G-PST/ESIG Webinar: Distributed Restart - Restoration of the Future	
Question	**Answer**
Do you find that the behind-the-meter resources, e.g. rooftop solar, behavior complicates the restoration ?	This issue was identified and has been discussed within the project and in our various stakeholder engagements. There will always be some level of variability in power that may arise due to changes in demand or generation. In designing any restoration process it will be necessary to be mindful of that, perform analysis as appropriate, and ensure there are sufficiently flexible resources to manage the variability. This may mean that some network areas need to be energised later in the process as a larger power island is needed to handle the variability.
Compare to hydro and steam plants, what are some of the specific challenges you need to overcome when using BESS for network restoration?	The industry is still getting used to BESS operation, especially in grid forming mode, so one challenge is simply a lack of familiarisation and confidence, which means thorough analysis is required. Fault current and the impact on network protection is one challenge but we found that it could be addressed with appropriate changes to settings. Our live trials showed that the BESS performance in frequency and voltage control was better than what is typically seen from hydro and steam plants.
POW is to reduce inrush current of transformers. For that you need single phase or CB´s with different closing times per phase. What did you use?	The POW relay used in the trials is designed for use with three-phase circuit breakers with the same closing time on all phases, as typically found on distribution networks. It is not as effective as having single phase CBs but still offers a marked improvement.
Did you try using hydros/steam as anchor generators but with grid following BESS to provide load balancing support?	Not specifically in our tests but we did do these elements in isolation and there is no reason to think that they would not operate as desired when combined given the individual tests success

Previous to Distributed Restart, how was communication between DNO and national grid? (i.e. direct communication or through transmission operators)?	Industry structure in GB is such that the approaches are different in Scotland compared with England & Wales, but the general approach is that there would be open communication between the parties involved in the restoration process. Section 7 of the following report describes the established communication process for the electricity industry during a restoration event: https://www.nationalgrideso.com/document/156216/download This can be found in the Documents Library on the Distributed ReStart website: https://www.nationalgrideso.com/future-energy/projects/distributed-restart/documents-library
Apropos DER restart could you comment on island operation of distribution using BESS GFMI to provide voltage for inverter PLL	This was studied earlier in the project then demonstrated in the Redhouse live trial.
Did you specify Grid forming inverter settings that could operate normally (grid-tie) and when needed be able to stand alone and start-up other resources?	In the Redhouse trial the grid forming battery was used to establish a power island then this was resynchronised with the main system, with the battery continuing to operate with the same settings. We didn't test going in the opposite direction, from grid tied operation to islanded. We decided early in the project that we would not consider auto-islanding as it added further complexity and is not necessarily beneficial to the overall system.
Are you in touch with AEMO. One of the fascinating problems we have in Australia is that the DNS are at many times virtually independent, resynchronisation when there are a number of independent restart regions	We've had some minor engagement with AEMO and are aware of the significant achievements and ongoing challenges in system operation in Australia. We're not actively talking to them on this topic at the moment, but National Grid ESO and AEMO are both part of the Global PST Consortium where a wide range of topics, including system restoration, are discussed.
Could you describe again the restart transformer energising	Detail of this will be available in the report
What was the total MWH capability of the battery used in the test? (edited)	8MWh
For the point-on-wave relay is there any difference in performance based on how long the transformer is de-energized for prior to re-energizing?	None, as long as the transformer is de-energised for more than a few seconds. The remnant flux will then remain approximately constant indefinitely so the POW can be used hours/ days after de-energisation.

What other technologies exist other than point-on-wave relay to reduce transformer in-rush current?	We could have utilised reduced volts or soft start (ramping up) in our tests but had no need given the success of the POW .
Can you provide a sample tender document for grid restoration services?	The materials from the project's mock tender event in 2021 are available on our website: https://www.nationalgrideso.com/future-energy/projects/distributed-restart/procurement-and-compliance The materials for the latest, real tender for restoration services are also available: https://www.nationalgrideso.com/industry-information/balancing-services/system-security-services/restoration-services#Document-library
In the re-synchronization of BESS with grid graph why is there a voltage offset after synchronization is complete?	This is due to the accuracy of data return issue.
Can the POW relay be used in "normal" grid operations?	In our case it lies 'dormant' / passive for normal grid operations and is utilised only when back energisation via DERs of the grid is required. However it could be used if thought useful.
What was the SCR of this simulated system? Low, medium, high?	We did a range of simulations earlier in the project covering different conditions but focusing on systems with low short circuit ratio. The live trials were done with real equipment so were not simulations; the SCR was generally low, sometimes very low.