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THE ENERGY STORAGE QUESTION: SPINNING FLYWHEELS, PUMPED HYDRO AND COMPRESSED AIR

Introduction:

E-ON recently completed a 10MW lithium iron battery, designed to hold roughly the same amount of power as 100 family cars, at the 30MW Blackburn Meadows biomass plant near Sheffield. (https://www.eonenergy.com/about-eon/media-centre/eon-completes-uk-first-battery-installation-at-blackburn-meadows-biomass-power-plant/).

The unit has been hailed as a breakthrough in the switch towards greener energy and the development of energy storage solutions capable of holding energy generated by wind farms and gas power stations, for release in times of excess demand.

The Issue of Energy Storage:

The National Grid is tasked with producing enough energy to meet supply. Excess energy from one source, such as solar, will prompt the grid's operators to switch off another.

Currently, renewable energy can only make intermittent contributions to the grid's output. As the sun does not shine 24/7 and some days are windier than others, the renewables sector eagerly awaits technology capable of storing energy.

There have been numerous suggestions as to how the energy storage conundrum may be solved.

Spinning Flywheels:

Through storage of kinetic energy, a flywheel operates like a mechanical battery, with some designs now able to spin at rates of up to 60,000 revolutions per minute. Although early models were generally very heavy, modern carbon fibre flywheels have the ability to contain twenty times more energy then a steel wheel. (http://www.economist.com/node/21540386)

A spinning flywheel will speed up when it receives electrical energy, and slow when there is a need to release the energy that it stores, at which point the kinetic energy will be transferred back into electrical energy.

Flywheels are an efficient method of storing energy. Round Trip Efficiency is generally 85% - 90%, meaning a spinning flywheel only wastes a seventh of the energy it absorbs. In comparison, coal and gas generators are half as efficient.

Compressed Air:

Compressed Air Energy Storage is currently the second biggest method of energy storage, and works by transferring electrical energy into high pressure compressed air that is stored underground

31 October 2017

In times of short supply, the compressed air will be heated and expanded to drive a turbine generator.

Currently there are two CAES plants in operation; one in Huntorf, Germany, and another in McIntosh, Alabama - http://www.powersouth.com/mcintosh_power_plant/compressed_air_energy.

Aquifers and porous rock are generally the ideal sites for CAES systems. Underground salt domes, which have long since been used to store natural gas, have also been used in the past, and are generally found at coastal sites where the potential to generate a lot of wind energy is high.

Geographically, there is thought to be good potential for CAES systems across Europe, including in Great Britain.

Pumped Hydro:

Pumped Hydroelectric Storage requires an upper and lower reservoir, and works by using excess energy to pump water to the higher reservoir, for storage as gravitational potential energy.

In times of short supply the water will be allowed to flow down to the lower point through a turbine and generator, transferring back to kinetic and then electrical energy in the process.

Whilst PHS schemes have been considered the best mass energy storage solution, they can only be installed at very specific terrains. The largest PHS scheme is currently near Dinorwig in Snowdonia National Park, one of four across the UK, and has become something of a tourist attraction (http://www.electricmountain.co.uk/Dinorwig-Power-Station).

It is thought that the hydroelectric facilities across Europe are now able to hold roughly 5% of the continent's electrical generating capacity.

Conclusion:

Renewables provided nearly 30% of UK Energy Generation between April and June 2017, and it is thought that the UK will need to be able to store around 200GWh of electricity by 2020.

E-ON's unit at Blackburn Meadows, designed to offer the grid energy in less then a second, comes as National Grid recently released a tender with a view to helping it manage supply and demand.

There is clearly as yet no clear answer to the energy storage question, but battery storage appears to have become very topical.

Other energy firms are developing similar projects to the one at Blackburn Meadows. EDF Energy is developing a 49MW plant at West Burton Power Station, Nottinghamshire, whilst Centrica are developing a project of the same size at a site in Barrow-on-Furness, Cumbria. (https://www.centrica.com/news/centrica-start-construction-new-battery-storage-facility-roosecote)

31 October 2017

Prospect Law is a multi-disciplinary practice with specialist expertise in the energy and environmental sectors with particular experience in the low carbon energy sector. The firm is made up of lawyers, engineers, surveyors and finance experts.

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