

A dramatic landscape featuring snow-capped mountains under a cloudy sky. A glowing yellow energy path, composed of multiple parallel lines, winds through a valley in the foreground, leading towards the mountains.

WELCOME

GC0156

Implementation of the Electricity System Restoration Standard

Meeting 3

16 June 2022

Online Meeting via Teams

nationalgridESO

Agenda

Topics to be discussed	Lead
Welcome	Chair
Review of Actions Log	Chair
ESO Updates from Actions	Sade Adenola & Tony Johnson
<ul style="list-style-type: none">Action 9: Clarification of the definition of 'Electricity Demand'Action 11: Restoration OverviewAction 12: Definition of Anchor Generator	
Agree on Terms of Reference	Chair
Updates on GC0148 and Distributed Restart	Tony Johnson
<ul style="list-style-type: none">Distributed Re-start Grid Code Legal DraftingDistributed Restoration Zone ContractsAreas for further development to facilitate implementation of ESRSPotential changes to LJRP's	
Next steps from ESRS Recommendations	Sade Ademola
<ul style="list-style-type: none">Finalise Subgroup NominationsReview Subgroup Terms of Reference	
AOB & Next Steps	Chair
<ul style="list-style-type: none">Review and discuss draft legal texts	

Members / Alternates & Observers

Role	Name	Representing
Chair	Banke John-Okwesa	Code Administrator (ESO)
Technical Secretary	Ruth Roberts	Code Administrator (ESO)
Technical Secretary	Milly Lewis	Code Administrator (ESO)
Proposer	Antony Johnson	NGESO
Proposer	Sade Adenola	NGESO
Workgroup Member	Abdi Osman	NGV Interconnectors
Workgroup Member	Alan Creighton	Northern Powergrid
Workgroup Member	Alastair Frew	Drax Power Station
Workgroup Member	*Andrew McLeod	Northern Powergrid
Observer	Andrew Larkins	Sygensys
Workgroup Member	Andrew Vaudin	EDF Energy
Observer	Audrey Ramsey	NGESO
Workgroup Member (Alternate)	Brad Kent	NGET
Workgroup Member	Brian Morrissey	SSEN Distribution
Workgroup Member	Cefin Parry	Northern Powergrid
Workgroup Member (Alternate)	Chanditha Udalagama	NGV Interconnectors
Workgroup Member	Colin Foote	SP Energy Networks
Workgroup Member	*Daniel Randles	Electricity North West Ltd
Workgroup Member	David Adam	SP Energy Networks
Workgroup Member	Dozie Nnabuife	NGESO
Workgroup Member	Eric Leavy	SP Energy Networks
Observer	Eva Shamu	NGESO
Workgroup Member	Garth Graham	SSE Generation
Workgroup Member (Alternate)	Gavin Anderson	Electricity North West Ltd
Workgroup Member	*Graeme Vincent	SP Energy Networks
Workgroup Member	Grace March	Sembcorp
Workgroup Member	Graz Macdonald	Waters Wye
Workgroup Member	Gwyn Jones	Western Power Distribution

*Lead / voting member

Role	Name	Representing
Workgroup Member	Howard Downey	SP Energy Networks
Workgroup Member (Alternate)	John Costa	EDF Energy
Workgroup Member (Alternate)	Lisa Waters	Waters Wye
Observer	Mark Bingham	NGET
Observer	Mark Holland	Scottish & Southern Electricity Networks Transmissions
Observer	Mark Jones	NGESO
Workgroup Member	*Michelle Macdonald	Scottish & Southern Electricity Networks Transmissions
Observer	Mike Kay	Distribution Code Administrator
Observer	Neha Gupta	NGESO
Observer	Neil Sandison	Scottish & Southern Electricity Networks Transmissions
Workgroup Member	Nikhil Singh	NGET
Observer	Paul Murray	Scottish & Southern Electricity Networks
Workgroup Member (Alternate)	Paul Youngman	Drax Power Station
Workgroup Member	Peter Couch	Joint Radio Company Limited
Workgroup Member	Priyanka Mohapatra	Scottish Power
Workgroup Member	Richard Poole	*NGV Interconnectors
Workgroup Member	Robert Longden	Eneco Energy Trade BV
Workgroup Member (Alternate)	Ross Strachan	Scottish Power
Observer	Toktam Sharifian	KREC
Workgroup Member	Tolu Esan	Electricity North West Ltd
Authority Representative	Christopher Statham	Ofgem



Timeline

Banke John-Okwesa – National Grid ESO Code Administrator

Timeline for GC0156

Milestone	Date	Milestone	Date
Proposal Presented to Panel	24 February 2022	Workgroup 10 – Review updated WG report and legal text following consultation responses, finalise solution(s) and legal text.	31 January 2023
Workgroup 1 – Understand / discuss proposal and solution, review and agree on Terms of Reference and Timeline, agree next steps.	26 April 2022	Workgroup 11 – Agree that Terms of Reference have been met, Review Workgroup Report and hold Workgroup Vote.	21 February 2023
Workgroup 2 – Review high level options and legal text, consider outputs from related modifications (such as GC0148).	19 May 2022	Workgroup Report issued to Panel	23 March 2023
Workgroup 3 – Review high level solutions / options	16 June 2022	Panel sign off that Workgroup Report has met its Terms of Reference	30 March 2023
Workgroup 4 – Develop solution(s)/options, identify/asses any possible alternative solutions	14 July 2022	Code Administrator Consultation	03 April 2023 – 03 May 2023
Workgroup 5 – Conclude on preferred options / consider and agree on alternatives	18 August 2022	Draft Final Modification Report (DFMR) issued to Panel	17 May 2023
Workgroup 6 - Develop WG consultation questions and report, assess alternatives (if applicable)	20 September 2022	Panel undertake DFMR recommendation vote	25 May 2023
Workgroup 7 – Refine WG consultation report and legal texts, agree alternatives	20 October 2022	Final Modification Report issued to Panel to check votes recorded correctly (5 working days)	29 May 2023 – 02 June 2023
Workgroup 8 – Finalise Workgroup Consultation and legal text	10 November 2022	Final Modification Report issued to Ofgem	05 June 2023
Workgroup Consultation (15 Working Days)	21 November 2022 – 09 December 2022	Ofgem decision	TBC
Workgroup 9 – Review/assess consultation responses	17 January 2023	Implementation Date	10 working days after Ofgem decision



Review of Actions Log

Banke John-Okwesa – ESO Code Administrator



Actions

For the full action log, [click here](#).

Number	Action	Owner	Status
5	To produce a clear requirement of what is required from this workgroup in terms of objectives	NGESO	Open
7	For all workgroup members to review the Terms of Reference and bring any further suggestions to the next workgroup meeting	Workgroup	Open
8	Workgroups meetings to be rescheduled to 13:00-16:30 on the days presented on the timeline	Code Admin	Complete
9	SA to provide clarity from BEIS on their definition of 'electricity demand'	SA	Open
10	SA to share the finalised Workgroup ToR with ESRS Steering Group and feedback comments post Workgroup 3	SA	Open
11	Request for pictorial representation of the wider restoration strategy including how DRZP and LJRP work together and the practical expectations	NGESO	Open
12	Look at definition of anchor generator as it will be used in tendering document	AJ	Open
13	Highlight recommendations from the ESRS Workgroup reports	NGESO	Open

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ESO Updates on Actions

Antony Johnson & Sade Adenola – National Grid ESO



Terms of Reference

Banke John-Okwesa – ESO Code Administrator

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Updates on GC0148 and Distributed Restart

Antony Johnson – National Grid ESO

GC0148 - Summary

- GC0148 Workgroup Consultation issued on 28 March 2022 and Closed on 27 April 2022
- A total of 7 responses were received
 - 7 in the public domain (including the ESO)
 - 0 Confidential
 - 2 Alternatives
- Overall there is support for this modification but an overriding view (including that of the ESO) that Distributed Re-Start should be taken out of GC0148 and included in GC0156 (Electricity System Restoration Standard)
- In May several meetings were held to review and finalise the Legal Text
- Two Alternatives have been raised (both relate to System State)
 - WAGM1 – System State without “Normal” and “Alert” States in the definition of GB NETS System State
 - WAGM2 – System State with “Normal” and “Alert” States in the definition of GB NETS System State
- The Workgroup vote was held on 27th May and the Original and both Alternatives were agreed to better facilitate the Grid Code objectives
- A show stopper meeting has been arranged for 13th June

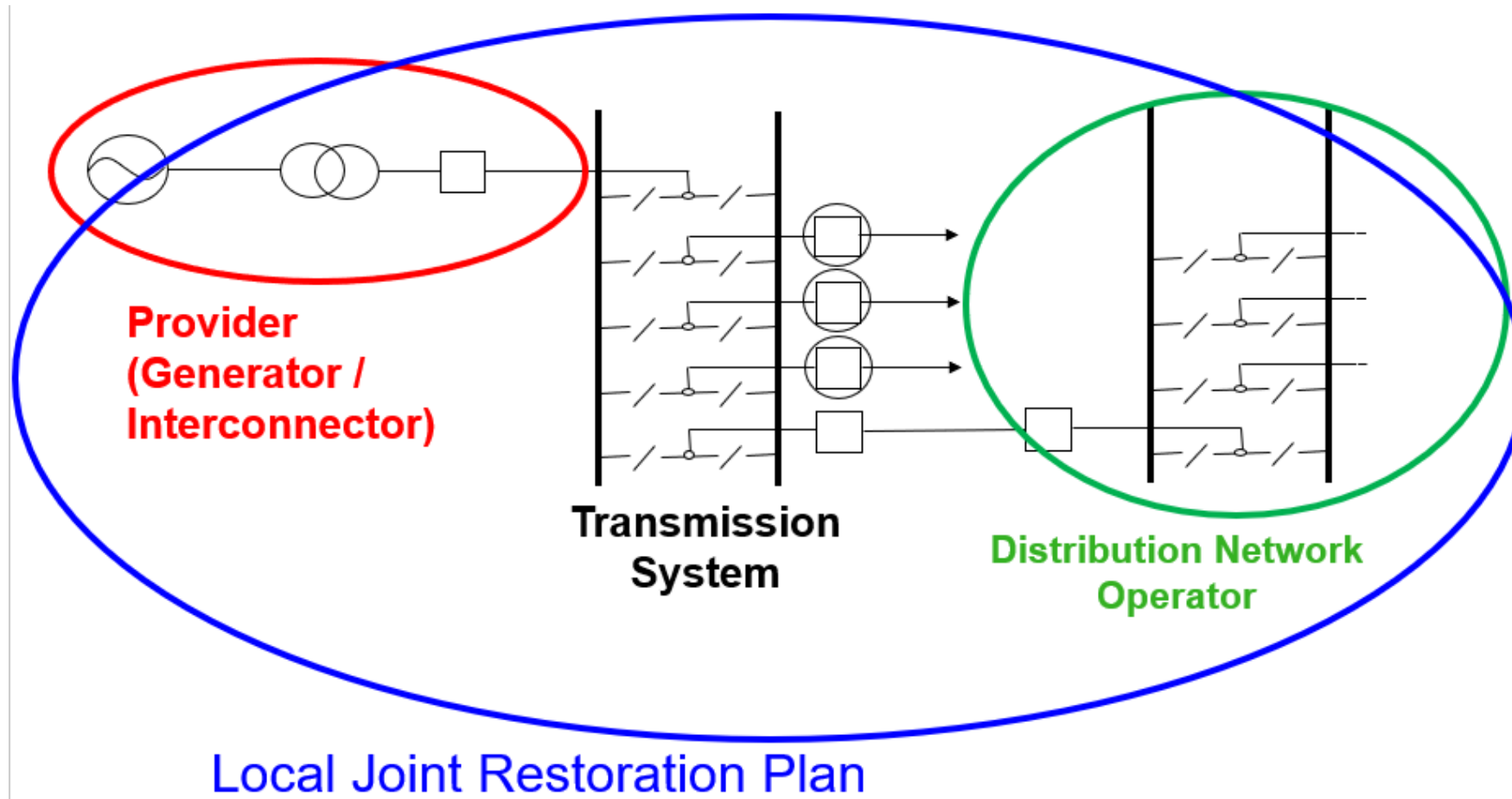
Facilitation of the the ESRS

- Special Condition 2.2 of National Grid's Electricity System Operator's Transmission Licence, the Electricity System Restoration Standard (ESRS) 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

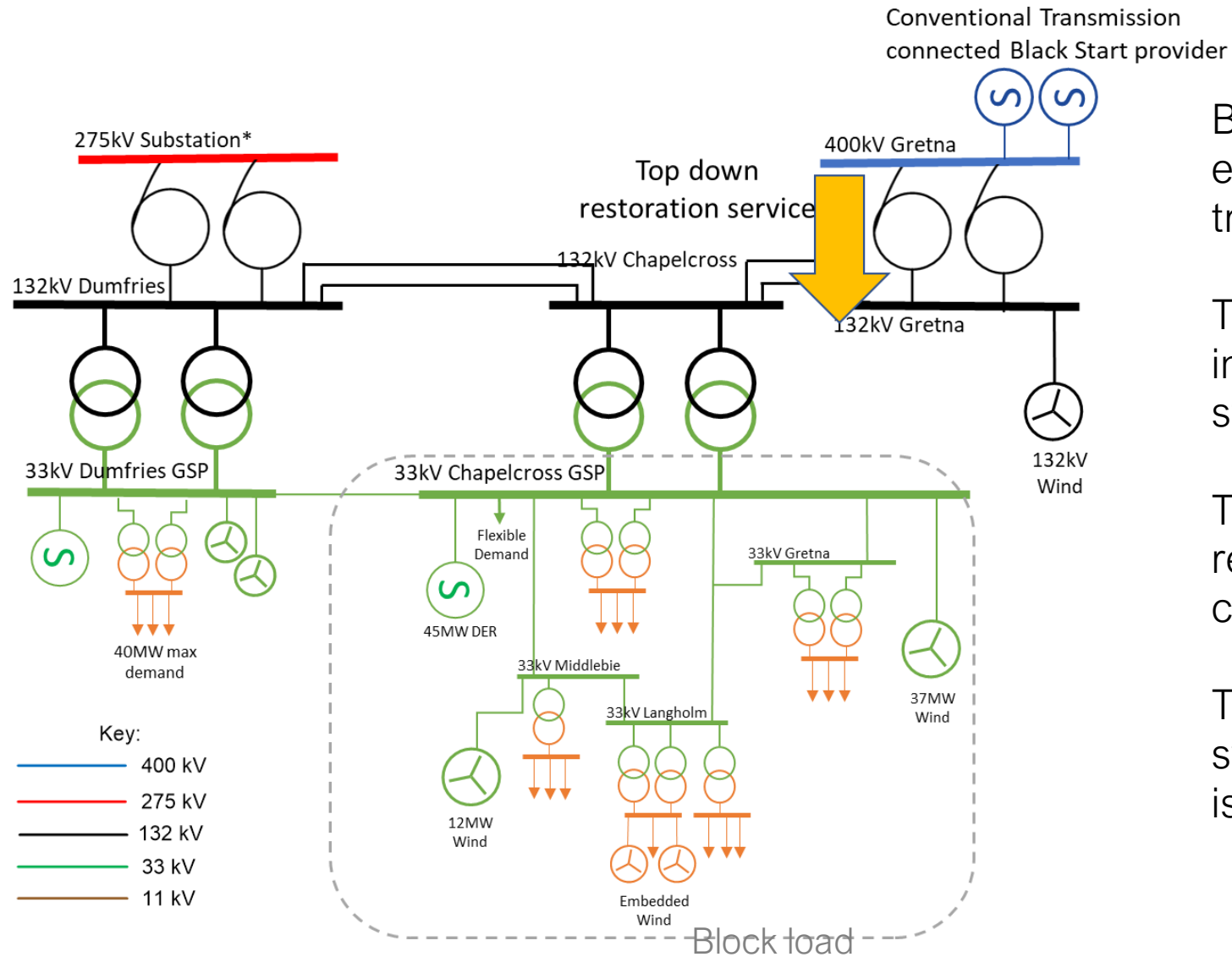
Black Start – Traditional Approach

- The traditional approach to Black Start the System is to place contracts with strategically located Black Start Stations across the country.
- In the event of a Black Start situation these Power Stations are instructed by the ESO to start within 2 hours and energise parts of the Transmission System.
- Sections of Distribution Networks are subsequently connected to with blocks of Demand connected. This process is referred to as a Local Joint Restoration Plan (LJRP)
- This process is run in parallel and in each case the LJRP is used to form a Power Island.
- The Power Islands are connected together to form a skeleton Network ahead of greater connection of Power Stations and restoration of demand
- This sequence is detailed in OC9 of the Grid Code with testing for Black Start Service Providers being covered in OC5
- Going forward the number of traditional Black Start Providers is reducing and additional solutions need to be identified to restore the system in accordance with the ESRS
- It is in Country's everyone's best interest to restore the system as quickly as possible in the most economic manner

System Restoration – Local Joint Restoration Plans



Black Start – Traditional Approach



Black Start 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 Black Start provider

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

Other Available 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
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 Black Start
	System Restoration Plan	Grid Code Governance structure being introduced for the System Restoration Plan
Distributed Re-Start	Enables DNO's to start sections of their Network using Restoration Service Providers	Capitalises on the growth of Embedded Generation Resources which can contribute to Black Start Legal Drafting prepared as part of GC0148 to be updated and refined as part of ESRS
ESRS Workstreams	To identify what additional requirements are necessary to give the system the best possible chance of recovery	Various – See slide 19

Distributed Re-Start

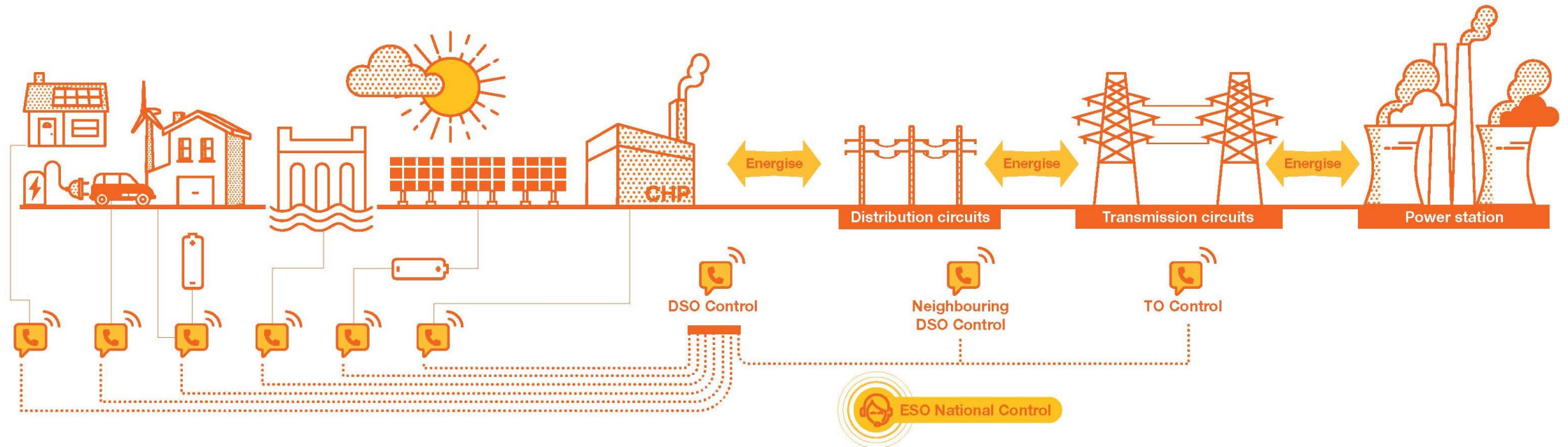
An aerial photograph of a lush green agricultural field, possibly corn, with distinct rows of crops. Several bright, glowing yellow diagonal streaks, resembling light trails or energy beams, cut across the field from the bottom left towards the top right. The text "Distributed Re-Start" is overlaid in white on the left side of the image.

Why Distributed ReStart?

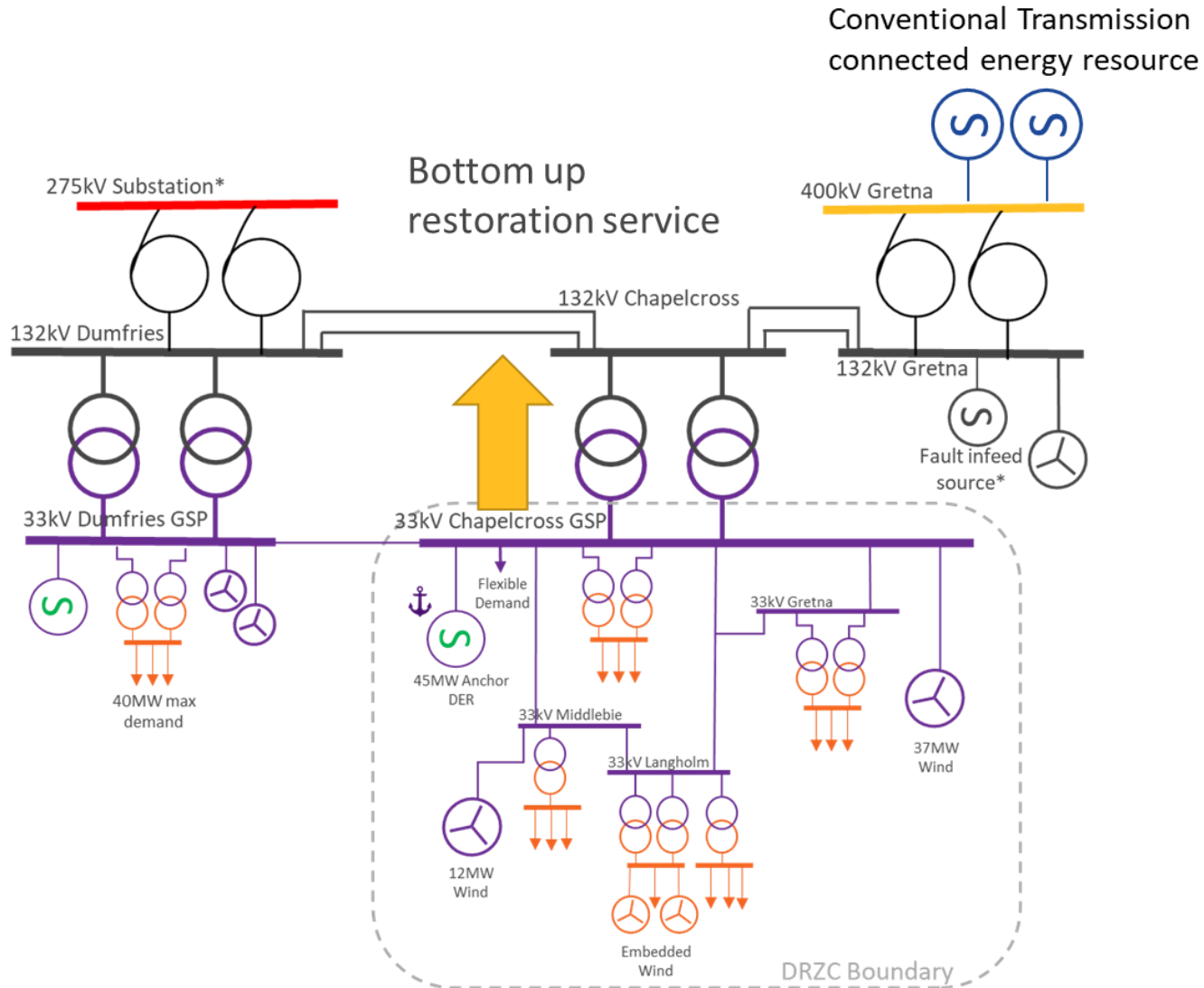
A 'Bottom up' approach for Black Start restoration from Distribution to Transmission using Distributed Energy Resources will:

- Reduce cost to consumers by introducing competition
- Decrease carbon footprint
- Future proof our networks
- Accelerate regional restoration timescales
- <https://www.nationalgrideso.com/future-energy/projects/distributed-restart>

energy.
with **renewable**
to prove **it's possible**
approach to **black start**,
This project uses a **bottom up**



Distributed Restart Procedure



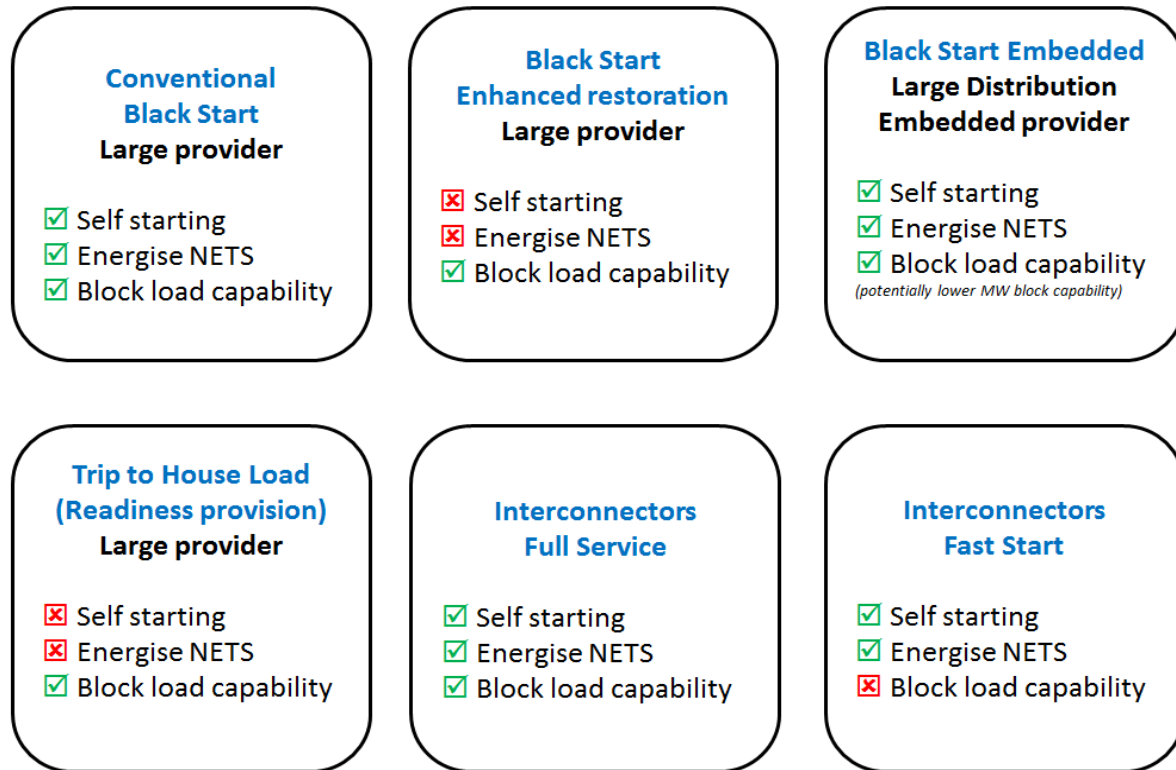
A distribution connected energy resource (Anchor DER) will start without external energy supplies

This will be used to energise other distribution connected energy resources which will collectively be used to energise the transmission system and restore local demands

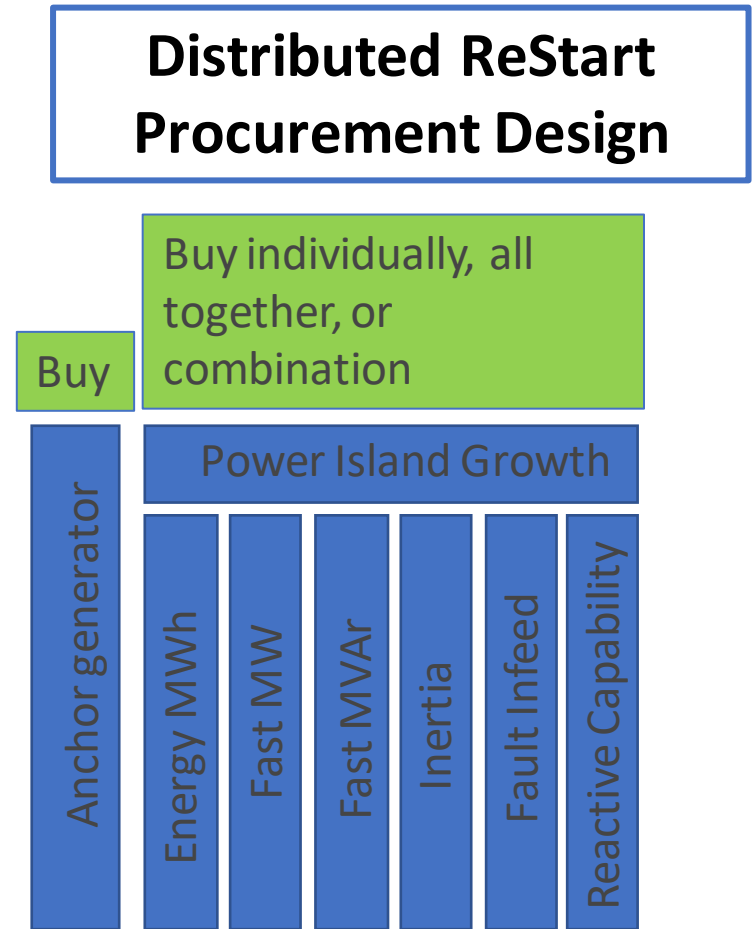
The collective capability of the demand and DERs will be used to provide outward transmission energisation and restore supplies to transmission connected energy resources

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

Traditional Procurement vs Distributed Restart Procurement Design



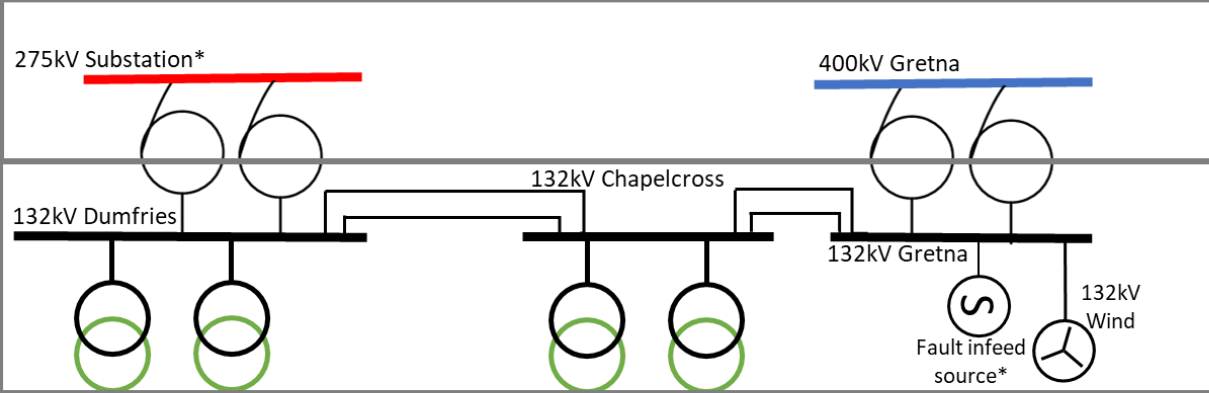
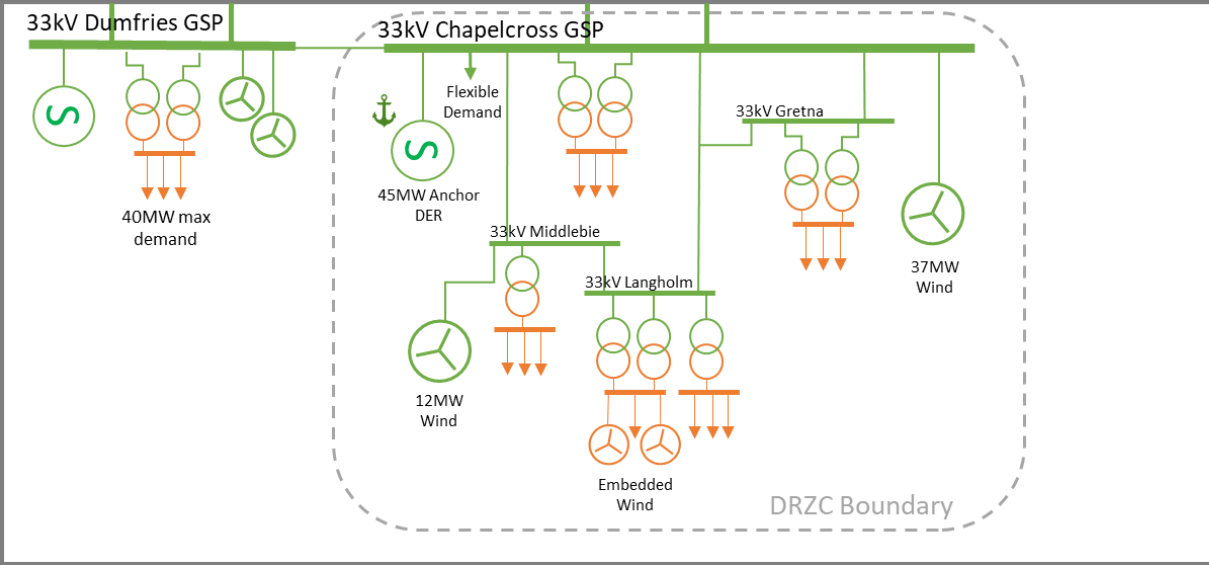
No discrimination on technology just capability, new services are procured through a tendered process but legacy sites have been bilaterally contracted



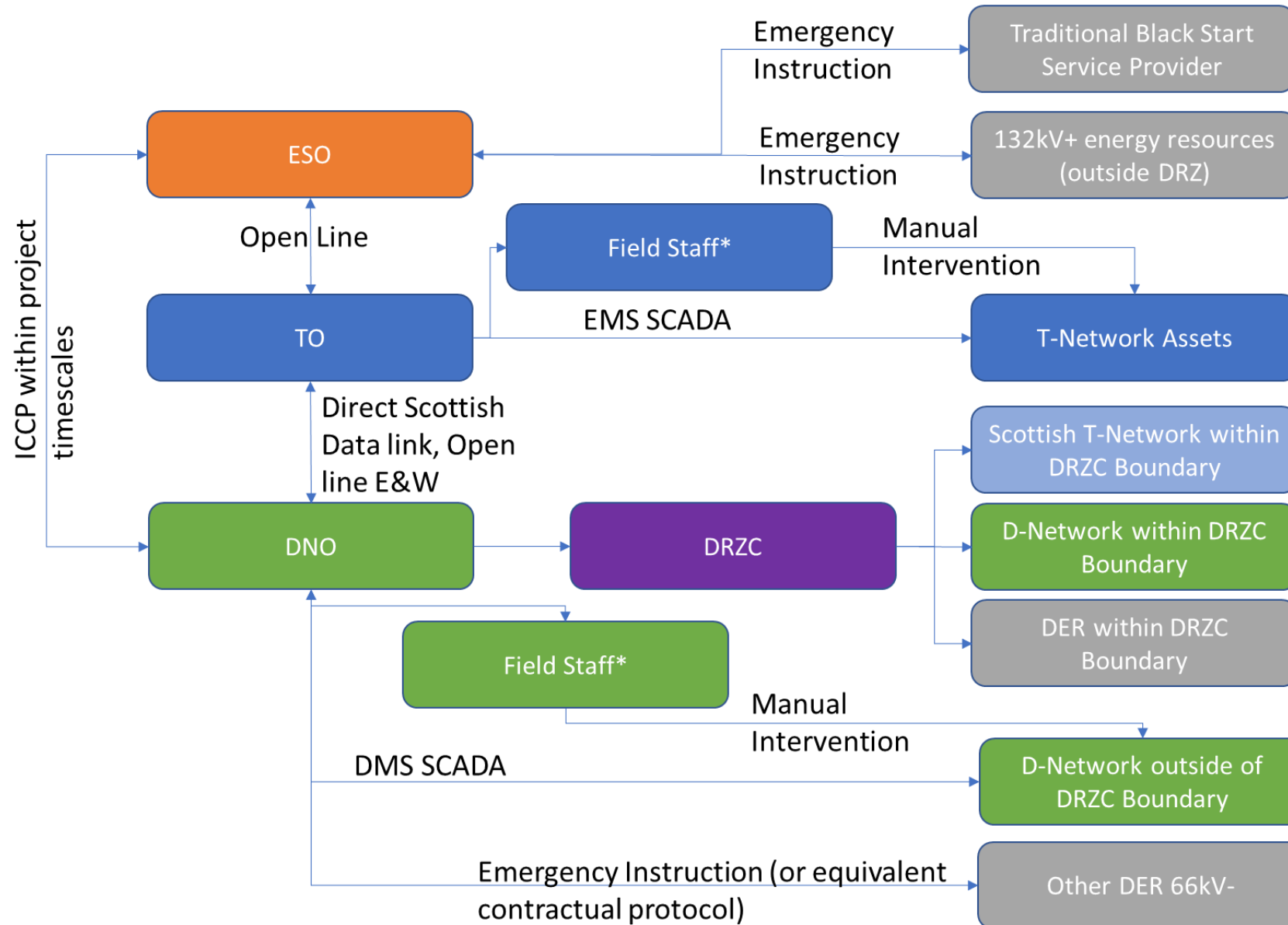
Black Start from DER Organisation – ‘Central Model’

ESO & DNOs work cooperatively with a minimum viable DRZ Controller & DNO Scada automation

- ESO coordinates nationally / regionally, DNOs coordinate locally

	Frequency Leader	Strategic controller	Key Systems
	NGESO	NGESO	EMS control
	DNO	NGESO	DMS control*, points mapped on EMS, DRZC virtual power plant
	DNO via DRZC	DNO after ESO instruction to start a DRZ	DMS and DRZC islanded operation

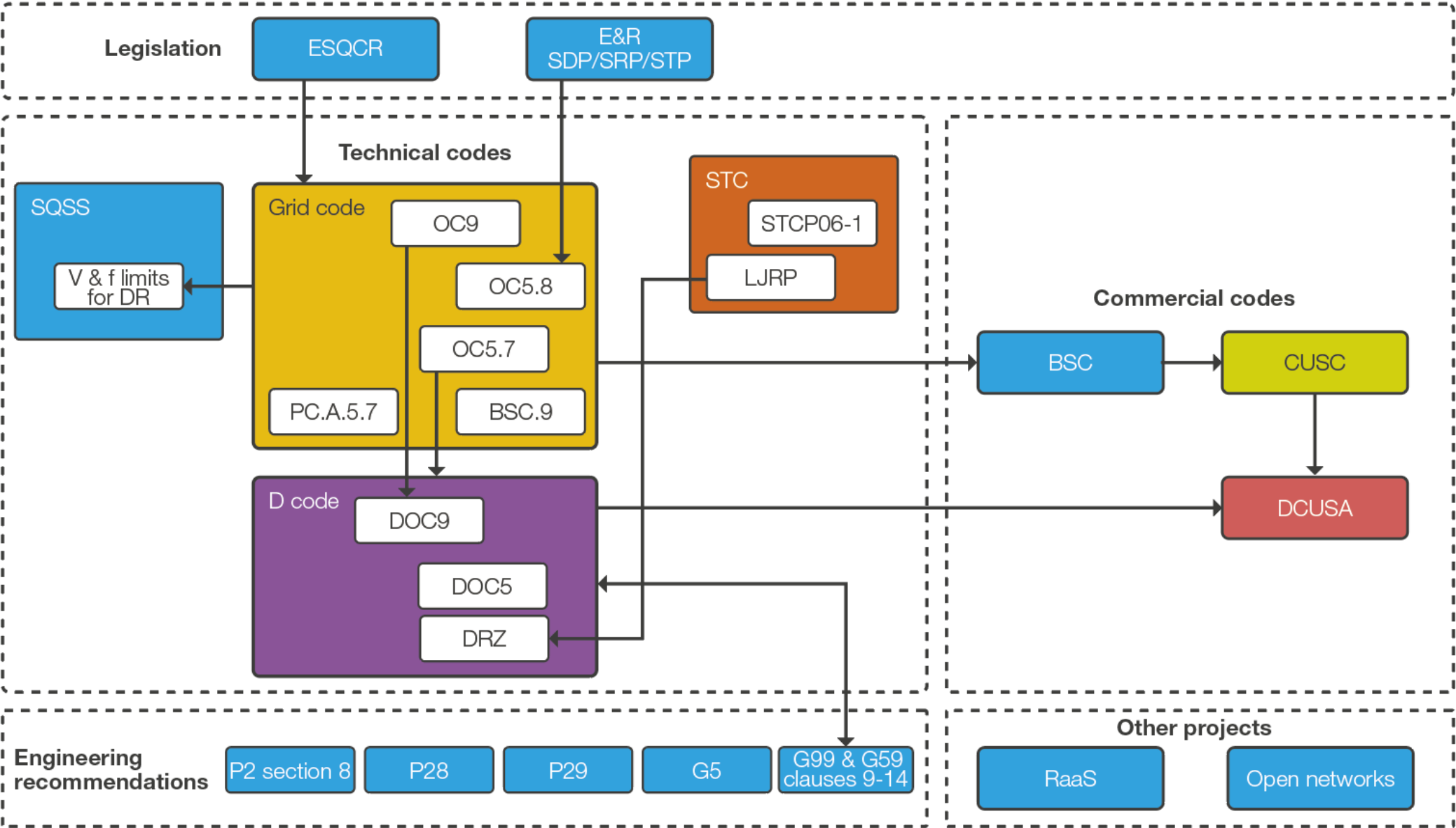
'Central Model' - Control & Communications



Automation of Restoration Process

- Stage 1: Network Preparation and Initialisation – Reconfigure network, change protection, confirm readiness to DER
- Stage 2: Anchor generator start up and initial network energisation – Energise skeleton network, instruct and supervise anchor self-start
- Stage 3: Power island expansion – Block Loading, energise and dispatch supporting DER, maintain all DER within limits
- Stage 4: Maintaining a stable power island – Maintain frequency and stability awaiting further expansion
- Stage 5: Transmission network energisation – Manage DER to prepare for transient conditions on energisation of the T network
- Stage 6: Power island resynchronisation – Co-ordinate anchor generator and DER to perform the synchronisation process
- Stage 7: DRZ termination – Manage transition to recover to normal grid connected operation.
- The restoration process will require a level of automation to overcome technical challenge and resource constraints.
- The concept of a Distributed ReStart Zone Controller (DRZ Controller or DRZ-C) has been developed to describe the system(s) that will enable monitoring, control and coordination of a range of DER and network resources to provide Black Start services.

Detailed Code Interdependencies Map



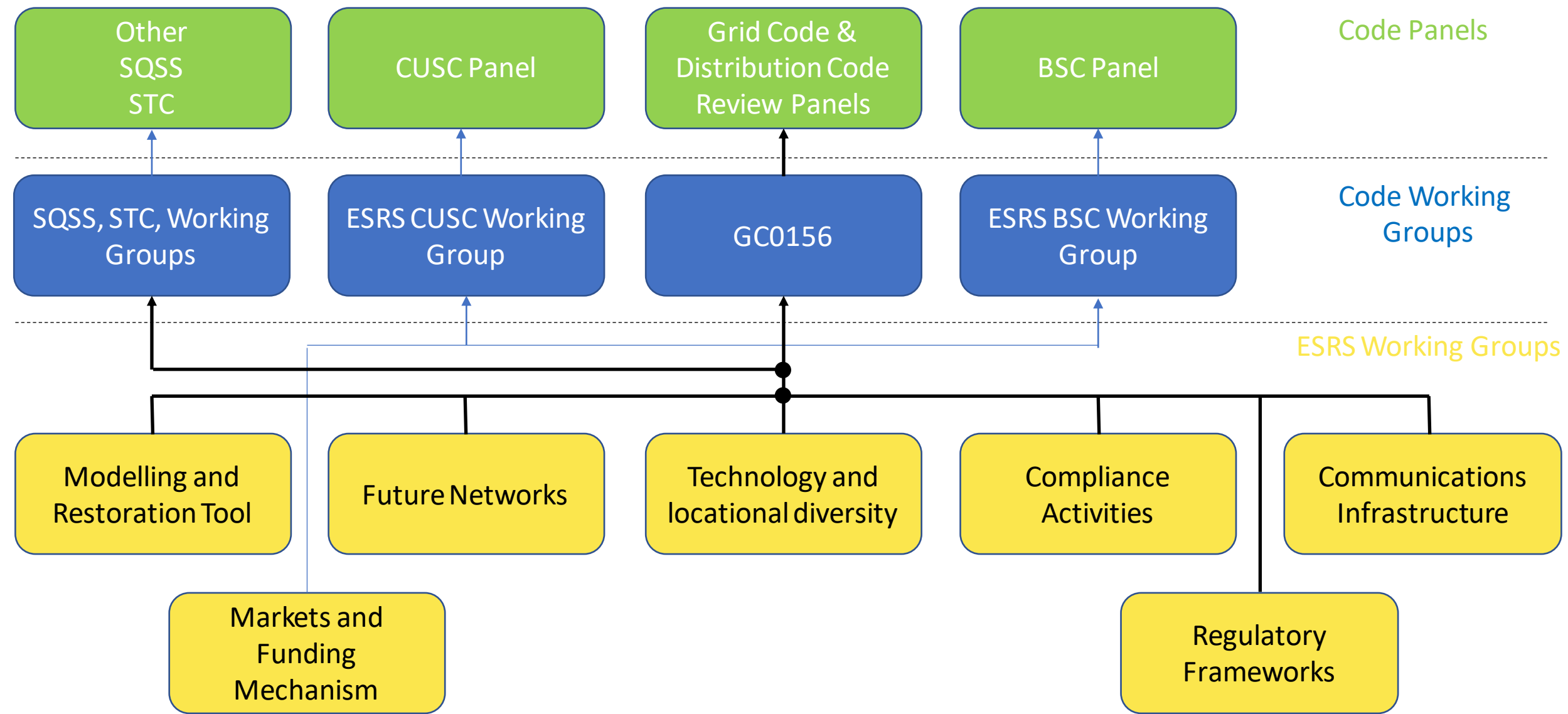
Grid Code and Distribution Code Development

- Grid Code drafting started in late 2020 with Distribution Code drafting in early 2021 and consulted upon as part of GC0148
- The Grid Code and Distribution Code drafting reflects the processes outlined above and the project team have been fully involved at each stage of its development to ensure consistency
- The Grid Code and Distribution Code drafting recognises the wider Black Start Strategy of re-energising the System and re-establishing Demand as soon as possible. This would be achieved through a combined “Top Down” and “Bottom up” approach in parallel.
- Instructions are issued by the ESO to Black Start Service Providers form Power Islands under a Local Joint Restoration Plan (LJP).
- Instructions are issued by the ESO to Network Operators to establish one or more Distribution Restoration Zones through Distribution Restoration Zone Plans (DZRP)
- The System is re-established by the connection of Power Islands, in which each individual Power Island could have been established through either an LJP or DRZP.

Distributed Re-Start Grid Code and Distribution Code Updates

Grid Code	Distribution Code
Glossary and Definitions	Glossary and Definitions
Planning Code	Distribution Planning and Connection Code 7 Distribution Planning and Connection Code 8
Connection Conditions	
European Connection Conditions	
Operating Code 5	DOC 5 – Testing and Monitoring
Operating Code 9	DOC 9 – Contingency Planning
Balancing Code 2	
Data Registration Code	Distribution Data Registration Code
General Conditions	
	G99
	G59

ESRS Hierarchy and Working Groups



Next Steps

- Identify Grid Code and Distribution Code gaps
- Review Distributed Re-Start Drafting and work
- Update the Grid Code, LJP Process and Contracts to provide similar arrangements to those developed for DRZP's – this is particularly important for Smaller generators in Scotland where Transmission is classified at 132kV and above
- Identify the outcomes and recommendations of the ESRS workstreams
- Identify other deficiencies that can improve the restoration process
- Remember – it is in everyone's interest to play their part in restoring the System in following a Blackout

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Next steps from ESRS Recommendations

Sade Adenola – National Grid ESO

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Finalise Subgroup Nominations

Sade Adenola – National Grid ESO

Subgroups

Ask

Nominations for members to join subgroups for:

1. Communications
2. Future Networks
3. Assurance Activities
4. Markets and Funding Mechanism

AOB / Next Steps

Banke John-Okwesa – ESO Code Administrator