Onsite Energy Techno-Economic Analysis Using REopt

Industrial Energy & Decarbonization Office

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Abstract

Since 2019, the National Renewable Energy Laboratory (NREL) has collaborated with IEDO's Combined Heat and Power (CHP) Deployment Program and the CHP Technical Assistance Partnerships (TAPs) to expand the capabilities of NREL's publicly available REopt® tool for techno-economic analysis of onsite energy. As a result, capabilities to analyze heating and cooling loads and serve those loads with CHP were added to the REopt tool in 2021.

Currently, NREL is using REopt to evaluate the economics and feasibility of deploying distributed energy resources. To develop a deeper understanding of the requirements of the industrial sector, we have partnered with five such companies and are examining how REopt analysis can offer them aid. This collaborative venture serves as a foundation for our forthcoming technical support services. The analysis is based on location, site-specific load data, customized utility bill analysis, and other criteria such as resilience needs and decarbonization targets. The objectives of the current effort are to (1) assist manufacturers with analyzing onsite energy options, including CHP, solar photovoltaics (PV), wind, and battery storage, (2) validate the capabilities and use of REopt to provide technical assistance to manufacturers, and (3) publish case studies showcasing the engagement, key takeaways, and lessons learned.

NREL Transforming ENERGY

What Is REopt?

REopt

Inputs
- Distributed energy resources (DER)
- Site attributes
- Goals

Model
- Decisions
- Constraints
- Objective: Cost minimization

Results
- DER sizes
- Project economics
- Progress toward goals

Project Overview

Previous: Develop tools and analysis capability, partnering with IEDO and CHP TAPs

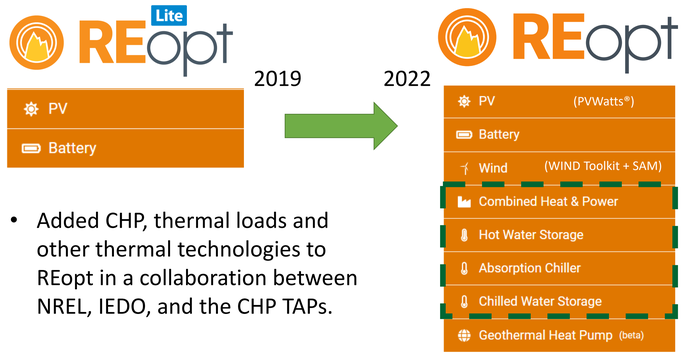
2023: Engage with industry to demonstrate technical assistance capabilities, publish case studies

Future: Outreach and training, develop new capabilities, support the onsite energy program

Alignment With Office Mission

This project supports industrial decarbonization and technology deployment by providing transparent analysis and tools to evaluate onsite renewable energy and storage options. These capabilities allow industry to cost-effectively meet their sustainability goals.

Tools and Developments



- Added CHP, thermal loads and other thermal technologies to REopt in a collaboration between NREL, IEDO, and the CHP TAPs.

Analysis Capabilities
1. Economics
2. Emissions
3. Resilience

Interfaces
1. Webtool (public access)
2. API (open source)
3. Julia package (open source)

Example Site and Scenario Analysis Results

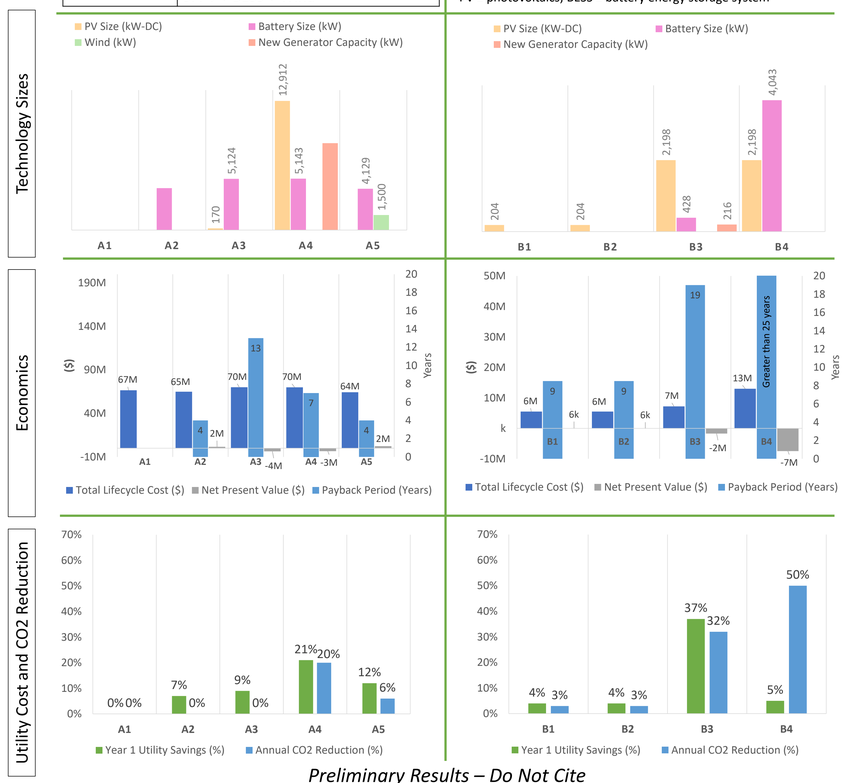
Site A Example Scenario Results:

1. PV	3. PV + BESS + 16-hour Resilience
2. PV + BESS	4. PV + BESS + 20% Emissions Target
	5. PV + BESS + Wind

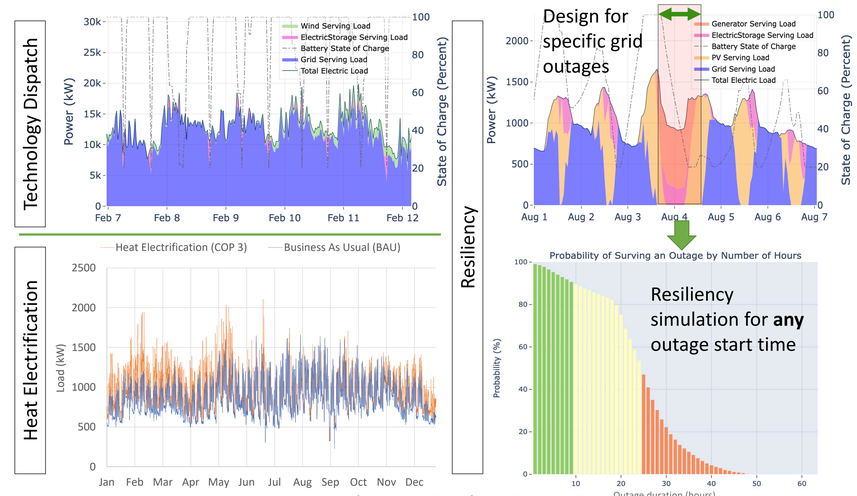
Site B Example Scenario Results:

1. PV	3. PV + BESS + 21-hour Resilience
2. PV + BESS	4. PV + BESS + 50% Emissions Target

PV = photovoltaics; BESS = battery energy storage system



Preliminary Results – Do Not Cite



Preliminary Results – Do Not Cite

Findings and Trends

- The recommendation of onsite energy technologies highly depends on the energy cost, load profile, financial parameters (such as discount rate), and the company's goals at their site.
  - Solar PV and wind are recommended when *energy* charges from the local electric utility is high. In contrast, battery storage is often driven by the *demand* charge reduction opportunity.
- When specific goals or constraints are layered on top of cost-savings, like ensuring a critical load is served during a grid outage or reaching a target reduction in emissions, REopt may find it necessary to include onsite energy technologies in the solution even if they are not cost-effective. In either case, REopt will determine the most economical way to meet the site's objective.

Key Achievements

- Initiated collaboration with five industrial partners to identify their unique goals, gather site data, and present analysis findings.

Future Work

- Continue engagement and collaboration with industry stakeholders and experts to perform technical assistance and identify gaps in analysis tool capabilities.
- Add capability to evaluate other technologies to reduce scope 1 emissions, such as electrifying process heating loads, using carbon-free fuels, and employing other clean heat strategies.
- Establish default cost and performance values for technologies appropriate for the scale of large industry consumers.

References

- REopt Web Tool: reopt.nrel.gov
- REopt API: github.com/NREL/REopt_API
- REopt Julia Package: github.com/NREL/REopt.jl

Acknowledgments

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