Bess system diagram

Bess system diagram

Before discussing battery energy storage system (BESS) architecture and battery types, we must first focus on the most common terminology used in this field. Several important parameters describe the behaviors of battery energy storage systems.

Capacity [Ah]: The amount of electric charge the system can deliver to the connected load while maintaining acceptable voltage. This parameter is strongly affected by the technology of the battery and its value is defined for specific temperature and discharge current.

Nominal Energy [Wh]: This is the energy generated from a full charge status up to complete discharge. It is equal to the capacity multiplied by the battery voltage. As it depends on the capacity, it is affected as well by temperature and current.

Power [W]: It’s not easy to define the output power for a BESS, as it depends on the load connected. However, nominal powerindicates the power during the most representative discharge situation.

Coulombic efficiency: This describes the charge efficiency with which electrons are transferred in the battery. It is the ratio between the charge quantity (Ah) released during the discharge period and the amount of charge needed to reset to initial state of charge. This efficiency is close to one for most common batteries, except, for example, lead-acid technology.

There are many different types of battery technologies, based on different chemical elements and reactions. The most common, today, are the lead-acid and the Li-ion, but also Nickel based, Sulfur based, and flow batteries play, or played, a relevant role in this industry. We will take a brief look at the main advantages of the most common battery technologies.

These batteries are very common in our daily lives. The base cell of this battery is made with a negative lead electrode and a positive electrode made of bi-oxide or lead, while the electrolyte is a water solution of sulfuric acid.

There are also limitations, for example, one relevant limit is the production of dendrites on the anode during cycling. It can create an electric shortage with a consequent increase in temperature and damage for the battery.

Thebattery management system that controls the proper operation of each cell in order to let the system work within a voltage, current, and temperature that is not dangerous for the system itself, but good operation of the batteries. This also calibrates and equalizes the state of charge among the cells.

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The battery system is connected to the inverters, in order to convert the power in AC. In each BESS there is a specific power electronic level, called PCS (power conversion system) usually grouped in a conversion unit, including all the auxiliary services needed for the proper monitoring.

The next level is for monitoring and control of the system and of the energy flow (energy management system). The general monitoring and control is usually included in the SCADA system (supervisory control and data acquisition system), while the energy management system has the specific purpose of monitoring the power flow according to the specific applications.

As described in the first article of this series, renewable energies have been set up to play a major role in the future of electrical systems. The integration of a BESS with a renewable energy source can be beneficial for both the electrical system and the renewable power plant.

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