The Demonstration Stage Q&A

Webinar annual event – May 2022

Question	Answer
Did you detect significant levels of negative sequence V or I when energising Glenchamber and/or North Rhins w/farms? That was the main cause of failure of an earlier (1980s) attempt to fire up Longannet feed pumps from a GT at Dunfermline. The fundamental problem is the lack of adequate/any transposition of single circuit OHLs.	We did not detect anything excessive or problematic with phase imbalance or negative sequence. The current on the long circuit lengths was quite low. The main lengths of overhead line used in the test are double circuit lines and the other side remained energised; this will have had some effect. Also, of the two main lengths of circuit, BG route from Glenlee to Newton Stewart has phasing BYR, while BT route from Newton Stewart to Glenluce has phasing RYB. So we will have benefitted from some transposition effects on the energisation route as a whole.
Do we have the final findings report for the Procurement and Compliance workstream? This will throw light on the necessary policy and regulation changes.	Yes, the final report and detailed appendices can all be found on our website: **https://www.nationalgrideso.com/future-energy/projects/distributed-restart/key-documents**. The regulation changes are part of the code text drafts which are being consulted and refined as part of GC0156 code modification process. Check out Appendix 3 for the proposed changes.
Even if the assets are connected at 11 kV, are these embedded or are they connected to the 132 kV at PoC?	Our designs have focused on DER in the 10–100 MW range and connected at 33 kV, but we have also considered the implications of DER connections at higher and lower voltages. It is important to be flexible and not rule out resources that might play a useful role in a Distribution Restoration Zone.
What is a block load?	The step-change increase in load when supplies are restored to customers, which the generators in the DRZ need to be able to handle while keeping frequency within limits.
What is the view on the issues faced if we were to look at re-energisation of a more capacitive network (e.g. via longer cables rather than OHLs)?	A more capacitive network will mean a bigger requirement to absorb the Mvar produced by that network, and that will be something that needs to be assessed and considered in the design of a DRZ and the procurement of services from DER to provide what is needed in the specific area.

What is the bandwidth and reliability requirement on the DNO communication network for the DRZ controller to meet its performance requirements?	We have produced a set of telecommunications functional requirement in our report but this may vary with implementation by different Distribution Restoration Zone Controller (DRZC) vendors. The published functional specification is as follows: End-to-end Service Availability – The end-to-end availability for a single-routed service (an un-switched service). 1. This shall be minimum of 99.94% over a rolling 12-month period. 2. There shall be no more than one break in service of greater than 10 seconds duration in any one year for any single service. 3. The difference between the total number of severely errored seconds and the total number amount if unavailable time expressed as a percentage of total time shall not be greater than 0.002%. ENA 48-6-7. Fast balancing communication link For IEC 61850-9-2LE up to 5.760 Mbps per analogue measurement may be expected. Slow balancing communication link – this is expected to be low due to the relatively slow polling rate of the protocols used (expected to be 1–2 seconds). Using DNP3.0 protocol, the bandwidth requirement is approximately 20 kbit/s.
We are deploying solar and would like to future proof its design to be able to offer electricity system restoration. Will there be some sort of guide to help developers with this?	Our Final Findings Functional Design and Specification report due out later this year (2022) is intended to provide an "entry point" into the project learning. *(The changes required column in Table 1 below is OSTs answer to this.)*

Area impacted	Current organisational requirements	Changes required
Interfaces	N/A	A new interface with the DRZ-C and resilient data and voice over IP DNO communications will be introduced.
Systems	Dependent on technology type.	It is anticipated that delivery of a contracted anchor or top-up service will require the distributed energy resource (DER) to install new equipment to deliver the service. This will include direct response to DRZ-C instructions. However, this upgrade would be funded as part of service provision.
Telecommunications requirements	Limited non-power resilient operational communications with distribution network operator (DNO) (in some instances), mobile phone or teleoperated assets with a central control room function that may be abroad are common.	The telecommunications requirements must meet the functional specification.
Training requirements	Dependent on technology type, many sites are unstaffed and use third-party contractors so will not have a training process.	The distributed energy resource (DER) must demonstrate a robust training process for restoration capability or a resilient automated response to distribution restoration zone controller (DRZ-C) input signals. This will form part of assurance requirements.
Staff requirements		A minimum staffing requirement should be maintained so that availability information can be provided at all times and that the contracted service can be delivered within eight hours of instruction. For service delivery, any contractor, called-in resource or self-starting organisational structures used must ensure that staff are dedicated to the specific provider in the event of restoration and that it does not compromise the overall ability of the energy resource to deliver the contracted service within eight hours.
External factors	The current arrangement for DERs will be extremely variable dependent on the technology, the scale and the businesses which operate them.	

Table 1

To what extent are grid-forming convertors part of your thinking?	We have done a fair amount of work on grid forming converters, including work in collaboration with Strathclyde University. Our Redhouse live trial is set to demonstrate the use of a grid forming battery for restoration.
What do you see as the greatest remaining challenges or risks?	It is clear that distribution restoration is complex, involving more parties, new systems, and new ways of working for all involved. We believe the project has demonstrated the feasibility of the concept and proposed solutions to the main challenges, but there will be further challenges to overcome as the concept is implemented for real. This includes technical issues that may be arise due to the specific network topology and equipment in a given area, or ensuring appropriate training for all personnel that would be involved in a restoration process. All of this imposes costs and it remains to be seen whether distribution restoration can offer a consistently cost effective alternative to large power stations or HVDC interconnectors in providing restoration services.
Will go live be 2025 at the earliest?	Yes, potentially, so long as we get a feasible shortlist of bidders in the upcoming South East tender that will form a feasible Distribution Restoration Zone (DRZ) to supplement the traditional 'full service' bids. Or in the Northern tender that will follow later this year.
How can this coordinate with traditional restoration? Will this distribution restoration lower the costs of traditional methods?	Yes, the processes have been developed considering running a distribution restoration approach in parallel with a transmission-based restoration process. Joint planning stages have been kept common, whilst distributing the local descision making to DNOs via the restoration zone controller makes better use of overall control engineer resources. We are formulating our assessment criteria in the South East tender to enable merit stacks across full service, AG and TuS bids. Regarding future cost, only time will tell as we need a live environment to understand the differences between different technology types bidding in for the different categories in this tender.
Do other countries do this?	This project represents a world first for restoration (as far as we know). Other countries do, or are exploring how to, use smaller, more local generators for restoration. But we think the scope of what we are considering, with the idea of potentially having DRZs across the whole country to supplement large power stations or other large sources, is unique. We are aware of interest in this project from the USA and elsewhere.
An anchor generator is not necessarily embedded? It could be sitting at a GSP of 132 kV?	Yes, if it can be part of a viable Distribution Restoration Zone (DRZ). The assessment of viability will be done by the ESO in collaboration with the local DNO and TO, taking account of the DER in a given area and the expressions of interest in participation in a DRZ.
If the anchor generator is BESS, will there be a stability problem for wind farms to join in the early stage of restart?	It is no worse for wind than for other sources, but the design relies on the ability to control/limit the power output from participating DER.
What is the most challenging problem for cases with BESS as an anchor generator rather than synchronous machines?	For all converter-based sources, challenges include transformer energisation, network protection, and ensuring sufficient system strength to allow other converter-based resources to connect.
The guidance of block loading of 10–20% of generator capacity is very useful context.	It varies depending on generator type and the specific capabilites of each plant and its control system.

Do you see fast balancing moving down to smaller block loads << 1MW? I am thinking of EV chargers, commercial/ domestic HVAC and heating loads etc. – to IIoT?	There will be a trade off between the cost of the comms and control infrastructure and the size of individual resources. In early DRZs it seems more likely that a fewer number of larger resources will be controlled to provide the fast balancing capability. There may be an opportunity for aggregation or indirect control of smaller loads, e.g. at domestic level, but that may introduce additional delays in the comms and so may be more suitable for slow balancing.
Do you see GFrm BESS / IBR re-energising the grid at < 1pu frequency to reduce transformer inrush?	We are aware that energisation below nominal frequency has been proposed as mitigation for transformer inrush and other effects but we have not considered that in any great detail. We have focused more on energisation with voltage magnitude below nominal, and this has been demonstrated in our live trials to be very effective.
Scottish islands offer an ideal geographic definition for a DRZ with the highest wind resource in Europe. When will the DRZ map be defined to enable these islands to plan new DERs to negate associated grid losses and provide more resilience?	Some locations will have greater DRZ potential than others due to local DER, or greater potential benefits in terms of reducing restoration time (compared with a conventional top-down approach). The Scottish islands are within the “Northern” region for which there is to be an ESR tender later this year.
It is important to establish how future network restoration for these Islands will be delivered in order to inform an EU project called AMAZE, Archipelago of Mull Actions for Zero Emmisions.	We were not aware of the AMAZE project; please do let us know how we can find out more about it. You may also be interested in SSEN’s Resilience as a Service (RaaS) project: **https://ssen-innovation.co.uk/raas/**