NREL
NATIONAL RENEWABLE ENERGY LABORATORY

REopt Lite Web Tool Evaluates Photovoltaics and Battery Storage

Building on the success of the REopt™ renewable energy integration and optimization platform, NREL developed a free, publicly available web version of REopt called REopt Lite. REopt Lite evaluates the economics of grid-connected photovoltaics (PV) and battery storage at a site. It allows building owners to identify the system sizes and battery dispatch strategy that minimize their life cycle cost of energy. This web tool also estimates the amount of time a PV and storage 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 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.

Resilience Evaluation

REopt Lite allows users to explore how PV and storage systems can increase a site's resilience during a grid outage if the systems are configured to operate when disconnected from the grid. 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 and storage system could sustain the critical load.

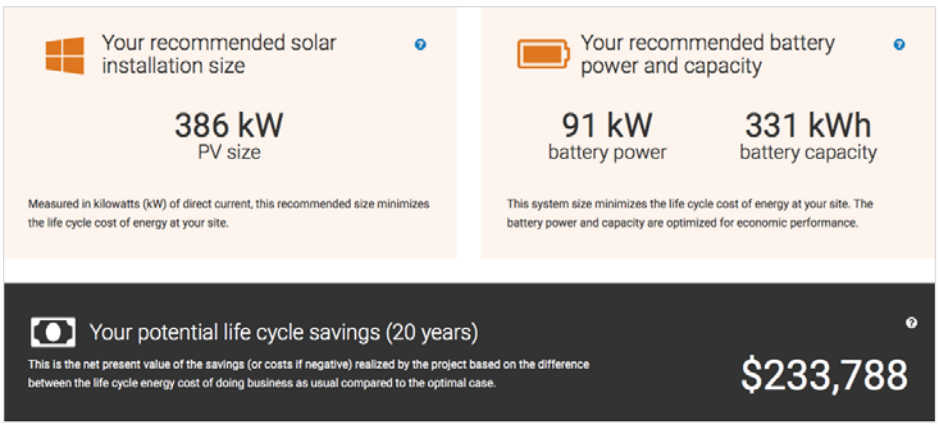

Figure 1. REopt Lite outputs include optimal system sizes and life cycle cost savings.

When to Use REopt Lite

REopt Lite helps users answer questions such as:

- What sizes of PV and storage are cost-effective for my site?
- What percentage of my energy needs can PV 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 and storage power my critical site energy load during a grid outage?

Required Site Data Inputs

- **Location:** Users enter a location to inform PV production (from PVwatts), utility rates, and climate zone.
- **Load Profile:** Users can upload an hourly load profile, or simulate the load based on annual electricity use and building type using DOE's commercial reference buildings.
- **Electricity Rate:** Users select a rate from a dropdown menu; options are based on rates specified in the Open EI Utility Rate Database (URDB).

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 re-runs 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 386-kW PV system combined with a 91-kW/331-kWh battery provides the site with the lowest life cycle cost of electricity—$233,788 less than the base case.

Resilience Results

The building owner is also interested in the ancillary resilience benefits the PV and battery system could provide if configured to operate when disconnected from the grid. By exploring the resilience graphic (Figure 3), she concludes the system has an 80% chance of sustaining the critical load during a 1-hour outage and a 50% chance of sustaining the critical load during a 4-hour outage. Last year she had a 4-hour utility outage on March 23, so she adjusts the inputs to ensure that the critical load can be sustained by the PV and battery system for at least 4 hours during the day. This results in a slightly larger PV and battery system and a reduced life cycle cost savings, but is still an overall savings from the base case.

Learn More

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

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

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

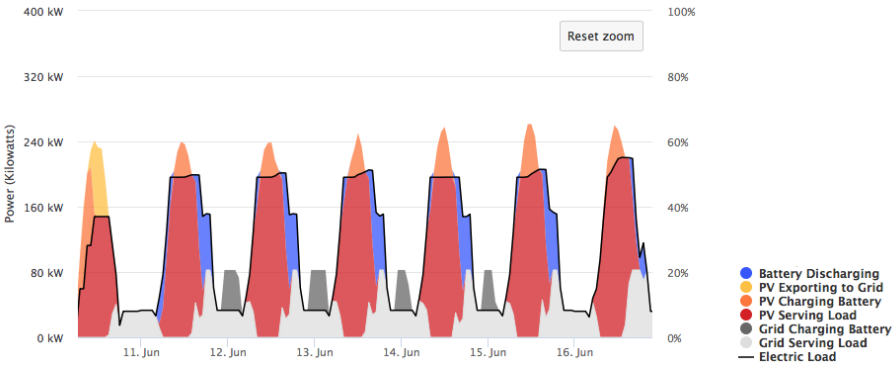

Figure 2. REopt Lite's hourly dispatch chart is optimized for maximum savings, and allows the user to see when PV is producing and when the battery is charged and discharged.

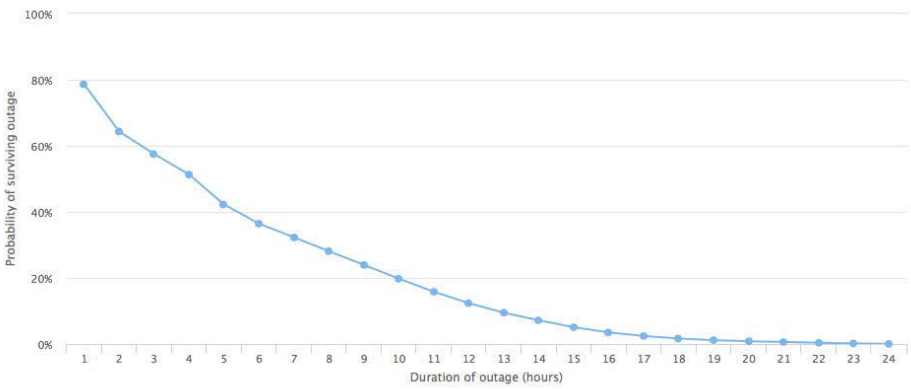

Figure 3. REopt Lite reports the probability of sustaining a grid outage of a given length.

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