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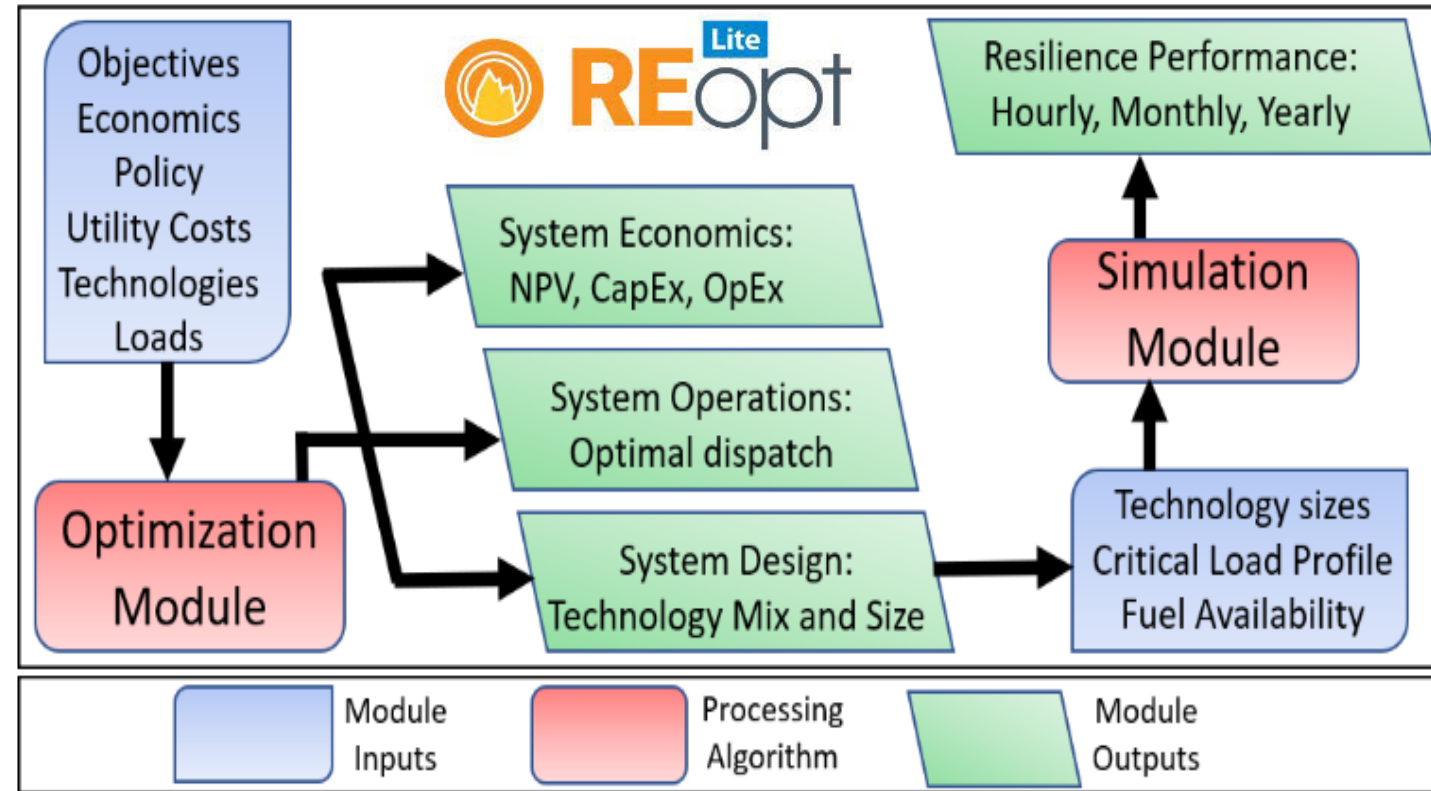


Probabilistic Resilience of DER Systems- A Simulation Assisted Optimization Approach

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Background

- Energy systems resilience is becoming more important as the frequency of major grid outages increases.
- We optimize behind-the-meter distributed energy resource systems to sustain critical loads during a specified grid outage using REopt Lite.
- Given a fixed system design, we use an outage simulator to estimate resilience beyond the fixed outage.
- We apply statistical analysis to understand how performance varies by hour, month, and year.

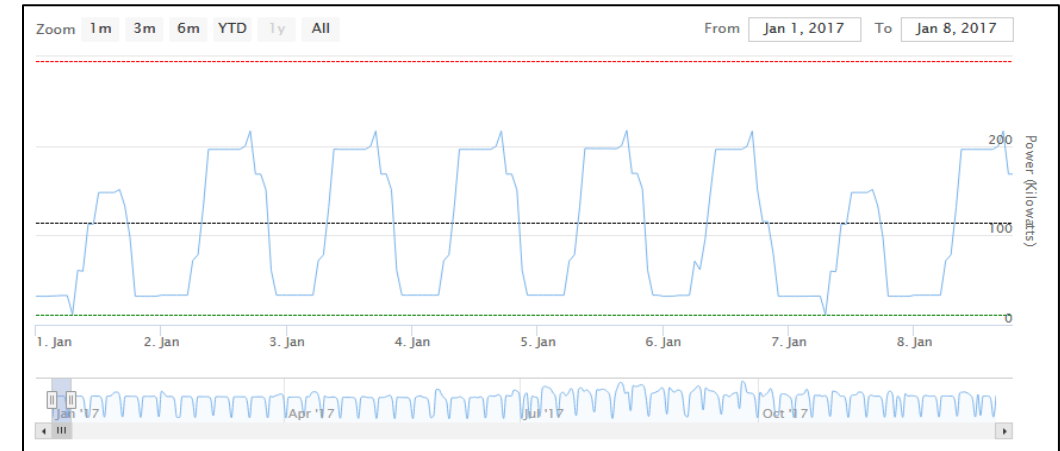


Results

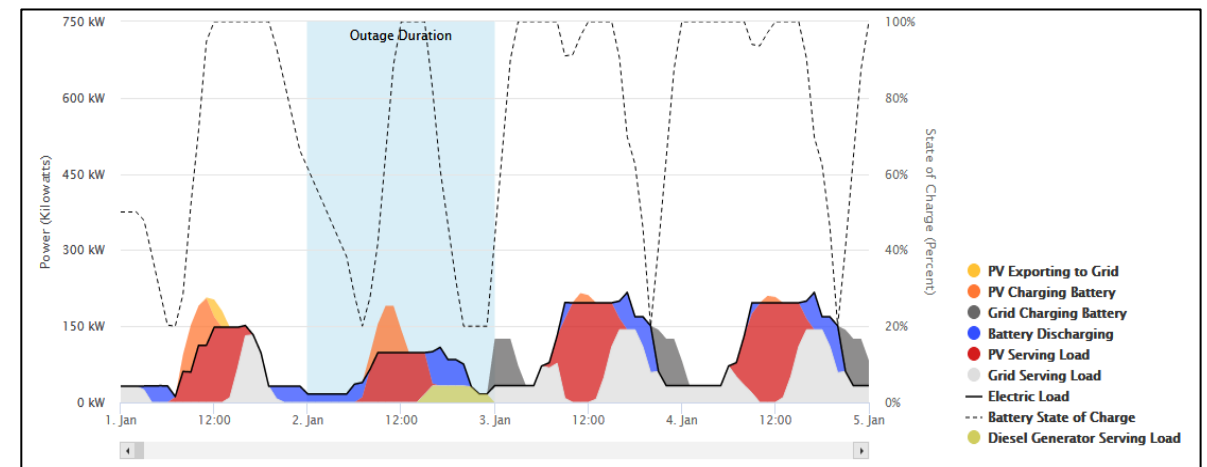
The model recommends the system that can meet the energy needs of the site at lowest lifecycle cost, while also sustaining the specified outage.

Outage	Optimal system
Scenario 1: Weekend (Jan 1)	375 kW PV 82 kW; 282 kWh battery 5 kW diesel generator
Scenario 2: Weekday (Jan 2)	386 kW PV 92 kW; 375 kWh battery 33 kW diesel generator

Load Profile, January 1-8

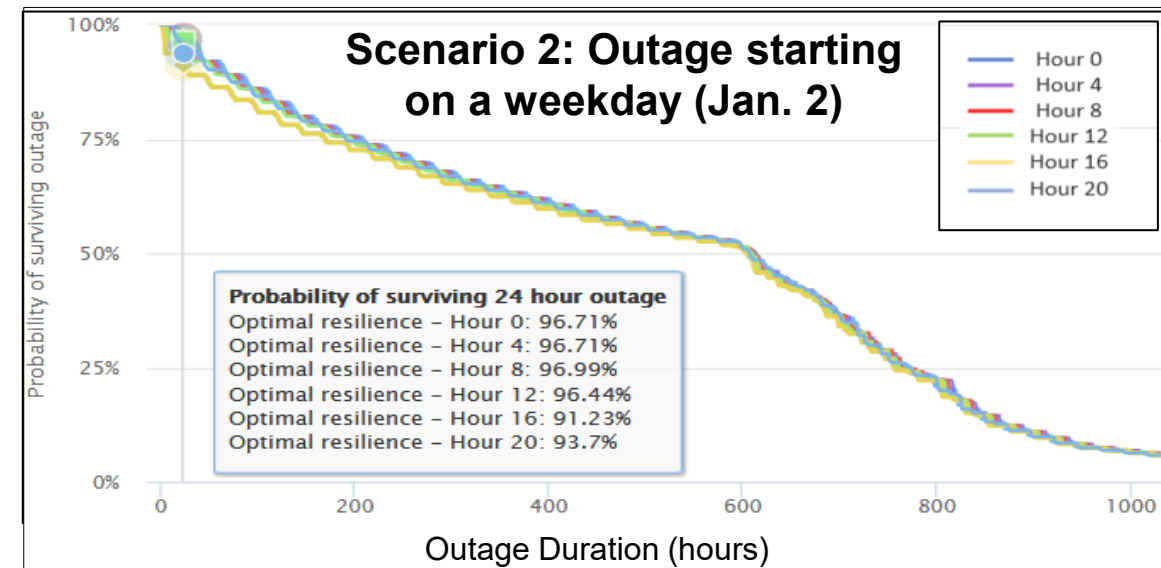
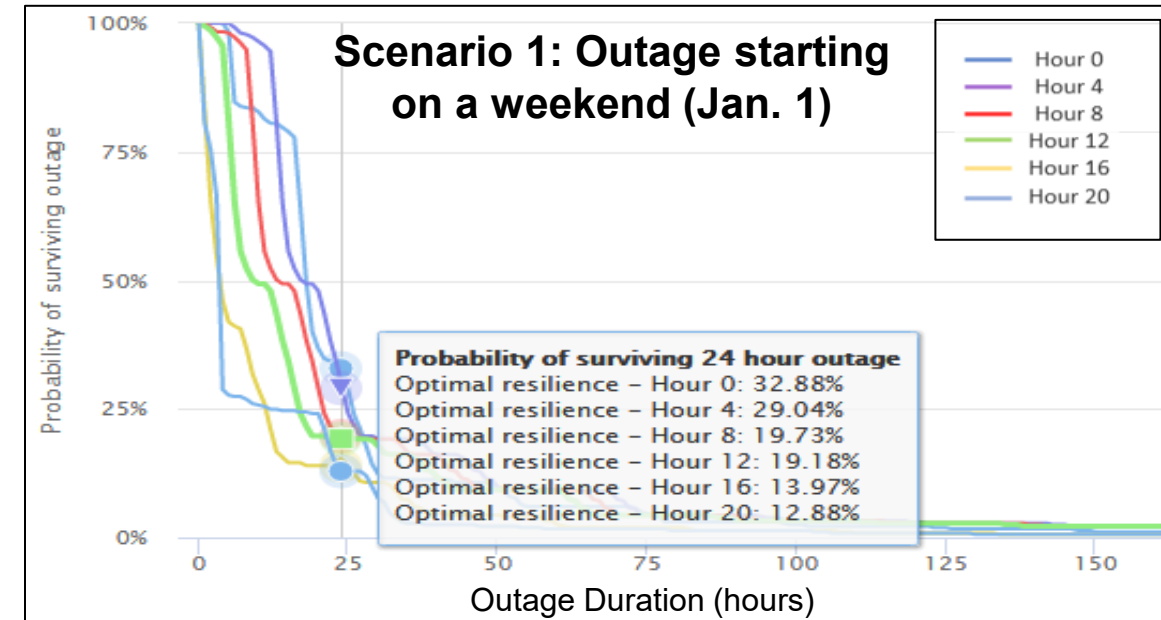


Dispatch strategy for weekday outage



Results

- The amount of time the system can sustain the critical load varies by the hour in which the outage starts.
- Systems designed for an outage starting on a weekend when the load is lower performed worse at other times of year.



Conclusions/Recommendations

- Evaluating system performance across a range of outages provides a more complete understanding of resilience benefits
- Future research will apply a stochastic approach to modeling the outage time and duration
- Future work will also consider uncertainty in the load and solar resource forecast
- This capability is free and publicly available through the REopt Lite Open Source model: <https://reopt.nrel.gov/tool>

Thank you!

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