



Hawai'i Natural Energy Institute Research Highlights

Grid Integration

Automated Distribution Circuit PV Hosting Capacity Estimation

OBJECTIVE AND SIGNIFICANCE: This project aims to develop improved algorithms that significantly advance accuracy while reducing computation time for estimating the maximum capacity of distributed photovoltaic (PV) systems that can be effectively interconnected to utility secondary distribution services. The goal is to ensure that these systems can be integrated without compromising the safety, reliability, and quality of service for all customers, within the constraints of existing infrastructure and controls.

BACKGROUND: HNEI, as a subawardee to the University of Central Florida, participated in a U.S. Department of Energy (DOE) project titled "Sustainable Grid Platform with Enhanced System Layer and Fully Scalable Integration." Under this subaward, the team developed a stochastic analysis-based method for estimating PV hosting capacity of distribution feeders (Figure 1).

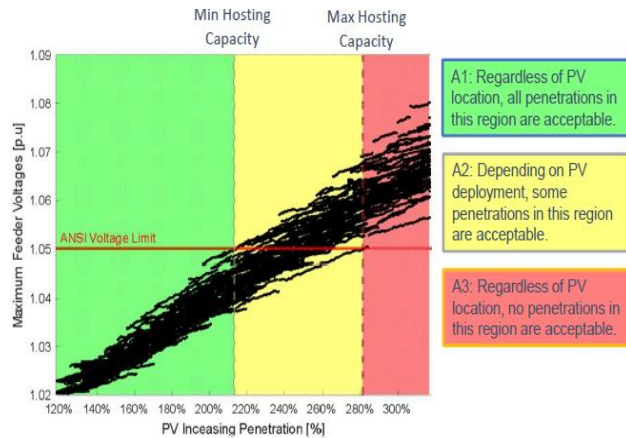


Figure 1. Schematic diagram of PV hosting capacity results.

PROJECT STATUS/RESULTS: HNEI's Grid System Technologies Advanced Research Team (GridSTART) successfully developed a novel two-phase PV hosting capacity analysis algorithm to improve efficiency and reduce computation time. The algorithm underwent rigorous testing across various distribution and low-voltage networks, considering multiple grid operational constraints including admissible voltage limits, unbalanced voltage limits, thermal overload of distribution components, substation overloads, and power losses. This thorough and systematic evaluation ensured the

algorithm's effectiveness across different network scenarios and operational conditions.

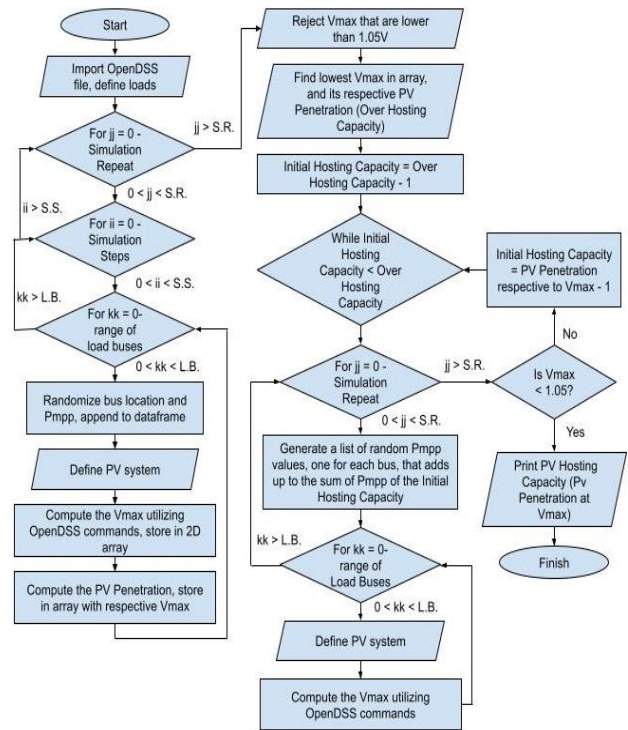


Figure 2. Flow chart of the new two-phase PV hosting capacity analysis algorithm.

The project provided valuable educational opportunities for an engineering undergraduate student to gain practical experience in distribution grid fundamentals, operational standards, OpenDSS software utilization, and Python programming for OpenDSS integration.

The research culminated in a conference paper presentation at the 2024 IEEE International Conference on Environment and Electrical Engineering and 2024 Industrial and Commercial Power Systems Europe (June 17-20th, 2024) and is pending publication in the IEEE Xplore digital library. The project is now complete following the conference's paper presentation and publication.

Funding Source: Office of Naval Research

Contact: Leon Roose, lroose@hawaii.edu

Last Updated: November 2024