nationalgridESO

Distributed Restoration

Development and demonstration of Black Start from DER

Questions and answers from the first webinar.

Listen to the webinar in full at: https://tinyurl.com/distributedrestorationwebinar

Q1: Testing UPS are typically capable of providing four days' supply. Most UPS have either kinetic or electrochemical storage coupled with diesel generation. Storage tanks are typically sized to cover a bank holiday weekend! (responding to the assertion of two hours of maximum delivery - this is simply incorrect)

While it is true that some DERs have large on-site storage or auxiliary generators to supply house load or critical plant such as pumps etc for several days during grid outages, we found this to be the exception rather than the rule. Most DER facilities have small battery or uninterruptable power supply (UPS) systems which can only provide a couple of hours of emergency power for essential control and communications equipment.

Q2: South Australia ended up black starting off the AC interconnector. Are National Grid looking at black start from HVDC interconnectors going forward? This is theoretically possible especially with Voltage Source Converter interconnectors with a strong source (eg: Norway hydro)

Yes - we are considering black start from future HVDC interconnectors for our 'normal' black start service.

Q3: Assuming that it's possible to create power islands, is it realistic to expect the transmission system to be energised from small embedded generators? And if not, how will this project help with restoration times for Grid Supply Points in large urban areas without embedded generation?

Energisation of the transmission system from small embedded generators is within the scope of this project. We do not expect it to form all of the Black Start Strategy, but we do anticipate that it may contribute significantly.

Q4: Is it possible to predict a possible partial or total shutdown ?

Black Start Standards are included in some ongoing work with Academia linked to the Black Start Task Group. This includes predicting the likelihood of shutdowns occurring.

Q5: Given the lack of suitable example with grid forming inverter and battery. Why don't you look to see if you can pair a synchronous generator and battery? This can help on the inertia and fault infeed issue.

The case studies include an example of synchronous generation paired with Battery Energy Storage (BES). This will allow us to investigate how the different plant capabilities can best be co-ordinated to help establish and maintain a power island. For example, the fault infeed from the synchronous generator will help ensure adequate protection operation, and the fast response of the battery will be useful to support the frequency associated with demand fluctuations and load pick up.

Q5: How will DER Black Start Generators be treated in terms of Grid Code, Black Start Assurance framework etc?

The project will explore 'Black Start assurance' in terms of identifying what changes may be required to areas such as the current technical requirements, assessment criteria, testing requirements and contractual requirements associated with DER providing BS services. In addition, any changes required to the relevant codes (e.g. Grid Code, Distribution Code/G99 etc) will be identified, and modifications proposed, as the project progresses.

Q6: What is the impact to the 'Anchor' Generator in a DER world? eg. Does the technical risk change when connected to multiple (lesser voltage) generators?

A DER 'anchor' generator will move from a 'steady state' role (where it would typically provide a fixed MW output continuously), to a more 'dynamic' role where it may now have to respond by varying its MW/MVAr output to match the connected network (where the frequency and voltage will be inherently less stable than before). Offline analysis will be undertaken to ensure the additional operational requirements are within the capability of the machine, and network restoration/control options chosen to minimise any additional stress.

Q7: Could you provide a view of the impact to the 'cost' of Black Start by using DER sources?

The loss of large fossil fuelled generation and the costs of developing black start capability under the current strategy are the key drivers for this project. It is within scope of this project to estimate the costs of required infastructure as compared with the potential savings produced through the enhanced competition.

Q8: What is the intention to encourage DER Black Start Generator sources - is this by an obligation, or by contractual incentive?

It is within scope of this project to develop recommendations on changes in code requirements and in service procurement methods.

Q9: Ongoing Black Start Expression of Interest calls from NGESO are looking for delivery on 2022 and the NIA and NIC projects are running in parallel of the procurement process and be finalised by 2023. When is the actual window opportunity supposed to happen for DER in BS?

The ongoing competitive process is to procure against our requirement under our current strategy for services starting April 2022.

The Black Start from DER project will be looking to implement recommendations into business as usual once the project concludes (2022-2025).

Q10: Existing BS procurement lists several criteria to be met. Will it be possible to set different criteria for different technologies as part of an integrated solution? (for example diesel generators can provide a lot of MW but are not great at leading MVar)

The currently published information relates to procurement under the current strategy. It may be that amended requirements are developed for DER or for an integrated solution under this project, however, we can't speculate at this stage what those may look like.

Q11: Do you have any plans to look to black start capability of offshore wind plants?

Yes. Offshore wind plants are outside the scope of this project, but we may prove some relevant concepts.

Q12: To what extent are you assuming that there will be operational telecoms capability to control the Distributed Generation and allow it to contribute to Black Start?

Establishing the requirements and resilience of operational telecoms to allow DER to contribute to Black Start is a key part of this project.

Q13: Will you need new temporary protection settings on the transmission lines as you energise 'up' the voltages; I am thinking particularly for the non-unit protection settings?

With the low fault levels associated with energising the distribution/transmission networks from only DER, providing adequate protection will be one of the main network challenges. It is likely that existing protections will not 'see' the reduced fault currents. Providing alternative 'black start protection settings' on existing relays may be one option (modern relays have the facility for remote changing to Group 2 settings), Alternatively, new protections may be required at strategic points on the network. This could be facilitated at 132kV, 33kV and 11kV. However, there will be a minimum fault infeed required to each network to ensure that all L.V (415v) fuses operate within the required timescales (it would not be practical to change the volumes of protection at this voltage level.)

Q14: What sort of timescales would you hope battery storage sites could dispatch for during a Black start?

It is envisaged that Battery Energy Storage (BES) would be used primarily as a source of control during DER black start, and not as a continuous power source, given its ability to respond rapidly and its inability to maintain a continuous output beyond typically thirty minutes. For example a BES unit may be used for: i) Distribution island primary frequency response - the BES could use its import/export capability to help to maintain the generation/load balance. A narrow bandwidth frequency control droop setting could be employed which ensures it takes the initial action to compensate for frequency changes,(this would also help to reduce the frequency control requirements of the anchor generator). ii) Enhance the block loading pick up capability of the distribution island - the fast response of the BES could be used to inject MWs (and/or remove demand) to help arrest the drop in system frequency when demand is switched onto a low inertia system.

Q14: Where can the technical requirements be found (e.g. service availability, time to synchronise, fuel reserve levels, block loading capability etc)?

For participation in the service under the current strategy, information can be found on the Black Start website.

https://www.nationalgrideso.com/balancing-services/system-security-services/black-start.

As part of the Power Engineering and Trials (PET) workstream a report will be produced in Q3 2019 which will include initial options for how the current Black Start requirements may be relaxed or otherwise modified to allow a potentially different type of service to be provided by DER.

We will publish information on selection criteria for case studies here.

https://www.nationalgrideso.com/project-black-start-from-der

As the project progresses and technical requirements for DER are developed, we will share these with industry.

Q14: There are only 3 embedded dispatchable synchronous generators in the South of Scotland. Will this project look out how many would be needed for the 'bottom up' approach to be viable? (larger than 10 MW)

Based on the case study essential criteria, (e.g. a synchronous generator connected at 33kV), analysis of the SPD network showed that 22 out of the total 63 Grid Supply Points (GSPs) currently meet the criteria. This was based on the existing connected generation and those contracted to connect in 2019 (the largest anchor generation capacity in a GSP was 55MW and the smallest 5MW.) Thus for SPD approximately one third of all GSPs may have potential Black Start (BS) capability. As part of the Power Engineering and Trials (PET) workstream report in Q3 2019, analysis of all DNOs in GB will be included, based on the essential criteria for BS suitability, to assess the total MW capacity across GB which potentially could participate in BS services.

Q14: Any consideration of cybersecurity within this project?

Telecomms resilience is in scope. Cybersecurity is not explicitly in scope. This is being addressed by a Cyber Security Task Group.

Q14: Re the Expression of Interest for Black Start (closing today), I assume that the research projects could provide new opportunities as we move in to the 2020s (so not locked out if we don't respond today)?Telecomms resilience is in scope. Cybersecurity is not explicitly in scope. This is being addressed by a Cyber Security Task Group.

The ongoing competitive process is to procure against our requirement under our current strategy for services starting April 2022. Submitting an Expression of Interest was a mandatory pre-requisite for this event.

As insights from the project become available, they will be considered in BAU where possible and appropriate. However, the concept needs to be developed and demonstrated prior to implementation.