

# Investment Views

DECEMBER 2023

## Lights on for investing in battery storage

On Friday 9th August, 2019 the lights went out across swathes of England, Wales and Scotland. One million National Grid customers found themselves without any electricity. Fortunately, the blackout was limited as the outage lasted just 45 minutes, but the disruption lingered for days with railway services the most acutely affected.

Few people now remember the episode, but it was a powerful reminder of the fragility of the world's energy infrastructure and the delicate balancing act that's constantly in train to ensure the dark ages are kept at bay.

The cause of the blackout? Bad luck. Shortly before 5pm, lightning struck an overhead power line just north of London. This triggered a fail-safe that diverts the excess voltage to the nearest transmission tower, then to the ground. The protective measures worked as planned with a number of small generators linked to the local network disconnecting automatically and the line returning to normal after just 20 seconds.

In isolation this was no cause for concern but, at the exact same time, two large generators (the Hornsea offshore windfarm in the North Sea and Bedfordshire's Little Barford power station) experienced independent technical difficulties that took them out of service. This caused a sudden collapse in energy supply to the grid. It was a complete fluke for all three issues to occur in unison, but it saw the equivalent of four nuclear reactors going offline all at once.

Had British households had the foresight to concurrently switch off over 1 million kettles, demand would have fallen sufficiently to compensate for the loss of output, allowing the network to remain in equilibrium. However, with electricity demand largely unchanged the backup power was quickly depleted, forcing the grid's protection systems into action. Pools of demand were automatically shut down and the ability of one million people to turn on anything electrical was removed for almost an hour.

In the grand scheme of things the emergency procedures worked well but had they failed the grid would have experienced cascading faults across multiple generators and a possible country-wide blackout.

Should the entire country lose power, the plan to restart the electricity network has an official name: "Black Start". Drax, one of the UK's largest power generators, describes it as "the most important back-up plan you've never heard of". It involves power stations being restarted one-by-one then gradually reconnected

to each other. Once the system is back up and running, critical facilities such as hospitals, emergency services and communication centres are unsurprisingly first in line to have their access to electricity restored.

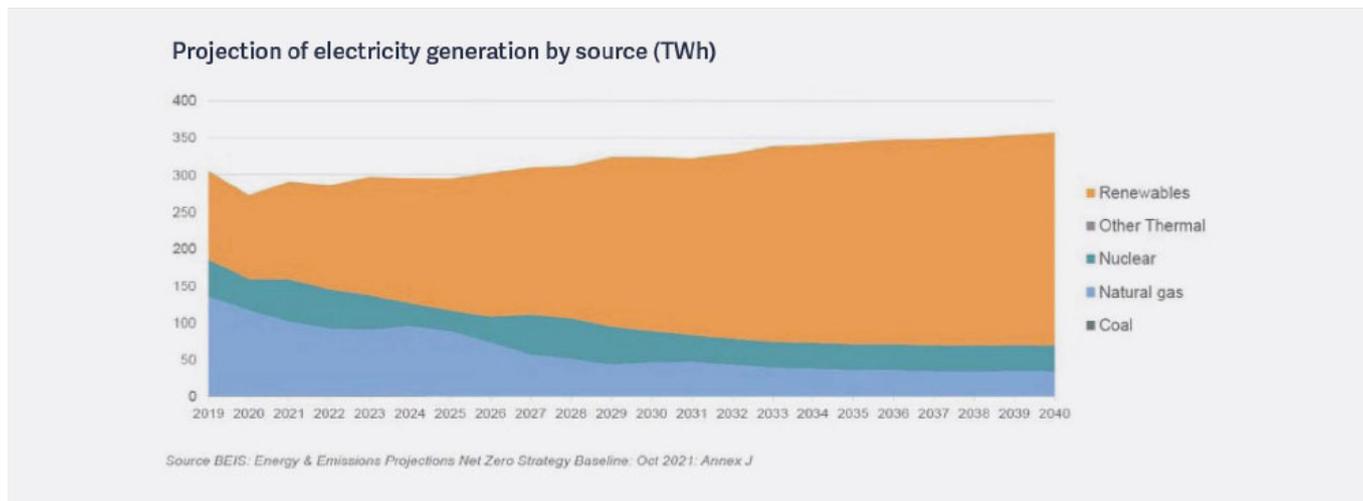
Whilst this is an extreme and unlikely outcome, last winter's energy crisis highlighted how the integrity and security of a nation's power supply are paramount.

Fortunately for those of us who live in the UK, the country benefits from a wide-range of domestic energy sources including fossil fuels, nuclear and renewables, leaving it better positioned than most as the world shifts increasingly towards clean energy solutions. Indeed, ex-Prime Minister Boris Johnson's assertion that the UK "has the potential to be the Saudi Arabia of wind" has merit given its consistent, robust and largely predictable winds.

This helps to explain why the UK's power generation mix has shifted materially over the past decade (see chart below). In the first quarter of this year, the percentage of the UK's electricity production stemming from renewables hit a record 48%, with wind power the dominant source. Conversely, coal (for so long the backbone of Britain's energy supply) has become a negligible and costly input.

The UK's long-term commitment to wind as a primary source of power is evidenced by the 55 gigawatts (GW) of potential daily wind supply that has already been installed across the country. This compares to a typical peak power demand of just 35GW-40GW, but relying on this intermittent source poses an enormous challenge for those tasked with keeping the electricity grid in balance.

For context, during any 24-hour period the amount of power actually generated from renewables can vary between zero and around 20GW. The upper bound is akin to what 40 nuclear reactors could produce. Yet with the UK's power consumption typically peaking first thing in the morning and again during early evening, renewable energy only becomes a reliable energy source if it can be stored effectively and released when it is needed most.



Pumped hydro systems have dominated power storage in the UK (and elsewhere in the world) for decades. They consist of two reservoirs located at different elevations with turbines controlling the flow of water between both. The UK has four such “water batteries”; two in Wales and two in Scotland. When power is abundant and cheap (typically when demand is low or there is a surplus of wind or solar power) the excess electricity is used to pump water from the lower reservoir up to the higher one. The water is stored until additional energy is needed on the grid. It then descends back to the lower reservoir, passing through turbines connected to generators, producing electricity as it does so. This approach has worked well for a long time but, due to planning issues, environmental challenges, high costs and excessive lead times, the UK hasn’t built a new pumped hydro facility for over 40 years.

Hence the need for a new storage solution if the UK is to continue increasing its reliance on renewable energy sources, whilst also mitigating the risk of further blackouts.

Grid-scale lithium battery storage involves the use of large batteries that hoard and release electrical energy as required. The batteries have been deployed successfully in Britain over the past five years with the core aim of making the grid more reliable and stable. Almost 5GW of total storage is available today, up from practically nothing in August 2019. Had the batteries been in operation back then, the blackout would almost certainly have been avoided.

The battery sites vary in size and are often located on undesirable brownfield plots adjacent to electricity substations. Importantly, given a pressing need to evolve to new demand and supply trends, they can be quickly and cheaply installed (unlike new nuclear reactors). Lorry containers full of lithium packs are literally driven into the site, placed on concrete pads and plugged into the substation.

The economics associated with the storage process make for an interesting investment proposition. The intermittency of energy supply and demand all but guarantees that power prices will vary significantly throughout the day. This allows the battery sites to consume (and store) electricity when supply is plentiful and cheap, then sell it back to the grid when demand and prices are higher. Indeed, taken to an extreme, the battery sites have

been paid to remove excess energy from the grid (i.e. a negative purchase cost), but even during normal conditions the difference between the buying and selling price for a unit of electricity can be stark, creating outsized profits potential for the companies that own and operate the batteries.

With UK policymakers’ supporting the rise of locally-sourced, clean and reliable power, the demand for these battery sites should continue to grow. We have researched a variety of ways to invest in this trend, but some of the purest plays are the listed battery storage operators including the Gresham House Battery Storage (GRID) Trust. We view the opportunity as too niche, volatile and high risk to qualify for our conservative core mandates, but we have this year initiated an exposure to the GRID investment trust in our Sustainable Growth portfolios.

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