LCN Fund Full Submission

Supplementary Answer Form

Tick if this answer is Confidential: ☐

Tick if this answer has been provided verbally: ☐

Project code:	Smarter Network Storage	Question Number	UKPN011
Question date	04 September 2012	Answer date	07 September 2012
Submission section question relates to	Section 2		
Topic	Project Description		
Question	How much energy will be 'lost' in the store and how will these losses be paid for?		
Notes on question			
Answer	There are impacts on losses due to the introduction of storage onto the distribution network across a number of different areas: 1. Gradual 'self-discharge' losses as a result of charged cells losing low levels of charge over long periods of time; 2. Cycle efficiency losses due to the losses in conversion and operation of the storage; 3. Reduction in losses incurred upstream of the 11kV busbars as a result of reducing peak demands; and 4. Reduction in losses as a result of reactive power support from the storage power electronics. The first two areas can be considered related to the actual storage device, whereas the last two areas are as a result of the operation and integration of the storage into the network. **1. Self-Discharge losses** In appendix I the Overall System Specification of the 6 MVA / 15 MWh Long Duration Solution specifies a Self Discharge Rate will be less than or equal to 5% over 6 months based on an initial state of charge of 100%.		

	During the project in the unlikely event that the battery installation remains static at full charge for 6 months the specified loss would be no greater than 125kWh per month, which is significantly less than the no-load loss of a system transformer (typically 11kW). **2. Cycle efficiency losses** Li-Ion storage technology as chosen in the project has one of the highest cycle efficiencies amongst storage technologies, and therefore is highly suitable for applications in which we are looking to maximise the utilisation and value of the storage flexibility. The losses due to cycle efficiency depends heavily on the pattern of operation of the storage, and the AC-AC nominal round trip efficiency is claimed to be in the region of 87%, including the step-up transformer. A greater understanding of the pattern of operation of storage, when leveraged for multiple purposes by a range of system participants, will be developed by the project and help to validate manufacturer's claims on losses (as well as lifetime) and will be an important learning outcome of the project for the industry. These losses will be monitored and accounted for due to the fact that energy imported and exported will be metered and reconciled with SmartestEnergy at wholesale purchase and sale cost. The cycle efficiency losses will reduce the gross income achieved from these ancillary services, but the impact is not expected to be material. **3. Reduction in distribution system losses** Storage will serve to reduce the peak demands on the network by providing energy locally at periods of high demand. This has the effect of lowering losses due to the different network loss rates experienced at high demand and low demand times, as reflected in the 'Loss Adjustment Factors' used to estimate these losses. By way of example, meeting a given level of additional peak demand with peak energy fed by the network causes losses to increase due to the higher loss rates during this time, as assets are more heavily loaded. When storage is present as an alternative to meeting these peak demands, the storage can be charged at off-peak times and therefore energy enters the storage device at a period when losses are typically lower as assets are lightly loaded. The storage then uses this energy to support the peak demand periods, therefore losses are reduced compared to meeting these demands over the network at peak. For the purposes of the project, UK Power Networks is not expecting to benefit from any incentives relating to any observed reduction in

	losses due to this effect. **4. Reduction in losses due to power factor support** The power conversion system element of battery storage is able to provide independent reactive power support to the network in order to improve power factor on the local network. This serves to improve the utilisation of the network assets, increasing the real power and further reducing the losses on the network. The SNS project will provide practical demonstration of the use of energy storage when leveraged for multiple purposes, and provide key operational data to validate the real operating costs of distribution-scale energy storage and quantify the overall impact on losses.
Attachments	
Verbal Clarifications (Consultants)	