

# Commercial-Scale Battery Energy Storage (+ Solar PV) Primer

Battery energy storage for commercial-scale applications, often paired with solar photovoltaic (PV) systems, is getting a lot of attention. Can your organization benefit from energy storage?

Determining the answer to that question is not easy. In this primer, Sage defines what battery energy storage is and walks you through the potential benefits, the state of the industry, and how to go about determining if energy storage is for your organization.

## What is commercial-scale battery energy storage?

Commercial-scale customers include most small to medium size businesses, public agencies, public and private schools, and houses of worship. It does not include residential or large industrial electricity customers.

Battery energy storage systems (BESS) are battery-based systems connected to your electric system on your side (the customer side) of the utility meter. BESS is used to store energy from the electrical grid and/or an onsite renewable energy generation system, such as solar PV, for discharge at another time. The technologies used in commercial-scale energy BESS, typically lithium-ion battery banks (similar to those found in electric and hybrid cars) paired with intelligent charge/discharge controllers and inverter electronics, are all fairly mature technologies that have been developed previously for other applications. Though the market for commercial-scale BESS is still evolving rapidly, the technologies utilized are well understood.

## What are the benefits of commercial-scale energy storage?

- **Demand Charge Reduction** - Electricity rates usually consist of two main components, energy and demand charges. Energy charges (sometimes called volumetric charges) are set for each kWh of energy you use during specific times of day. This is the purchase of the electrons you use. Demand charges are based on your peak usage for various time periods during the course of a month. Demand charges are used to offset the cost of generation and delivery facilities that the utility needs to install and maintain to make sure you don't run out of power at your peak load.

Demand charges are often set for the month by a relatively short demand spike, for instance when air conditioning is running at maximum capacity on a particularly hot afternoon and a walk-in freezer turns on simultaneously with the pool recirculation pumps. High demand peaks result in much higher electricity bills.

In California and elsewhere, utilities have recently been increasing demand charges to pay for infrastructure upgrades (the smart grid will not be free) and as a price signal to consumers to reduce their peak demands during certain times. Because solar PV systems cannot respond to demand spikes, increased demand charges negatively impact the financial returns of solar. This is why storage paired with solar increasingly makes economic sense.

Storage mitigates the impact of demand rate changes by storing energy during times of low demand and using that energy during times of high demand, thereby lowering your peak demand seen by the grid and substantially lowering your monthly energy bill.

- **Tariff Eligibility** – The commercial utility tariff that your electrical account is eligible for is probably based on your maximum demand during the most recent twelve-month period. By reducing peak demand as discussed in Demand Charge Reduction above, it may be possible to change the tariff your account is on to a tariff that lowers your utility energy bill. This is particularly useful when storage systems are paired with solar.
- **Time-of-Use (TOU) Arbitrage** – Theoretically, you should be able to store energy at night when the cost is low, and then discharge it during the day to offset expensive energy. However, this can be restricted when storage is installed with solar, due to the federal tax incentives that are used to offset the costs of the combined systems. Further, at today's prices for BESS, storing cheaper energy at night and discharging it during the day usually does not generate enough savings to make battery systems economically feasible. We believe this application will become economic over time as TOU peak periods shift into early evening, combined with other solar tariff changes and further reductions in the cost of battery systems.
- **Backup Power** – It is possible, though not common, to use BESS for backup power. Adding backup capability to solar+storage projects adds significant cost and complexity. In addition, sizing storage systems to backup critical loads during extended blackouts can result in much larger storage systems than are economically efficient for offsetting demand peaks. For these reasons, it is rare for commercial storage systems to be used for backup power. As the price of storage systems drops, this application may begin to make more economic sense.
- **Grid Services** – Customer sited BESS can also provide value to the utilities that operate the electric grid. Deriving financial benefit for these services is still some years in the future, so Sage does not take this into account when modeling storage solutions.

## What is the state of the commercial energy storage market?

As mentioned earlier, the technologies that make up commercial BESS are all reasonably well developed. However, there are important aspects of this emerging market that make battery storage a complex project decision:

- **Companies** – As a relatively young market, most of the companies in battery storage are young and untested. Some of these companies will survive, some will not. Entry of larger players into the market is inevitable as the market matures. To reduce risk, we look for companies that use proven technologies and components, are diversified or owned/backed by larger corporations, and that have captured significant market share.
- **Financing** – How to price BESS is a challenge. Unlike the solar PV market where the product, kWh, is easily measured and financing vehicles have been developed over at the last two decades, BESS projects are relatively opaque. Financing mechanisms are still highly inconsistent from vendor to vendor, as the industry has not settled on an easily understandable structure that equitably shares risk between the vendor and customer. *Financing inconsistencies between vendors is perhaps the most significant barrier to understanding and comparing different product offerings.*
- **Cost of batteries** – Over the next five years, it is estimated that Lithium-ion battery pack costs will decrease as much as 50%. Because batteries are currently the largest cost component in battery storage systems, this will have a dramatic impact on the cost of these systems, making many applications financially feasible without large incentives. This is similar to what has been seen in the solar PV market, with panel prices dropping dramatically over the past decade resulting in significantly increased deployment.
- **Incentives** – Both state and federal incentives are currently available for BESS projects in California. Which incentives are used is dependent on whether the storage systems are

installed with solar PV. The incentives used can impact when during the day the batteries are charged, which impacts the financial performance of the project.

- **Lack of transparency** – As mentioned above under Financing, the financial benefits of a storage system are difficult to directly measure. The results of moving energy around during the day are highly tariff and load dependent, so software needs to keep track of those factors and optimize charge and discharge cycles. The storage vendor measures and calculates the financial benefits of this, usually without independent confirmation.
- **Tariffs** – storage systems derive their primary benefit from storing and discharging energy to take advantage of energy rate changes during the day. As such, their financial performance is subject to changes in tariffs. Given that BESS generally reduces peak loads on the grid, together with tariff pricing trends that emphasize high demand charges, tariff changes are expected to increase the value of BESS over time.

## Is energy storage a good fit for your organization?

There are a number of things to consider to determine the answer to that question. Here are the steps you should go through gathering the information you'll need to make an informed decision:

1. **Set goals** – Almost all commercial customers are looking to save money on energy bills. Today, the bulk of those savings comes from demand cost reduction. Improved savings can be achieved through tariff eligibility when storage is paired with solar.
2. **Evaluate your current energy usage** – Energy management and efficiency measures are often more cost effective than storage systems or renewable generation. Find out if you can effectively and sustainably manage your load to reduce usage and demand before installing storage or solar. Remember to take into account planned changes to your site and other factors that can impact usage such as demographic trends and adoption of new energy efficiency technologies.
3. **Determine your energy usage after efficiency measures** – Once energy efficiency measures have been identified and modeled, the remaining energy usage profile can be addressed with storage, solar, or a combination of both.
4. **Determine solar PV siting and production first** – If you are considering solar+storage, solar siting and production for the site must be modeled first, as storage will work with the residual energy usage not offset by the solar system. Once a solar production profile is determined, the solar project size can be optimized with storage system sizing to determine the most financially efficient project.
5. **Determine if storage adds value and size storage and solar PV systems** – This step is particularly complex. It is highly dependent on the assumed utility TOU and rate structures, and the financing of the combined systems. This analysis will require sending site usage and solar production data to potential BESS vendors who will model the systems and propose optimal system sizes based on their financing mechanism(s). To effectively validate and compare different project proposals requires renewable energy and storage systems expertise.

## How to get started

Due to the complexity of BESS offerings and potential integration with solar, BESS projects typically require outside expertise to manage well. **Sage Renewables** can provide you with the expertise you need to fully understand the storage market, evaluate your site needs, define an appropriate project scope, vet potential vendors, compare financing mechanisms and validate claimed project performance.

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