Network Innovation Competition Full Submission

Supplementary Answer Form

Tick if this answer is Confidential: ☐

Tick if this answer has been provided verbally: ☐

Project code:	SSEEN01	Question Number	10
Question date	20 August 2013	Answer date	22 August 2013
Submission section question relates to	Appendix 9		
Topic	Project plan		
Question	Referring to the project plan, activity 33 is "Run RTS programme" (600 days). Please describe what this activity entails.		
Notes on question	N/A		
Answer	The planned purchase of the RTS racks in 2014 (prior to the planned commissioning of the MTTE in 2017) enables the academic partners to start to developing the models required by the MTTE, including for example: reviewing, developing and validating existing system models to identify gaps and developing improved models of key components such as HVDC equipment where required. A typical example of the approach taken to developing and implementing a series of models, tests and trials to ensure the correct operation of the RTS models is shown on the attached page. This activity 33 in the project plan refers to the delivery of this programme of model development and validation in the Real Time Simulator (RTS) systems prior to commissioning the RTS in the MTTE.		
Attachments	yes		
Verbal Clarifications (Consultants)	N/A		

SSEEN01 – Attachment to Question 10

Development and Testing of RTS System.

At the heart of the MTTE is a Real Time Simulator (RTS) which can model both the AC transmission network, and the HVDC converter stations, or other controlled devices, which are to be connected to the system. The RTS system needs to be developed and populated with models of both the AC and DC systems. These models will need to be developed and installed in the RTS and the outputs validated to give confidence that the RTS system is producing accurate results. This work will be carried out in advance of receiving any replica panels from vendors.

Our outline approach to developing and implementing the RTS system is described below, this will be subject to further development and will be confirmed as part of the requirements specification and design stages of the project.

Phase 1 - the first phase of testing will check the correct functioning of the RTDS hardware system, the control system and the communication systems. Initial studies would consider AC networks only under steady state and dynamic conditions. The number of test scenarios to be considered would be defined in detail prior to the operational trials. Results achieved should be checked against non-real time studies of the same circuit executed in programmes such as PSS/E, PSCAD or Dig Silent. Due to computational restrictions, the AC network is normally modelled as a “reduced network” which has been derived to have the same dynamic response as the full GB network. This reduced model will need to be refined to reflect the location being studied ie East Coast of England, Northern Scotland etc.

Phase 2 would introduce a 2 - terminal HVDC link into the AC model. To test the computational power of the RTS processor, this link should be of the Modular Multi-level Converter (MMC) design of Voltage Source Converter (VSC) HVDC. These trials would use a generic HVDC control and protection system, anticipated to be available as a function within the RTDS operating software. Similar steady state and dynamic cases would be studied as executed in Phase 1 and similar checks with the results from other computational tools would be made.

Phase 3 testing would introduce a 2nd HVDC link into the model ie a multi in feed scenario, also of the MMC topology, connected at a common AC point to check that the RTS processors are able to compute solutions for this condition in real time. A similar regime of system studies would be executed as in Phases 1 and 2, with the additional operating scenarios introduced by the presence of two parallel HVDC converters.

Phase 4 testing would replace the two HVDC links by a multi-terminal system, comprising of 3 HVDC converters connected in parallel on their DC terminals and at different points on the common AC network. Each HVDC station would be of the MMC topology. This introduces many more operating scenarios to be studied for steady state and dynamic behaviour.

In the longer term the generic control and protection systems used in the above trials would be replaced with proprietary systems provided by HVDC manufacturers.

A similar approach would be used to introduce and develop models to study the impact of other types of active controllers, e.g. those for Static VAR Compensators, (SVCs), Static Synchronous Compensators (STATCOMS) and wind turbines.