Evaluate Distributed Energy Technologies for Cost Savings and Resilience With REopt Lite

NREL's REopt Lite™ web tool evaluates the economics of grid connected photovoltaics (PV), wind, and battery storage at a site. It allows users to identify the system sizes and battery dispatch strategy that minimize a site's life cycle cost of energy, and it estimates the amount of time a PV, wind, battery, and diesel generator system can sustain the site's critical load during a grid outage.

Economic Sizing and Dispatch

REopt Lite utilizes a mathematical optimization model to recommend the optimal size and dispatch for solar PV, wind, and energy storage. Users are prompted for a few simple inputs about the site, such as location, utility rate, and energy consumption. More advanced users can also edit the model's default values such as technology costs and efficiencies, analysis horizon, and financial parameters. Users are provided with a summary results table, an interactive dispatch graph, and a downloadable pro-forma spreadsheet.

Resilience Evaluation

REopt Lite allows users to explore how PV, wind, storage, and diesel generator systems can increase a site's resilience during a grid outage. The tool can size systems to sustain critical loads during a user-specified outage; it also calculates the probability of sustaining outages of varying length, and reports the minimum, average, and maximum number of hours the PV, wind, storage, and diesel generator system could sustain the critical load.

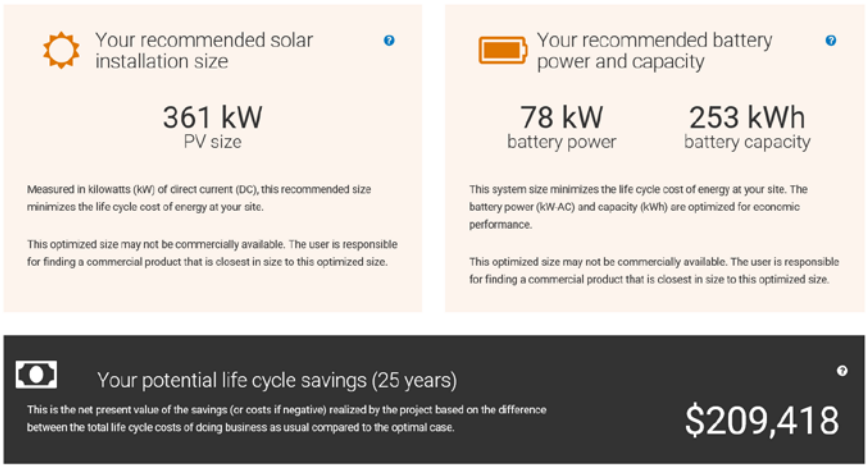

Figure 1. REopt Lite outputs include optimal system sizes and life cycle cost savings.

When To Use REopt Lite

REopt Lite helps users answer questions such as:

- What sizes of PV, wind, and storage are cost-effective for my site?
- What percentage of my energy needs can PV and wind cost-effectively provide at my site?
- How can I use storage to reduce demand charges at my site?
- When should I charge and discharge my battery to minimize my energy costs?
- How long can PV, wind, and storage power my critical site energy load during a grid outage?

How To Access REopt Lite

REopt Lite offers access for different types of users through the web tool, application programming interface (API), or open source software (OSS).

Web tool: Use the simple, user-friendly, web-based interface for single-site analysis.

API: Get programmatic access to run multisite analyses or embed in custom applications.

OSS: Download the source code to add custom features and capabilities.

REopt Lite Case Study

A building owner in Palmdale, California, is interested in adding PV and storage to lower her energy costs and sustain her critical load during a grid outage. By entering a few simple inputs in REopt Lite (location, annual energy consumption, building type, and utility rate), she can get an initial estimate of the sizes of PV and storage that may be cost-effective at her site, along with the potential savings (Figure 1).

When the tool's initial results indicate positive potential savings from PV and storage, she decides to refine her inputs by uploading actual load data from the building, adjusting the utility cost escalation rate to historic rates at her site, and adding an incentive available from the local utility. She then reruns the analysis.

Economic Results

REopt Lite generates a pro-forma spreadsheet that provides annual PV production, cost savings, and cash flows, and an interactive hourly chart (Figure 2) that shows PV production and battery dispatch in relation to her site's load. The economics look positive, so she contacts local installers for more detailed analysis and cost estimates for a PV and battery system.

Note that the PV and battery system sizes are not an input in REopt Lite. Rather, the system sizes that result in the lowest life cycle cost of energy to the site (subject to constraints such as roof area available) are provided as an output by the model. In the example here, a 361-kW PV system combined with a 78-kW/253-kWh battery provides the site with the lowest life cycle cost of electricity—$209,418 less than the base case (Figure 1).

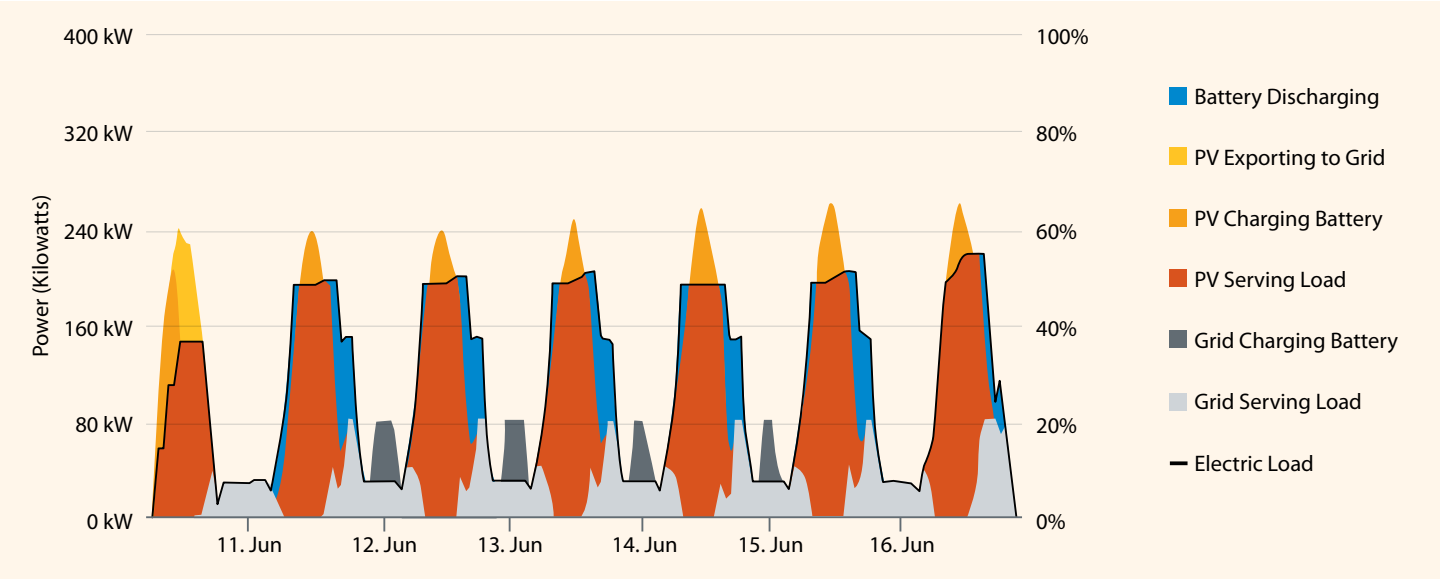

Figure 2. REopt Lite's hourly dispatch chart is optimized for maximum savings and allows the user to see when PV is producing and when the battery is charged and discharged.

Resilience Results

The building owner is also interested in the resilience benefits a PV and battery system could provide if configured to operate when disconnected from the grid. She selects the resilience focus and specifies a critical load factor of 50% and an outage lasting 48 hours, starting on September 24. The recommended PV and battery sizes are now increased to 448 kW and 126 kW/747 kWh respectively, and the net present value is reduced. While the system is sized to meet the user-specified 48-hour outage, it has an 80% probability of sustaining any 48-hour outage occurring during the year (Figure 3).

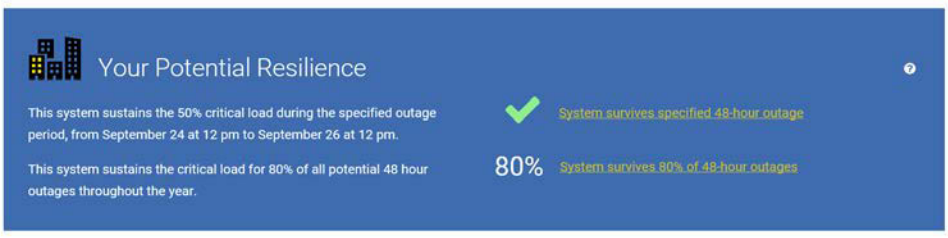

Figure 3. REopt Lite reports the probability of sustaining a grid outage of a given length.

Learn More

Evaluate the economics of PV, wind, and battery storage systems using the REopt Lite web tool: reopt.nrel.gov/tool.

Find more information about the REopt™ platform: reopt.nrel.gov/.

Contact the REopt development team: reopt@nrel.gov.

NREL

National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, CO 80401
303-275-3000 • www.nrel.gov

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