REopt Model Background & Overview for ISWG

Emma Elgqvist, NREL
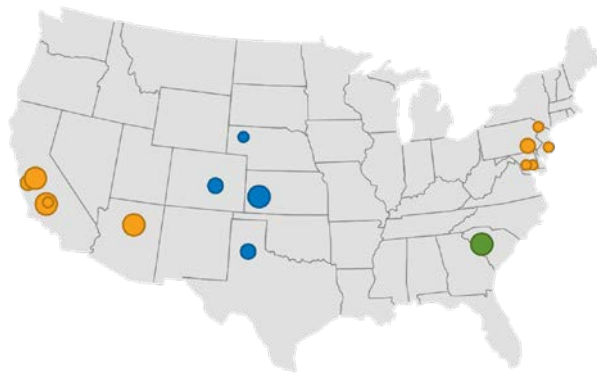
Rachel Shepherd, FEMP

December 7, 2017

REopt Integration and Optimization

Optimization • Integration • Automation

Master Planning	Economic Dispatch	Resiliency Analysis

- Portfolio prioritization
- Cost to meet goals

- Technology types & sizes
- Optimal operating strategies
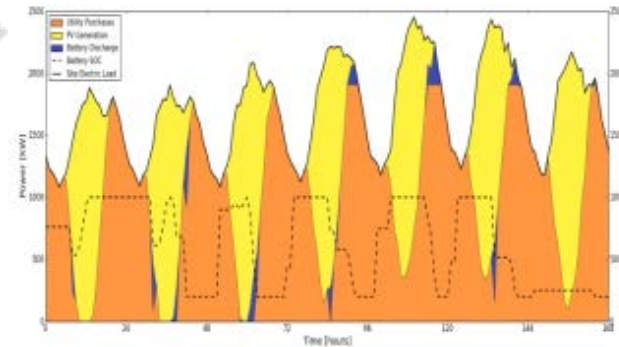
- Microgrid dispatch
- Energy security evaluation

Cost-effective RE at Army bases

Cost-optimal Operating Strategy
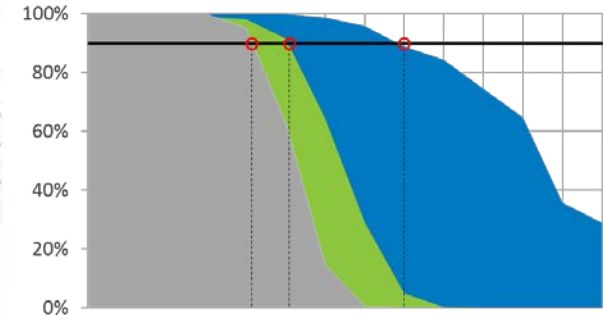
Extending Resiliency with RE

REopt Inputs and Output

Drivers

Resources

Goals
Minimize Cost
Net Zero
Resiliency

Economics
Financial Parameters
Technology Costs
Incentives

Utility Costs
Energy Charges
Demand Charges
Escalation Rate

Technology Options

Renewable Generation
Solar PV
Wind
Biomass, etc.

Conventional Generation
Electric Grid
Fuel Supply
Conventional Generators

Energy Storage
Batteries
Thermal storage
Water tanks

Dispatchable Technologies
Heating and Cooling
Water Treatment

Energy Conservation Measures

REopt
Energy Planning Platform
Techno-economic Optimization

Technologies
Technology Mix
Technology Size

Operations
Optimal Dispatch

Project Economics
CapEx, OpEx
Net Present Value

Optimized Minimum Cost Solution

Thermal Loads

**Electric Loads**

Water Demand

Loads

FEMP's Support of REopt

FEMP uses REopt to help agencies screen and evaluate renewable energy opportunities and focus resources on projects that have economic and technical viability.

REopt has been used to assess opportunities at over 10,000 sites, REopt analyses have supported decisions that led to more than 260 MW of renewable energy development.

- US Forest Service
- National Park Service
- Fish and Wildlife Service
- Department of Defense
- Department of Energy
- Department of Commerce
- Department of State
- General Services Administration
- US Department of Veteran's Affairs
- Department of Homeland Security
- US Department of Agriculture
- US Bureau of Reclamation
- Bureau of Land Management
- Indian Health Service
- Western Area Power Administration
- Navajo Generating Station

2007
2009
2011
2013
2015
2017
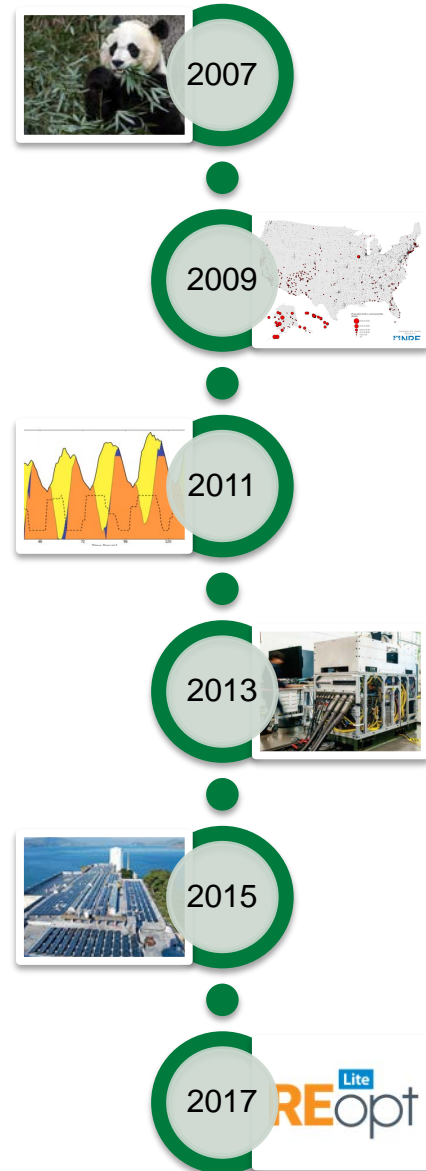
Developing the REopt Lite Web Tool

Mission

Provide access to a decision support tool for site-specific, optimized, and integrated analysis

Vision

Advance data-driven decision-making and deployment of renewable energy and energy storage technologies
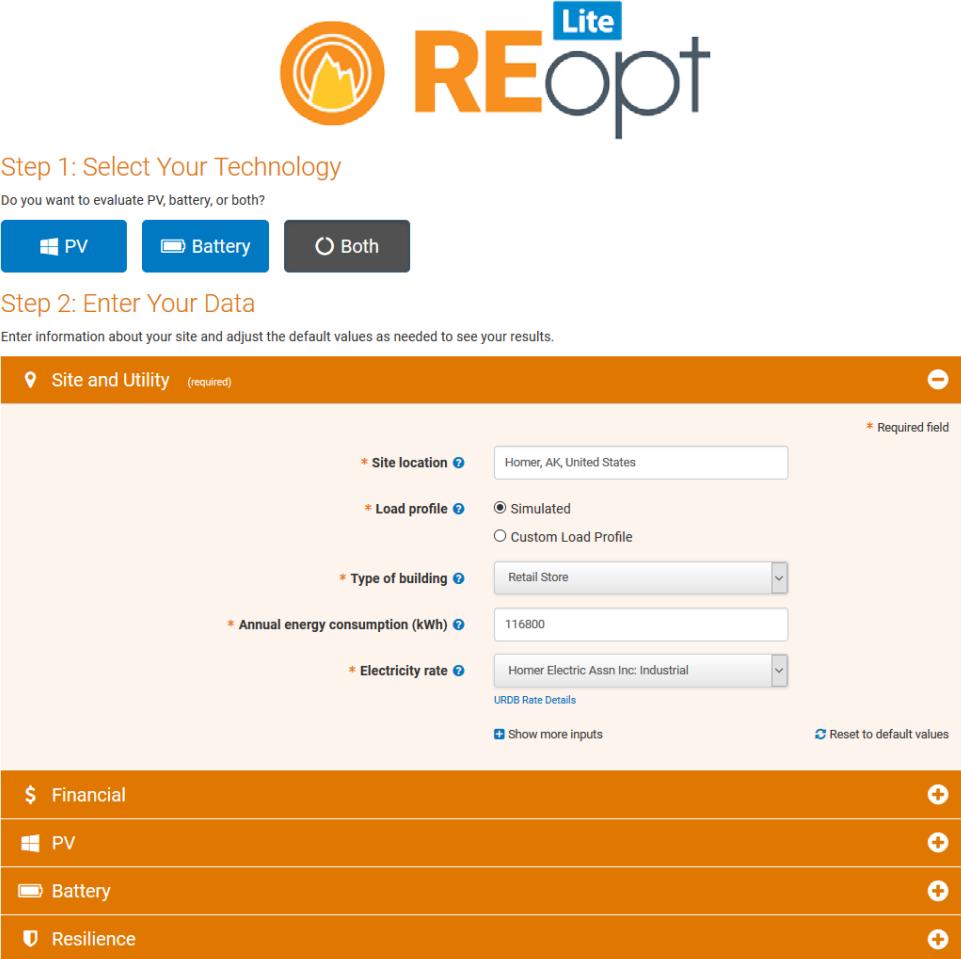
REopt Lite Web Tool Overview

Emma Elgqvist

REopt Lite Web Tool

- The REopt Lite Web Tool offers a no-cost subset of NREL's more comprehensive REopt model

- Beta version of web tool launched September 2017

- Evaluates the economics of grid-connected PV and battery storage at a site

- Allows building owners to identify the system sizes and battery dispatch strategy that minimize their life cycle cost of energy

https://reopt.nrel.gov/tool

REopt Platform vs. Web Tool Phase 1 Capabilities

	Current Platform Capabilities	Phase 1 Web Tool Capabilities
Technologies Evaluated	PV, SHW, SVP, Wind, Biomass, LFG, WTE, GSHP, Storage, Conventional reciprocating and combustion turbine generators	PV + Storage
Sites Evaluated	Multi-site	Single site
Load Types	Electric, thermal, interval data from actual load profiles or simulated from DOE commercial reference buildings, others for customized analysis	Electric only interval data or simulated from DOE commercial reference buildings
Rate Tariffs	Blended rates, simple rate tariffs, and custom rates entered by user	Rate tariffs selected from URDB
Resiliency Analysis	Simple outage analysis or complex stochastic outage modeling	Simple outage analysis

Required Site Specific Inputs

NATIONAL RENEWABLE ENERGY LABORATORY

Additional Inputs Can Be Edited, Or Left As Defaults

Summary Results Include System Sizes and Savings

Results for Your Site

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

◉ Edit Inputs

REopt **Lite**

⊞ Your recommended solar installation size ❓

392 kW
PV size

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

🔋 Your recommended battery power and capacity ❓

93 kW
battery power

342 kWh
battery capacity

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

💵 Your potential life cycle savings (20 years) ❓

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

$238,450

Additional Results Output: Economics Summary

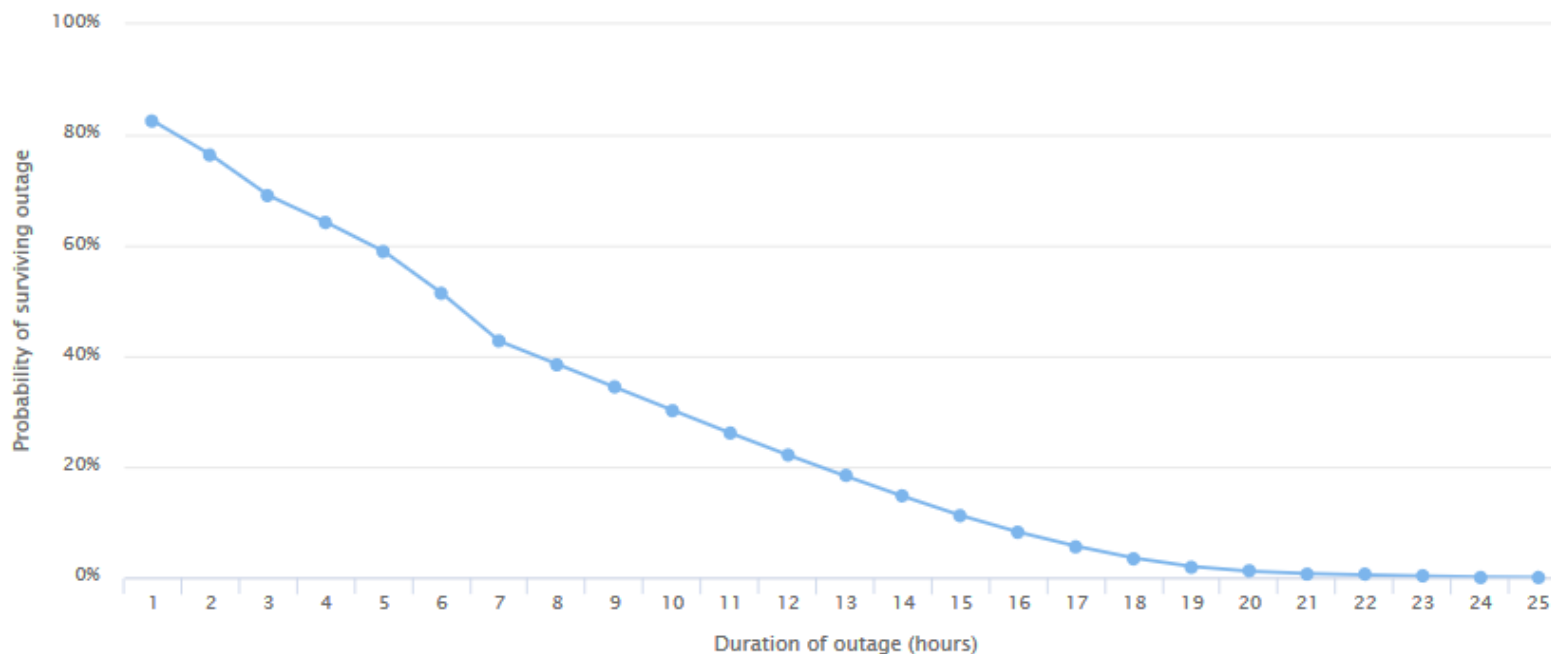|	Business As Usual	Optimal Case	Difference
System Size, Energy Production, and System Cost			
PV Size	0 kW	392 kW	392 kW
Annualized PV Energy Production	0 kWh	680,826 kWh	680,826 kWh
Battery Power	0 kW	93 kW	93 kW
Battery Capacity	0 kWh	342 kWh	342 kWh
DG System Cost (Net CAPEX + O&M)	$0	$526,342	$526,342
Energy Supplied From Grid in Year 1	1,000,000 kWh	358,623 kWh	641,377 kWh
Year 1 Utility Cost — Before Tax			
Utility Energy Cost	$118,263	$34,216	$84,047
Utility Demand Cost	$40,008	$18,623	$21,385
Utility Fixed Cost	$3,110	$3,110	$0
Utility Minimum Cost Adder	$0	$0	$0
Life Cycle Utility Cost — After Tax			
Utility Energy Cost	$857,868	$248,200	$609,668
Utility Demand Cost	$290,213	$135,089	$155,124
Utility Fixed Cost	$22,562	$22,562	$0
Utility Minimum Cost Adder	$0	$0	$0
Total System and Life Cycle Utility Cost — After Tax			
Life Cycle Energy Cost	$1,170,644	$932,194	$238,450
Net Present Value	$0	$238,450	$238,450

Download ProForma Spreadsheet

Simple Resiliency Evaluation

Outage Simulation

Evaluate the amount of time that your system can survive grid outages.

Average Resiliency ❓	7 hours
Minimum Resiliency ❓	0 hours
Maximum Resiliency ❓	25 hours

FY18 REopt Lite Development Plan

Task	Description
API	Expose API and provide wiki to call model via API
Resiliency	Expand resiliency analysis • Build up a critical load profile based on equipment • Model existing diesel and PV systems • Design system based on probability of sustaining critical load • Incorporate the value of lost load
User data storage	Allow user to retrieve and edit stored inputs for future analysis
Wind	Add wind technology
Custom utility rate	Allow user to enter custom utility rate tariff
Report	Downloadable sensitivity analysis report and dispatch strategy
User resources	Training materials and case studies

FY18 development funded by FEMP, and the Kresge Foundation through the Clean Energy Group

Resources

- REopt website: https://reopt.nrel.gov/

- REopt Lite web tool: https://reopt.nrel.gov/tool

- REopt technical report: https://www.nrel.gov/docs/fy17osti/70022.pdf

- REopt fact sheet: http://www.nrel.gov/docs/fy14osti/62320.pdf

REopt Website
https://reopt.nrel.gov/

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NREL

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