High voltage battery storage

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The growing adoption of electric vehicles (EVs) and the transition to more renewable energy sources are reducing our more-than-century-long reliance on fossil fuels. Electric utilities are increasingly turning to solar panels and wind turbines rather than natural gas-fueled turbines to generate the electricity needed to charge EVs, as well as help power our homes and businesses. Together, these trends are poised to bring us closer to a sustainable energy future.

Those same trends also pose a big challenge to the electricity grid. Demand can vary throughout the day - and so can supplies of solar and wind energy based on changes in the weather. That"s why batteries are becoming an essential component of the grid.

"Batteries can fill in the gap when it"s cloudy and the wind dies down," said Richard Zhang, a Virginia Tech professor who teaches power electronics and has worked in the grid and energy industry for 25 years. "And batteries improve the economics of electricity because they can be charged during off-peak times, providing electricity for charging EVs at peak times."

Getting batteries to safely, reliably and cost-effectively store and release the large amounts of electricity running through the grid is a complex challenge. That"s where our company"s expertise in providing advanced battery-management semiconductor solutions can make a big difference.

"The bigger, higher-voltage batteries used in the grid require better thermal management and more precise monitoring," said Samuel Wong, our company"s vice president and general manager of Battery Management Solutions. "Effectively managing those batteries requires understanding battery chemistry and adapting high-performance semiconductor devices to safely get the most out of each battery."

The adoption of solar and wind generation and EVs is good news for the planet, Richard said. The problem is that power grids weren"t originally designed to handle these new types of electricity demands on available energy.

"Getting people to switch to EVs is easier today than it was just a few years ago," he said. "Now the growing issue is getting the electricity infrastructure to handle them, alongside other energy demands."

The challenge, Samuel said, is grid instability - in other words, fluctuations in electricity generation and usage. Variations in energy supply occur in solar and wind generation, especially the complete loss of solar power at night. Supply and demand swings may also occur from the charging routines of EV owners.

Samuel Wong, TI"s vice president of Battery Management Solutions, left, and Richard Zhang of Virginia Tech discuss the impact of battery energy storage systems.

Samuel and Richard, like most power experts, agree on the solution to grid instability: energy storage systems (ESS). Storage systems - usually in the form of batteries - can capture and hold excess energy in the grid when supply is high and demand is low, and then make it available at other times. You may be picturing the relatively small, light battery cells used in EVs. But for the grid, an ESS might consist of a railroad-car-sized stack of bigger, heavier cells that each can operate at as much as 4 megawatt-hours (MWh) - enough energy to power thousands of homes.

Staging storage systems at different points in the grid optimizes their ability to distribute enormous amounts of electricity to neighborhoods when and where they"re needed. That can mean placing an ESS alongside a solar panel farm, where it can soak up the excess energy during the day and then pump it back out to the grid at night. Or, an ESS placed in a community can more easily grab energy from local rooftop solar panels and later supply the extra electricity needed to charge nearby EVs. "An ESS can serve as a local reservoir for the community," Samuel said.