Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: REVISE

Tick if this answer has been provided verbally: ☐

Project code	WPD/EN/NIC/05	Question Number	33
Question date	13 September 2018	Answer date	17 September 2018
Submission section question relates to			
Topic			
Question	Building on question 12 and the discussion at the Expert Panel meeting on 05 September, the approach in Revise does not seem to allow for different design philosophies for the 33kV network, other than the existing one. It also seems that the shift in design philosophy of C2C is not understood, based on the answer to Q12. C2C is a method to obtain more capacity pre fault, not post fault. It does so by converting a radially operated system into a meshed system, and deals with the resulting protection challenges by the intelligence in the network management system (NMS). In other words C2C consciously rejects the design requirement that a protection system must only disconnect unhealthy circuit elements. Instead it allows healthy system to be disconnected, and then use the intelligence of the automatic reconnexion sequences in the NMS to restore the healthy circuits. It does this in under three minutes. Given the challenges on ensuring discrimination which method 2 of Revise seeks to resolve, it seems that one relevant counterfactual would be to redesign the network to use the C2C philosophy, thus avoiding the need for DPS. Whist it is not obvious at all that such an approach will be appropriate for the 33kV networks in question, it is also not immediately obvious why not. There is a broader underlying issue here. Why is it appropriate to simply roll forward historical design philosophies, and then seek to innovate to make them work in radically changed circumstances. The proper counterfactual for Revise should be based on a wider review of design philosophies. Is it possible to reconsider the counterfactual for Revise in the light of this challenge?		
Notes on question	None		

Answer	Summary DPS does not seek to "roll forward historical design philosophies" and "seek to innovate them to make them work in radically changed circumstances". On the contrary, DPS is an entirely new protection philosophy that will build upon the research of previous projects, including C2C, and adaptive protection systems. Both previous innovation projects and adaptive protection systems have shown to have significant benefits and facilitate the operation of an autonomous network. There is therefore no need for pre-determined network configurations. C2C investigated the benefit of paralleling two 11kV feeders that were previously operated radially to facilitate additional load or generation capacity connections to the network. The existing or predicted demand was the limiting factor where the network parallel was broken in a post-fault scenario. This is evidenced in Section 6.3.2 of the C2C Closedown Report: *"The SDRC had a target of ten managed agreements with customers seeking new connections or additional load/ export capacity by September 2014 and the Project had only secured 6. The primary reason for this difficulty was a reduction in maximum demand on our Trial circuits".* The C2C Closedown Report (Section 2 "Technology effectiveness") states "*Specifically at HV, the C2C Method closes the NOP between two adjacent HV circuits to form a closed HV ring which will in general releases the inherent capacity to customers.*" Unlike C2C, REVISE focuses on the wider network issues whereby constraints borne by both load and generation output are considered rather than just maximum demand. Another key consideration is the network's need to dynamically re-configure, and in some instances mesh, to better balance networks. The balancing of networks is critical where one network is dominated by load and the other generation for an extended period. Whilst paralleling networks for capacity release is an option, it is not in all circumstances the most effective in releasing network capacity given that the disconnection of increased numbers of customers is deemed unacceptable. Traditionally DNOs have looked to split existing parallel networks, whether at primary substations or at system mid-points to increase the system capacity. An example is splitting two 10MVA circuits to enable 20MVA load or generation to be connected to each of these networks, which is not possible when operating in parallel, unless they were by good fortune impedance matched. Critical to both this methodology and the one developed and tested as part of C2C, is that they rely on customer flexibility whether that is load turn-down or generation turn-up in a post fault scenario. In contrast, REVISE will develop robust technical tools and methodologies to deliver network flexibility that will look to integrate and utilise customer commercial agreements, to benefit the wider system where possible, but fundamentally will not rely on them. Protection Philosophy Referring to the statements within the question, a protection design philosophy which actively "*allows healthy system to be disconnected*" is not a suitable counterfactual to DPS. Any counterfactual should aim to reduce customer interruptions rather than increase them. Although C2C restores customer supplies in "under three minutes" any unnecessary and avoidable customer supply interruptions, regardless of the duration, are unacceptable for customers. Our stakeholders would not support such a solution which

would detrimentally affect customer supplies.

Network Voltage Level

Importantly, C2C focussed on the 11kV network where an average number of customers connected to a feeder is between 1000 and 1500. REVISE will focus on the 33kV network where the average number of customers per feeder is ten times that of the 11kV network with the potential to impact customers to a greater degree. Furthermore, any interruption to Distributed Generation will have a substantial impact on operations, due to the general requirement that manual intervention for re-synchronisation is required, and is likely to significantly increase lost revenue. Clearly, this does not support the aim to decarbonise electricity supplies and aid the transition to a low carbon economy. This is highlighted in the C2C Closedown report in the lessons learnt for future innovation projects, Section 9.2.1 Trial area selection and deployment,

> *"A note of caution with this approach: it may have required a reactive process for application of required P2/6 derogations on potential areas of non-compliance".*

The DPS Counterfactual

In relation to an updated counterfactual, the NIC governance document states that "*The difference between the Base Case Cost and the Method Costs is the financial benefit of the Project*". Where the Base Case (or counterfactual) is the "*lowest cost method of delivering the Solution (on the scale outlined as part of the Project) which has been proven on the National Electricity Transmission System or on the Distribution System*" (please refer to Page 38, Section 5.48 and Page 70, Appendix 1 – Definitions). The protection / operational philosophy for C2C has not been adopted as BAU across the "National Electricity Transmission System or on the Distribution System", therefore we did not consider it a valid Base Case to be used in the FSP. In preparing our response to this question we have confirmed with our ENW colleagues that whilst customer flexibility agreements have been offered, to date no additional (post-project) 11kV networks have been changed to parallel operation for this purpose.

As stated in Section 3.5.2 of the FSP, there is no "*credible base case*" which can meet the required levels of stability and sensitivity to ensure that a flexible, constantly changing network is adequately protected. In addition, as we stated during the discussions at the Expert Panel meeting, providing a counterfactual to DPS would **increase** the financial benefits for this Method and in-turn the total Project benefits (please see reference to governance above).

Key Differentiating Factors

As part of the C2C Closedown Report the following detail is provided in Section 6.2.1 Trial area selection and deployment:

> *"In addition, operational constraints were identified and need to be considered at the planning stage for any future large scale rollout. These constraints include:*
>
> - *Insufficient alarms at the primary substation to allow automatic restoration sequence functionality on the closed ring*
> - *Fault level issues that prevented the auto-reclose feeding HV circuit breakers*
> - *Inability to deploy remote control on some midpoint substations due to design of HV switchgear*
> - *Lack of LV supplies at certain switching stations."*

	Building on the key differentiators information in Appendix N of our full submission, (which looks at all DNO projects, not just those led by ENW), the four points below will be addressed throughout the three Methods of REVISE: • The implementation of DPS will enable the addition of a number of alarms and information points to ensure that the central control system and that employed in INR has the correct level of information to enable automatic re-configuration and restoration of supply; • The deployment of INR will have fault level detail integrated to ensure that the optimised running arrangement considers the impact on fault level as well as its principal aim of system optimisation (this dynamic approach then necessitates a dynamic protection system that, in real-time can suitably protect the network and minimise customer disconnections in the event of a fault); • The implementation of the ACS will enable midpoint remote control of the 33kV; and • A key consideration in the novel technical design and application of the ACS was the previous innovation projects' issues (and often BaU new connections) with sourcing suitable LV supplies to power ancillary equipment; ACS will develop and trial an integrated voltage reference source generated from the incoming 33kV supply that acts as a protection reference and ancillary power supply.
Attachments	