

Batteries and Grid Stability

Comment



Battery storage systems are playing an increasingly central role in grid stability and grid control, particularly in the context of the energy transition and the expansion of renewable energy sources. They enable the flexible provision of energy and protect the grid against fluctuations – they are technically fast, efficient and emission-free. In addition to the task of temporarily storing energy from renewable, volatile sources in order to ensure a daily balance, batteries with grid-supporting behaviour can support the stability and secure operation of grids across all voltage levels. This includes the following aspects:

PROVISION OF BALANCING ENERGY

Battery storage systems can react extremely quickly to frequency deviations in the electrical grid. This makes them ideal for providing balancing power in interconnected grids as well as in small island grids. The primary control (frequency containment reserve FCR) must react to frequency fluctuations within seconds by feeding missing power into the grid or taking excess power from the grid. The outputs and the converted energy quantities are comparatively small and can be easily covered by battery storage. In Germany, the share of batteries in the primary balancing power market is already more than 50 %.^[1]

One of the main requirements in this context is a fast response time, and this can be met by battery storage systems. This means that even virtual flywheel mass can be provided. This means that the battery storage system reacts to small frequency changes in the same way as a classic synchronous machine with its flywheel mass, thereby helping to stabilise the frequency. This is an important aspect when conventional power plants with synchronous machines are gradually replaced by converter-coupled feed-in.

ELIMINATION OF GRID BOTTLENECKS

At the lowest grid level in the low-voltage grid, the grid-friendly use of battery storage systems can eliminate temporary local line or transformer overloads. Inadmissible voltage increases or decreases can be avoided there by targeted use of storage. This opens up interesting application possibilities for storage systems, particularly in connection with photovoltaics and/or electromobility. In order to provide grid services, the storage system must be equipped with a suitable predictive charging management system.

Batteries can also be useful at higher voltage levels. In Germany, large-scale “grid booster” storage systems are put out to tender in order to eliminate grid bottlenecks in the transmission grid and avoid expensive redispatch measures^[2]. In Australia, the Hornsdale Power Reserve, a large-scale storage facility, was put into operation in 2017 and expanded to 194 MWh in 2020^[3]. One area of application for this storage system is the provision



of quick reserves to bridge the time that conventional replacement power plants need for the ramp-up process in the event of generation outages.

FRAMEWORK CONDITIONS

Utilising energy storage systems in such a way that they can and, above all, want to actually provide a benefit for the overall system requires appropriate legal and regulatory framework conditions. System-friendly behaviour can already be remunerated, for example on balancing energy markets by contributing to the power balance of the entire supra-regional electrical grid. The situation is quite different for grid-friendly behaviour. The aim here is to primarily combat local problems in the grid, for example those caused by short-term feed-in or consumption peaks. Grid operators themselves are not permitted to operate storage systems due to the legally binding separation of electricity trading and the electrical grid. Operators of electricity storage systems, on the other hand, currently lack the financial incentives to act in a grid-friendly manner; this also applies to battery storage systems in private single-family homes. In Austria, the new Electricity Industry Act (EiWG), which has recently been under review, may provide a remedy.

Other tasks still to be solved in the area of “batteries and the grid” are not of a technical nature, but relate to aspects of sustainability and dependency. If we increasingly rely on batteries to ensure grid stability, we will continue to become dependent on a small number of producers. At present, there is an even greater concentration of manufacturers in this area than for fossil fuels. The second important point concerns recycling: to ensure that the large amount of grey energy used to produce the battery is not lost at the end of its service life and that the valuable raw materials are re-used for as long as possible. Here, too, there is still a need for globally standardised, mandatory solutions.

Links:

- [1] www.regelleistung-online.de/batteriespeicher-dominieren-den-pri-markt/
- [2] www.amprion.net/Presse/Presse-Detailseite_75521.html
- [3] <https://hornsdalepowerreserve.com.au/>
- [4] www.mynewsdesk.com/de/lew/videos/20231023-erklaervideo-netzbooster-118742?autoplay=1