FUTURE OF ENERGY

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STORAGE

Capacity crowd: who's leading the charge for lasting storage?

While long-duration energy storage has played an inconspicuous role in the net-zero mix so far, it's as important as wind and solar generation – and it's poised to emerge from their shadow

Jim McClelland

Energy storage technologies do attract attention, but this is generally reserved for batteries and their limitations, mostly during discussions about range anxiety relating to electric vehicles. Even though relatively few people are talking about it, long-duration energy storage (LDES) is arguably the most significant technology to monitor in the new power play.

Short-duration storage is measured in minutes, 240 at the most. Medium-duration storage runs from four to 12 hours and LDES covers everything beyond that. It can stretch to weeks, months or even quarters. The tech has become a hotbed of investment and innovation of late. What factors are behind this upsurge in R&D activity?

First and foremost, LDES is seen as vital to energy security and market stability, helping the electricity grid to manage peaks and troughs in supply and demand. It minimises the risk of brownouts – unexpected drops in voltage – and blackouts. Given the proliferation of extreme weather events such as winter storms, such resilience is becoming ever more important.

LDES is also vital for high-volume power users such as heavy industry, as well as for consumers in remote areas where grid connectivity and supply can be limited. In effect, it provides them with a safety net. But the climate emergency means that LDES is more than an insurance policy against shocks to the system. It's become key to the energy transition.

Decarbonising the electricity supply is crucial to achieving net zero, especially with the electrification of transport and heat fuelling global demand for green power. Harnessing the full potential of renewable energy sources such as the Sun and wind requires their variable and intermittent output to be optimised over time.

As a result, storage is booming. Growth in the global market broke records last year, according to BloombergNEF, which reports that capacity was up 68% on 2021 and forecasts that it will grow 15-fold by the end of the decade.

But the demand for long-term storage is growing at an even faster rate. The Long Term Duration Storage Council, an industry body comprising more than 60 members in 19 countries, has forecast that the world's electricity grids will need to deploy 85TWh to 140TWh of LDES by 2040. This growth trajectory places the market's potential value by that year somewhere between £1.2tn and £3.2tn.

Potential scenarios explored by National Grid suggest that the UK will require at least 50GW of LDES capacity by 2050, in line with the nation's net-zero aims. To put that number in perspective, there is about 5.3GW of LDES operational in Great Britain today. This comprises roughly 2.8GW of pumped hydro and 2.5GW of newer lithium-ion battery storage. In short, then, there's a lot of work to be done.

But the industry is working hard on the task at hand. As evidenced by the range of projects approved for some of the £69m funding awarded last year under the government's Longer Duration Energy Storage Demonstration (Lodes) competition, the possible solutions take many forms.

The Lodes portfolio contains all of the core technologies with a genuine prospect of working on a commercial scale. These include compressed-air energy storage (CAES), liquid-air energy storage (LAES), thermal energy storage, flow batteries and pumped hydropower; plus power-to-low-carbon gases, developed in conjunction with the production of green hydrogen. The materials in the mix range from metal hydrides to 3D-printed concrete. Some of the more exotic-sounding solutions involve the lifting and lowering of weights in a vertical underground shaft, the use of salt caverns as a hydrogen store and the creation of a 30MWh vanadium flow battery that's set to be one of the largest of its kind in the world.

The newer technologies in particular – including CAES, LAES, flow batteries and hydrogen – have great potential, according to Dr Thomas van Lanschot, director of power and low-carbon energy at Fitch Solutions. He believes that these are likely to dominate the market in the long run.

But he adds: "In the near term, CAES and LAES projects are gaining traction globally and could provide a more rapid solution to our LDES needs."

The real growth opportunity for LDES lies in the property sector, so tapping into the residential market makes sense. That's the view of Lee Fraine, head of building services and sustainability at Rapleys, a property consultancy.

"We should be talking about LDES more in the domestic market," he argues. "At present, there are really only two operational forms: the solar store and the home surplus storage system. But neither is scalable in terms of both space and cost for the vast majority of people."

Some projects have already made it through the demo phase. For instance, the Earba Storage project, which will use two lochs in the Scottish Highlands, is set to provide significant amounts of both power (up to 1.5GW) and stored energy (up to 33GWh), making it the largest pumped-hydro scheme in the UK. And Highview Power is looking to raise £400m, most of which will go towards what's been billed as the first commercial-scale LAES facility near Manchester.

While progress is being achieved, Stuart Murphy, founder of tidal lagoon system TPGen24, believes that wider market cooperation is still required to generate meaningful momentum.

"If the government cannot afford to explore every avenue at this stage, it should open doors for the private sector, whether that's through innovation funds, tax incentives or supporting investor relations," he says.

The stage is set for LDES, then, but any further measures to stimulate this high-potential market would clearly be welcome.

THE LONG GAME IN ENERGY STORAGE

Climate Tech VC, 2023

Cumulative funding for LDES tech worldwide ($bn)