NINES Project relevance to GB mainland network

Introduction

It has been recognised that there is relevant learning and application from the proposed Shetlands Project to the mainland GB system. We note that although the size of the Shetlands network in relation to GB is small and that system dynamics are therefore very different, an understanding of the behaviour and performance of the entities connected to it will provide an ideal insight into how renewable generation and demand response might behave on the GB mainland given the right control environment, market arrangements and incentives.

We recognise that there are progressive phases proposed for the project and that we will need to consider how each of these elements could be developed in line with the project phasing. Our thoughts at this stage are therefore based on the project as a whole and not specific to any of the phases.

From a supply chain perspective these involve integrating existing and new demand profiles and behaviours with intermittent generation. They fall broadly into the following areas:

- Developing demand responsiveness
- Integration of micro generation and 'large scale' generation
- Integration of low carbon heat and transport
- Efficient and reliable network investment and operation

From a System Operation and Control perspective these include:

- Dynamic behaviour of renewable generation and flexible demand, with particular reference to low carbon demand
- Development of forecasting tools and techniques for demand behaviour and demand response to external signals, both direct and price driven
- Despatch methods
- Frequency control methods
- Development of contingency arrangements
- Local network constraint management and how this impacts on despatch (market balancing) and system balancing

nationalgrid

Supply Chain Perspective

The commercial framework for the GB system largely dictates the generation (and demand) that is scheduled to meet demand whereas the Shetland system is vertically integrated. Despite this difference in the supply chain from the Shetlands and the mainland, a key parallel is the need to develop and optimise the use of demand side management. Communities are generally more engaged in responding to societal drivers and the Shetlands is probably more engaged still because of the nature of its network. Nevertheless there will be a number of aspects that could be applied to the GB environment:

- Consumer engagement - understanding end consumer views and satisfaction with the systems installed.
- Level and behaviour of discretionary load and the resultant demand profiles
- The behaviour and level of control that could be expected from micro generation

System Operation and Control Perspective

Dynamic behaviour of renewable generation and flexible demand, with particular reference to low carbon demand:

- Governor response, machine characteristics and interrelation with demand
- Demand “dynamic” response characteristics e.g. measure equivalent primary & secondary response characteristics for low carbon demand e.g. heat pumps and Electric Vehicles
- Micro generation dynamic performance
- Frequency response curves
- Performance of wind generation under non steady state conditions - potential to get a measured understanding of wind farm performance to step change in frequency

Development of forecasting tools and techniques for wind, demand behaviour and demand response to external signals; both direct and price driven:

- Validity of data (20%sample v 100%)
- How effective is demand despatch (TOU price signals or direct instruction - market performance)
- Equivalences between domestic thermal storage, PHEV and batteries (assuming all of these elements will be present)
- Wind Forecasting – GB data and capabilities v needs of Shetland

Despatch methods:

- Automated despatch instructions (assess if realistic)
- Open or closed ‘instructions’ if manually instructed
- Size of blocks of instructions

- Demand-side instruction-following performance. (i.e. comparison of what was expected to what was realized)
- Cost/risk order call-off methods (e.g. determine choice for Demand-Side High Freq Response [if avail] against wind disconnection [when approaching 100% wind])
- Short term (mins/hours) Demand profile prediction (for despatch purpose automated or manual)
-

Frequency Control methods:

- Frequency response capabilities and characteristics of installed generation and demand-side for Both High and Low frequency
- Varying applied amounts of demand-side frequency response – Both High and Low frequency. (for varying ratios of demand)
- Shetland system frequency performance data for above frequency control trials.
- Optimal frequency response needed for size of system and fuel mix at any one time.
- Types of frequency response categorisation (primary, secondary high etc)

System Operating Plan methods

- Long term (days) Demand forecasting for anticipating generation fuel mix (diesel or wind) and anticipating Demand-side despatch capability and Frequency Response requirements
- Wind forecasting performance
- Operating Margin requirements (rolling basis)
- Network outages and taking any constraint impacts into account – impact on fuel mix and margin calculations.
- Generation outages – impact on fuel mix and margin calculations.

SO Resilience

- Back-up plans for failure of demand-side and/or generation despatch facilities

National Grid Contacts:
Mike Edgar mike.edgar@uk.ngrid.com
Ian Welch ian.welch@uk.ngrid.com