Electricity Network Innovation Competition Full Submission

Supplementary Answer Form

Project: OSEAIT

Tick if this answer has been provided verbally: ☐

Project code	NGET_OSEAIT	Question Number	29
Question date	17 September 2015	Answer date	22 September 2015
Submission section question relates to			
Topic	Facility Use		
Question	NIC period. Please provide details of one project for each of the three priorities identified by [redacted] (new asset deployment; testing of condition monitoring techniques; end of life asset assessment).		
Notes on question	This question is being dealt with in more detail as part of our reply to the 1st Bilateral meeting with the Expert Panel on the 16th September. The full reply will be provided in the pack on Friday 25th September and will consist of further detail.		
Answer	<u>New Asset Deployment – Mobile Substation Bay (MSB)</u> A field trial is necessary to develop the understanding and experience necessary to implement the MSB into the business as a risk assessed solution. The opportunities to use the MSB focus on providing: 1. A tactical option to quickly restore supply and power flows following a failure. 2. An alternative to building a permanent SGT when operational management of outage conditions is not possible. 3. A pre-fault risk mitigation tool to manage post-fault risk. *Why this work can only be done at Deeside* For a solution of this novel nature to work in the current environment it is necessary to evaluate the impact of a departure from using traditional deployment and civil construction methods associated with a permanent installation. Deeside would provide a unique opportunity to		

develop the solution and optimise the implementation procedure off-line rather than having to work in the confines of an operational substation. This will reduce the safety constraints associated with working in a substation, will increase the time available for trials, will reduce the risks to connected customers and will improve the likelihood of a successful development. Specifically, the use of Deeside would:

1. Reduce the very long commissioning programmes associated with installing innovation in an operational substation: To trial the installation of the MSB would likely need an outage in three adjacent bays in the first instance. In addition to the time the project would need to wait to be allocated outage slots, the disconnection of two further bays would likely incur significant constraint costs
2. Allow us to examine different deployment situations: The short outage window that is likely to be available in a live substation will significantly reduce the likelihood of the optimal installation procedure to be identified as there will not be time to examine different solutions. to be accepted onto the system, this would take much longer in an operational site.
3. Reduce the requirement for the the constant supervision of a Senior Authorised Person (SAP) during work near live circuits: SAP resource is scarce and best deployed to deliver the major capital investments taking place across the system.
4. Remove any risk of reducing the customer's security of supply: Trialling the MSB concept will require the protection and control functions of the new mobile bay to be interfaced into the legacy substation system. This is not without risk and any trip will have a negative impact on the security of supply.

<u>Testing of Condition Monitoring Techniques – Thermal Imaging / Hot-Joint modelling</u>

The aim of this project is to enhance our understanding of the non-intrusive measurements made using thermal cameras. These measurements are valuable in identifying joints that have degraded / are operating at elevated temperatures. The project will allow us to better define the limits of measurements that deem the joint to be in an acceptable condition. The output of this work will allow enhanced correlation between the non-intrusive measurement of thermal cameras and conventional measurements such as resistance and actual temperature of

	the joint. The project will improve our ability to take enhanced asset management decisions that prevent unnecessary maintenance while managing the risks associated with sub-standard assets (joint failures - the resulting risk to the public and a loss of a portion of the network with the corresponding impact on security of supply / constraint costs). This project will have three specific outputs:- 1. Produce a general correction method that ensures the camera measurement of joint temperature allows for ambient conditions and environment (temperature, wind, distance, etc) 2. Produce a predictive load model that allows the joint temperature to be forecasted from the load conditions at the time of survey and the resulting temperature when the asset is heavily loaded to be predicted. 3. Develop a method that allows the general load/temperature curve to be modified to suit other assets types or designs if required. *Why this can only be done with the facility* If this work was performed on an individual, standalone asset, the thermal model that was developed would not consider a range of factors including the circuit parameters impacting the diffusion gradient (i.e. the busbar acting as a heat sink). Doing the tests at Deeside would:- 1. Allow measurements to be done while the asset was connected to a circuit – if required multiple conductor types could be used either side of a joint to confirm the impact of connected components. 2. Allow us to develop a process and measuring method in an environment that replicates the constraints inherent in a live substation (physical viewing constraints, safety procedures, clearances, physical barriers, etc.) 3. Allow validation of the methods proposed through the ability to take direct temperature measurements over a long period in a range of different environmental conditions and with a range of loads. 4. Allow rapid validation of the applicability of the developed method to other assets contained within the OSEAIT site 5. Develop dynamic models applicable to more assets that are based on the current and recent load levels.

	End of life asset assessment National Grid has invested significant resources into developing models that better describe the rate at which transformers age. This is increasingly critical as the loading of transformers changes with the increasing levels of intermittency. However, National Grid has not been able to validate the safety margins inherent in this models as we have not been willing to allow assets fail on the system given the risk to both safety and customer supplies. Trials are required that will allow us to evaluate the confidence we have in applying end of life models to high value transmission systems assets. Improving our confidence in end of life models will allow us to defer capital investment associated with asset replacement and permit higher levels of loading to be applied to some of our transformer fleet. Doing the tests at Deeside would:- 1. Allow assets to be energised with varying levels of voltage and current – the operating voltage and temeperature both being key factors in determining the ageing rate of electrical insulation. 2. Support the ability to inject varying levels of harmonics into the system (high levels of harmonics being detrimental to asset life) and transients. 3. Allow equipment to be run to failure without a consequential reduction in customer security, an increase in constraint costs and the uncertainty it would create in our outage planning programme. 4. Protect the safety of our workforce as any failure would take place in a low fault level environment. 5. Allow a more comprehensive suite of measurements to be taken as the asset is aged towards failure, improving future failure models / remaining life calculations.
Attachments	