New report shines light on installed costs and deployment barriers for residential solar PV with energy storage

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Researchers from the U.S. Department of Energy (DOE) National Renewable Energy Laboratory (NREL) are making available the most detailed component and system-level cost breakdowns to date for residential photovoltaic (PV) solar systems equipped with energy storage- and quantifying previously unknown soft costs for the first time.

The report, titled "Installed Cost Benchmarks and Deployment Barriers for Residential Solar Photovoltaics with Energy Storage: Q1 2016," was written by researchers from NREL, the Rocky Mountain Institute, and the Energy Department.

"There is rapidly growing interest in pairing distributed PV with storage, but there's a lack of publicly available cost data and analysis," said Kristen Ardani, lead author of the report and a solar technology markets and policy analyst at NREL. "By expanding NREL's well-established component- and system-level cost modeling methodology for solar PV technologies to PV-plus-storage systems, this report is the first in a series of benchmark reports that will document progress in cost reductions for the emerging PV-plus-storage market over time."

Declining costs in customer-side energy-storage products have opened the door for batteries to improve the value and flexibility of residential PV systems while falling costs in PV technologies have been driving the growing adoption of combined PV and storage solutions. However, gaps

remain in developing an in-depth understanding of the costs of combined PV and battery systems and in effectively communicating their value proposition.

Through in-depth analysis of those costs and barriers to adoption, the report's authors provide technology manufacturers, installers, and other stakeholders with invaluable information to help guide their efforts to identify cost reduction opportunities. In addition, the analysis informs decision makers on market factors that are headwinds to further growth.

The analysis covers alternating current (AC)- and direct current (DC)-coupled systems for residential use, as well as retrofitting batteries to installed arrays, and the costs of enhancing the resiliency benefits of the combined system by switching to a battery with greater capacity. Both systems are designed to provide back-up power for critical loads in the event of a grid outage, and they enable a typical customer to optimize self-consumption of PV electricity-including peak-demand shaving and time-of-use shifting.

The authors separate installed system cost into 13 categories that range from direct hardware costs, such as the PV modules and batteries themselves, to soft costs that include items such as labor for installations, permitting and inspections, and net profits. The resulting cost for a DC-coupled system that integrates a 5.6-kilowatt (kW) PV array and a 3-kW/6-kilowatt-hour (kWh) battery is $27,703, which is roughly half hardware costs and half soft costs. An AC-coupled system, which can be more effective in applications that tend to use the energy from the PV array at the time of generation, costs $1,865 more if the battery is installed at the same time as the array. In settings where the battery is retrofitted to an existing AC-coupled system, the cost is increased by $3,218 to $32,786. The system design that provides for greater resiliency with a 5-kW/20-kWh battery costs $45,237 when DC-coupled and $47,171 when AC-coupled.

This granular cost breakdown offers deeper insights into the potential for cost reductions than simply looking at price trends or hardware costs alone. It also provides critical information on where stakeholders should focus cost-reduction efforts. This cost benchmarking will be updated periodically to allow the tracking over time of the progress in declining costs.

This in-depth cost analysis and accompanying stakeholder interviews also uncovered key barriers to adoption of combined PV-and-storage systems. These challenges vary across different contexts, but include inconsistent permitting processes, complexity in adequately valuing the benefits of energy storage, and flat utility rates. The authors discuss steps to consider in reducing these barriers and decreasing associated costs, such as the importance of educating permitting officials about storage technologies.

This research is supported by the DOE's SunShot Initiative, a national effort to drive down the cost of solar electricity and support solar adoption. SunShot aims to make solar energy a low cost electricity source for all Americans through research and development efforts in collaboration with public and private partners. For residential PV, the SunShot goal is to get to $0.09/kWh by 2020 and $0.05/kWh by 2030.

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Provided by National Renewable Energy Laboratory