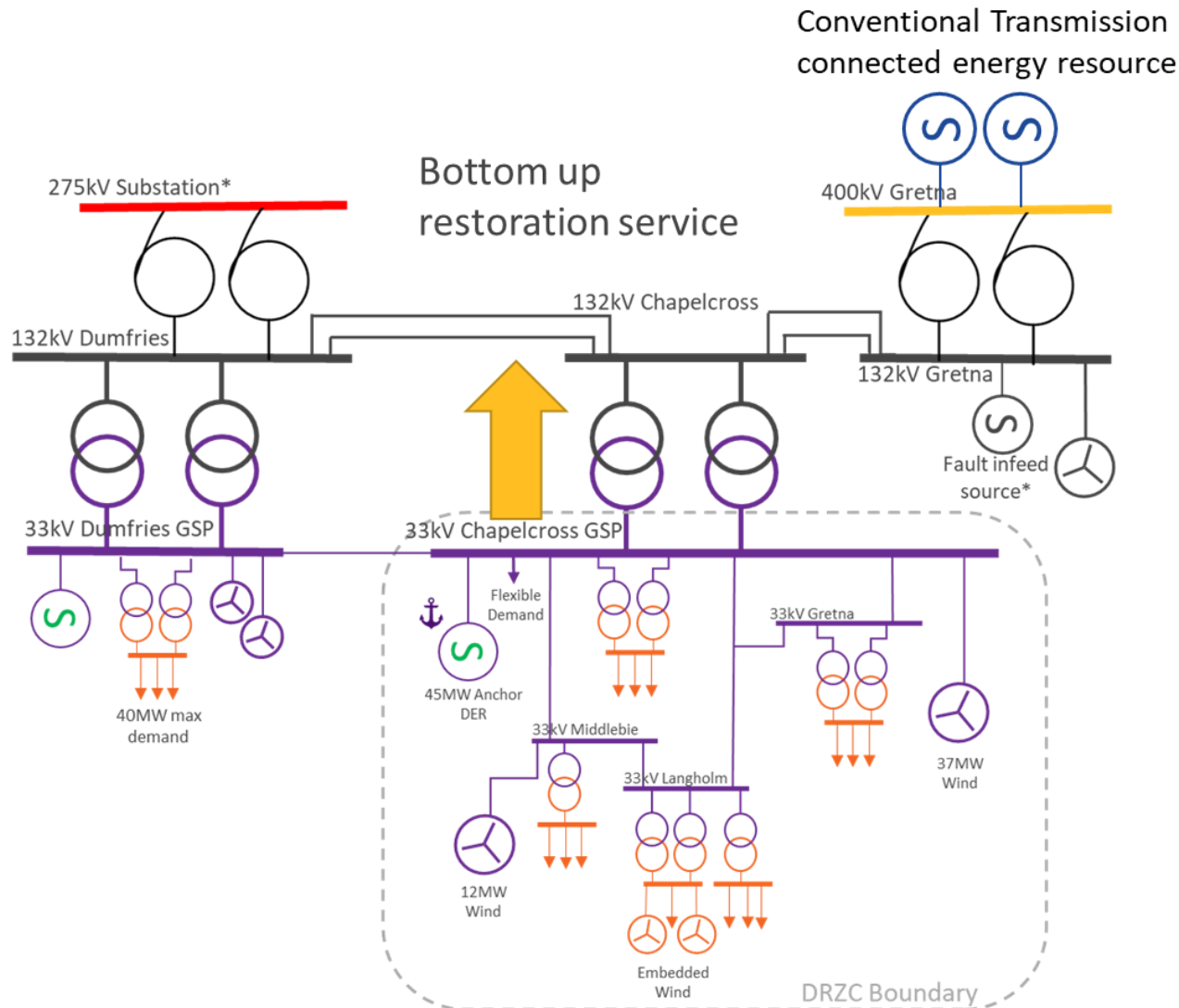
How have the current defects been identified?

- In November 2021 seven Subgroups were established to consider the issues necessary to implement the ESRS
 - Modelling and Restoration
 - Future Networks
 - Technology and Locational Diversity
 - Compliance Activities
 - Communications Infrastructure
 - Markets and Funding
 - Regulatory Frameworks
- In April 2022 the first GC0156 Workgroup was held which included four Subgroups
 - Future Networks
 - Assurance
 - Communications
 - Markets and Funding (used to develop CMP398 Workgroup (CUSC) based on technical requirements)
- The thinking from these Subgroups has been used to develop the proposed Grid Code Text

Key Features of the GC0156 Grid Code Drafting

- Introduction of Distributed Re-Start – See next Slide (initially developed as an NIC Project)
- Introduction of enhanced Critical Tools and Facilities – ie the ability to operate critical systems and assets during a System Shutdown or Partial Shutdown including data and communications systems
- Introduction of an Assurance process including regular testing, desk top exercises and reporting including confirmation of successful plant running when site supplies are restored.
- Improved testing processes and procedures
- Updates to the Grid Code to permit restoration of from Offshore Systems (currently excluded – see STCP 06-1)
- Amendments to the Local Joint Restoration Plan to enable the use of Anchor Generators (formerly called Black Start Generators) and Top Up Restoration Service Providers to ensure equitable treatment between Local Joint Restoration Zone Plans (LJRPs) and Distribution Restoration Zone Plans (DRZPs).
- Enhanced Assurance data reporting and submission, especially for Restoration Service Providers and those parties involved in Restoration as part of a LJP or DRZP
- Updates to Relevant Electrical Standards – Control Telephony Standard, Communications Standard and the introduction of a Distribution Restoration Zone Control System Standard
- Updates to definitions and explicit reference to Demand for the purposes of ESRS in Operating Code 9
- Work with the DNO's to facilitate Distribution Restoration and changes to the Distribution Code
- Definition of Black Start changed to System Restoration

Distributed Re-Start



A distribution connected energy resource (Anchor DER) will start without external energy supplies

This will be used to energise other distribution connected energy resources (Top Up DER) which will collectively be used to energise parts of the DNO System and in some cases part of the Transmission system and restore local demand

This bottom up process (Distribution Restoration Zone Plans (DRZP)) will run in parallel with Local Joint Restoration Zone Plans (LJRP) to form Power Islands so the Total System can be re-established as quickly as possible

Broad consistency between Plant participating in an LJRP and DRZP

Transmission Demand

- The ESRS requires 60% Transmission Demand to be restored (all regions) within 24 hours and 100% within 5 Days
- We treat Demand – for the purposes of ESRS as
 - *Electricity system **Demand** in the “**Electricity System Restoration Standard**”, is treated by **The Company** to be the forecast peak **National Demand** which would have occurred within the 24 hour period following the start of the **Total Shutdown** or **Partial Shutdown** had the **Total Shutdown** or **Partial Shutdown** not occurred.*
 - *National Demand in the Grid Code is defined in the Grid Code Glossary and Definitions as*

National Demand	The amount of electricity supplied from the Grid Supply Points plus:- <ul style="list-style-type: none">• that supplied by Embedded Large Power Stations, and• National Electricity Transmission System Losses, minus:- <ul style="list-style-type: none">• the Demand taken by Station Transformers and, Pumped Storage Units’ and Electricity Storage Modules’. and, for the purposes of this definition, does not include:- <ul style="list-style-type: none">• any exports from the National Electricity Transmission System across External Interconnections.
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Other Factors

- Retrospectivity will potentially be an issue for many CUSC Parties, especially for critical tools and facilities which requires a 72 hour resilience period. The funding mechanisms for this are the subject of CUSC Modification CMP398
- Distribution Restoration Zones are not mandatory but are important in re-establishing the network as quickly as possible
- It is proposed to set up a Subgroup under GC0156 to consider how technical requirements (currently part of Tender Contracts) can be placed in a Relevant Electrical Standard
- The requirements need to be in place by 31 December 2026 so the aim is to have the codes updated as soon as possible – target 2023
- The ESRS can only be achieved on the basis that network assets and Customers Plant and Apparatus (e.g. generation, storage, HVDC etc) are in an operational and functional state.

Proposed High Level Grid Code Changes

Grid Code Section	Summary of Update
Glossary and Definitions	Introduction of new definitions – changes to some existing definitions
Planning Code	Data reporting for Restoration Service Providers and Parties forming part of a Distribution Zone
Connection Conditions/European Connection Conditions	Changes to Protection, Control and Governor Settings, amendments to Offshore to enable Offshore Generation to participate in Restoration, broad normalisation of Anchor Plant and Top Up Restoration Plant, introduction of Distribution Restoration Zones/obligations on Network Operators, reinforcement of Critical Tools & Facilities, introduction of Assurance activities
OC1	Notification Demand Data for System Restoration Purposes
OC2	Outage data in respect of Restoration Service Providers and Network Operators
OC5	Enhanced Testing and Assurance requirement including deadline charge and remote Synch tests
OC9	Fundamental restructure to include Local Joint Restoration Plans and Distribution Restoration Zone Plans
BC2, BC4 & General Conditions	Consequential changes to reflect changes to Restoration
Data Registration Code	Consequential data changes

Other Documents Affected

- System Defence Plan
- System Restoration Plan
- Test Plan
- Control Telephony Standard
- Communications Standard
- Distribution Restoration Zone Control System – High Level Functional Requirements

Summary

- The GC0156 Consultation runs from 21 November 2022 – 30 December 2022
- Changes to other Industry Codes (eg STC, CUSC and BSC) will have their own consultation and fall outside this modification
- The ESRS aims to ensure there is a good level of confidence that the Industry has sufficient tools in place to restore the System as quickly as possible should a Partial or Total System Shut down occur whilst acknowledging this is against intact and operable System Conditions
- It is in everyone's best interests to play their part to make sure the System can be restored as quickly as possible

A landscape photograph featuring snow-capped mountains under a cloudy sky. In the foreground, several bright yellow light trails curve across a grassy field. The text 'Q&A' is overlaid in the center.

Q&A