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| Network Innovation Competition 2020 Supplementary Answer form | | |

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| Project Name | Constellation | | |
| Question number | #15 | Pro forma section | Section 10.2.2.2 |
| Question date | 08/09/2020 | Answer date | 10/09/2020 |
| Question summary | This question is to some extent a corollary from SQ4 – but the focus of this question is how the benefits have been arrived at. From Table 13 please explain how the fault information from ADMS has enabled you to estimate the number and duration of DER interruption. Can you split this down by connexion voltage? Please then explain how method 2 will obviate these interruptions, ie what actual protection operations have caused the interruptions and how the wide area protection will obviate these interruptions in method 2. Please also explain how the ALoMCP will not undercut these benefits | | |

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## Answer (please retain document formatting and do not exceed 2 pages unless otherwise agreed with Ofgem)

The wide area protection element of Method 2 will provide increased fault ride through capabilities during:

* System wide instability events (such as the recent low frequency event); and
* Faults on parts on the network local to the connected DER (the adjacent circuit to the DER itself).

This will enable DER to support network recovery and protect the smart services they (DER) provide to DNOs and/or the ESO. The two scenarios above are illustrated in the first two diagrams in Figure 4, section 2.2.1.5.

The ALoMCP enables NGESO to operate the grid more efficiently through replacement of vector shift protection with RoCoF and through less sensitive RoCoF settings[[1]](#footnote-1). These changes provide a significant benefit[[2]](#footnote-2) and also increase the risk of unintended islanded operation (within accepted safety limits). While ALoMCP can resolve some of the challenges described in the full submission as part of the unnecessary DER disconnection, we believe Constellation can provide further enhancement to the programme. For example, the rapid change in voltage and current due to a fault that occurs close to a busbar can still trigger the EREC G59/G99 settings on a generator connected to an adjacent feeder.

We believe that Constellation can build on the success of the ALoMCP to prevent unnecessary disconnection of DER operation, while reducing the risk of unintended islanded operation. Our proposed solution is scalable (deployed gradually as DNO reliance on DER and smart services increases) and achievable (most G59/G99 relays have the necessary blocking capabilities). As we continue decarbonising towards Net Zero, we believe ALoMCP alone will not be sufficient to provide the necessary resilience in the long term and Constellation will complement the program to provide increased resilience for network operation. With the network becoming actively managed, heavily utilised and designed to rely on smart services, we expect instability events that trigger post the updated G59 settings to happen more often. Furthermore, Constellation’s wide area G59/G99 protection will enable future opportunities to call upon inverter based DG to switch between operating in voltage control mode or power factor mode to provide additional smart services and support the system stability further.

However, there are significant challenges in assessing the performance of distributed generators in response to a network fault[[3]](#footnote-3). This is due to the visibility issues surrounding distributed generation, as we do not measure frequency or RoCoF. Additionally, we do not collect sufficiently granular operational monitoring of DER to enable power system studies that can estimate the impact of network faults. As such, we only estimated the effect of unnecessary DER interruption due to faults on adjacent feeders. As part of EREC G99, some of these issues will be resolved over time, but the data limitations will remain on existing G59 installations for some time.

As described in the answer to SQ14, the methodology to calculate the protected capacity benefit from wide area protection uses established forecasts, historic performance and key assumptions. We used our historic ADMS data to identify how often (and how long) DER protection operation events occur. To identify how many of these instances caused a generator to be disconnected unnecessarily, we applied our operation expertise and assumed that any DER interruptions shorter than three hours were unnecessary. To ensure Constellation delivers benefits to the network and our customers, we included both the total number of faults and the number of assumed unnecessary interruptions within the sensitivity analysis. We acknowledge that our historic data likely includes generators with vector shift protection or with outdated RoCoF settings and the ALoMCP can resolve those specific issues. Nevertheless, we believe that our low range on the sensitivity analysis accounts of this.

This approach allows the data to be split by DER connection voltage. In the entire data set 55% of events were on 11kV network, 39% on 33kV network and 6% on the 132kV network or unknown.

1. Accelerated Loss of Mains Change Programme, ENA, <https://www.energynetworks.org/electricity/engineering/accelerated-loss-of-mains-change-programme.html> [↑](#footnote-ref-1)
2. Distribution Code: DC0079 Frequency Changes during Large Disturbances and their Impact on the Total System, Ofgem, 2019 [↑](#footnote-ref-2)
3. 9 August power outage report, Ofgem, 2020 [↑](#footnote-ref-3)