

Technology At Work

Capturing the Sun

Dozens of Projects Nationwide Examine How Best to Combine Solar and Energy Storage

By Sarah Stankorb

As more solar power generation comes online, utilities face a growing challenge (and opportunity) to store excess daytime energy for use in the evening, when electricity demand increases. Solar power presents a tremendous potential source of energy but not *capacity*—available on demand and with the flexibility to adjust energy flow as needed. Energy storage devices such as batteries can store solar energy to provide this capacity, but grid-integrated storage remains in development.

EPRI is investigating many aspects of deploying solar and storage. For example: How should solar and storage technologies be combined and configured? Where are optimal locations on the grid? Can the same battery technologies serve sunny desert grids and cloudy northern systems? How can solar generation and energy demand be forecast to support the most effective use of batteries?

To answer questions about solar, storage, and other distributed energy resources, EPRI is leading more than 20 [Integrated Grid pilot projects](#) and many more related demonstration projects and initiatives across the United States. Some are supported by the [U.S. Department of Energy](#), while others involve regional collaborations among utilities and other electric power industry stakeholders.

“The research is *not* trying to replace the grid connection with solar and batteries,” said EPRI Technical Leader Ben York. “Instead, we want to optimize both so that the grid can operate effectively with distributed energy resources.”

Research on how best to combine batteries and solar is being conducted at residential and commercial locations and at utility-scale solar power plants connected to the distribution grid. “It’s a matter of scale,” said EPRI Senior Project Engineer Steven Coley. “At all levels, you’re trying to serve load, either for individual customers or many customers.”

There’s debate regarding whether distributed or central solar and storage would enable a more efficient, cost-effective grid, and EPRI’s demonstrations are testing both models.

“Both models could potentially work in different locations, depending on local weather, electricity demand, costs, incentives, local mandates, and market rules,” said Coley. “There’s likely not a one-size-fits-all model.”

Highlights from EPRI’s Integrated Grid pilots include:

- **Entergy**, which serves customers across Arkansas, Louisiana, Mississippi, and Texas, recently installed and integrated utility-scale solar and advanced lithium ion battery storage systems in New Orleans. The utility is testing batteries’ ability to optimize the value of solar by smoothing its variability, shifting peak production, and enhancing power quality. Researchers are remotely monitoring and controlling the site and reconfiguring the distribution feeder.
- **Southern California Edison** is studying the impacts of distributed battery energy storage on its distribution planning. Preliminary analysis shows that locating battery storage in a way that increases hosting capacity on the distribution system may enable certain grid services, such as supplying energy capacity to distribution and bulk transmission systems, but there may be constraints on dispatch.

Consider the example of a battery located on a distribution system far from the substation. At certain times, providing its full power capacity to the transmission system may violate distribution system reliability standards.

- **New York Power Authority (NYPA) and Central Hudson Gas & Electric** are evaluating the ability of solar and storage coupled with smart inverters to minimize the impact of variable power flow in the distribution grid. A second NYPA pilot with Consolidated Edison is investigating how to use solar forecasting to predict output fluctuations. Researchers also are exploring how to manage load and demand response to optimize the use of renewable energy and energy storage on the grid.

Key insights emerging from these and other projects:

- Accurate solar forecasting is essential to dispatch batteries appropriately and avoid their overuse and resulting degradation.
- Unique vendor approaches are common, and standards are needed for configuring and communicating with solar-storage systems.
- To cost-effectively integrate large amounts of distributed solar and storage, better tools are needed for analyzing the economics and technical aspects of bulk system and distribution system impacts.
- Accurately valuing distributed solar-storage solutions requires a much better understanding of the value of resiliency and customers' willingness to pay for uninterrupted power.

Key EPRI Technical Experts

Ben York, Steven Coley