



**CONNECTING THE FUTURE**  
**AUGUST 2-6, 2021**



# Evaluating Distributed Generation Cost and Resilience with REopt Lite





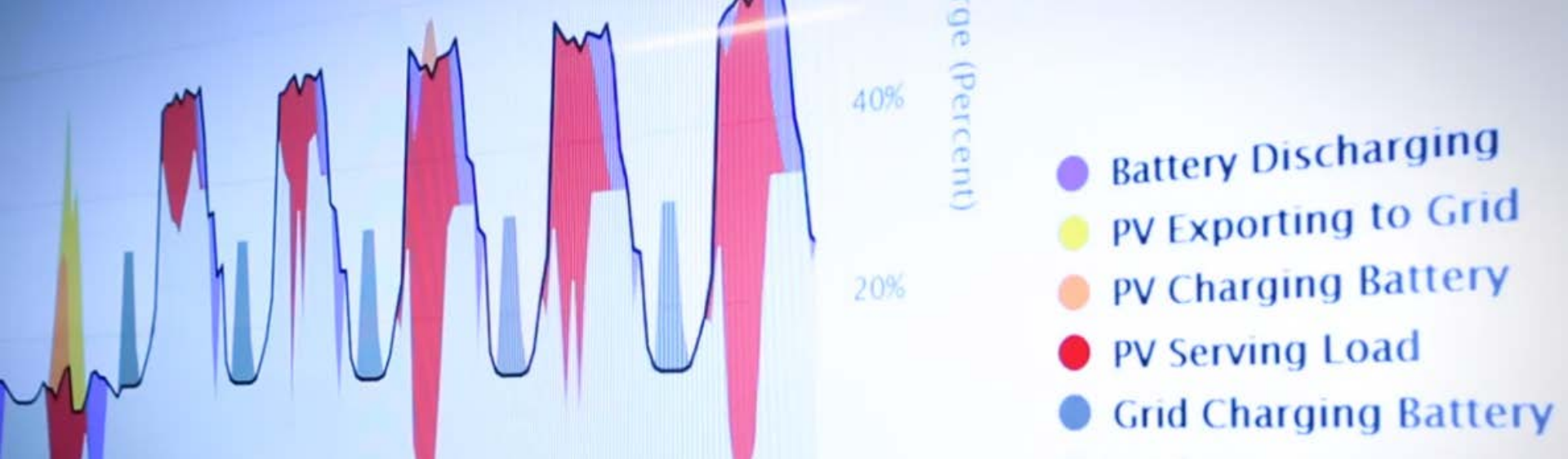
# Kate Anderson

Chief of Staff

Energy Systems Integration Directorate

National Renewable Energy Laboratory





# REopt Lite Web Tool Transforms Complex Decisions Into Actionable Results

- The free, publicly available web tool guides investment in economic, resilient energy technologies
- Transforms complex decisions into actionable results for building owners, utilities, and industry
- Integrating CHP enables analysis of hybrid CHP (CHP + PV, wind, and/or storage)
- Open Source API access to the tool enables analysis at scale



# Will Distributed Energy Work for Your Site?



Technology Costs  
& Incentives



Utility Cost &  
Consumption



RE  
Resource



Financial  
Parameters



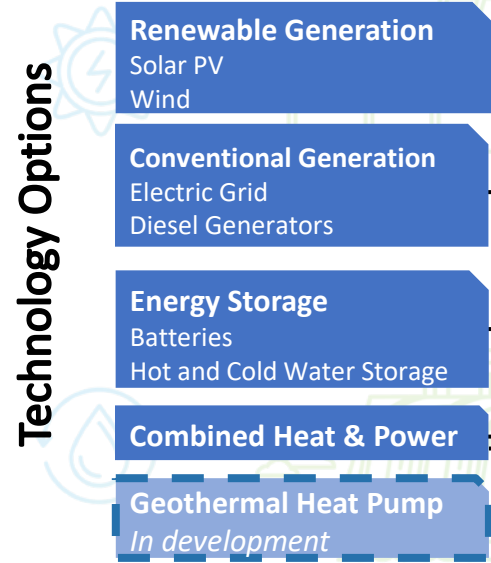
Resilience  
Goals

*Many factors affect whether distributed energy technologies can provide cost savings and resilience to your site, and they must be evaluated concurrently.*

# REopt Lite: Free Web Tool to Optimize Economic and Resilience Benefits of DERs

*Formulated as a mixed integer linear program, REopt Lite provides an integrated cost-optimal energy solution.*

## Drivers

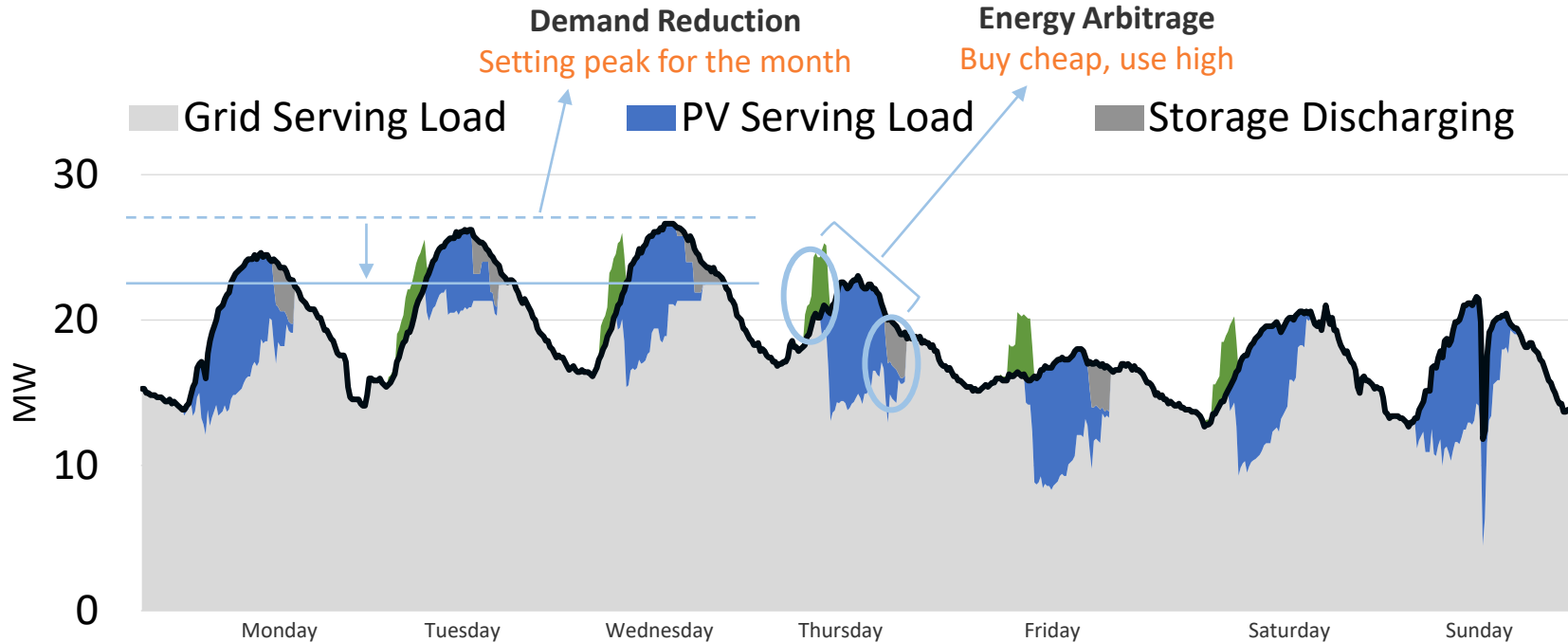


**REopt Lite**  
reopt.nrel.gov/tool



# How Does REopt Lite Work?

*REopt Lite considers the trade-off between ownership costs and savings across multiple value streams to recommend optimal size and dispatch*

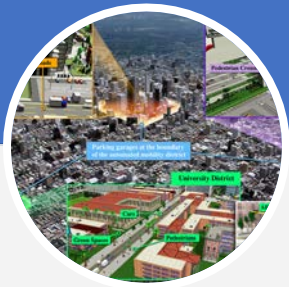


Example of optimal dispatch of PV and BESS



# REopt Lite Provides Solutions for a Range of Users

*Researchers, developers, building owners, utilities, and industry*



What is the optimal size of DERs to minimize my cost of energy?



How do I optimize system control across multiple value streams to maximize project value?



Where do market opportunities for DERs exist? Now and in the future?



What will it cost to meet a sustainability or on-site generation goal?



What is the most cost-effective way to survive a grid outage spanning 1 day? What about 9 days?



# REopt Lite

- **REopt Lite** is a web tool that offers a no-cost subset of NREL's more comprehensive REopt model
- **Financial mode** optimizes technology sizes and dispatch strategy to minimize life cycle cost of energy
- **Resilience mode** optimizes technology mix to sustain critical load during grid outages and to minimize life cycle cost of energy
- To access REopt Lite: <https://reopt.nrel.gov/tool>

## Step 1: Choose Your Focus

Do you want to optimize for financial savings or energy resilience?

Financial

Resilience



## Step 2: Select Your Technologies

Which technologies do you wish to evaluate?

PV

Battery

Wind

CHP

Chilled Water Storage

Existing boiler type and assumed CHP thermal production type

Hot water

Select additional CHP technologies to evaluate

Hot Water Storage

Absorption Chiller

## Step 3: Enter Your Site Data

Enter information about your site and adjust the default values as needed to see your results.

📍 Site and Utility (required)	+
📊 Load Profile (required)	+
💰 Financial	+
🔥 Emissions	+
⚙️ PV	+
🔋 Battery	+
🏠 Combined Heat & Power	+

# REopt Lite Key Outputs

## System Size and Net Present Value

Results for Your Site New Evaluation

These results from REopt Lite summarize the economic viability of PV, wind, battery storage, and/or CHP at your site. You can edit your inputs to see how changes to your energy strategies affect the results.

[Copy](#) [Download PDF](#)

**Your recommended solar installation size**

1,751 kW  
PV size

Measured in kilowatts (kW) of direct current (DC), this recommended size minimizes the life cycle cost of energy at your site.

This optimized size may not be commercially available. The user is responsible for finding a commercial product that is closest in size to this optimized size.

**Your recommended battery power and capacity**

328 kW  
battery power

1,557 kWh  
battery capacity

This system size minimizes the life cycle cost of energy at your site. The battery power (kW-AC) and capacity (kWh) are optimized for economic performance.

This optimized size may not be commercially available. The user is responsible for finding a commercial product that is closest in size to this optimized size.

**Your recommended CHP electric capacity**

392 kW  
CHP reciprocating engine size

Measured in kilowatts (kW) of alternating current (AC), this recommended size minimizes the life cycle cost of energy at your site.

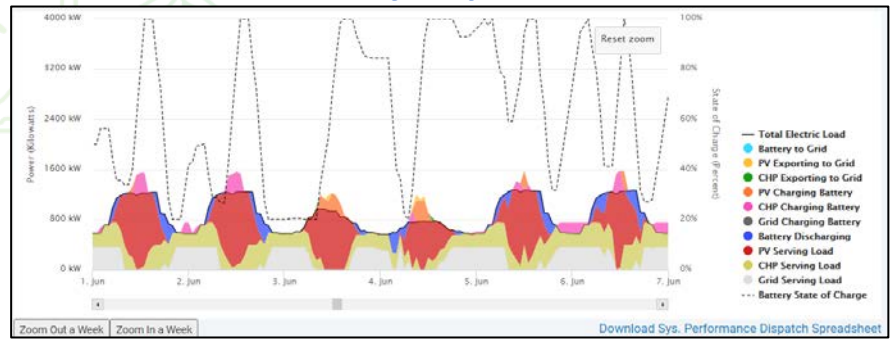
This optimized size may not be commercially available. The user is responsible for finding a commercial product that is closest in size to this optimized size.

**Your potential life cycle savings (25 years)**

This is the net present value of the savings (or costs if negative) realized by the project based on the difference between the total life cycle costs of doing business as usual compared to the optimal case.

\$2,813,245

## Hourly Dispatch



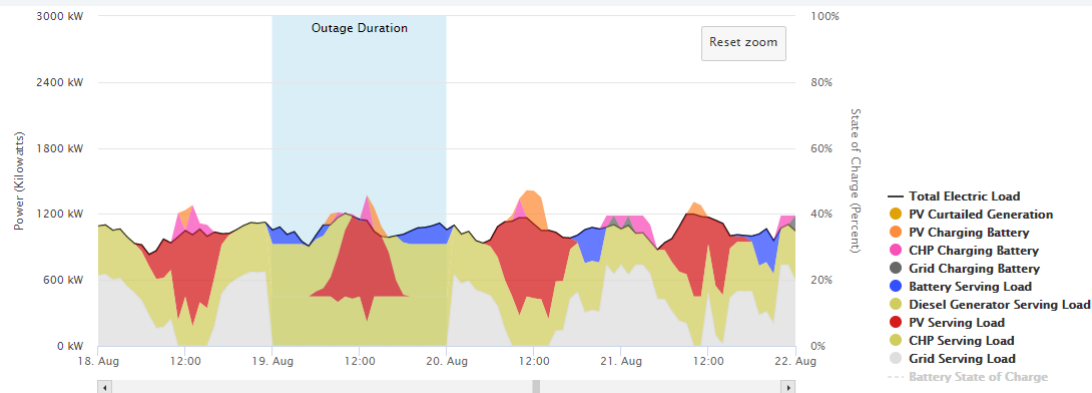
## Detailed Financial and Energy Outputs

Summary Financial Metrics				
<b>Total Upfront Capital Cost Before Incentives</b>		N/A	\$4,828,681	N/A
<b>Total Upfront Capital Cost After Incentives</b>		N/A	\$3,070,132	\$3,070,132
<b>Lifecycle O&amp;M and replacement costs, after tax</b>		N/A	\$1,399,584	\$1,399,584
<b>Total Life Cycle Costs</b>		\$15,056,424	\$12,243,179	\$2,813,245
<b>Net Present Value</b>		\$0	\$2,813,245	\$2,813,245
<b>Payback Period</b>		N/A	5.56 yrs	5.56 yrs
<b>PV Levelized Cost of Energy</b>		N/A	\$0.074	\$0.074
<b>Internal Rate of Return</b>		N/A	16.23%	16.23%

# Critical Infrastructure Resilience

- System designed to sustain 24-hour outage at wastewater treatment plant
- Free on-site biogas resource for CHP
- Adding hybrid CHP-PV-battery system provides economic savings and reduces diesel fuel use

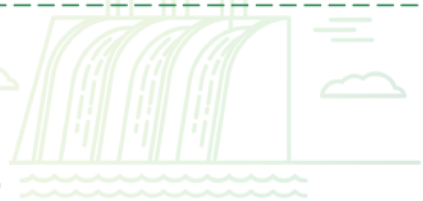
	Diesel Only	Hybrid System
System Size	1204 kW Diesel generator	478 kW Diesel generator 1,508 kW Solar PV 203 kW; 1279 kWh Battery 448 kW CHP
Net Present Value	-\$777,530	-\$57,009
Diesel fuel used	2,021 gallons	660 gallons





- REopt Lite (tool and help manual): [reopt.nrel.gov/tool](https://reopt.nrel.gov/tool)
- REopt website (analysis services and case studies): [reopt.nrel.gov/](https://reopt.nrel.gov/)
- Send tool feedback and ask a question: [reopt@nrel.gov](mailto:reopt@nrel.gov)

 **CONNECTING THE FUTURE**  
**AUGUST 2-6, 2021**



NREL/PR-5C00-80541



This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC06-08-0028308. Funding provided by the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Federal Energy Management Program. The views expressed herein do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.