Batteries on the Grid: Opportunities, Challenges, and New Technologies

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It is widely believed that energy storage devices such as batteries can be used on the electric power grid to enable broader deployment of volatile renewable energy sources, improve grid reliability and efficiency, and decrease the cost of electricity for grid customers. While numerous battery technologies have been tested for grid energy storage applications, the high cost, limited lifetime, and safety hazards of existing battery technologies have generally limited their installation and operation on most large electric grids.

In this presentation, the case for batteries in support of volatile renewable energy sources such as solar and wind power is presented. Batteries can be charged or discharged for a matter of minutes to smooth the output power of solar or wind farms during intermittent clouds or gusts. They may also be discharged slowly to provide power at night or during extended calm conditions. The opportunity for batteries to support renewable energy has resulted in a mandate of the installation of batteries providing 1.3 GW of power in California alone, and in other regions, the pace of battery deployment in support of renewables is also accelerating.

This presentation will also examine the limits of today's battery technologies, as well as the new technologies under development. Conventional batteries such as lithium-ion and flow batteries each suffer from fundamental cost structure or performance limitations that have resulted in slow adoption of them by grid storage customers. In the past several years, commercial development of several fundamentally novel battery chemistries has begun, including aqueous sodium-ion batteries using organometallic Prussian Blue electrodes. This new battery chemistry has the potential to provide an order of magnitude longer operational lifetime than existing technologies, resulting on a lifetime cost low enough for a wide variety of stationary energy storage applications include the support of renewable energy generation. To conclude this presentation, the current status, challenges, and future prognosis for batteries based on Prussian Blue will be assessed.