Supplemental Project Notice

SOLAR PV + ENERGY STORAGE TECHNO-ECONOMIC ANALYSIS

Phase 2

PROJECT HIGHLIGHTS

- Evaluate several energy storage technologies with 4- to 12-hour durations charged with a dedicated solar PV plant
- Understand the cost and performance of energy storage paired with solar PV as a function of storage discharge duration and system design
- Understand the impact of different solar resources on the optimal configuration
- Improve optimziation of solar PV + storage plant design to support resource planning

Background, Objectives, and New Learnings

EPRI recently conducted a Phase 1 study to analyze the levelized cost of electricity (LCOE), capital costs, and performance of several energy storage technologies paired with a solar photovoltaic (PV) plant. The study evaluated a large parameter space of energy storage technologies and discharge durations, solar-to-storage ratios, and storage charging capacities to identify solar PV + storage configurations with the lowest LCOE and highest annual and seasonal capacity factors.

The purpose of this Phase 2 project is to build upon the methodology developed in the previous study (Phase 1) to gain additional knowledge on the optimization and tradeoffs of different solar PV + storage configurations. This will include:

- Updating cost estimates for solar PV and energy storage technologies based on recent studies and industry data.
- Further evaluating DC-coupled solar PV + storage pairings for energy storage technologies beyond lithium ion batteries that allow for DC coupling.
- Performing more granular analysis around the optimal parameter space identified in the Phase 1 study.
- Expanding the solar resource profile evaluation to a broader range of locations to understand the impact of solar resource on optimal plant configuration.

Benefits

This project aims to further the understanding of the cost and performance trade-offs of solar PV + energy storage plants as a function of storage discharge duration and system design. By providing a techno-economic assessment of various energy storage technologies paired with solar PV, the optimization of PV + storage plant designs may be improved, supporting resource planning and helping to develop a more economically optimal power system to meet the electric demands of the public in a safe, reliable, and affordable manner.

Funders will benefit from insights into the energy storage technologies evaluated, the pros and cons of different plant configurations, and up-to-date cost and performance estimates

for a range of solar PV + storage technologies and designs. This evaluation can help to inform future resource planning and integration of solar PV + storage plants into a generation portfolio.

Project Approach and Summary

This project builds upon the methodology developed during the Phase 1 research to further evaluate solar PV + energy storage plants.

With input from project funders, initial efforts will define the energy storage technologies to be evaluated under this study, with the prioritization and selection of several technologies that are commercially available or are expected to be commercially available within the next three to five years. Technologies that can be DC-coupled and are likely to be developed at durations ranging from 4 to 12 hours will be the primary focus. After selecting the storage technologies to be evaluated, data on technology performance characteristics and component costs of each storage technology, as well as updated solar PV cost and performance data, will be collected as inputs to the analysis.

Input from project funders will support the prioritization and selection of multiple locations for solar resource analysis. This selection will aim to cover a variety of solar resources to help evaluate the impact that different solar and locational parameters (e.g., irradiance, ambient temperature, and latitude) have on plant performance and optimization.

Parametric analyses will be run to identify optimal configurations for each of the energy storage technologies at storage discharge durations of 4, 6, 8, 10, and 12 hours paired with a solar PV plant. This will involve developing solar electricity output profiles using the National Renewable Energy Laboratory's System Advisor Model or a similar PV modeling software and analyzing the full parameter space of storage technologies and PV system sizing using the Python model developed in Phase 1. Analysis will include hourly, monthly, and annual capacity factors for the hybrid plants and LCOE estimates for each configuration.

Results from the parametric analyses will be evaluated to identify "optimal" configurations, including those with the lowest LCOEs and the highest capacity factors, as well as the tradeoffs between the two.

Deliverables

Results from this study will be communicated with project funders throughout the analysis. Specific deliverables are expected to include:

- Periodic webcasts to prioritize technologies, agree on assumptions, and discuss progress
- Webcast presenting draft results
- Webcast presenting final results
- Annotated slide deck technical update report

The non-proprietary results of this work will be incorporated into EPRI's R&D programs, and available to the public for purchase, or otherwise.

Price of Project

The price to participate is $30,000 with a minimum of six (6) funders needed to complete the full scope of work. This project is eligible for Self-Directed Funding (SDF).

Project Status and Schedule

This project is estimated to span 12 months, with an estimated start date of June 2024 running through May 2025.

Who Should Join

This project will provide valuable information to assist with assessing a range of solar PV + energy storage options for a generation resource portfolio. Members who are interested in incorporating solar PV + storage projects into their resource plans or are interested in developing solar PV projects with extended plant output profiles will benefit from participation in this project.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

Technical Contact

Robin Bedilion at 509.714.1766 (rbedilion@epri.com)

Member Support Contacts

Jimmy Herren at 650.855.2320 (jherren@epri.com)

Russell Pennington at 704.595.2413 (rpennington@epri.com)

Product ID: 3002029087 **Project ID:** 1-119367 **April 2024**

EPRI

3420 Hillview Avenue, Palo Alto, California 94304-1338 USA • 800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com