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A battery energy storage system (BESS), battery storage power station or battery energy grid storage (BEGS) or battery grid storage is a type of energy storage technology that uses a group of batteries to store electrical energy. Battery storage is the fastest responding dispatchable source of power on electric grids, and it is used to stabilise those grids, as battery storage can transition from standby to full power in under a second to deal with grid contingencies.[1]

Battery storage power plants and uninterruptible power supplies (UPS) are comparable in technology and function. However, battery storage power plants are larger.

For safety and security, the actual batteries are housed in their own structures, like warehouses or containers. As with a UPS, one concern is that electrochemical energy is stored or emitted in the form of direct current (DC), while electric power networks are usually operated with alternating current (AC). For this reason, additional inverters are needed to connect the battery storage power plants to the high voltage network. This kind of power electronics include gate turn-off thyristor, commonly used in high-voltage direct current (HVDC) transmission.

BESS warranties typically include lifetime limits on energy throughput, expressed as number of charge-discharge cycles.[15]

Lithium-ion batteries are designed to have a long lifespan without maintenance. They generally have high energy density and low self-discharge.[18] Due to these properties, most modern BESS are lithium-ion-based batteries.[19]

A drawback of some types of lithium-ion batteries is fire safety, mostly ones containing cobalt.[20] The number of BESS incidents has remained around 10--20 per year (mostly within the first 2--3 years of age), despite the large increase in number and size of BESS. Thus failure rate has decreased. Failures occurred mostly in controls and balance of system, while 11% occurred in cells.[21]

By 2024, the Lithium iron phosphate (LFP) battery has become another significant type for large storages due

to the high availability of its components and higher safety compared to nickel-based Li-ion chemistries.[28] As an evidence for long-term safe usage, an LFP-based energy storage system was chosen to be installed in Paiyun Lodge on Mt. Jade (Yushan) (the highest alpine lodge in Taiwan). Up to now, the system still operates safely since 2016.[29]

Storage plants can also be used in combination with an intermittent renewable energy source in stand-alone power systems.[34]

While the market for grid batteries is small compared to the other major form of grid storage, pumped hydroelectricity, it is growing very fast. For example, in the United States, the market for storage power plants in 2015 increased by 243% compared to 2014.[84] The 2021 price of a 60MW / 240MWh (4-hour) battery installation in the United States was US$379/usable kWh, or US$292/nameplate kWh, a 13% drop from 2020.[85][86]

As of May 2021, 1.3 GW of battery storage was operating in the United Kingdom, with 16 GW of projects in the pipeline potentially deployable over the next few years.[91] In 2022, UK capacity grew by 800 MWh, ending at 2.4 GW / 2.6 GWh.[92] Europe added 1.9 GW, with several more projects planned.[93]