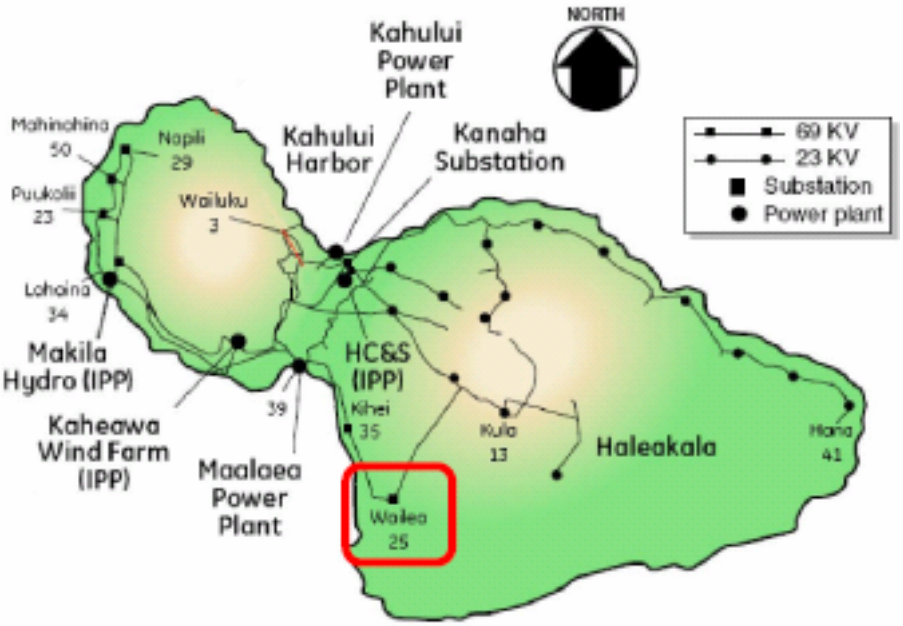
University of Hawaii RDSI Demonstration Project
"Managing Distribution System Resources for Improved Service Quality and Reliability, Transmission Congestion Relief, and Grid Support Functions"



"

University of Hawaii Project Overview

The overarching project objective is to develop and demonstrate a Distribution Management System (DMS) that aggregates distributed generation (DG), energy storage, and demand response technologies in a distribution system to achieve both distribution and transmission level benefits. Ideally, the application of these technologies would increase system reliability and improve power quality along with reducing costs to both the utility and its customers.

The project will contribute to DOE's mission in two ways. First, achievement of the project objective should provide new insights on how to substantively reduce peak demand. Second, the project should also provide solutions to achieving higher percentages of as-available renewable energy systems on the grid without decreasing grid reliability and stability.

DOE Renewable and Distributed Systems Integration (RDSI) Demonstration Projects

In 2008, DOE selected nine microgrid projects for federal funding, totaling $55 million over five years. The objective of these Renewable and Distributed Systems Integration (RDSI) Demonstration Projects is to increase the use of renewable and distributed generation and decrease peak loads on a distribution feeder by 15%. The systems can operate in both grid parallel and islanded modes. The projects are aligned with RDSI goals of increasing reliability, reducing emissions, using fuel more efficiently, resolving cyber system vulnerabilities and allowing consumers to manage their energy costs. Five

of the projects are in the western half of the continental U.S., three are in the eastern half, and one is in Hawaii.

Project Criteria: Six Critical Elements

The University of Hawaii's Smart Grid project can be aligned with the six critical elements that EPRI has identified as key criteria to achieve the goals of its five-year Smart Grid Initiative.

Integration of multiple distributed resource types

To further expose issues that need to be addressed and enable widespread integration of DER.

In Hawaii, almost all power is oil-fired. Hence, generation resources are driven by oil prices. 30 MW of wind resources have been installed on Maui, and another 40 MW are possible. For the total Hawaiian Electric company service region (Oahu, Maui, and the Big Island), the amount of photovoltaics (PV) installed in 2007 was greater than the sum of PV installations in the three previous years combined. Then, in the first half of 2008, the same amount of PV as in all of 2007 was installed. The fluctuations of both wind and PV lead to frequency excursions and voltage sags that can be significant.

A single distributed resource solution is not the answer in Hawaii; an integrated solution is needed. The specific types and amounts of distributed resources to be demonstrated will be defined at the conclusion of the first phase. However, it is highly likely that a diverse set of renewable and other distributed generation, demand response, and various storage technologies will be incorporated into the project. A key aspect is to address the variability of renewable resources in order to avoid negatively impacting grid stability.

Application of critical integration technologies and standards

To identify gaps associated with standards, harden critical integration technologies, and advance adoption.

This project will emphasize interoperability and vendor-agnostic solutions. Due to the legacy nature of the grid infrastructure in Hawaii, the project will necessarily face challenges of integrating newer systems with existing technologies. Consequently, another key aspect of the project will be to validate that the energy management, control and communications protocols conform to the utility's operational and security requirements and adhere to all applicable standards.

Incorporation of dynamic rates or other approaches to link wholesale conditions to customers

To evaluate integration issues and incentives associated with customer response and linking supply with demand.

Integration into system planning and operations

Demonstrate integration tools and techniques to achieve full integration into system planning and operations.

The DMS control and communication platform will feature:

- An integrated distribution system control and communications architecture that combines and coordinates the following:
  - Advanced metering infrastructure (AMI) as a home portal for direct demand response signals, as well as structured electricity rates
  - Building automation to implement energy conservation and demand response
  - Meter information gathering, mining, and reporting functions in the distribution system control platform
- Energy management, implementing optimal dispatch of DG, storage, and loads on the feeder
- Tieline dispatch controls, allowing tight dynamic control of the power exchange between the distribution system and the transmission grid
- Integrated voltage/VAR control to minimize losses and control the voltage profile

Compatibility with initiative goals and approach

Enable high-penetration of DER and advance interoperability and integration for the electric power industry.

Most mainland utilities are not yet experiencing grid instability as a result of variable renewable resources (owned by customers and Independent Power Producers). However, as the penetration levels of these resources increase, instability will become more probable. Hence, Hawaii is ahead of the curve in its goal to address this issue since the methods that will be demonstrated in this project (to maintain grid stability while integrating significant variable renewable resources) are likely transferrable to other mainland regions facing similar challenges. Another transferable aspect is the lessons learned in the development and deployment of demand response/demand reduction with near-term benefits.

Leverage of additional funding sources

Secure required participation, commitment, and funding for a successful project.

This project, led by the Hawaii Natural Energy Institute at the University of Hawaii, leverages nearly $7 million in DOE funds and slightly more than $7 million in industry funds over three years. Principal funders are the Hawaiian Electric Company and the Maui Electric Company; with additional contributions by General Electric and First Wind.

Technical Contacts

Matt Wakefield at 865.218.8087 (mwakefield@epri.com)
Terry Surles at surles@hawaii.edu
Mario Sciulli at mario.sciulli@netl.doe.gov