

LCN Fund Full Submission

Supplementary Answer Form

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Project code:	SPD2004	Question Number	SPD001
Question date	23/08/2012	Answer date	30/08/2012
Submission section question relates to	3		
Topic	Project Business Case		
Question	For each of the seven case studies in Section 3 of the Full Submission pro-forma please provide a more detailed description of what it is planned to do e.g. describe the relevant ANM scheme including what it consists of, how it will operate, the extent to which the constituent parts exist or need to be developed and what it will deliver and how.		
Notes on question			
Answer	<p>As part of the ARC project, key GSPs in the project trial area will be ANM-enabled. ANM-enabling involves the following:</p> <ul style="list-style-type: none"> • Upgrading and extension of the existing communications infrastructure to support ANM solutions. Details are provided in our original submission. • Installation of an ANM control platform layer at required GSPs. Through the Expressions of Interest process SPEN has selected Smarter Grid Solutions' ANM platform for implementation in the trial area. The platform, to be paid for by the project as a component of DNO Operational IT infrastructure (e.g. telecommunications or SCADA) consists of the following: <ul style="list-style-type: none"> ◦ CommsHUB. An SGS software product that allows ANM schemes to communicate with measurement locations, generators, end-point devices and higher level system via a suite of industry protocols. CommsHUB performs data handling and persistence services for SGcore. ◦ SGcore. An SGS software product that operates as an application container capable of hosting 'hard' real-time ANM 		

control applications such as: power flow management and voltage control.

SGS's SGcore and CommsHUB products serve as a dual redundant platform for deploying ANM applications (i.e. control algorithms) within the ARC area. This platform will be used to target the deployment of SGS' ANM software applications for the management of power systems problems such as network constraints.

Generators and other end-points/controlled devices participating in any of the ANM schemes in the ARC trials will require the following components:

- **A local ANM controller.** The local interface controller acts, in part, as an interface between generator/end-point device control systems, the ANM scheme infrastructure and the ANM control applications running on SGcore. The local ANM controller software is configured to ensure the safe operation of the end-point devices during failure of communications and/or any other critical component of the ANM scheme.
- **Communications between the local ANM controller and one of the ANM-enabled substations.** A communications link will be required. There are a number of available technologies that can be used to this end and we envisage the generator, with support from SGS, selecting a technology which is appropriate for their site and the economics of their project.

We envisage that the local ANM controllers and the communications between generator and the nearest ANM enabled GSP or primary will be paid for by the generator participating in the trial. We have included the cost of a limited number of local ANM controllers in our budget for existing generators or devices.

Whilst the ANM platform is being trialled in other projects in the UK (Low Carbon London and Flexible Plug and Play), we see the potential for learning in the novel application of control functions on this platform. We believe the majority of these control functions (the management of multiple N-1 constraints, the management of thermal constraints at the GSP, the management of constraints across voltage levels) to be innovative, i.e. they have not been attempted in existing UK projects or, to our knowledge, abroad. There is one case (Case 3) where we envisage building directly on the learning of Orkney RPZ, however, our learning objective in this area is to understand how we offer such solutions to customers and how we build ANM into our network design process.

The ANM platform SGcore, CommsHUB, local ANM controller and ANM applications are existing Smarter Grid Solutions products. These will not require any further development to deliver the project but will be configured at installation to accommodate the specific controlled devices and power systems problems being addressed.

Case Study 1: The Exporting GSP

As part of the ARC project, key GSPs in the Borders will be ANM-enabled, including the exporting GSP identified in case study 1. The exporting GSP case study was identified as a connection application currently in progress and hence likely to be delivered as a project trial. SPEN will use this case to

explore both technical and commercial solutions to the problem of exporting GSPs with the developers at the case study site and with National Grid.

The nature of the commercial and regulatory arrangements governing reinforcements at GSPs will require tripartite discussions regarding what will constitute an acceptable technical solution for all parties. This represents a key opportunity for learning as part of LCNF. So, whilst we do not fully understand the requirements of that solution at this stage, we have proposed and budgeted for the following elements of an ANM solution:

- **ANM-enabling of the GSP.** As described above.
- **Deployment of SGS's ANM application software for power flow:** SGS's power flow management application, SGi, has seen over 2 years of operational experience as part of the Orkney RPZ. However, on Orkney only one running order, i.e. network configuration, is dealt with. On Orkney a particular set of network access rights, known as last-in first-off (LIFO) is used. Using SGi to manage N-1 conditions, as described in the case study, is novel and SGi has not been trialled elsewhere. To our knowledge no ANM scheme currently deployed in Europe manages generation in this way.
- **ICCP link:** An ICCP link between the ANM scheme and the DNO's DMS and the TSO's EMS will allow both parties to have visibility of and the possibility of control over the ANM scheme and the participating generators/end-point devices. SGS's CommsHUB product supports ICCP, however, this functionality has not been trialled in as part of any major demonstration project. The innovation in using ICCP is secondary to the need to understand how ANM should be deployed at the Grid/Distribution network boundary. Whilst we see the technical learning associated with trialling such a link as useful, we expect the main area of learning to be in the understanding of how such a scheme will need to operate and how different stakeholders will interact/interface with it

Whilst the component parts of the technical solution already exist, they have not been used in this manner before. As the use of ANM to manage constrained connections at the DNO/TNO/TSO boundary has not been trialled within the UK, there are a number of points where learning is required.

Case Study 2: Multiple Issues for N-1 Contingencies

The proliferation of single issue intertripping and constraint management systems is already a concern and is replicated across both of our license areas. This case study highlights a situation where the configuration and response of an existing inter-trip scheme limits the opportunities for subsequent generator connections, the converse of learning from the Orkney RPZ where the number of generators connected to the scheme continues to grow. Our initial attempts to understand and attempt to resolve such issues were undertaken during an EPSRC programme with ABB and UKPN, then EDF, however these did not reach the point of demonstration on any network network.

Learning from the Orkney RPZ has led us to believe that ANM as a

technology has matured to the extent where it can now be used to address these problems, however, no trials of using ANM in this way have been undertaken in the UK. Managing multiple issues for N-1 contingencies will require the coordination of power flow management and voltage control solutions. This has yet to be demonstrated in the UK.

For this type of case we will:

- **ANM-enabling of the GSP.** As described above.
- **Install a local interface controller at participating generator sites with a communications link to the nearest ANM-enabled GSP or primary.** Same as case study 1.
- **Use SGS's SGi and SGv software application products to manage power flow and voltage constraints under N-1 constraints.** Voltage constraints would be managed by automatically ramping down connected generation to a predefined level to limit any voltage step cause by the sudden loss of that generation. Use of these products together has not been demonstrated in the UK. Coordination between voltage control and power flow management functions will be required. We intend to explore different options during ARC and enhance learning in this area.
- **The use of fast generator controls.** Should any generators on the network offer the possibility of voltage support through power factor control, this will be explored. However, this would require the testing of the functionality within the ANM prior to installation. Should such a case present itself during the ARC project, it is our intention to test and demonstrate such functionality at PNDC before deployment on the network.

Case Study 3: A High Cost Firm Connection due to Thermal Constraints

The technical solution would be akin to that deployed as part of the Orkney RPZ. A local interface controller would be deployed at the participating generator site and SGS's SGi product would then be used to manage the output of the wind farm to keep thermal constraints within limits using the SGi control application running at the appropriate GSP.

Case Study 4: High Cost Firm Connections due to Voltage Rise

Voltage rise and its knock-on effect on the capacity of MV networks to support DG is well understood. Following from the Marthem RPZ, SPEN intended to trial the use of GenAVC and GEN+ for two of the connections in case study 4, only to find that GenAVC was no longer commercially available. SPEN is currently trialling an ANM solution for voltage rise in North Wales as a Tier One project in collaboration with SGS. We see that as a potential solution for deployment during ARC as it reaches the appropriate TRL. That solution monitors voltage rise on the feeder and curtails the real power output of participating generators in order to keep voltage within limits.

In addition, our invitation to express interest process identified other potential solutions from alternate vendors which have not been trialled in the UK. It is our intention to tender for solutions in the event that such a connection request is made within the project. Such a solution must

interact with the overall ANM scheme in order to provide coordinated actions across the trial area. The use of such end devices with an ANM scheme has not been trialled before.

Case Study 5: The Infeasible Application

Case study 5 does not represent a situation where technical solutions are necessarily sought at this stage. In the first instance we would envisage these cases being identified earlier in the connections process, initiating a dialogue with the developer on how they might wish to process, e.g. resize or relocate their projected and/or consider smart interventions as a way of bringing connection costs down to an economically viable level.

Case Study 6: The Small Scale Community Scheme; and

The small scale community scheme will look to coordinate community generation with community load, where the community will be responsible for managing such a scheme. However, we envisage that the ANM platform and ANM applications would administer the connection to the community level control systems to ensure that the community scheme is compliant with the terms of its connection and ensure operation of the network within its limits. For example, if these terms are violated and the community scheme exceeds its export capacity, the ANM scheme will curtail community generation.

For this type of case we will:

- **ANM-enabling of the GSP.** As described above.
- **Install a local ANM controller at participating community sites with a communications link to the nearest ANM-enabled GSP or primary.** Same as case study 1.
- Use of SGS's SGI application to manage excursions should the scheme not operate correctly.

Case Study 7: Impact of Small Scale Generation on the Exporting GSP.

In the first instance the ANM system in the enable GSPs will monitor the impact of small scale generation. However, when small scale generation begins to trigger the curtailment of larger generators at higher voltage levels, we shall use the ANM platform to manage constraints across voltage levels. At this stage we have not defined the commercial or network access arrangements which would determine how the ANM scheme should operate under those conditions. We intend to explore this during the project. SGS's ANM applications already allow various network access arrangements to be configured .

For this type of case we will:

- **ANM-enabling of the GSP.** As described above.
- **Install a local ANM controller at participating small scale generation or group of small scale generator sites with a communications link to the nearest ANM-enabled GSP or primary.**
- The local ANM controller would allow the ANM scheme to curtail small scale generation based on the principles of access which will be defined during the course of the project.
- Use of SGS's SGI application to identify and manage power flow

	<p>constraints by monitoring key network nodes and issuing curtailment signals to local ANM controllers.</p> <p>All the components required to deliver this trial exist but have yet to be configured and tested for use in this way.</p>
Attachments	
Verbal Clarifications (Consultants)	