

Storage Sizing and Placement in Distribution Grids

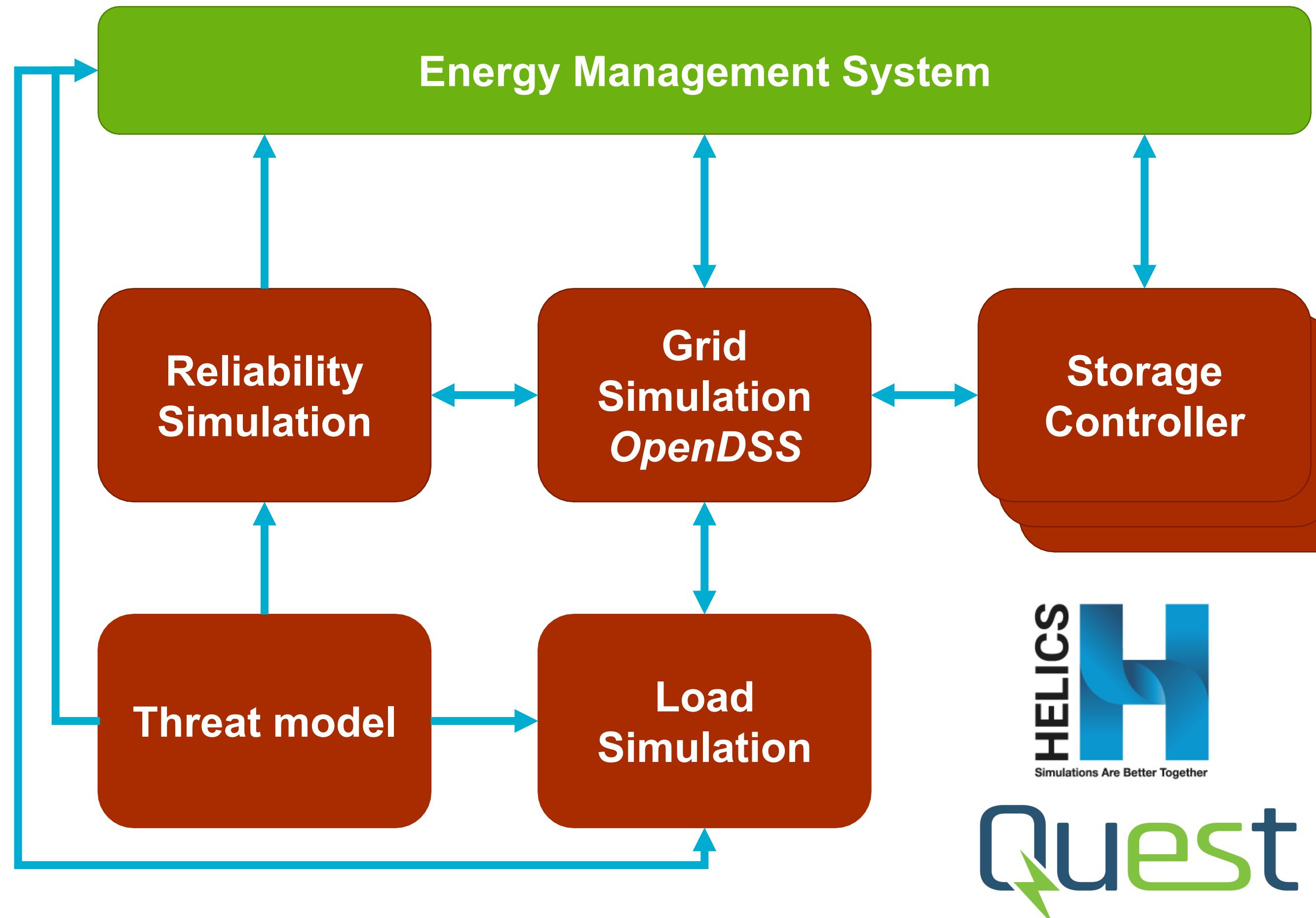
Will Vining, Ujiwol Tamrakar, John Eddy

Purpose

Identify optimal sizing and placement of Energy Storage assets on a distribution grid while considering:

- Grid physics
- Grid reliability
- Disruptions caused by extreme events

Disruptions caused by Simulation Overview

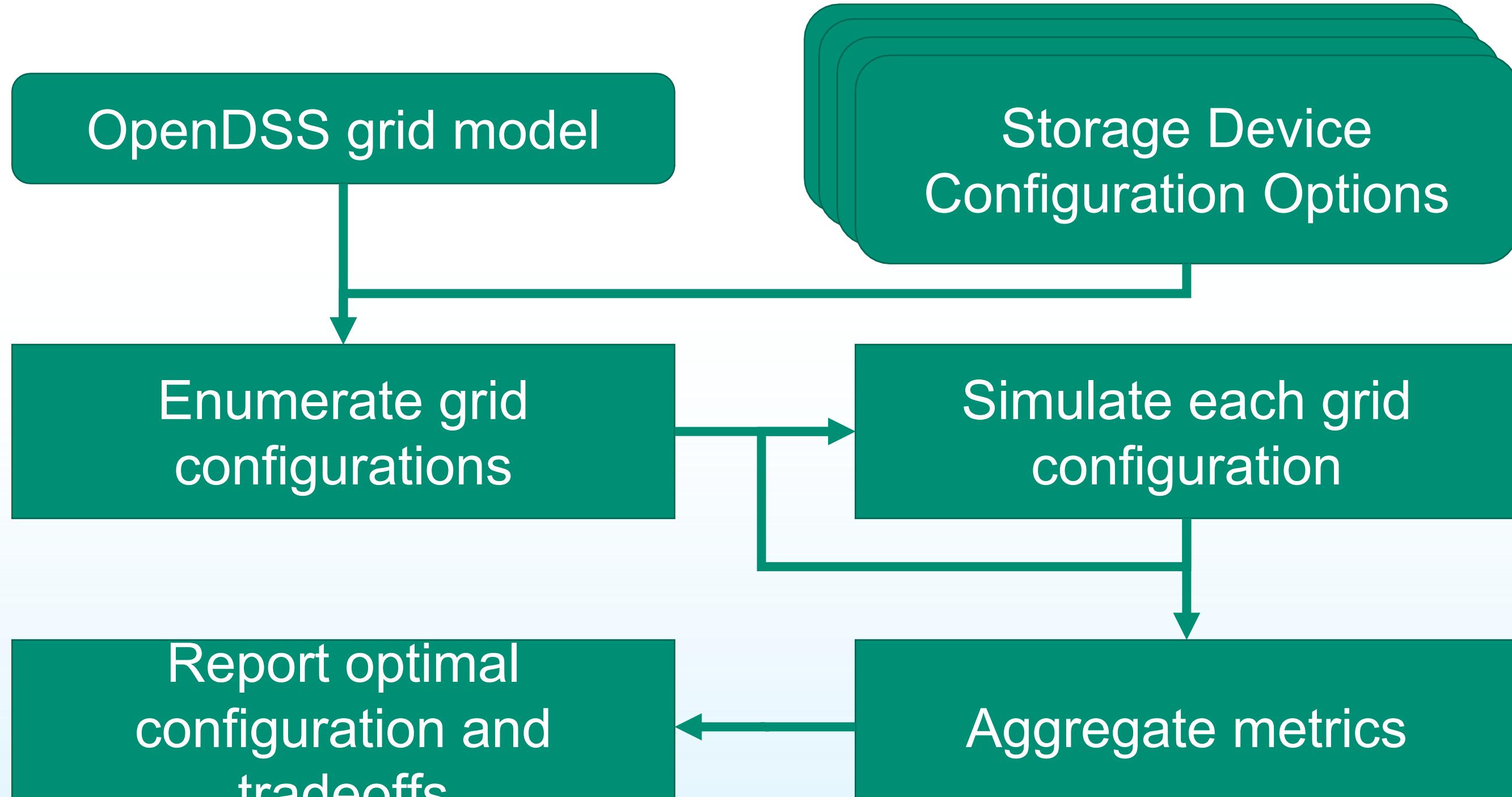


A HELICS-based co-simulation couples:

- OpenDSS grid simulation
- Grid reliability simulation
- Energy management system simulation
- Storage controller simulations

The simulation will be distributed as an *open source* component of Sandia's QuEST tool.

Analysis & Optimization Overview

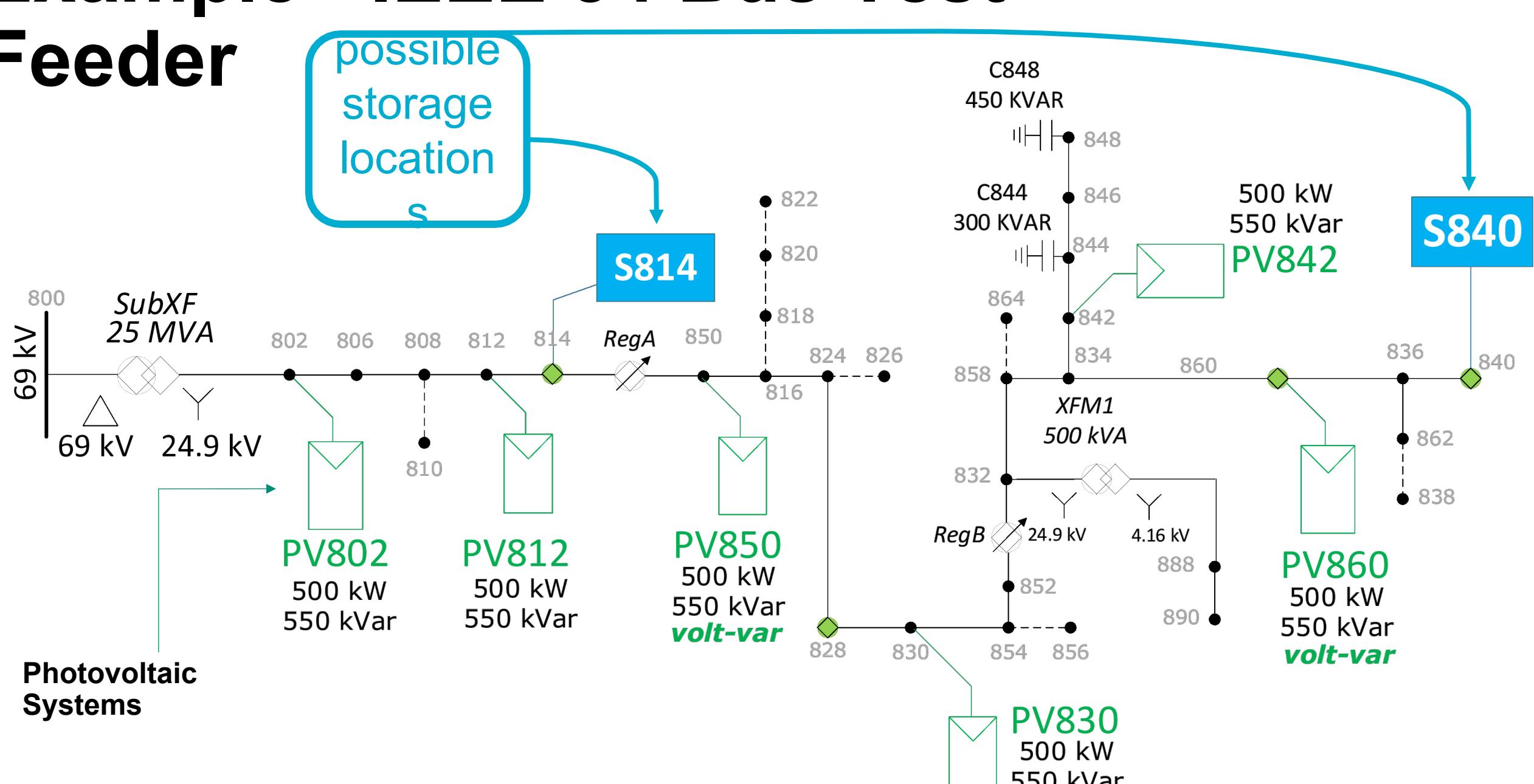


Metrics

- Metrics are captured and aggregated across the grid to quantify the impact of each storage configuration and allow comparison of different configurations.
- Metrics are normalized so that different quantities of interest can be compared directly. For example, voltage levels across the grid can be “traded-off” against line loading, energy service, or any other quantity of interest.

Example - IEEE 34 Bus Test

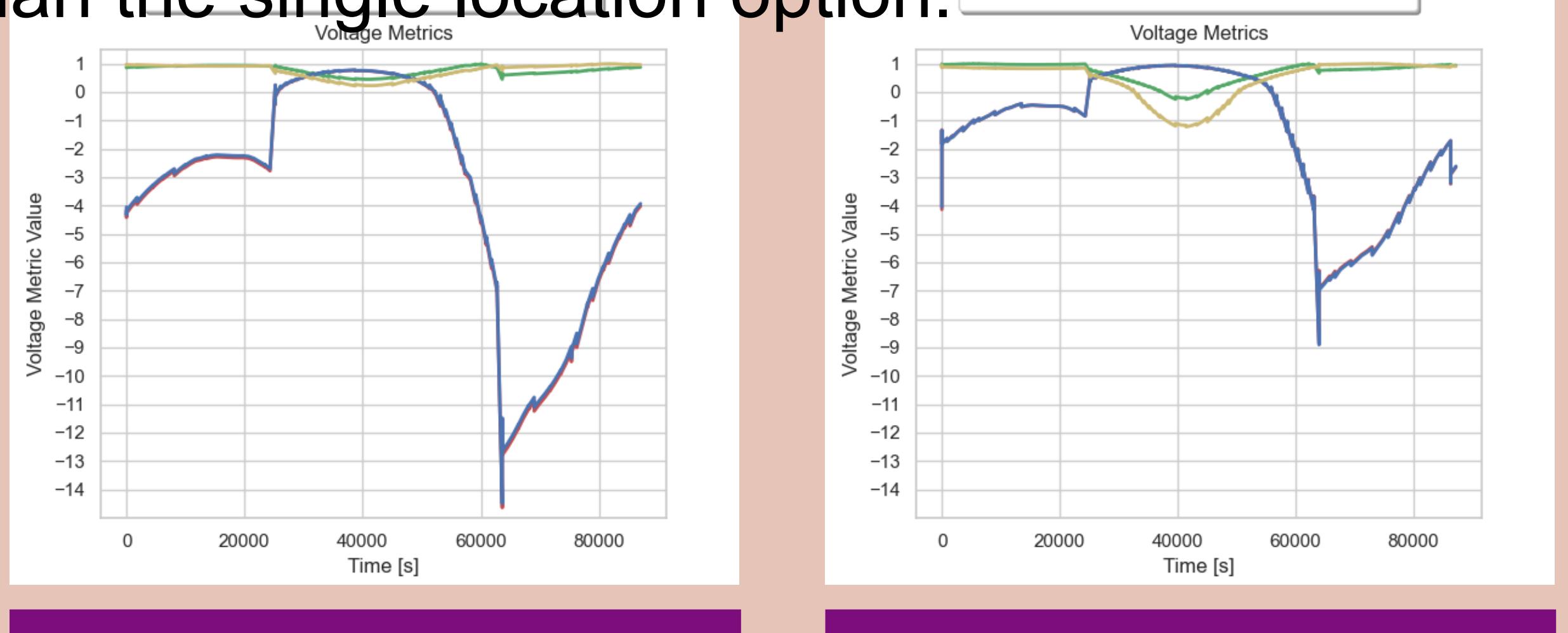
Feeder



Metrics for voltage quality at 4 busses from system.

The metric values become increasingly negative as the limits on voltage are exceeded.

The dual storage configuration performs better than the single location option.



Future Work

- Simulate building energy demand accounting for environmental and grid conditions.
- Simulate threats to the grid such as extreme weather.
- Include different energy storage controls as part of the optimization parameters

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