Title: Assessing the Peak Shaving Ability of Energy Storage Peak across the United States

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Abstract

Large-scale energy storage systems are gaining more attention as their costs continue to decline rapidly, especially for lithium-ion batteries. Due to its dispatchable nature, energy storage can contribute to reliable operation of the grid by reducing peak demand and ensuring the availability of sufficient generating capacity. Because storage is energy-limited, we must consider the impact of discharge duration on its ability to meet peak demand. We present a new method to calculate the equivalent hours of storage duration required across a range of reductions of peak demand in the ten largest US balancing authorities. Our analysis utilizes the most recent hourly demand and concurrent, historical renewable generation data from EIA's Form 930 database. We find that the required energy and power capacity of the energy storage system increases along with the peak demand reduction target and can vary significantly across balancing authorities due to differences in load shape and peak duration. Across the 10 largest balancing authorities, the maximum equivalent hours of storage required to reduce peak demand by 10% ranges from 5.18 to 7.89 hours within the data years examined. In addition, the deployment of solar tends to narrow the daily peaks, thereby reducing the requirements for the maximum equivalent hours of storage. Compared to solar, wind is less correlated with demand and thus has less of an impact on storage requirements.