Supporting the deployment of safe Li-ion stationary batteries for large-scale grid applications

DSO perspective

Susete Albuquerque, EDP Distribuição

Düsseldorf, 10 March 2015
Organization....
Scottish and Southern Energy Power Distribution owns:

- One electricity transmission network
- Two electricity distribution networks
- 106,000 substations
- 130,000 km of overhead lines and underground cables
- 100+ submarine cable links

The company serves **3.5 million customers** across **one third of the UK’s landmass**
Changes....

» European Directives;

» Distribution networks power flows unidirectional (HV → MV → LV) → Bidirectional power flows;

» Increasing decentralised generation with high fluctuations (e.g. wind or PV);

» Introduction of mobile loads (EVs) and less stable consumption patterns;

» Increase of electricity consumption.
The Distribution Grid is evolving to GofT......
Storage: Types and methods....
Usual Storage applications....

<table>
<thead>
<tr>
<th>PRO</th>
<th>TSO</th>
<th>PRE</th>
<th>DSO</th>
<th>Retailer</th>
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<tr>
<td>Black start</td>
<td>Participation to the prim. frequency control</td>
<td>Renewable generation flexibility</td>
<td>Capacity support</td>
<td>End-user peak shaving</td>
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<tr>
<td>Arbitrage</td>
<td>Participation to the sec. frequency control</td>
<td>Capacity firming</td>
<td>Dynamic, local voltage support</td>
<td>Time-of-use Energy cost management</td>
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<tr>
<td>Support to conventional generation</td>
<td>Participation to the terc. frequency control</td>
<td>Limitation of upstream perturbations</td>
<td>Contingency grid support</td>
<td>Particular requirements in power quality</td>
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<td>Improve of the freq. stability of weak grids</td>
<td>Curtailment minimization</td>
<td>Intentional islanding</td>
<td>Continuity of Energy supply</td>
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<td>Investment deferral</td>
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<td>Reactive power compensation</td>
<td>Limitation of upstream disturbances</td>
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<td>Participation to angular stability</td>
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<td>Distribution power quality</td>
<td>Compensation of the reactive power</td>
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Storage as a helpful tool for DSO.... And also....

» Actively Managing the grid;

» Increase DER integration ;

» Increase QoS;

» But also as a Market facilitator.....
SSS – Smart Storage System

- Losses Reduction
- Peak-shaving
- Backup
- QoS
- Voltage Regulation

- Transient over voltage
- Harmonics distortion
- Voltage imbalance

10 Mar 2015
STALLION–STABALID seminar, Düsseldorf
EDP D Deployment example...

- **Location in Évora** (InovCity) a typical rural network
  - University of Évora–Institutional Client MV
    - Max. 480 kVA

- **Chosen and Dimensioned**:
  - Quality of Service
  - Load Profile
  - CAPEX

- **Selected Technology: Li-Ion**
SSEPD’s energy storage projects

- 100kW / 150kWh Zinc Bomine flow battery
- 1MW / 6MWh Sodium Sulphur battery
- 3x 25kW / 25kWh Li-ion batteries
- 2MW / 500kWh Li-ion battery
- 1MW / 3MWh Lead acid battery
- 16kW / 16kWh – Li-iron battery
Slough Low Voltage Connected Battery Project

» Project started in 2011
» Technology L-Ion 3x 25 kW 25kWh
» Connected at 230V
» Main objectives:
  • to determine the operational issues and benefits the batteries can provide
  • gain experience of installation and operation of the battery
  • gain experience of integration with local Demand Side Response to remove station peaks providing additional Demand capacity
  • Full safety case completed to ensure units were safe to install / operate
Low voltage connected battery project

Greenwatt Way, Chalvey, Slough

http://www.ssezerocarbonhomes.com/
Low voltage connected battery, Slough

Network location of the batteries
Low voltage connected battery project

Installation photos
Low voltage connected battery project

 CES Operation 4th September - Peak Shaving on Phase A (5 minute averages)
Orkney Energy Storage Park Project

- Project started in 2011
- Technology L-Ion 2MW 500MWh
- Connected at 11kV
- Main objective:
  - gain better understanding of the commercial markets that storage can operate in
  - gain experience of installation and operation of the battery
  - gain experience of integration with Active Network Management system
  - Full safety case completed to ensure units were safe to install / operate
Potential Revenues Streams

» STOR
  » Committed
  » Flexible
» TNUoS avoidance
» DUoS avoidance
» Capacity payments
» Arbitrage
Orkney Energy Storage Park
We are in the right track
Trends....
Importance/Interim conclusions
Stabalid&Stalion projects....

- Storage is indeed a helpful tool;

- DSOs in Europe are becoming more aware and interested in this technology from business point of view but also as a market facilitator;

- Safety standards not clearly defined, but needed;

- Standards will help to mitigate certain uncertainties and facilitate deployment;

- …
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Thank you!

DSO perspective

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