Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Black Start from Distributed Energy Resources

Tick if this answer has been provided verbally: ☐

Project code	ESOEN01	Question Number	12
Question date	14 August 18	Answer date	16 August 2018
Submission section question relates to	Section 4		
Topic	Innovation		
Question	Please provide further information on what wider studies on black start from DERs were used to inform the project (p25).		
Notes on question			
Answer	Past and ongoing NIA and NIC projects, international studies, reviews and consultations focused on Black Start and management of DERs have informed the scope and methodology of this project. The majority of the work that has been done thus far has been conceptual or has involved tests on microgrids. This project will build on these foundations and further test these concepts on a larger scale through the performance of live trials on the DNO network. Summaries of these projects and their relevance to NIC this project are detailed below. **Black Start from Distributed Sources, System Operability Framework[1]** This report concluded that there are opportunities for distribution connected providers, especially large embedded generators, to play an increasing role in Black Start provision, contributing to the rationale for carrying out our project. It was suggested that more specific design and research is required,		

[1] https://www.nationalgrid.com/sites/default/files/documents/SOF%20Report%20Black%20Start%202017.pdf

	especially around the roles and responsibilities of different organisations and the need for additional infrastructure. **Black Start Alternative Approaches, ESO Network Innovation Allowance (NIA) Project[2]** DNV GL undertook a desktop study for ESO to provide an independent view of alternative solutions for Black Start procurement. Different system re-energisation strategies were analysed to identify the most resilient and the results indicated that a limited Zonal methodology combined with a Spine and Top-down approach may be more efficient than the current Zonal methodology. DNV GL's suggested next steps were to analyse and appraise NGET's current Black Start approach to determine the differences between the current approach and the alternative proposed. **Black Start Alternative Approaches, ESO NIA (Mott McDonald)[3]** Mott McDonald concluded that, beyond existing Black Start providers, CHP/thermal and energy storage should be capable of providing Black Start services, whilst wind and solar were better suited to the restoration process than energisation. Our NIC project will develop this concept further through real-world case studies and test they hypotheses in live trials. **Germany: Black Start via a 15MWh battery[4]** A 15 MWh battery system, paired with a combined cycle gas turbine, has been used to successfully restart a disconnected microgrid in Germany. This test demonstrates that storage is technically capable of providing Black Start services. **China Microgrid Black Start Testing[5]** China State Grid carried out a study on Black Start from a combination of PV, battery and diesel generators. A black start strategy based on a hierarchical control scheme was developed and the simulated results suggested that the approach could be feasible and effective on a microgrid. Our NIC project will take these conceptual learnings and apply them to our much larger-scale tests. **Consideration of DER Provision of Black Start Services, Australia** Australia Energy Market Commission's (AEMC) System Security Market Frameworks Review[6], AEMC's draft review of the market and regulatory frameworks in the National Electricity Market[7] and the Joint AEMO and

[2] DNV GL, Black Start Alternative Approaches, September 2015
[3] Mott McDonald, Black Start Alternative Approaches, September 2015
[4] Younicos, Schwerin Battery Park, December 2017 https://www.younicos.com/wp-content/uploads/2016/07/Younicos_Reference_Project_Schwerin.pdf
[5] Xu Z, Yang P, Zeng Z, Peng J, Zhao Z, "Black Start Strategy for PV-ESS Multi-Microgrids with Three-Phase/Single-Phase Architecture", Energies 2016, 9, 372. https://pdfs.semanticscholar.org/d983/8bc767e52994b20d2cfba5d6156bdeae0c69.pdf
[6] AEMC, FINAL REPORT System Security Market Frameworks Review, 27 June 2017. https://www.aemc.gov.au/sites/default/files/content/f510069a-791b-4e4d-8bc0-9e6a216be7a2/System-Security-Market-Frameworks-Review-Final-Report.pdf
[7] AEMC, DRAFT REPORT Frequency Control Frameworks Review, 20 March 2018. https://www.aemc.gov.au/sites/default/files/2018-03/Draft%20report.pdf

	Energy Networks Australia Initiative Consultation - 'Open Energy Networks'[8] - show that the capability of DER to provide Black Start services is being discussed in Australia but has yet to be implemented, further demonstrating the innovative nature of our project. **Power Potential, ESO and UKPN 2016 NIC** ESO and UKPN are delivering an innovation project to create a new reactive power market for DER and generate additional capacity on the network. We have engaged closely with the Power Potential delivery team during the preparation of this bid to capture relevant learning across a number of areas.
Attachments	

[8] AEMO and Energy Networks Australia, Open Energy Networks, 2018. https://www.aemo.com.au/-/media/Files/Electricity/NEM/DER/2018/OEN-Final.pdf