



Storage Sizing and Placement in Distribution Grids

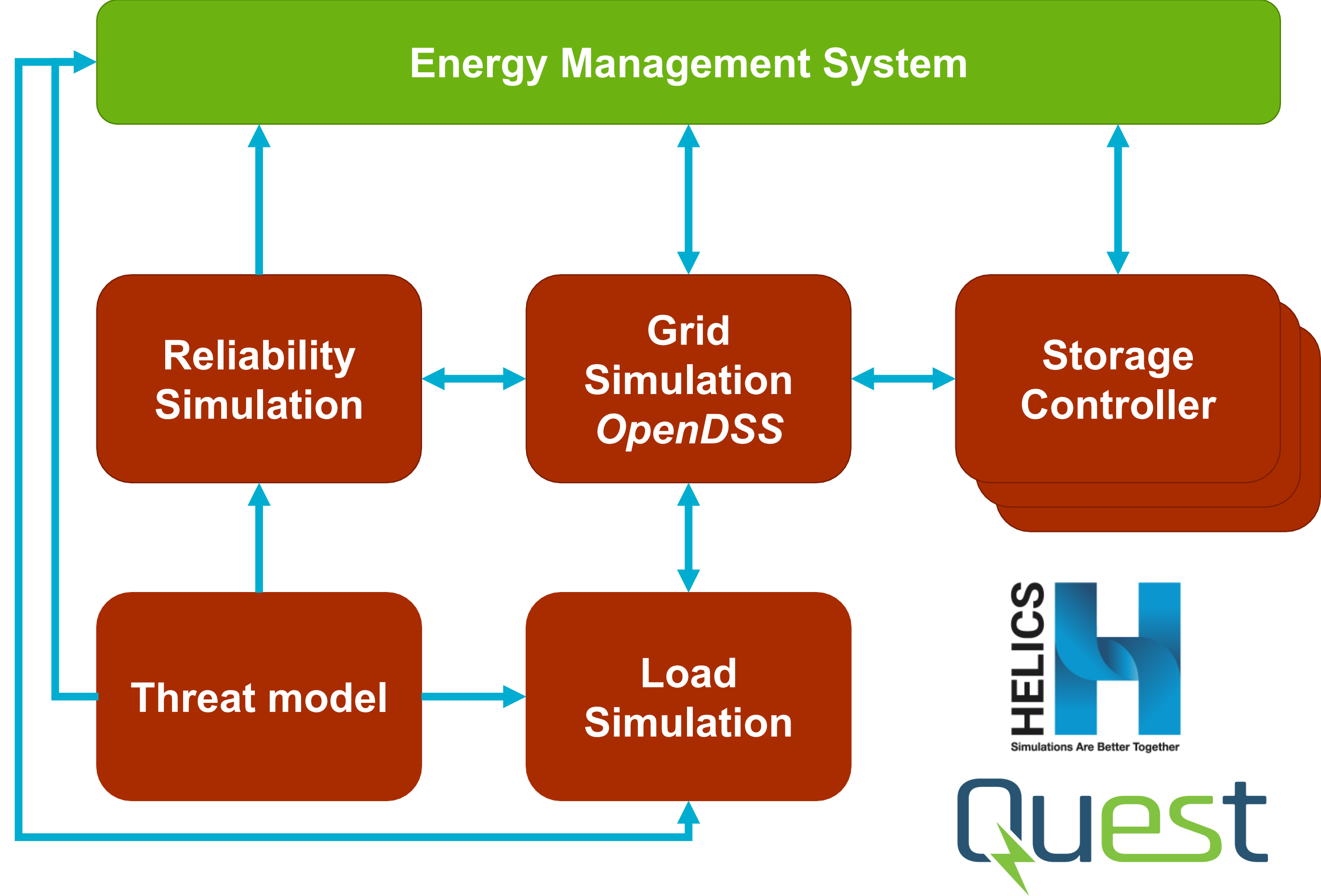
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Purpose

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

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

Simulation Overview

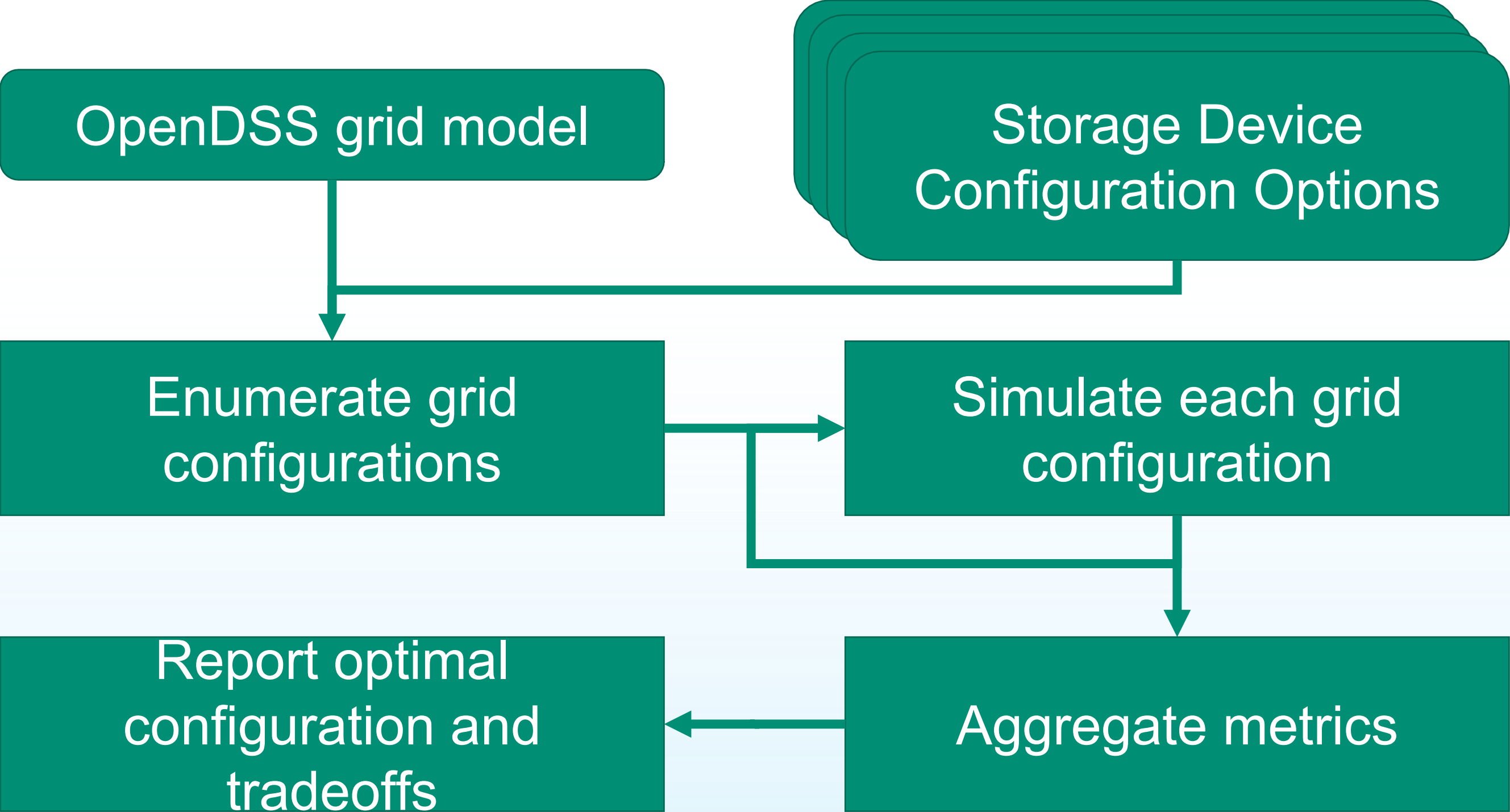


A HELICS-based co-simulation couples:

- 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.

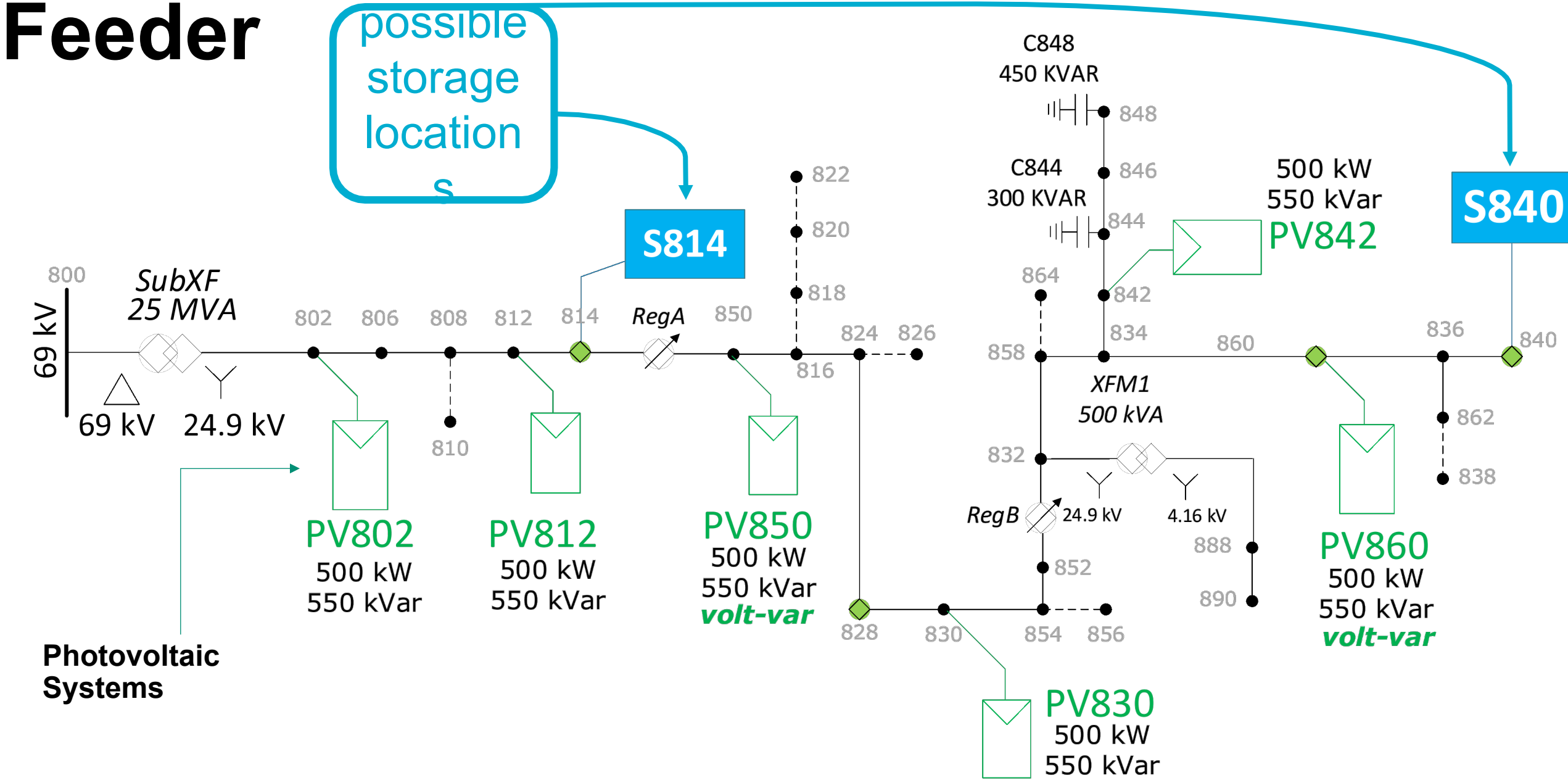
Analysis & Optimization Overview



Metrics

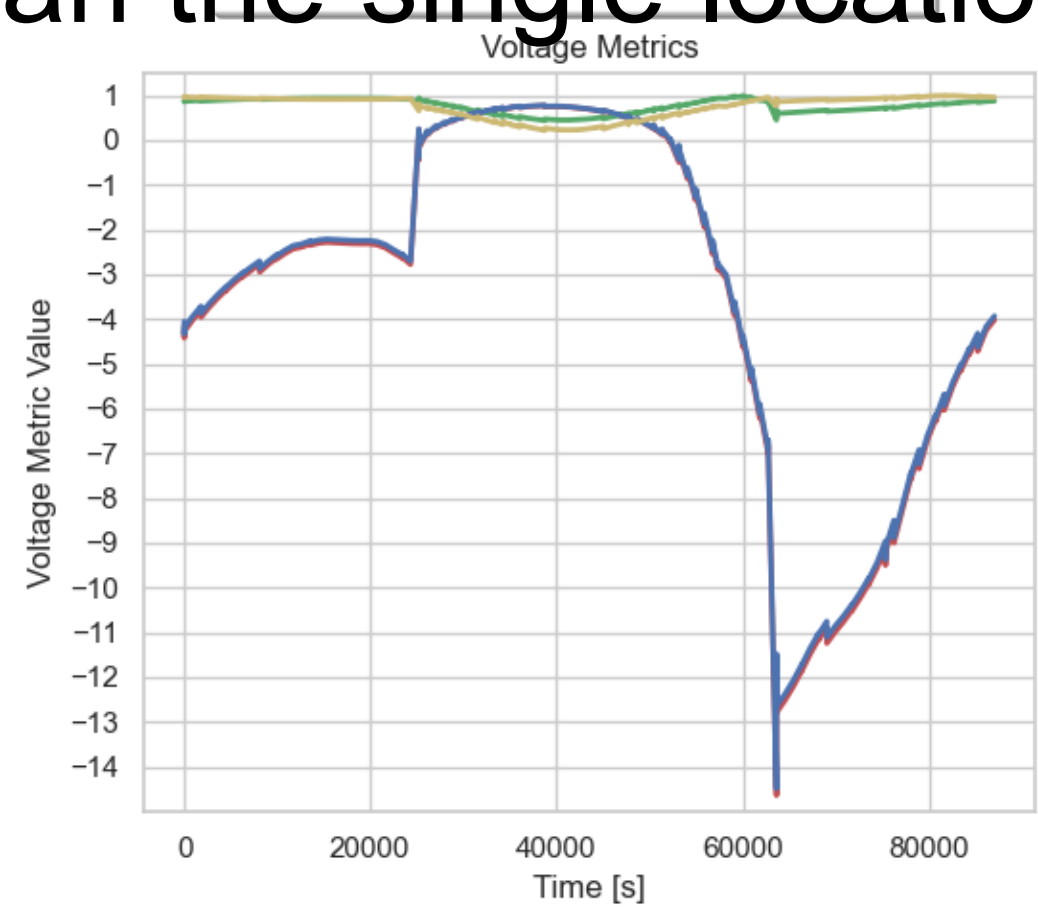
- Metrics are captured and aggregated across the grid to quantify the impact of each storage configuration and allow comparison of different configurations.
- Metrics are normalized so that different quantities of interest can be compared directly. For example, voltage levels across the grid can be “traded-off”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

Example - IEEE 34 Bus Test Feeder

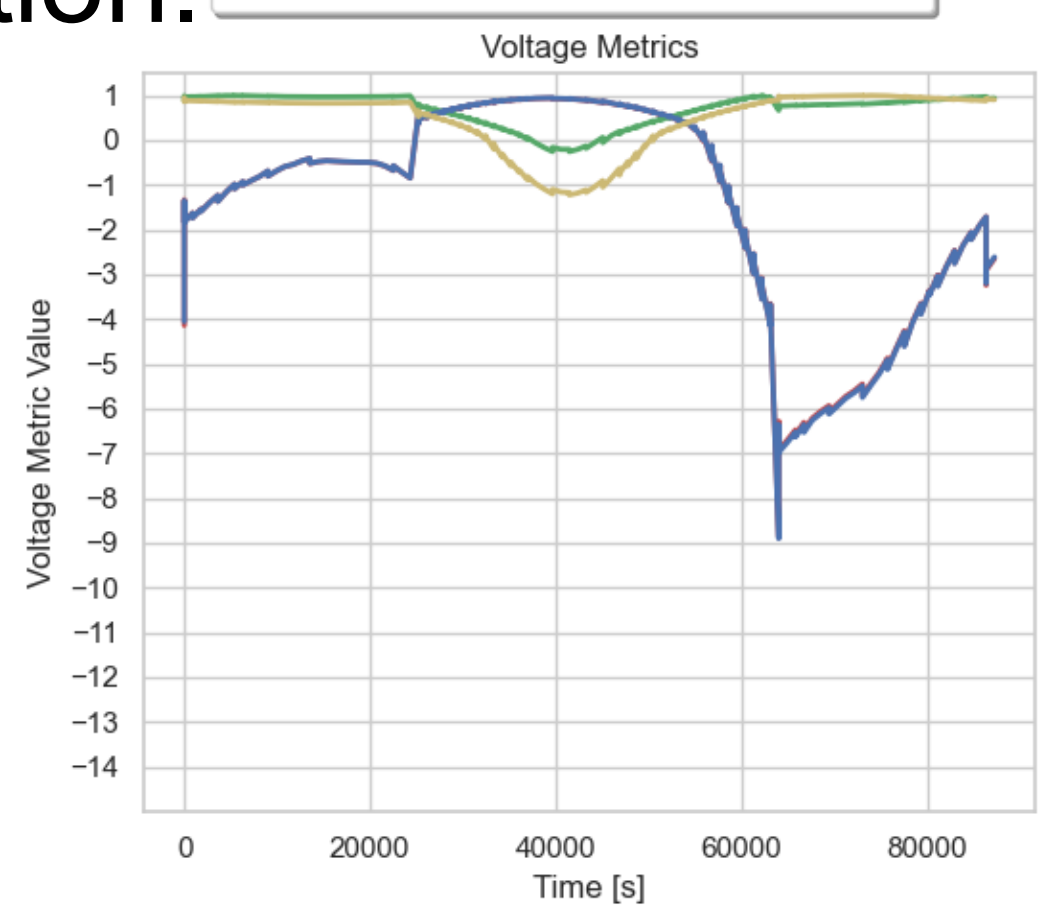


Metrics for voltage quality at 4 busses from system. The metric values become increasingly negative as the limits on voltage are exceeded.

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



Storage at bus 814 only



Storage at bus 814 & 840

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.

We would like to thank the DOE Office of Electricity energy storage program managed by Dr. Imre Gyuk for funding this work