LCN Fund Full Submission

Supplementary Answer Form

Tick if this answer is Confidential: ☐

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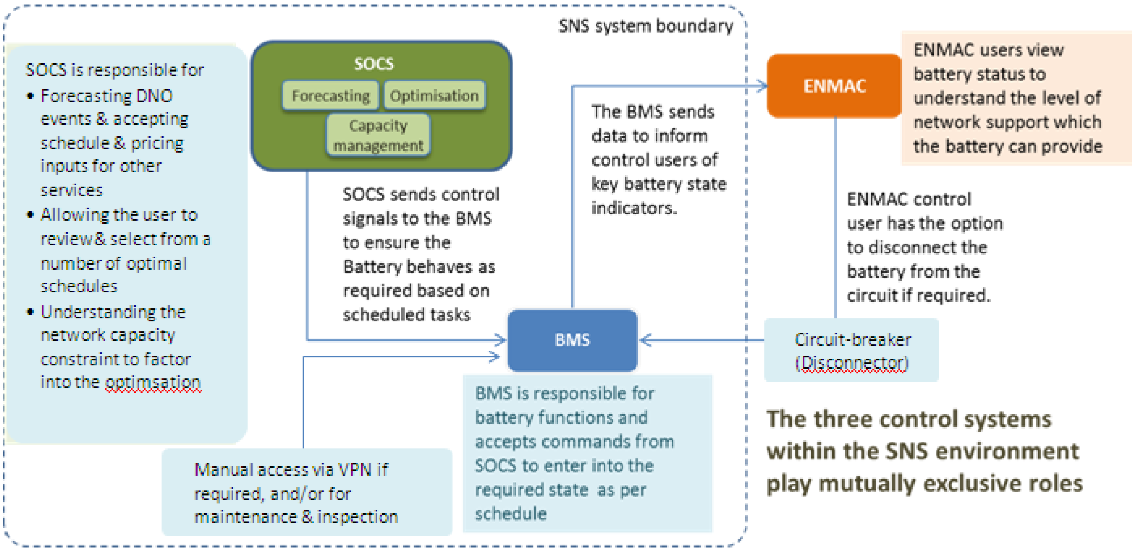
Project code:	Smarter Network Storage	Question Number	UKPN028
Question date	20 September 2012	Answer date	24 September 2012
Submission section question relates to	Section 2		
Topic	Project Description		
Question	Please provide a clear explanation and diagram of how the various control systems to integrate the operation of the battery with the distribution network will work without conflict		
Notes on question			
Answer	The SNS systems environment contains three control systems playing mutually exclusive roles: 1. SOCS: The Smart Optimisation and Control system runs a forecasting and optimisation algorithm based on various requirements (e.g. DNO event predictions, STOR window schedule and prices, Wholesale windows and prices) and constraints (e.g. Network capacity, Battery degradation) to formulate an optimum schedule on a regular periodic basis. SOCS then makes sure the battery operates as required by the optimum schedule for each 30-minute time slot. This is achieved through communication with the local battery management system (BMS – also known as SG Domain controller). The system will have a number of core functional modules: **Forecasting engine** – in order to predict peak demands and determine when support may be required were there to be a fault. This needs to forecast across a range of timescales, looking ahead in order to schedule potential service windows, and also monitor more real time network conditions to evaluate actuals versus forecast in case of changing conditions. **Capacity engine** – in order to calculate the rate of import/export that can be scheduled within expected network constraints, and therefore the state of charge of the battery at any given time **Optimisation engine** – in order to calculate and determine an optimal		

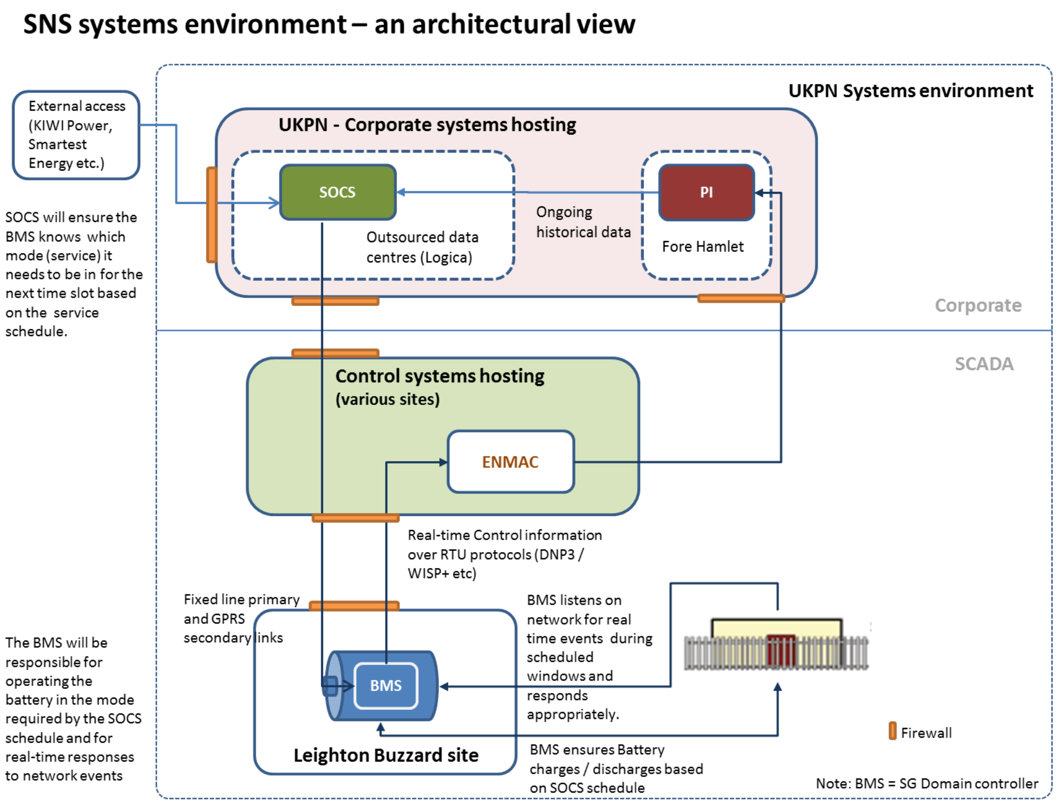
schedule for storage capacity, based on known and predicted time, network and commercial constraints.

2. BMS: The Battery Management System accepts commands from SOCS to operate in the required mode in accordance with the optimum schedule. The BMS also listens on the network for signals where a scheduled window requires a real-time response (e.g. STOR or Frequency Response) and responds directly once such a signal is received

3. ENMAC: The existing core control system for UK Power Network's SCADA network will incorporate display battery state information including current level of charge, and duration of energy available to inform the control function of the level of network support available and provided by the battery. If required, a control operative will also be able to disconnect the device from the network in the event of abnormal operation or other unplanned events.

The following diagrams illustrate the logical coexistence of the three control systems and the provisional technical architecture which will be further refined within the design phase of the project:





At any point during the storage device's internal protection or UK Power Network's 11kV protection may operate in response to the fault, in effect overriding the SOCS and battery management system.

We are familiar with and comfortable with the hierarchy of default within National Grid's model contracts (for example for STOR) and note that only faults which impact >10% of rating or capacity are regarded as default. Similarly force majeure covers many of the 'business-as-usual' interruption events which would not necessarily qualify as exceptional events under Ofgem's Quality of Supply Incentive.

We are considering, and will discuss with the Expert Panel on Wednesday 26th September, a rationalisation of this work stream. This would involve some increase in labour, sacrifices in usability, and a limit to the optimisation possible. However use of a manual solution and processes during the project may allow for some cost savings and deferral of IT development to a later stage, once proven successful.

Specifically, a manual process for identifying and implementing a schedule could potentially be performed during the project. Whilst this would be sub-optimal in terms of total value that might be extracted from the storage facility, could still create learning relating to multiple value streams.

Similarly, the forecasting engine represents more detailed contingency analysis than we would typically carry out for 11kV networks, but can be carried out offline using traditional planning tools such as Digsilent, or automated simulations using scripting language. The capacity engine may also be simplified at the expense of a reduced granularity of control and scheduling of capacity, allowing larger operating safety margins for the import/export from the device.

Attachments	
Verbal Clarifications (Consultants)	