

Project Overview

Oahu Distributed PV Grid Stability

Study Part 3: Grid Strength

Anticipated Completion: March 2017

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**Prepared for:
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Introduction

The Hawaii Natural Energy Institute retained GE Energy Consulting to conduct a technical assessment of the Oahu power grid with the goal to utilize power system models to understand and quantify the impact of increasing variable renewable energy technologies, specifically distributed photovoltaic (DPV) energy, on system stability, reliability, and economics. This multi-faceted project covers several topics of renewable integration.

The first two phases have been completed and final reports, *Oahu Distributed PV Grid Stability Study Part 1: System Frequency Response to Generator Contingency Events*, and *Oahu Distributed PV Grid Stability Study, Part 2: System Frequency Response to Load Rejection Events*, are available on the HNEI website at <http://www.hnei.hawaii.edu/publications/project-reports#HESP>. The third phase is underway to assess grid strength.

Phase 3 Project Outline

As power electronic sources of generation (such as wind, solar, and battery energy storage) increase on a grid, the amount of generation from conventional synchronous generators (gas turbines, steam turbines, etc.) is reduced. Strong grids are those with many synchronous machines, where each synchronous machine acts as an “anchor” to fix the grid voltage at a selected value and oppose sudden changes in the voltage of the grid at locations close to the synchronous machine. Conversely, “weak grids” are those in which there are relatively few synchronous machines online. These weak grids have fewer “voltage anchors,” which leaves them susceptible to larger fluctuations in voltage during disturbances and poses challenges to stable operations of the grid and sustaining power transfer.

The objective of this third phase of the study is to evaluate the trends in grid strength across the Oahu power system as additional distributed PV is added. It is intended to be an exploratory analysis only. Quantifying grid strength related risk across an entire power system is a relatively new endeavor and more information on the performance of DPV inverters is required before full conclusions can be made, minimum thresholds can be drawn, and requirements can be codified. Instead, this study is intended to increase awareness around weak grid issues on Oahu, illustrate the trends with increased DPV additions, and to outline a series of next steps to investigate further.

The final report, *Oahu Distributed PV Grid Stability Study Part 3: Grid Strength* will be posted to the HNEI website upon completion, at <http://www.hnei.hawaii.edu/publications/project-reports#HESP>, estimated for March 2017.