Large-scale storage gains toehold in the UK

Grid services | The potential for storage to help stabilise the grid has finally been recognised in the UK, where battery projects took all of the 200MW on offer in a recent frequency response tender. David Pickup looks at the evolving role of storage in the future grid and how further policy support can help it flourish

Energy storage is big news and, thanks in part to some high-profile companies such as Tesla, has got people in many different industries very excited. And rightly so; as the costs have fallen, for lithium-ion in particular, large-scale storage systems are becoming viable across the world and have the ability to revolutionise power networks.

A number of global trends explain the long-term strategic importance of storage. First, renewables (solar and wind in particular) are reaching cost parity with conventional centralised generation, and this trend is set to continue. Secondly, the move towards a low-carbon energy system, accelerated by the Paris climate change agreement that came into force on 4 November, is now a priority for governments across the world. While the timescale for achieving these aims is up for debate, the direction of travel is clear.

The combination of these political and technological drivers means decentralised renewables are set to dominate the world's energy supply; renewables' global capacity has already overtaken coal and new installations in 2015 outstripped all fossil fuel sources. Supporting variable renewables through greater system flexibility is increasingly important for the development of an efficient, low-carbon and secure energy system.

The Solar Trade Association (STA) is the UK's representative body for the solar industry, representing both solar PV and thermal. The STA has been looking at storage for over a year, culminating in the report 'Solar + Storage = Opportunity' published in September this year.

The mutual benefits between solar and storage are obvious. For end users it allows solar to be available around the clock; in 2015 41% of new solar PV systems in Germany were tied to storage, showing remarkably quick adoption. However energy storage systems are not commercially economical for all customers yet, and more work needs to be done to support continuing cost reduction. The STA's immediate focus will be on laying the foundations for a strong, sustainable, solar + storage market. Globally the solar + storage market alone is predicted to be worth US$8 billion by 2026, with the storage sector as a whole worth even more, according to Lux Research.

Credit Renewable Energy Systems

The potential for large-scale battery storage to support grid stability is to be given its first significant test in the UK

The UK's position as an island, with relatively old grid infrastructure, increases the potential value that flexible and smart grid infrastructure such as storage can deliver. Last December the UK's former Department for Energy & Climate Change (DECC) published a policy paper covering the challenges that the energy system faces over the coming years and focussing on how to deliver affordable, clean and secure energy through a smarter system. DECC said that the benefits of a smart grid include: less investment, reduced balancing costs and a reduced need for curtailing generation. Each unit of energy generated can be used more effectively, leading to a cheaper, greener, more resilient energy system.

Ofgem, the UK's energy regulator, is working with the new Department of Business, Energy & Industrial Strategy (BEIS) in this area, specifically leading on enabling new business models and in facilitating the transition to new roles for distribution network operators and industrial or commercial users. However Ofgem's position paper admits there needs to be clarification of the legal and commercial status of storage.

In October 2015 the Treasury set up the National Infrastructure Commission (NIC) to advise on long-term strategic infrastructure. The NIC's first report in March 2016, 'Smart Power', found that £8 billion (US$9.95 billion) could be saved annually by 2030 through increased flexibility from a combination of additional interconnectors, energy storage and demand-side flexibility. The report specifically said the UK should become a world leader in storage through reforming the regulatory and legal status of storage, and removing barriers. BEIS is expected to consult on smart networks this autumn, although that consultation had not been announced at time of writing.

There have been many positive signs for the storage industry in the UK; in October Baroness Neville-Rolfe, the minister responsible, said "making energy storage more commonplace means stability" and "we are actively supporting the UK storage industry through our innovation programme". However there has also been some uncertainty, such as the merger between DECC and the Department for Business, Innovation and Skills into BEIS, as well as the vote to leave the European Union. These may have an impact on the timelines, but neither changes the fundamental reasons why energy storage is so important.

While storage can offer a host of services for the grid, it is with intermittent renewables such as solar where it can make the biggest difference. In a world with high battery penetration into the grid the intermittency of renewables moves from a cost on the grid into savings, as the extra flexibility helps smooth peaks and troughs of production.

The STA recently commissioned a report into the costs associated with intermittency from independent researchers Aurora Energy Research. The report found that current intermittency costs equate to around £1.30/MWh, and rise to £6.80/MWh with the central forecast of 40GW of solar by 2030. However in that same future scenario but with high battery penetration the costs drop to £-3.70/MWh, delivering actual savings. This means that within this system solar production is actually more beneficial than a baseload equivalent output profile.

Domestically there are already a number of companies launching products; there is a lot of excitement around new products from high profile brands such as Tesla, Nissan and E.On, for example. The drivers are obvious: solar energy is largely produced during the day while people are at work and demand remains after the sun has gone down; storage allows you to use solar power at night.

The system can be that simple, however there is no reason why the business model for solar + storage need be the same as solar-only models. Peer-to-peer trading at a local level could provide value for a domestic customer. An aggregator-owned approach would allow an aggregator to provide balancing services to the grid through a large number of small domestic batteries. Another model could be a large-scale battery installed as a "bank," allowing people to deposit excess generation and other consumers to withdraw on the same basis.

At a large scale, solar farms and energy storage seem intuitively a perfect match. Grid connections are typically underutilised due to the variable nature of solar generation and lack of sun at night. Space is typically available and planning permission either already granted or relatively simple to obtain. They can also offer further services than just energy generation, including frequency response.

Storage and frequency response

In the summer the UK government announced the outcome of its Enhanced Frequency Response (EFR) tender, with eight contracts between £7-12/MW/hr (see box, above). EFR can react to frequency changes in under one second, helping maintain the grid at the requisite 50Hz. Battery sites featured heavily in the bidding process and all eight of

Low Carbon's move into energy storage

Renewable energy investor Low Carbon was the biggest winner in the National Grid's recent EFR tender. Investment director, Ian Larivé, discusses the company's contract wins and expansion into energy storage

Low Carbon is a UK-based renewable energy investor committed to mitigating the negative effects of climate change. We invest in renewable energy projects leveraging proven technologies including solar PV, onshore wind, combined heat and power, anaerobic digestion and concentrated solar power. The latest addition to Low Carbon's portfolio of renewable energy investments is large-scale battery storage.

National Grid's EFR tender

Low Carbon has long been evaluating the potential of large-scale energy storage. Submitting responses to National Grid's Enhanced Frequency Response (EFR) tender process was a natural extension of this work.

The tender process was very involved with many intricacies. As participants to the tender process, we were required to provide comprehensive details for each of our proposed projects including: site details and land arrangements, grid connection details, full construction and technical details including technical proposals from equipment suppliers and build contractors, response parameters of the proposed system and timetable for delivery. To be successful in the process we were required to demonstrate the forecast performance of each project as well as show our ability to finance the construction and commissioning of the projects.

Preparation and proposed projects

Based on a comprehensive set of selection criteria, the National Grid awarded eight significant energy storage contracts, as part of its inaugural EFR service tender. Low Carbon is one of just seven businesses to be awarded tenders – and the only business to be awarded two contracts. The two Low Carbon sites, Cleator in Cumbria (10MW) and Glassenbury in Kent (40MW), will give the National Grid the ability to access 50MW of this unique grid stability service – greater capacity than any other provider named. Both sites will make use of large-scale battery storage technology in the form of lithium-ion batteries.

What the future holds

The UK energy mix can be broadened and secured through a series of complementary generation and storage solutions. Supporting domestically sourced energy solutions is also the key to securing the UK energy supply now and in the future. Low Carbon is targeting both projects to be operational during 2017. We recognise the tremendous potential of energy storage technology and will continue to look for opportunities to grow our portfolio in 2017 as part of ongoing mission to help mitigate the negative effects of climate change.

the successful contracts were to storage systems.

EFR is important because of the potential for savings it offers – National Grid predicts approximately £200 million in reduced costs – so other nations will be watching with interest. The price for the successful bids was also unexpectedly low, below even Fast Frequency Response (FFR) that has a timescale of 10 seconds. This demonstrates the ability for battery systems to compete in the marketplace.

One of the reasons that the price for EFR could fall so far was the contract length. At four years the contracts on offer were much longer than traditional FFR ones; this enabled lower financing costs as investors had greater security. For renewable technologies looking to go subsidy-free this provides useful information on how changes to the business landscape can affect the viability of projects.

There is clearly a bright future for storage technologies. The grid of the future will have large amounts of renewables on it, with storage helping to even out the peaks and troughs. However, government needs to act to provide the right environment to help the industry flourish: currently there is no clear regulatory framework for storage; the industry will remain limited until that issue is solved. This is especially important for multi-use sites such as solar + storage.

Currently storage is treated as generation, and subject to network charges on that basis. Any electricity stored is therefore charged twice: firstly for importing and storing the energy and secondly for discharging and using that energy. If charges were levied on final consumption and not all consumption this double-charging problem would be solved and level the playing field for storage.

To fulfil storage's potential new marketplaces for services must be made. Distribution Network Operators (DNOs) are network operators, not distribution system operators. As a result they are unable to procure and tender for services to ensure the stability of the grid in the way that National Grid can: we couldn't have an EFR tender at the local level, for example. This means that a significant amount is spent on passive grid reinforcement even if by spending a lesser amount DNOs could procure storage services that would mean upgrades are not required.

Storage, along with solar, has a major role to play in the transformation of the UK's energy system into a truly smart grid fit for the 21st Century. The UK is making progress in this area, but more can be done; the potential benefits from such a system are too big to pass up. ■

Authors

David Pickup is policy manager at the Solar Trade Association, responsible for economic modelling and policy analysis. He provides in-depth guidance and briefings to STA member companies, as well as developing the STA's view on wider policy issues. David is also the lead at the STA for storage, and authored the recently published STA position paper on energy storage.

The analyst's view

By John Parnell

Sam Wilkinson, senior solar analyst at IHS Markit, discusses the winning companies, likely technology choices and chances for a second round of bidding in the UK's Enhanced Frequency Response tender

PV Tech Power: What did you think of the pricing of the winning projects?

Sam Wilkinson: Our analyst team did some preliminary work on what to expect. The final results were fractionally below what we thought they would be. There was a reasonable spread there too. One thing to remember is that the enhanced performance that this provides would allow the batteries to command a premium over the conventional gas-fired solutions that are providing frequency response as well.

How advanced do you think the winners will be with their procurement?

I would imagine that as they are bidding in with prices, they would already have provisionally selected technology suppliers to provide all the components and the systems. I'd be very surprised if they had gone ahead with pricing in the bid if that wasn't at least provisionally established.

The timeframe looks relatively short considering the experience that we have so far building utility-scale storage projects. I think the biggest [in the UK] is 6MW at Leighton Buzzard and some of these projects are in the range of 40MW; that's a significantly larger project than we have ever tackled before. Given some of the uncertainties, it does look like a pretty aggressive time frame to get those projects completed in time for the contract start date. I would say that the winners will start moving quickly so that they can allow the maximum amount of time for issues that may come later with, for example, siting, grid connection or permitting.

A second EFR tender round is widely expected. Could that happen sooner rather than later given the interest in round one?

To me it would follow that we would expect these projects to go into operation and get some preliminary feedback on how well they perform and how much they live up to the expectation placed on them, before they go ahead with a potentially larger tender. To me it would seem unusual to launch a second tender just because the first is so oversubscribed.

Which battery technologies do you expect to win out?

There are very few technical details available but I would be amazed if they are not lithium-ion batteries. That is the technology to beat right now for battery-based frequency response. They are very good at high-power situations; typically frequency response is in periods of 30 minutes or shorter and Li-ion is typically chosen because of its ability to respond extremely quickly and inject high amounts of power.

What else was interesting about the results of the tender for you?

The winners were predominantly renewables EPCs and developers. That strengthens the link between the renewable industry and the battery industry. At the same time, there are three extremely established utilities there that have already got a lot of expertise in providing services like frequency response and they also have a lot of assets built out, and the fact that they can then site these batteries there at these existing grid connections, allows them to lower costs compared to building a site on a brand new piece of land and a grid connection just for that one battery project.

To find out how storage is being primed for a key role in the UK's future power system, turn to page 80