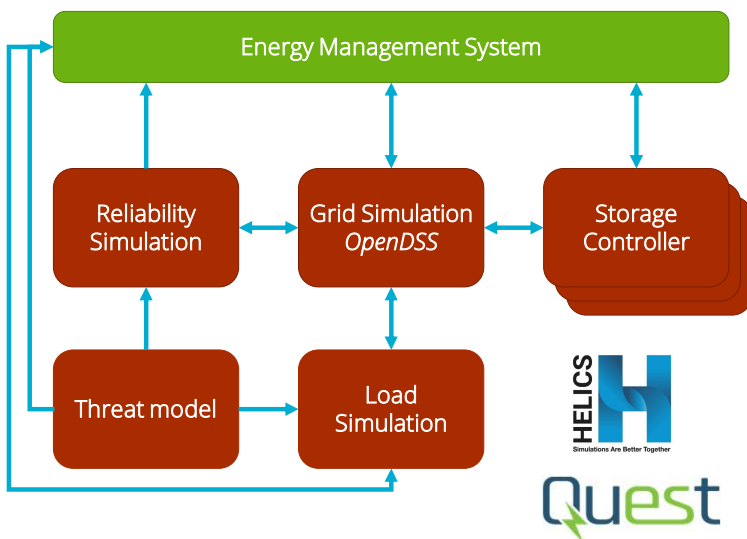


# Storage Sizing and Placement in Distribution Grids

Will Vining, Ujjwol Tamrakar, John Eddy

Identify optimal sizing and placement of Energy Storage assets on a distribution grid, incorporating considerations of:

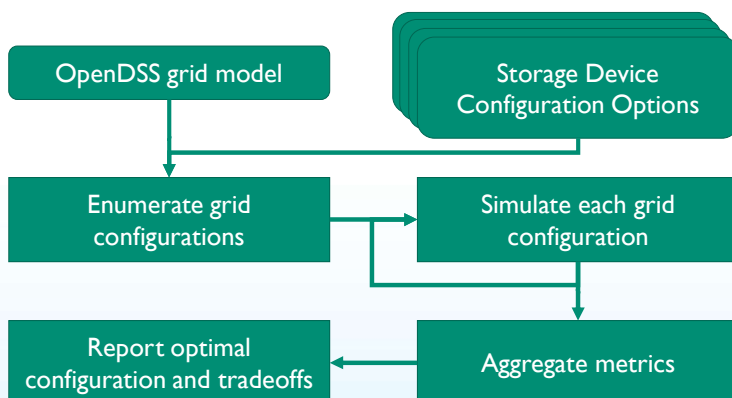
- Grid physics
- Grid reliability
- Disruptions caused by extreme events



A HELICS-based co-simulation couples:

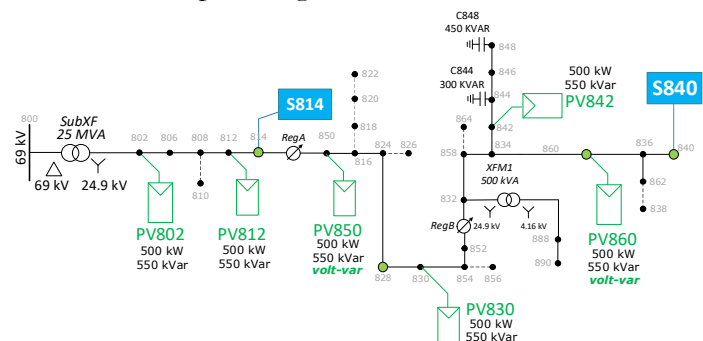
- OpenDSS grid simulation
- Grid reliability simulation
- Energy management system simulation
- Storage controller simulations

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



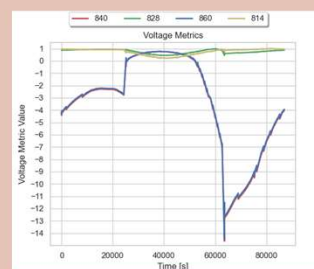
- Metrics are captured and aggregated across the grid to quantify the impact of each storage configuration and allow comparison of different configurations.
- Metrics are normalized so that different quantities of interest can be compared directly. For example, voltage levels across the grid can be “traded-off”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

Storage devices may be placed at bus 814 and bus 840 in this example using the IEEE 34 bus test feeder

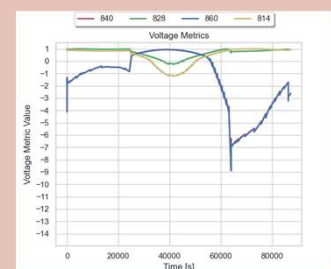


Metrics for voltage quality at 4 busses in the feeder above. The metric values become increasingly negative as the limits on voltage are exceeded.

The configuration shown on the right exhibits better performance.



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