



STORAGE SIZING AND PLACEMENT TOOL IN DISTRIBUTION GRIDS (QUEST MICROGRID-SSIM)

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PROJECT PROFILE

Topic: Analytics & Tools | Vertical: Analytics
Strategic Pathway: Optimize
Project start and finish: FY21-FY26

PROBLEM

- Optimal energy storage sizing and placement tool required to ensure affordability, reliability and security
- 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
- Current tools are limited to low-fidelity grid models and cannot span multiple simulation domains

APPROACH

Simulation Architecture of QuEst Microgrid-SSIM

- QuEst-SSIM utilizes HELICS-based co-simulation to couple:
 - OpenDSS grid simulation
 - Grid reliability simulation
 - Storage controller simulations
- HELICS enables co-simulation across multiple domains and timescales
- Normalized metrics support optimization over multiple objectives

RESULTS

UI Improvements

- Completely revamped to a modern UI using PyQT
- Features added to improve usability and lower barriers for users:
 - Intuitive interface to configure storage and DER options/controls
 - Save and export functionalities
 - Improved visualization: Grid visualization, interactive plots
 - Error handling capabilities incorporated

Case Study

- Energy storage sizing and placement decision to improve voltage profile in a realistic grid model from city of Santa Fe, New Mexico
- Scenario: Loads and significant DERs causing voltage regulation issues

Option busses: ['11046', '10118', '11005', '10546']
Possible Sizes: 2 MW, 2h or 4h units
Volt-Var controls

Synthetic Grid Model of Santa Fe, NM
Source: Palmintier, B., Mateo Domingo, C., Postigo Marcos, F., Gomez San Roman, T., de Cuadra, F., Gensollen, N., Elgindy, T., & Duenas, P. (2020). SMART-DS Synthetic Electrical Network Data OpenDSS Models for SP2, GSG, and AUS. [Data set]. Open Energy Data Initiative (OEDI). NREL.

Configuration 7 with 2 MW, 4h BESS at Location 1 (10546) performed best

CONCLUSIONS & IMPACT

- Demonstrated capability of tool to provide analytics on sizing and placement decision in a realistic sized distribution network
- Initiated collaborations:
 - University of Utah using tool for energy storage research
 - DOE MG-RAVENS project
- Beta release: <https://github.com/sandialabs/quest-ssim>
 - ~1,100 downloads in the last year
- Has been integrated with Sandia's QuEst app suite

QuEst Microgrid

FUTURE DIRECTIONS

- Next beta release (v 1.0.0.beta5)
- Validate and expand feature through partnered real-world projects in collaboration with relevant stakeholders
- Seek opportunities to continue development for new features and usability improvements.

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