



BATTERY STORAGE SOLUTIONS FOR COOPERATIVES

Throughout the day, electric co-ops are constantly balancing the supply and demand of electricity. Energy storage, however, can ease that balancing act by capturing energy and storing it for later use.

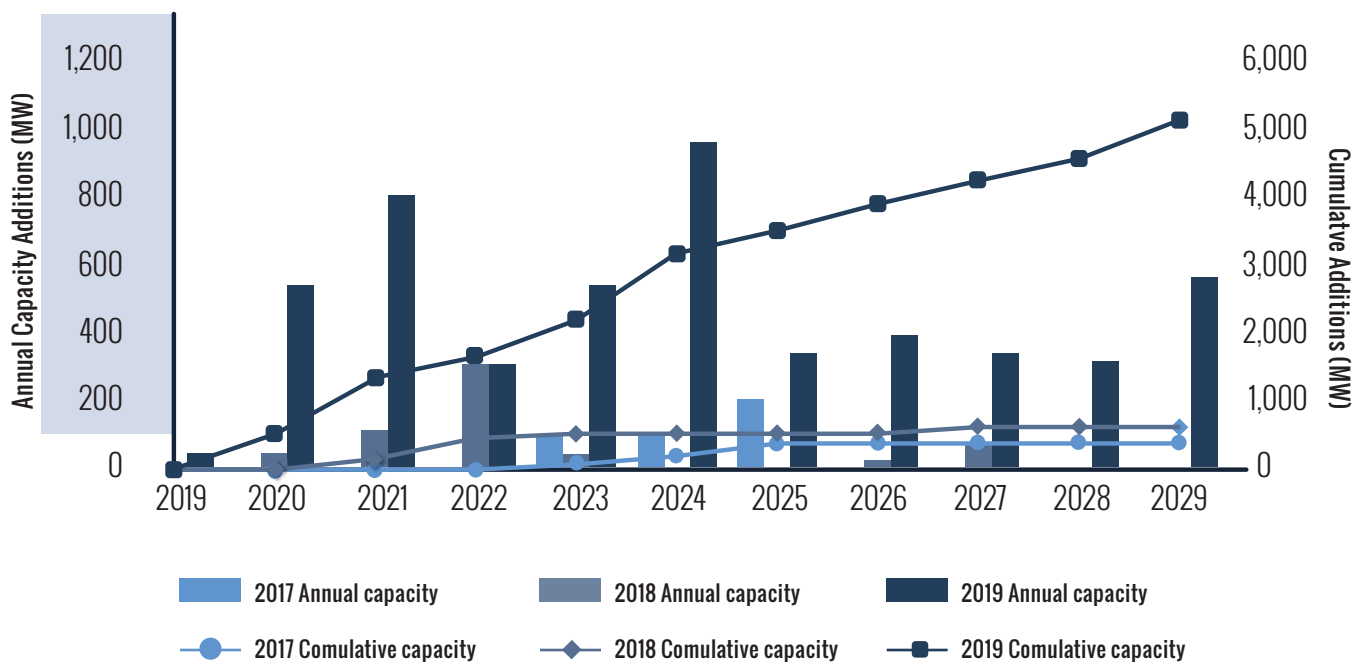
Utility-scale energy storage is not new – it has been around for decades, primarily in the form of pumped hydro storage – but the last few years have brought technological advancements and cost reductions to another promising form of energy storage: battery storage.

Battery storage uses a group of batteries to store energy and can be connected to distribution/transmission networks (substations) or generation assets. It increases flexibility in power systems, supports the use of more variable sources of electricity, like solar photovoltaics (PV) and wind energy, and provides numerous other benefits.

Integration of battery storage is continuing to increase as costs come down and pilot projects prove successful.

STORAGE DEPLOYMENTS AS MODEL EE IN RESOURCE PLANNING BY FILING YEAR THROUGH 2029

Source: Wood Mackenzie



BENEFITS FOR MEMBERS

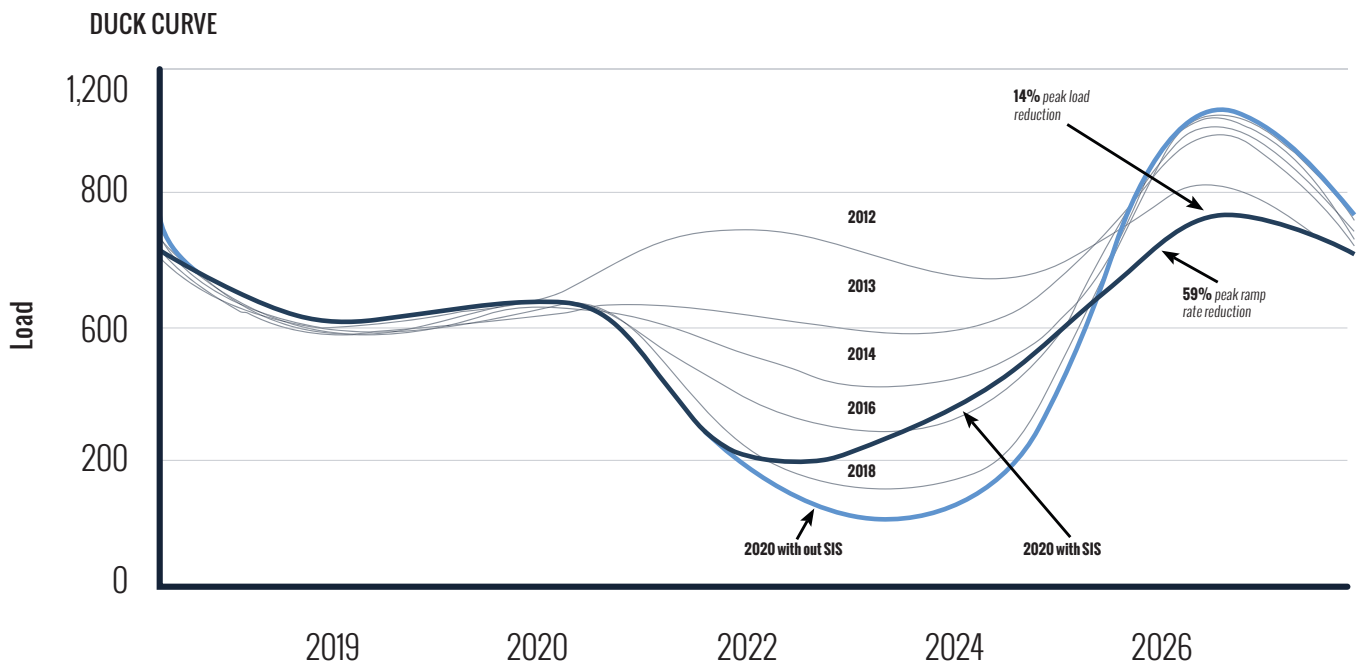
Increased Reliability and Power Quality - Battery storage gives grid operators more flexibility when managing the grid, leading to fewer system disruptions for members.

Increased Energy Security and Resiliency - Battery storage can help keep sections of the grid online during outages.

BENEFITS FOR GRID OPERATION

Frequency Regulation - If there is an imbalance between power supply and demand, the frequency of the grid can rise or fall, which can cause outages. Currently, co-ops must keep some power plants on standby or lower their output to meet capacity levels, which is costly and inefficient. While conventional power plants require several seconds or minutes to respond to operators' commands, battery storage can provide frequency regulation within milliseconds.

Flexible Ramping - When demand for electricity rises or drops dramatically, system operators must quickly respond, and the growing penetration of solar PV can cause periods of especially high ramping in some areas of the country (a load profile known as the "duck curve"). Battery storage can be used to smooth out the steepness of the demand curve and make the grid easier to manage.



Black Start Services - In the event of a grid failure, power plants require power to start up again, known as a black start. On-site diesel generators currently provide this service, but battery storage is a suitable alternative. And when they're not needed for black start, they can be used elsewhere, providing additional revenue streams.

BENEFITS FOR INVESTMENT DEFERRAL

Energy Shifting and Capacity Investment Deferral - Traditionally, peaking power plants have supplied electricity during periods of high demand, but in some cases, battery storage can be deployed instead.

Transmission and Distribution Congestion Relief - Network congestion occurs when the power flow through transmission and distribution networks exceeds load-carrying capacity. Currently, additional transmission and distribution networks would be built to meet maximum power needed, but because transmission construction is expensive, deferral is a high value-added investment. Battery storage could be controlled by system operators to provide an instantaneous response during the few hours each year when the existing network substations may be overloaded.

BENEFITS FOR RENEWABLE ENERGY GENERATORS

Reduced Renewable Energy Curtailment - In times of high renewable generation and low demand, where grid constraints prevent transporting excess generation, renewable energy generators have to reduce (curtail) their power output. To avoid this scenario, battery storage can be used to store the excess clean energy and discharge it when demand is higher.

Storing Energy from Small-Scale Distributed Renewables - A centralized large-scale battery can be deployed in an area with many small-scale renewables, such as solar installed on residential rooftops.

Capacity Firming - Renewable energy generation fluctuates throughout the day based on cloud cover (for solar) and wind speed (for wind). Coupling battery storage with renewables can reduce fluctuations at the point of interconnection. It can smooth power output and control the ramp rate to eliminate rapid voltage and power fluctuations.

BENEFITS FOR MICROGRIDS

Reduced Reliance on Diesel Generators - Island and remote communities often rely on diesel generators for reliable energy, but the combination of battery storage and renewables could decrease this dependence and be used in microgrids, which are independent electric systems that use local energy resources and control technologies to help power a defined area.

*This article was provided by Advanced Energy, a nonprofit energy consulting firm.
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