



LEGISLATION

Why is Energy Storage Needed?

As California continues implementing one of the world's largest and most rapid shifts to renewable power, energy storage is becoming essential to keeping the grid reliable and optimizing renewable investments. Since the largest piece of the state's renewable energy portfolio is solar, the imbalance between supply and demand means there is excess energy during the day and potential renewable shortfalls during the night. Two key strategies to solve these problems include small- to mid-scale distributed energy storage and large-scale bulk energy storage.

Distributed Energy Storage: Batteries

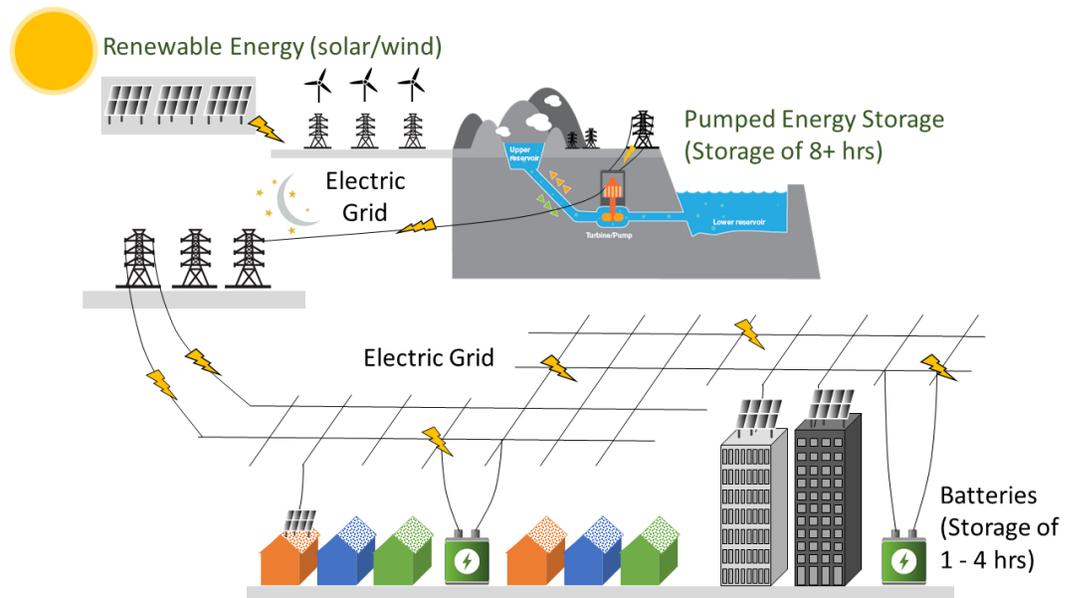
Distributed energy storage helps integrate renewable energy using small- to mid-sized battery systems with capacities of tens of megawatts and 1 to 4 hours of storage. These modular systems can be swiftly deployed to meet immediate renewable integration challenges. However, these systems have limited service life and may be more costly than large-scale bulk energy storage facilities.

Bulk Energy Storage: Pumped Storage

Bulk energy storage solutions will be necessary to maximize renewable energy integration with the electric grid. Pumped storage is the most-proven and cost effective of the bulk energy storage technologies, offering hundreds of megawatts of capacity and 8 or more hours of storage per project. These systems act as giant batteries that use renewable energy when it's plentiful to pump water from a lower reservoir to an upper reservoir, then reverse the pumps to produce energy when needed. These facilities take many years to develop, but function for generations with modest operational and maintenance investments. That means pumped storage facilities are strategic, long-term investments that support the region's future 100 percent renewable energy goals. In addition, pumped storage facilities generate significant jobs during construction.

Benefits of Pumped Storage

Pumped storage provides three vital benefits to California. First, it allows for integration of massive amounts of renewable energy into the grid. Without pumped



Bulk Energy Storage

storage, significant renewable energy assets will be curtailed or wasted. Second, pumped storage reduces emissions of greenhouse gasses by curtailing the need for fossil fuel generation at night when renewable energy generation declines. Third, pumped storage provides a long-term asset that will support the integration of batteries and other energy storage technologies as they are developed.

For all these benefits, pumped storage systems have very low environmental footprints. Unlike today's most popular battery systems, pumped storage technologies do not require large amounts of rare materials like Lithium and Cobalt that are difficult to mine and handle in socially responsible ways.

Supporting the Grid with Energy Storage

Energy storage systems help provide four interrelated services essential to keeping the lights on while encouraging California's continued shift to renewables.

Balancing energy supply and demand – Pumped storage allows power supplies to be available when they are needed, not just when they are generated.

Using renewable investments – Pumped storage reduces or eliminates the need for curtailment of renewable sources.

Stabilizing the grid

– Pumped storage provides voltage regulation and quick ramping (i.e. “spinning reserve”).

Optimizing transmission lines

– Pumped storage reduces the need for new transmission lines to maximize the use of existing lines.

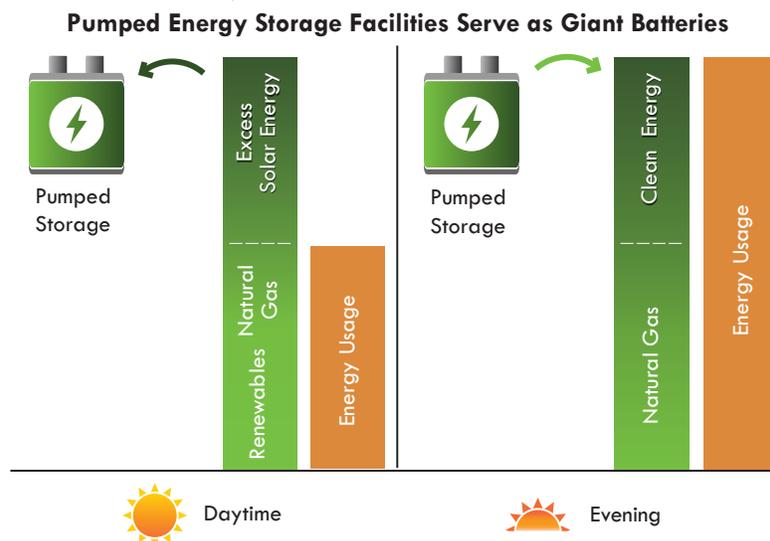
Pumped storage and smaller battery storage systems provide these four services in complementary ways.

Global Investments in Pumped Storage

Progressive energy planners around the world are investing in pumped storage to complement their renewable portfolios. For example, in Spain, the country's massive investment of solar and wind is being deployed in tandem with 6,000 megawatts of pumped storage. Other countries investing in pumped storage to complement renewable energy development include Australia, the United Kingdom, China, South Korea and Switzerland.

Innovative Energy Solutions for California

Even though bulk storage is essential to integrate large-scale renewables, today's markets and regulatory systems in California do not create the incentives needed for investors to build these storage systems. New thinking is important to provide the long-term, innovative solutions that California residents expect from policymakers. Pumped storage will facilitate the migration from fossil fuels to renewables in California while meeting morning and nighttime energy demands at the lowest long-term cost. Stabilizing pump storage investments through appropriate legislation will encourage investors and benefit electricity ratepayers in California. ■



Pumped energy storage projects work like giant batteries by storing excess renewable energy during the day, when renewable power production peaks. Energy is released from the “battery” in the evening, when energy usage increases and renewable energy is not available.



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