Welcome to

The Demonstration Stage

An interactive webinar event

25 May 2022

Slido: ReStart

Distributed ReStart

Energy restoration for tomorrow

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SP ENERGY NETWORKS

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Agenda

- **Review of last year and the year ahead**
  Peter Chandler
- **Design Architects**
  Colin Foote and Dan Auty
- **Power Engineering & Trials**
  Neil Miller
- **Organisational, Systems & Telecommunications**
  Chris Salter and Dozie Nnabuife
- **Procurement & Compliance**
  Roop Phull
- **Final thoughts**
  Peter Chandler
- **Q&A**
  Project team

Review of last year & the year ahead

Peter Chandler

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Review of last 12 months – in demonstration mode

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Power Engineering and Trials workstream

1. We defined the technical capabilities required to enable a feasible Distribution Restoration Zone.
2. Now demonstrating using different technology types to prove successful energisation.
3. In partnership with OST, we defined & developed & factory-tested a prototype DRZ- Controller.

Organisation, Systems and Telecoms workstream

1. We defined & tested the communications requirements for this process including automation: DRZC FAT Report.
2. We confirmed the new organisational design, roles and responsibilities.
3. We demonstrated how the process and joint action would work in practice between ESO-TO-DNO-DERs.

Procurement and Compliance workstream

1. We defined the approach and process to procure services from DER providers.
2. This was demonstrated via our Procurement Test event in the summer.
3. We have facilitated distribution restoration through ongoing industry code changes.

From a stakeholder engagement perspective, it's clear that the energy industry has a deep interest in this new restoration process and their part in making it a success for the GB electricity networks. As a project team, we have enabled a culture of 'continuous improvement' between project and stakeholders and this is evident from the feedback we receive.

Looking ahead to the end of the project in December

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What's left to complete?

We have three key focus areas:

1. **Complete the remaining Live Trials:**
   - Chapelcross
   - Redhouse

   "Live Trials Part 2" report due in the autumn

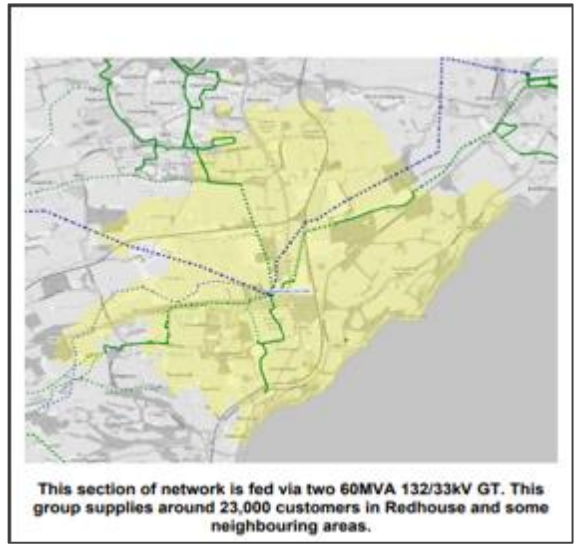
2. **Finalise Testing of the DRZ-Controller:**

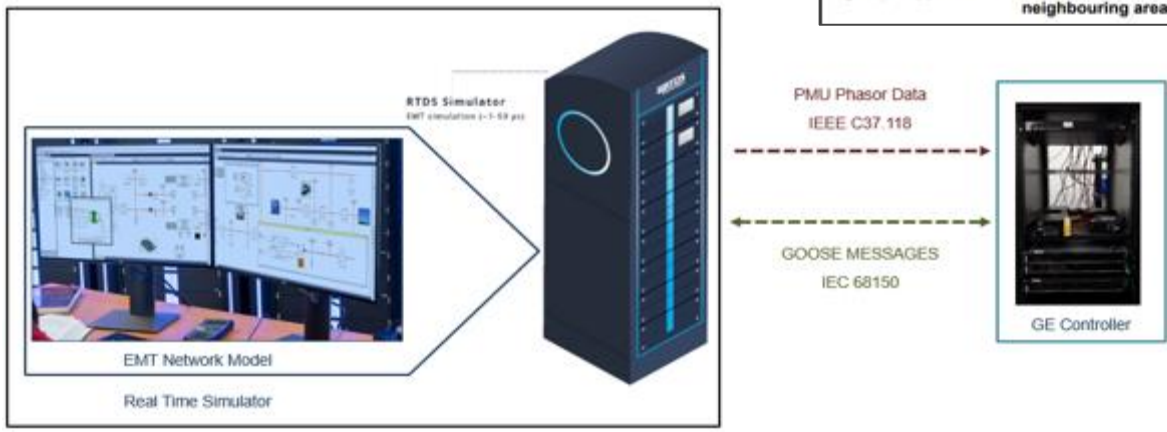
   At the National HVDC Centre

3. **Produce final project reports:**
   - Final findings report – handover to BAU
   - Closedown Report for Ofgem – NIC deliverables confirmed

Stevens Croft Biomass Generator
(image courtesy of newcivilengineering.com)

Redhouse GSP (image courtesy of Network Development Plan – Parts 1 & 2: SP Distribution Capacity and Development Report





Design Architects

Dr Colin Foote and Dan Auty

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Inside and outside the project

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Electricity System Restoration Standard

RIIO-ED2 Business Plans: DSO Transition

Future System Operator

Rapid expansion in new battery connections

Green Recovery Fund: Synergy

Testing and Demonstration

Desktop Exercises

DRZC Prototype

Mock Tender

Live Trials

Knowledge Sharing

Black Start Trials and Demos

GC0137: Grid Forming Capability

GC0148: Emergency and Restoration Code

GC0156: Electricity System Restoration Standard

ESR Tender Roll-out Plan 2022

Power Engineering and Trials

Neil Miller

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Findings and forward view

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Demonstration – Live Trials

Galloway Live Trial Site – Testing Completed (six days in total)

- A ‘small’ hydro generator (13 MVA, connected at 11 kV) was able to be used as the ‘anchor’ to energise the test network, ranging from 11 kV to 275 kV, including ~60 km 132 kV overhead line and two 240 MVA 275/132 kV super grid transformers.
- A stable power island was able to be established with the anchor gen and two 33 kV connected wind farms. The fundamental principle of a Distribution Restoration Zone (DRZ) has now been proven in practice.

Report – Live Trials Report Part 1 (issued December 2021)

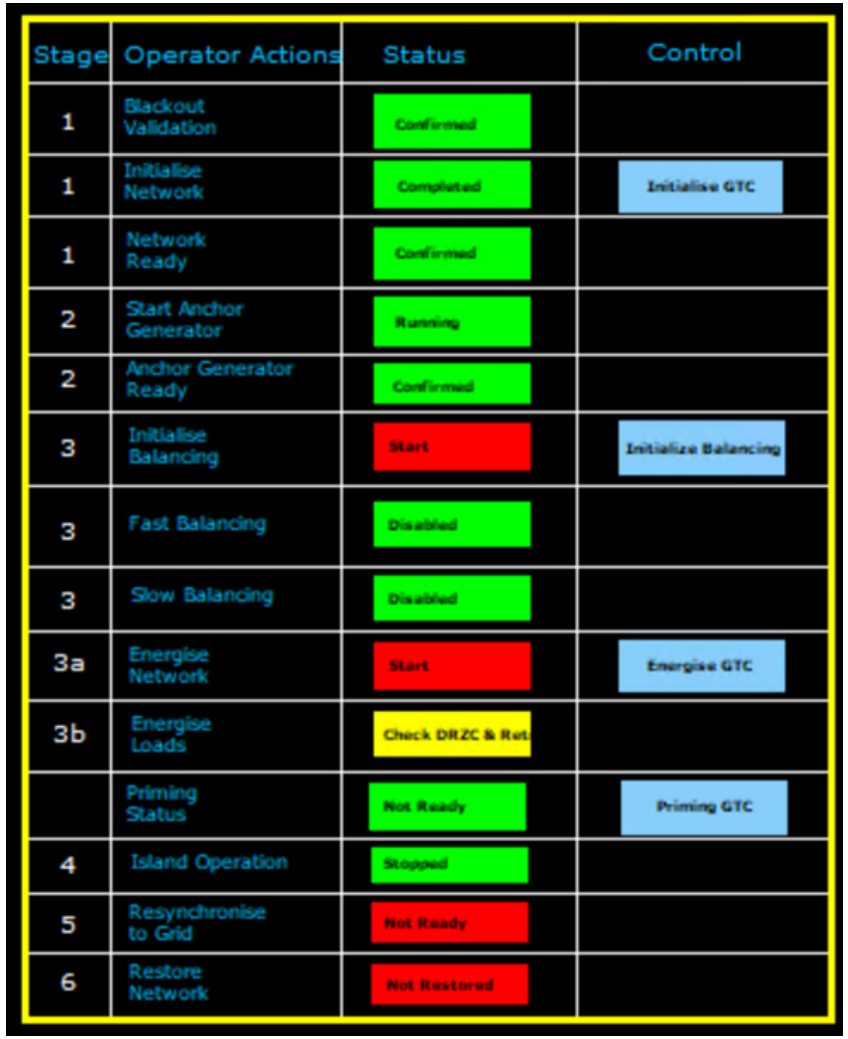
- Detailed analysis of Galloway live trials and development of Chapelcross and Redhouse trial sites.

Development – DRZ Controller (DRZC)

- Following on from the functional design specifications obtained for a DRZC (to develop a controller to overcome the human resource and technical limitations associated with establishing and maintaining a power island with multiple DER) General Electric (GE) have developed a prototype DRZC. This has been factory acceptance tested (FAT), based on a simulator model of the Chapelcross live trial network.
  The main functionality proven being:
  - Fast balancing – sub-second control of DER to enable the frequency to be maintained when block loads are applied to the DER.
  - Slow balancing – ensuring a constant balance between generation and demand to maintain the frequency.

Future

- Further live trials (Chapelcross and/or Redhouse sites) and ‘Part 2’ live trial report.
- Further testing of DRZC prototype on The National HVDC centre Real Time Digital Simulator (RTDS).
- Comprehensive technical requirements for a DRZ included in project final report.



Stage	Operator Actions	Status	Control
1	Blackout Validation	Confirmed	
1	Initialise Network	Completed	Initialise GTC
1	Network Ready	Confirmed	
2	Start Anchor Generator	Running	
2	Anchor Generator Ready	Confirmed	
3	Initialise Balancing	Start	Initialize Balancing
3	Fast Balancing	Disabled	
3	Slow Balancing	Disabled	
3a	Energise Network	Start	Energise GTC
3b	Energise Loads	Check DRZC & Ret	
	Priming Status	Not Ready	Priming GTC
4	Island Operation	Stopped	
5	Resynchronise to Grid	Not Ready	
6	Restore Network	Not Restored	

Organisational, Systems & Telecommunications

Chris Salter and Dozie Nnabuife

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Findings and forward view

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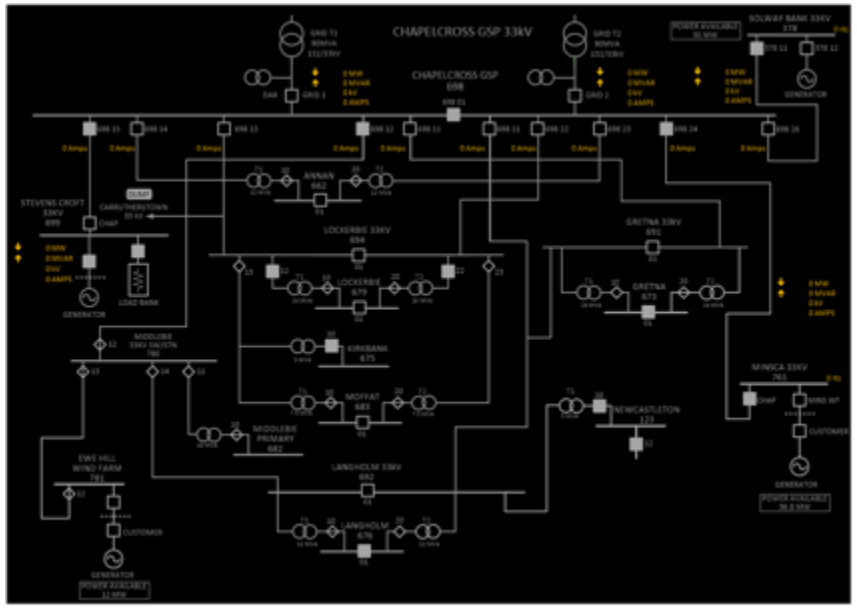
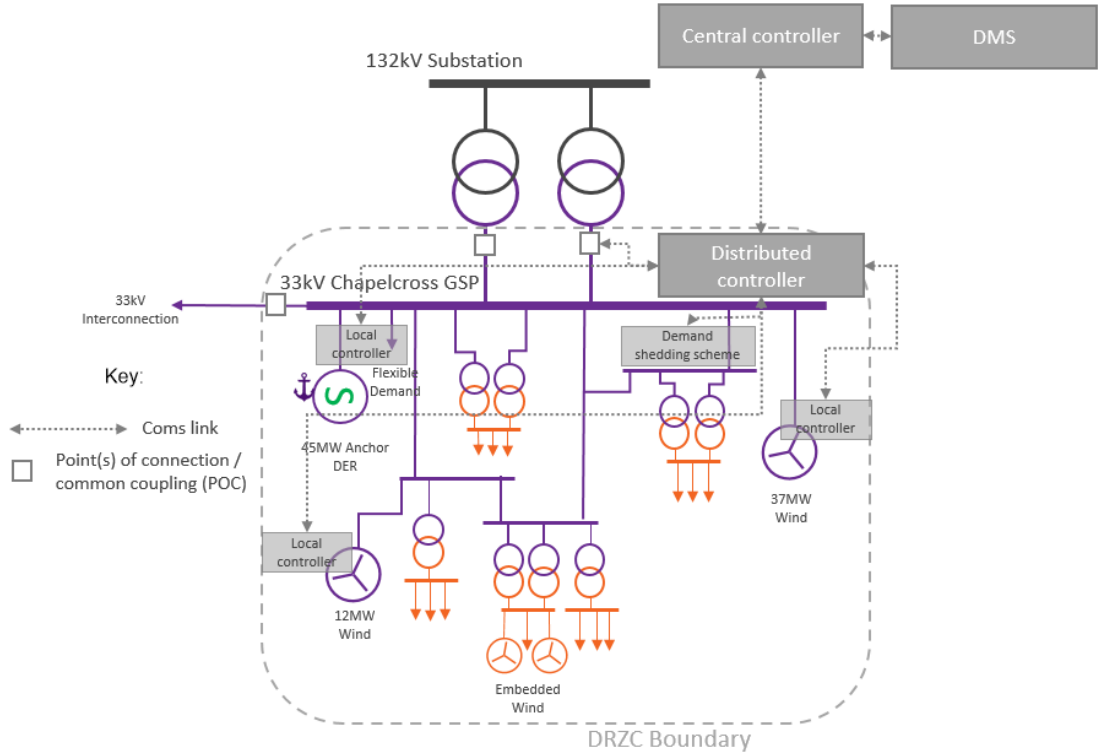
Our 3 desktop exercises over the summer of 2021 demonstrated the effectiveness of the proposed Central Organisational Model that supports a distributed ‘bottom-up’ restoration. In partnership with PET workstream and General Electric (GE), we designed, developed, built & factory tested a prototype DRZ-Controller and proved that it works!



DTE simulation tool – shot of the Chapelcross SLD in action

GE Controller

Our final joint deliverable will be to support the publication of the upcoming HiL testing at the HVDC Centre in Cumbernauld. This will build on the FAT 1 report already published and demonstrate the viability of our automation designs in an RTDS environment.



Cross-industry representation and participation

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First desktop exercises – 27 May
22 observers, 4 NGESO/TO, 4 DNOs, 6 DERs

Second desktop exercises – 8 June – 56 invitees:
17 observers, 8 NGESO/TO, 11 DNOs & 11 DERs

Third desktop exercises – 6 July – 46 Invitees:
15 observers, 11 NGESO/TO, 7 DNOs, 31 DERs

DRZ Controller Factory Acceptance Test & report summary

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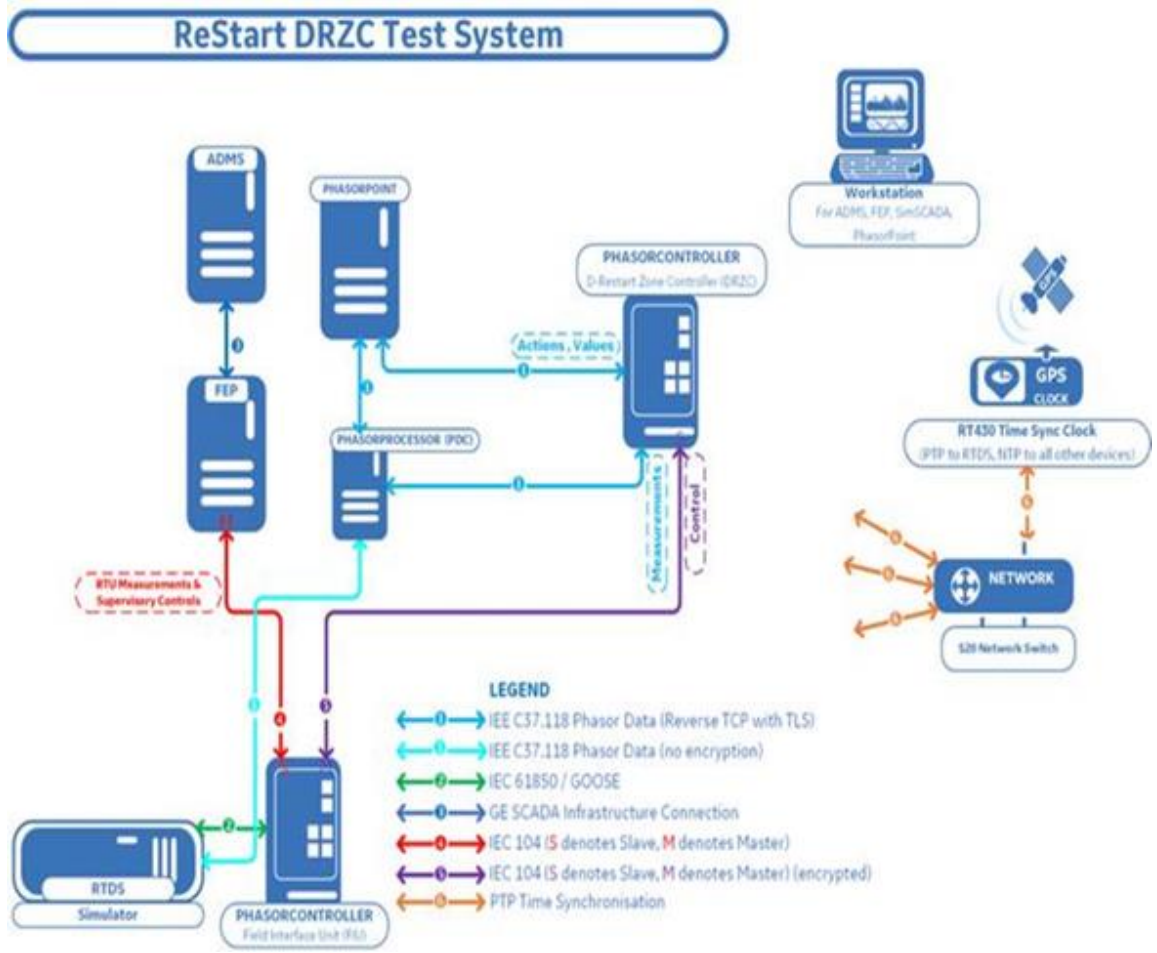
- This report showcases the successful Factory Acceptance Testing (FAT) of the prototype DRZC within a Hardware-in-the-Loop (HiL) test environment.
- The FAT was performed within GE premises using an Opal-RT simulator, against a model based on network data provided by SP Energy Networks (SPEN).
- The report provides useful information that will be increasingly required for a transition to a net-zero network.
- The tests covered all stages of a possible distribution restoration process from anchor generator start-up to termination of island operation.
- The tests were all completed successfully, and the report provides important evidence of the viability of a DRZC and the distribution restoration concept.

The report includes a series of short assessments of the viability of the communications and cyber-security designs. View the report



Procurement & Compliance

Roop Phull

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Findings and forward View

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1. Proposals meet the commercial objectives for a distribution restoration service – to promote accelerated restoration times and add financial value to end consumer

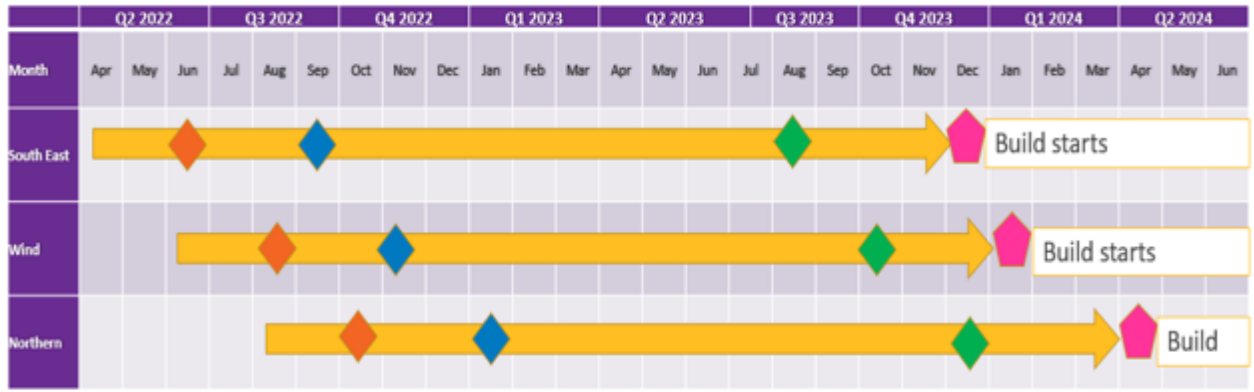
2. Our service designs will look to procure the right functional capabilities from the right DER providers in a DRZ in order to be compliant with the new ESRS by 2026

3. A fit for purpose, end-to-end procurement process has been designed – this will support the swift transition into BAU to work in conjunction with the existing restoration service (not replace it)
   i. ESO to lead the procurement with in-depth collaboration with DNOs
   ii. DER costs settled by ESO and DNO costs through own price control

4. Codes work will future-proof distribution restoration service – a detailed review of the industry codes, legal text drafting and progressing through ongoing code modifications GC0156

5. Stakeholder-led final recommendations – proactive engagement through webinars, the Test Procurement Event, attendance at forums and one-to-one meetings with DER providers, DNOs and wider industry

ESR tender rollout plan for 2022 – including DERs for distribution restoration



South East – EOI in June 2022, service go-live in July 2025
Wind – EOI in August 2022, service go-live in October 2025
Northern – EOI in October 2022, service go-live in November 2025


Final thoughts
Peter Chandler
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Your participation in distribution restoration

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WHO

- DERs, DNOs, TOs, ESO, Ofgem
- Equipment and service providers

WHY

- All industry parties have a role in restoration, however it is delivered
- All parts of the industry will need to work together to satisfy the challenging new ESR Standard
- Consumers, government, Ofgem and others expect DER to be utilised if effective
- Development of new restoration services and capabilities aligns with other smart network and flexibility goals

HOW

- Engage with ESO/DNO on strategic review of requirements and opportunities in each zone
- Develop organisational capacity to support a distribution restoration process
- Implement equipment modifications and enhanced comms and control as required

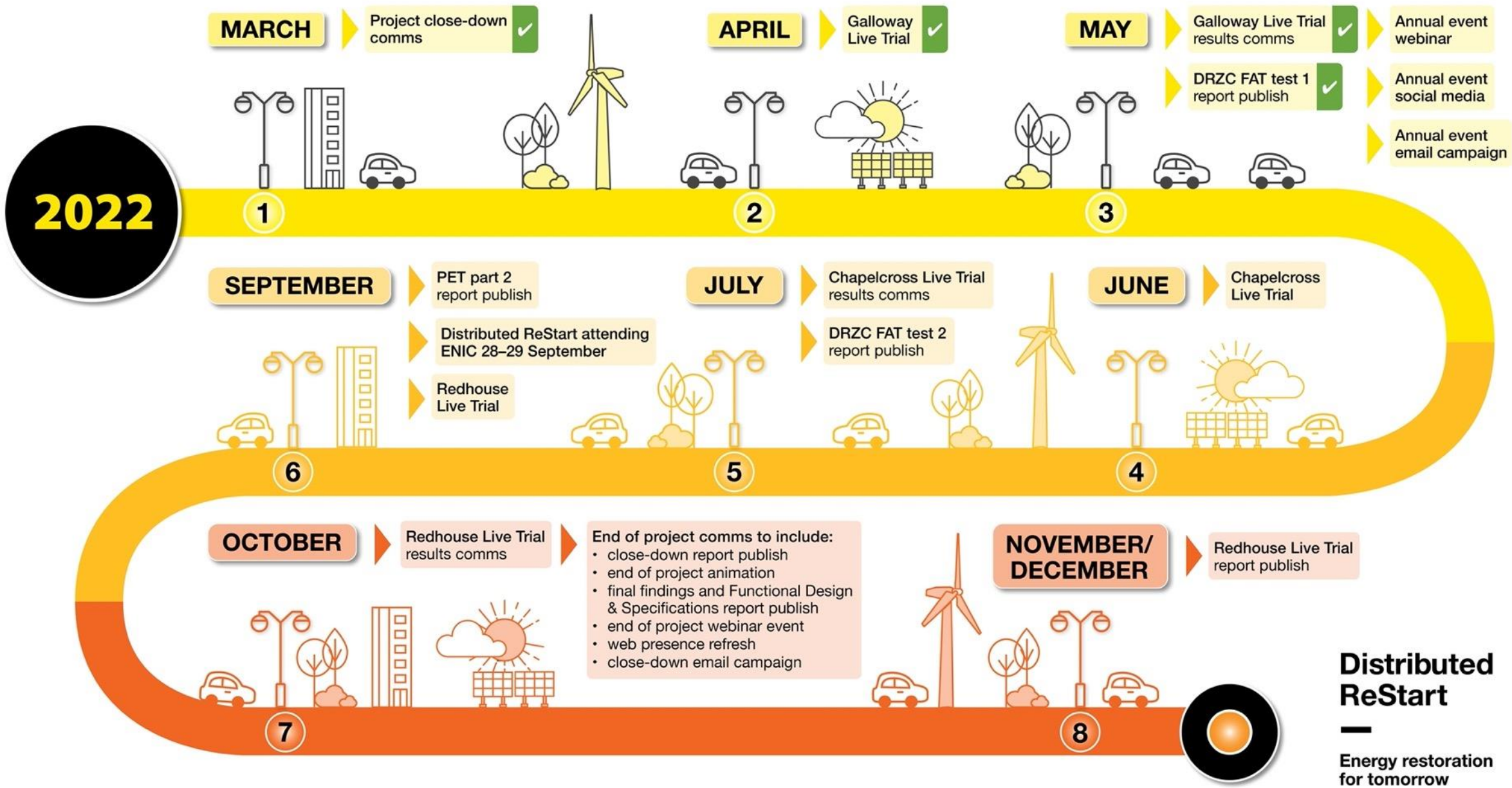
WHERE

- Across all of GB on a zonal basis, focusing on specific areas of opportunity

WHEN

- As per national strategy for ESRS and the timing of existing contracts

Distributed ReStart Communications Timeline



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In summary – some key findings...

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- This concept can harness the growth of DER to provide bottom-up restoration requirements – Over the past three years, Distributed ReStart has aimed to prove this capability with thorough testing, live trials and stakeholder engagement of the commercial, technical and organisational designs.
- DER can contribute towards ESRS compliance – The new standard requires 60% restoration of demand in each Distribution Restoration Zone (DRZ) by end of first 24 hours and 100% in 5 days. We see our proposals as supplementing traditional restoration services, not replacing them.
- Distribution restoration is technically complicated – There is no ‘one size fits all’ solution as all DRZs will be different. The costs for implementation are likely to vary widely across DRZs.
- Enhanced role and requirements from DNOs and DERs in the whole process – From regional strategy development through to the organisation and coordination of the Distribution Restoration Zone Plan (DRZP).
- Use of DRZC automation – A pure ‘manual’ DER-based restoration will be slow and difficult to manage. Our DRZC designs support automation and acceleration of the process, which could help meet the ESRS regional restoration targets.
- Doing the right thing for all participants – The proposed procurement process provides a more open and transparent route to market for DER providers, through a technology agnostic competitive tender route.
- The importance of being stakeholder-led – Co-creation with DER stakeholders, DNOs and other industry expertise through numerous webinars, bi-laterals, exercises, live trials and networking with various key industry forums.
- Further industry engagement is still required before this can fully transition into BAU – There are many learning points to consider, however the timeline for Restoration Service tenders means there is urgency to get this mobilised.

Q&A

Project team

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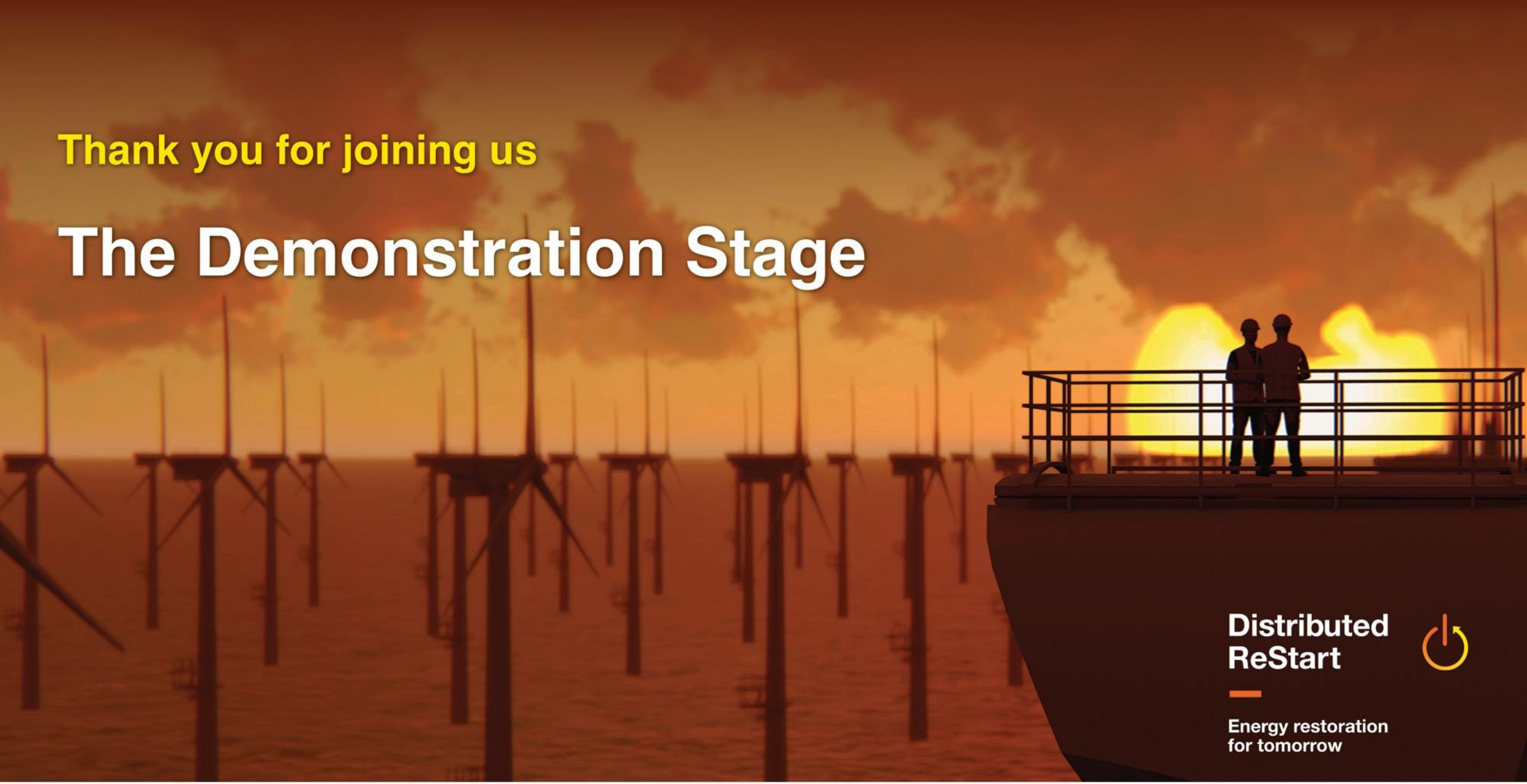

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