



# Storage Sizing and Placement Tool in Distribution Grids

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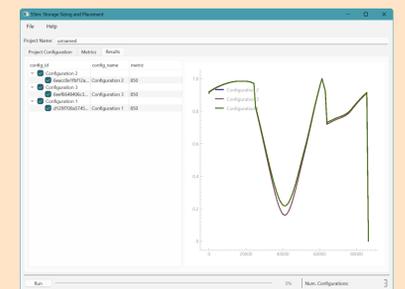
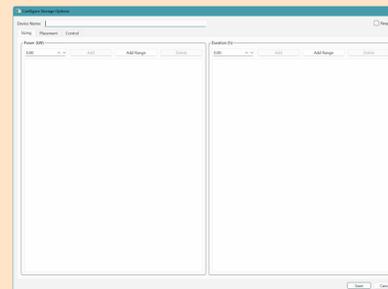
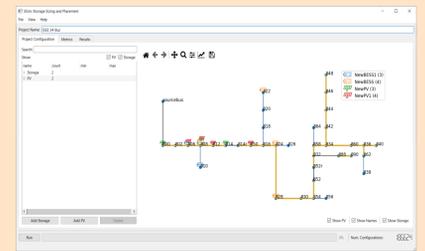
## Overview

- Identify optimal sizing and placement of Energy Storage and other DER 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
- Beta release: <https://github.com/sandialabs/quest-ssim>
- Has been integrated with Sandia's QuEST app suite



## Improved User Interface

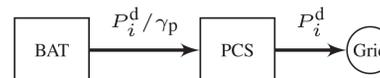
- Transitioned to a improved user interface
  - Modern, intuitive and user friendly
  - PyQT library used
  - Facilitates simplicity for future development



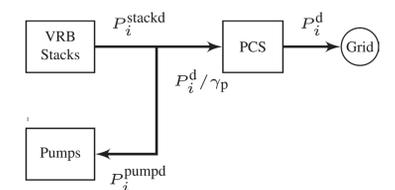
## Improved Energy Storage Models

- Technology-specific modeling capabilities added to the simulator
  - Better captures nonlinearities as the charge/discharge efficiencies of batteries in practice a function of SOC, temperature, and charge/discharge powers
- Lead acid, Li-ion, and Redox Flow batteries incorporated
  - Can be parametrized using nameplate or testing data of batteries
  - Capability will be expanded to other storage technologies
  - Add capabilities for user-defined storage models

### Lead-acid and Li-ion Batteries

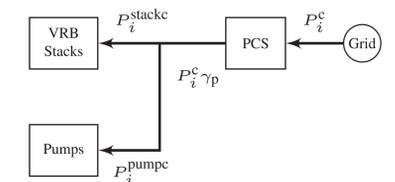
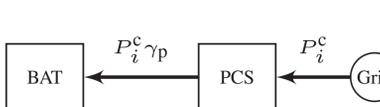


### Vanadium Redox Flow Batteries



Charge

Discharge

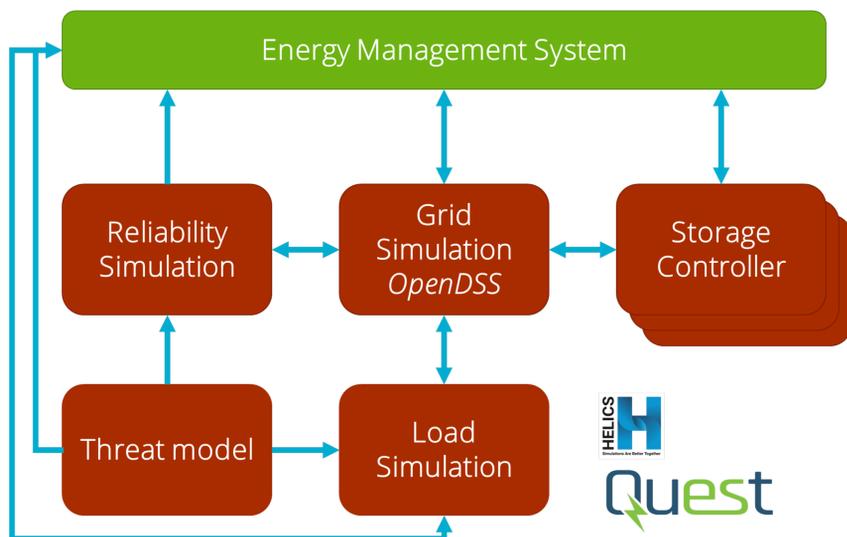


## Key Accomplishments

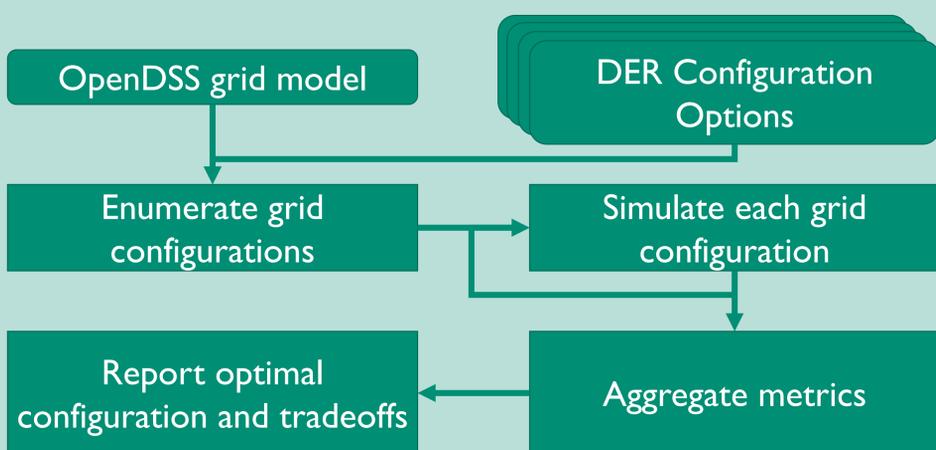
- Published and presented a conference paper at the IEEE EESAT conference
  - U. Tamrakar, W. Vining and J. Eddy, "An Open-Source Tool for Energy Storage Sizing and Placement in Electric Grids," IEEE Electrical Energy Storage Applications and Technologies Conference (EESAT), Charlotte, NC, USA, 2025.
- Beta releases have been downloaded 431 times over the last 6 months
- DOE MG-RAVENS (current), DOE UVM EnergyShed (Interest)

## Future Work

- Release new QT-based UI
- Incorporate new algorithms to automate optimization over configurations
- Build-out new case studies and examples showcasing advanced features
- Develop and integrate new metric types
- Develop more sophisticated EMS and threat modules
- Optimize to add ability to run longer simulations



## Storage Sizing and Placement Tool



- Metrics are captured and aggregated across the grid to quantify the impact of each storage configuration
- Metrics are normalized in such a way that different quantities of interest can be compared directly.