Grid stabilization equatorial guinea

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Around the world, alternative energy sources are being connected to utility grids to improve sustainability and reduce environmental impacts. Nevertheless, the proliferation of power sources can make grid management more complex. This article quickly surveys some responding approaches and shows how load banks can offer value.

Utility grids typically connect multiple power plants to customers across a wide area. To ensure safe and proper operation, the voltage, frequency, and other electrical characteristics of the grid must be maintained within specific ranges. If these parameters go out of range, the grid could become unstable, producing effects that impact or damage equipment on the power network. One effect ... when the amount of power on the grid exceeds demand, its operating voltage can increase, creating a reverse power effect that can damage power generation equipment in utility power plants.

One might conclude that utilities should reduce their power input by throttling back or shutting down generating stations. They can ... to a point. However, powerplant generating apparatus, which typically involves large steam boilers and complex and sensitive steam turbines, may not be able to operate properly without producing a minimum amount of power. In addition, a utility could face high expenses and operating losses if its generating apparatus is not loaded as designed. For these reasons and more, utilities need to maintain base levels of power output.

There are a variety of solutions for managing excess power that would otherwise destabilize a power grid. The following sections briefly survey three approaches.

Several means can be used to store excess energy for consumption when demand exceeds supply. One approach is to use storage batteries, which charge whenever excess power becomes available, then discharge when demand increases. Doing so at scale can apply sufficient load to avoid a reverse power condition and meet peak demands. Perhaps the most famous example of a battery storage solution is the Hornsdale Power Reserve near Adelaide in Southern Australia, which uses technology and equipment developed by Tesla.

This approach is not without limitations. One is that batteries have a finite capacity to store power. This becomes relevant when the area served by a grid experiences an extended run of sunny temperate weather. When the batteries reach capacity, there will be no further ability to absorb excess power. Without another means to absorb or consume this power, the batteries could fail to stabilize a grid once fully charged.

Furthermore, defects in design or manufacturing could result in conditions such as thermal runaway, where batteries become hot enough to cause fire or thermal damage. In February 2018, the U.S. Consumer Product Safety Commission reported 25,000+ incidents of overheating or fire involving more than 400 types of lithium battery-powered consumer devices over five years. 1More recently, lithium-ion batteries that power

automobiles may have played a role in a fire that resulted in the sinking of a cargo ship. 2

Space Requirements: Storing energy at scale requires space, potentially much of it. For a battery storage project, the equipment footprint can be large, for a reservoir, much larger still. Consequently, these facilities work best outside of urban areas where space is less likely to be available and surrounding communities would more like be affected by potential impacts.

Finite Capacity to Absorb Load: When batteries are fully charged or a reservoir is full, the solution can no longer be used to stabilize the grid when excess power is available. Likewise, a completely filled energy storage solution cannot distribute power until sufficient demand returns.

Environmental Impacts: The life cycle of energy storage solutions impacts the environment, albeit in different ways. For batteries, environmental concerns begin with the mining of minerals, extend through manufacturing, and then to disposing of the toxic substances used to construct them. For hydropower, the construction of a dam and reservoir consumes a large area of land that might otherwise have ecological, agricultural, or economic value.

Excess electricity can power the electrolysis of water, a relatively straightforward process that yields hydrogen and oxygen gases. Industrial uses for these substances already exist, and hydrogen can be used as a fuel stock. Oxygen is also used in healthcare. A cleaner-burning fuel, wider use of hydrogen could play a role in future energy strategies and has been suggested as a replacement fuel for motor vehicles and other applications that presently rely on petroleum.

Load banks are electrical devices that convert power to heat, which is subsequently dissipated to the surrounding environment. Easy to install and operate, they do not rely on the chemical conversion of energy in the way that storage batteries and hydrogen production do.