MAKING SENSE OF MARKET TRENDS
– an ELEXON perspective

Electricity storage in the GB market

The conventional GB electricity market model of large scale, controllable, thermal generation operating to meet predictable patterns of demand is becoming less relevant as the penetration of low carbon generation technologies increases and the advance of 'smart' technologies changes patterns of consumption.

Why storage?

The future market has an increased need for flexibility of both supply and demand to manage the variability of intermittent generation and more dynamic patterns of consumption. Storage offers one possible source of flexibility, absorbing or releasing energy to smooth intermittent generation patterns and demand variability. It can also help to manage the implications of potentially more variable patterns of consumption for the grid, offering an alternative to conventional network reinforcement. Therefore, the role of storage in the GB electricity system is expected to increase as the system decarbonises and smart solutions develop.

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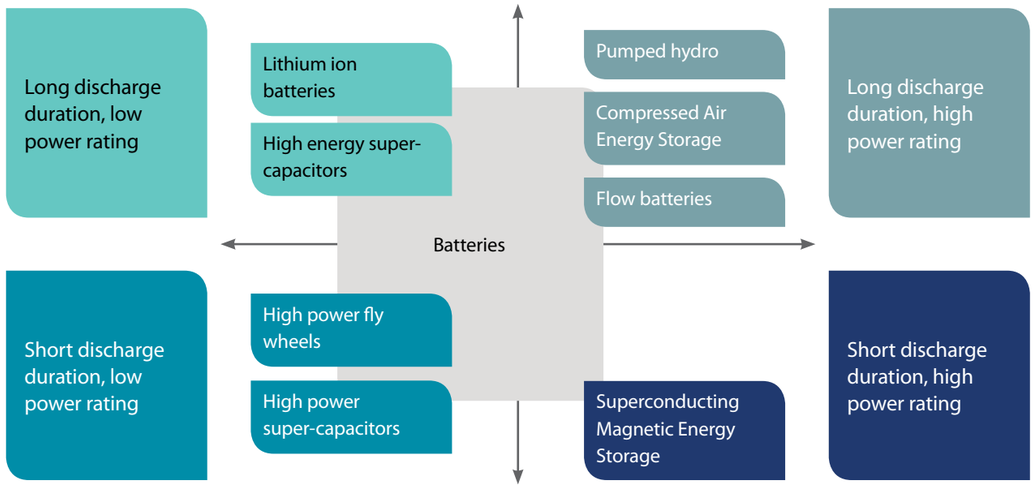
What is storage?

The term 'energy storage' is not a single, uniform concept, but encompasses a wide range of technologies with diverse capabilities, as Figure 1 shows.

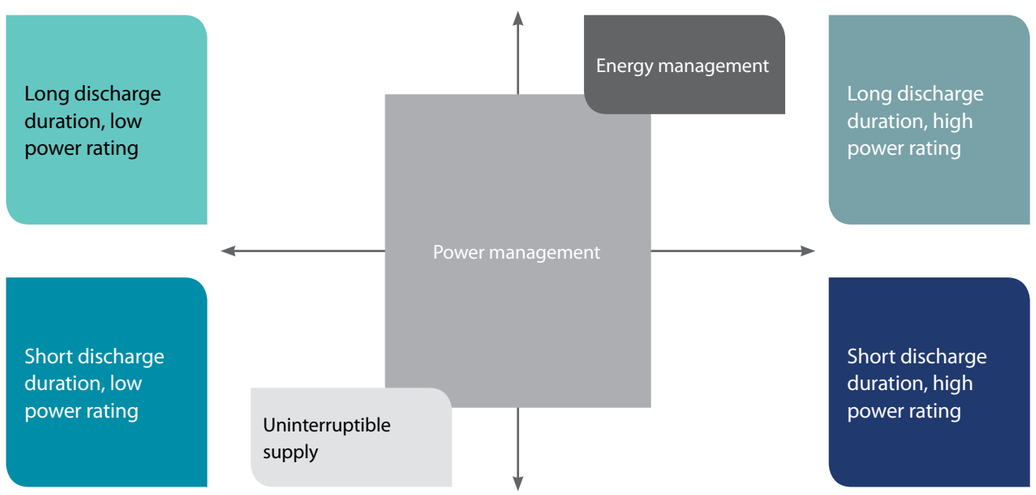
FIGURE 1 – MAPPING STORAGE TECHNOLOGIES TO CHARACTERISTICS



This diversity means different technologies lend themselves to different applications, so a range of potential business models can be explored. Possible applications include the following, as mapped in Figure 2:

- uninterruptible power supply: provision of services to end-users providing security and quality of electricity supplies.
- power management: provision of services to distribution and transmission network operators to deliver system stability, manage peak load and provide balancing services.
- energy management: bulk energy trading.

FIGURE 2 – MAPPING APPLICATIONS TO SERVICES



What are the business models?

Delivering future deployment of storage projects requires viable business models. A storage device can be used for multiple applications which increases its potential sources of value. But it also means that the business case is multi-layered and relies upon accessing multiple revenue streams.

Business models vary across projects by scale, owner, operator and application(s), as Figure 3 shows, based on ongoing/ prospective projects. Some grid-scale projects (particularly proof of concept demonstrations) only focus on local network use cases (eg reinforcement substitute, peak load management, voltage control and power quality). Other grid-scale projects seek to realise value from commercial applications in the market (eg bulk energy trading, arbitrage and ancillary services). Others combine local network services and commercial applications. Non-grid-scale projects can provide benefit individual users (eg uninterruptible supply and lower energy costs) while also, through aggregation, providing network services and allowing market participation.

What are the interactions with settlement?

FIGURE 3 – BUSINESS MODEL MAPPING

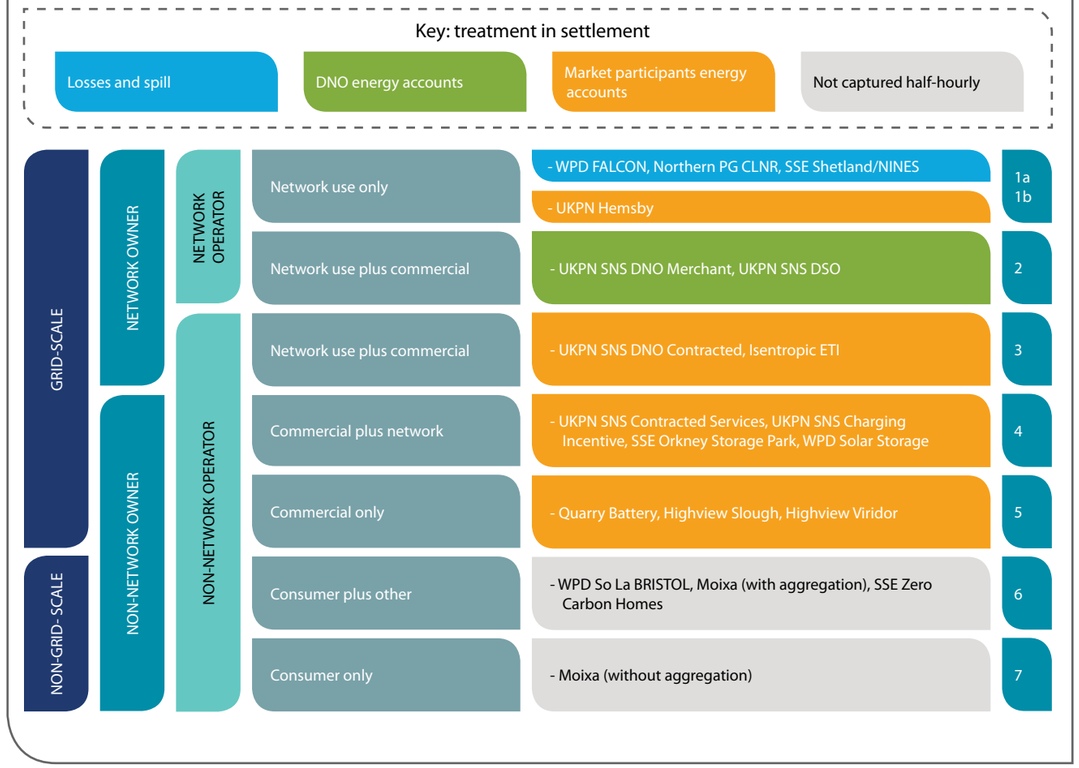
GRID-SCALE	NETWORK OWNER	NETWORK OPERATOR	Network use only	- WPD FALCON, Northern PG CLNR, SSE Shetland/NINES - UKPN Hemsby	1a 1b
			Network use plus commercial	- UKPN SNS DNO Merchant, UKPN SNS DSO	2
		NON-NETWORK OPERATOR	Network use plus commercial	- UKPN SNS DNO Contracted, Isentropic ETI	3
	NON-NETWORK OWNER		Commercial plus network	- UKPN SNS Contracted Services, UKPN SNS Charging Incentive, SSE Orkney Storage Park, WPD Solar Storage	4
			Commercial only	- Quarry Battery, Highview Slough, Highview Viridor	5
NON-GRID- SCALE			Consumer plus other	- WPD So La BRISTOL, Moixa (with aggregation), SSE Zero Carbon Homes	6
			Consumer only	- Moixa (without aggregation)	7

These business models interact with settlement in four ways, as shown in Figure 4:

- losses/spill: energy inflows and outflows are treated as network losses and spill, and are not metered for settlement.
- settled on half-hourly basis in Distribution Network Operator (DNO) energy account: energy flows are included directly in the energy account of a DNO.
- settled on half-hourly basis in market participant energy account: energy flows are included directly in the energy account of the owner/operator or another trading party on its behalf.
- not settled on half-hourly basis: energy flows ultimately feed through into energy accounts following the reconciliation process but are not settled on a half-hourly basis.

Our assessment of the ongoing viability and implications of these methods is as follows:

FIGURE 4 – BUSINESS MODELS AND INTERACTION WITH SETTLEMENT



- Losses and spill: this is not likely to be a tenable solution beyond initial demonstration projects because:
  - (a) it imposes costs on other market participants as the net inflow/outflow position is picked up in losses.
  - (b) it effectively precludes provision of services to the market, removing a potential value stream for storage assets, compromising the business case for future applications.
- DNO energy accounts: the current regulatory framework precludes distribution businesses from participating in the market. This option is not possible at present. In principle, DNO trading could be accommodated within central settlement using the standard market participant model or the National Grid model for its role as System Operator. However, this must be preceded by changes to the regulatory and legal framework to revise the role of distribution businesses. Without these changes, DNOs cannot operate energy accounts.
- Market participant energy accounts: this appears to be the most likely model for grid-scale storage assets in the short/medium term. It allows network owned assets to provide market-oriented services via contractual arrangements with a third party who already has trading functionality and energy accounts under the BSC.
- Not captured half-hourly: this is the default situation for small-scale storage that is off-grid or grid-edge, with operation effectively invisible to the market and half-hourly settlement. This approach can continue to operate, but as deployment of such assets increases, so does the impact of the lack of visibility. Suppliers, in particular, may want to improve visibility of such assets within settlement arrangements. Asset owners/developers are also likely to seek better access to the wholesale market to capture value. If not harnessed, this resource could disrupt the market. Therefore, drivers for change on this front may come from several sides.

How could storage penetration develop?

When considering growth in storage potential, several manufacturers, developers and commentators endorse the ambition of an additional 2000MW by 2020. This is based on a number of studies, which indicate that system savings

arise from installation of a minimum of 2000MW[1] with further potential growth thereafter.

If the 2020 ambition is delivered, this would increase the quantity of installed storage capacity from around 3GW at present to around 5GW by 2020, with further growth potential thereafter. While existing storage is largely provided by large scale, centralised pumped storage assets, the incremental capacity will probably be provided by different types of assets. Consumer led and distributed storage assets could make up a significant proportion of new storage capacity deployment. Substantial expansion of non-grid-scale or 'grid-edge' projects could have an important influence on future market dynamics.

There are a number of commercial and regulatory factors affecting potential deployment of storage within the GB market including:

- Classification of storage: electricity storage is not recognised as an activity or asset class in the GB regulatory frameworks. Instead, storage is treated as generation, which along with the generation licensing regime, constrains ownership and operation of storage by DNOs and influence sizing decisions.
- Capacity market: the forthcoming capacity market could be a valuable revenue stream for storage, but a potentially open-ended load following obligation (or penalty exposure) affects viability.
- Balancing services: access to balancing services markets provides an important value stream for storage. Flexibility in service requirements to reflect evolving system needs and capabilities of new technologies is important.

Providing an appropriate regulatory framework sets the basis for commercial arrangements and business models for the development of future storage deployment. Getting this right will help storage to develop, and will support the delivery of a smarter, lower carbon electricity system in GB. ELEXON will play its part in this process, supporting innovation projects where possible and considering further the potential growth of small scale storage and its interactions with settlement.

For further information or a copy of the full report produced with the support of Pöyry, please email ELEXON at market.operations@elexon.co.uk.

[1] Strategic Assessment of the Role and Value of Energy Storage Systems in the UK Low Carbon Energy Future', Imperial College report The Carbon Trust, June 2012.

This report is one in a series developed by ELEXON, in accordance with our agreed business plan, to understand and fully participate in developments in our market place.

ELEXON is vital to the smooth operation of the wholesale electricity market. We compare how much electricity generators and suppliers said they would produce or consume with actual volumes. We work out a price for the difference and transfer funds accordingly. This involves taking 1.25 million meter readings every day and handling £1.5 billion of our customers' funds each year.

The rules are set out in the Balancing and Settlement Code (BSC). We administer the Code and provide and procure the services needed to implement it. Our expertise and impartiality give our customers the confidence that the BSC operates efficiently and accurately.