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using an innovative form of
Compressed Air Energy Storage

Storelectric

Analysis of National Grid's Summer Outlook Report 2021

Storelectric: Enabling an Affordable, Reliable and Resilient Energy Transition

On 8th April 2021 National Grid has published its Summer Outlook Report 2021, in which they analyse the ability of the system to cope with anticipated supply, demand and grid issues during the coming summer. This document analyses its content.

Review of Lockdown 2020

National Grid's Summer Outlook Report reviews (p12) the first lockdown of Spring 2020 (which was the most extreme of the three lockdowns from a grid management viewpoint. However it only does so from the viewpoint of energy flows on the grid, omitting the lack of inertia that led to most of the £826m interventions of that lockdown. Loss of stability is the most important factor driving grid management / control costs during low-demand periods. Despite this crucial and very large omission (glossed over in the second-last paragraph on p14), the analysis largely confirms the conclusions of our own analysis at the time, which (using National Grid's own figures) concluded that without sufficient large-scale long-duration inertial storage, grid costs will increase by over £1bn p.a. by the 2030s.

Wind Generation

And therein lies the problem (p14): just like in the Winter Outlook Report 2020-21 (which we analysed when it was published), it depends on ~7GW statistical average outputs from wind - and, as is well known, the wind doesn't always blow at a statistically average speed; often it's slower or absent, leading to a large multi-GW shortfall for which National Grid will have to fire up power stations intended to remain closed until winter. As these power stations close permanently, this will rapidly become a big problem.

Sufficiency of Supply

Indeed (p14), in 2021 there are only planned to be 9-13GW dispatchable and baseload generation versus a demand of 16-20GW. Add in a required 10% supply margin, that demand becomes 17.6-22GW. Looking week by week, this gives a minimum shortfall of 4.6 out of 17.6 GW = 26%, and a maximum shortfall (week commencing 3 May) of 10.8 out of 19.8 GW = 55%.

When such shortfalls occur, National Grid will have to fire up power stations intended to remain closed until winter. And these power stations are closing permanently...

Interconnectors

As has been demonstrated before, the UK cannot rely on interconnectors for its firm import or export needs. Therefore (p13) it is comforting that, unlike the winter, the grid is not reliant on interconnectors provided that the forecast amount of wind power is being generated. However (p16) the report makes a great virtue of the planned opening of two new interconnectors totalling 2.4GW, both very poorly located for the needs of the grid.

- The 1400MW North Sea Link interconnector has the virtue that Norway has sufficient surplus storage to provide reliable energy. But that depends on the UK having contracts to receive such energy in preference to other Norwegian export routes, notably to Sweden, Denmark and Germany. Given that the UK's regulatory system provides ever-shorter contracts, this is unlikely. And the landfall of the cable is in Blyth, Northumbria, the wrong side of one of the key grid constraints.
- The 1000MW ElecLink interconnector runs from France, which is in the throes of closing a large proportion of its nuclear power stations in favour of intermittent renewables that (a) won't be generating when our nearby renewables stop generating and (b) are being developed very slowly, to Kent, where (apart from the England/Scotland and Scottish Highland/Lowland boundaries) congestion on the grid is greatest.

Moreover, both interconnectors are HVDC – they have no natural inertia. This means that they cannot provide the most fundamental elements of grid stability.

Therefore one wonders how these interconnectors will help the British electricity system, other than to keep energy prices lower during times of surplus (p17-18). This is not the unalloyed good that it appears to be: by shaving the profits of British generation during times of surplus, they drive up the price of retaining such generation for times of need; and if this then makes such power stations uncompetitive, this in turn reduces supply, which is a significant part of the reason why we have the insufficiency of supply discussed earlier in this analysis.

Accelerated Loss of Mains Change Programme

The Accelerated Loss of Mains Change Programme (p20-21) largely consisted of adjusting the settings on breakers throughout the system so that the trips experienced during the blackouts of 9th August 2019 won't cause widespread blackouts. However, the purpose of breakers is to prevent a disturbance getting through to customers where it can cause damage to their systems and equipment, and this relaxation of breaker settings was expressly so that they wouldn't be tripped by such disturbances: it was therefore a fancy name for a multi-million-pound dereliction of duty.

Much better would have been to build sufficient large-scale long-duration inertial storage which would have built sufficient real inertia on the system to overcome such problems while also reducing or eliminating the grid's reliance on interconnector imports and on statistical average renewable generation. It would also have been in line with the Future Energy Scenarios 2020 requirement for 20-40GW of storage (which we believe to be an under-estimate of the need, by a factor of 2 or 3) by 2050.

Dynamic Containment

National Grid also trumpets the introduction of "the new fast acting service, Dynamic Containment" (DC) (p20). It creates no new capability as it replaces various Frequency Reserve (FR) contracts. What it does achieve is the abandonment of forward contracting:

FR was let on 2-year contracts, whereas DC contracts are let weekly and moving to shorter timescales. These ever-decreasing contract durations make it ever harder to finance new plant.

Overall Reducing Costs?

The conclusion (p22) that overall costs will reduce in relation to last summer is comparing a relatively normal next summer with an extremely costly event. The reality is that system costs are increasing inexorably; last year was an outlying early peak, so this year just resumes the increasing path of costs. Not that we believe that stability and frequency costs are going to drop significantly…

About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage to enable renewables to power grids reliably and cost-effectively: the world's most cost-effective and widely implementable large-scale energy storage technology, turning locally generated renewable energy into dispatchable electricity.

- Innovative adiabatic Compressed Air Energy Storage (Green CAES ™) will have zero / low emissions, operate at 68-70% round trip efficiency, levelised cost significantly below that of gas-fired peaking plants, and use existing, off-the-shelf equipment.
- Hydrogen CAES ™ technology converts & gives new economic life to gas-fired power stations, reducing emissions and adding storage revenues; hydrogen compatible.

Both technologies will operate at scales of 20MW to multi-GW and durations from 4 hours to multi-day. With the potential to store the entire continent's energy requirements for over a week, global potential is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES, all of which will greatly improve storage cost, duration, efficiency and global potential.

About the Author

Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He is also a United Nations expert advisor in energy transition technologies, economics, regulation and politics – invitation here – and advisor to other bodies too.

A graduate in Physics with Electronics, he has 12 years' world-wide management and innovation consultancy experience. In a rail multinational, Mark transformed processes and developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics (innovating services) and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses expand into new markets.