

MANAGING DISTRIBUTION SYSTEM RESOURCES FOR IMPROVED SERVICE QUALITY AND RELIABILITY, TRANSMISSION CONGESTION RELIEF, AND GRID SUPPORT FUNCTIONS

or

MAUI SMART GRID PROJECT



Hawaii Natural Energy Institute University of Hawaii at Manoa



Maui Electric Company, Ltd.



Hawaiian Electric Company



GE Global Research

United States - India - China - Germany



GE Energy



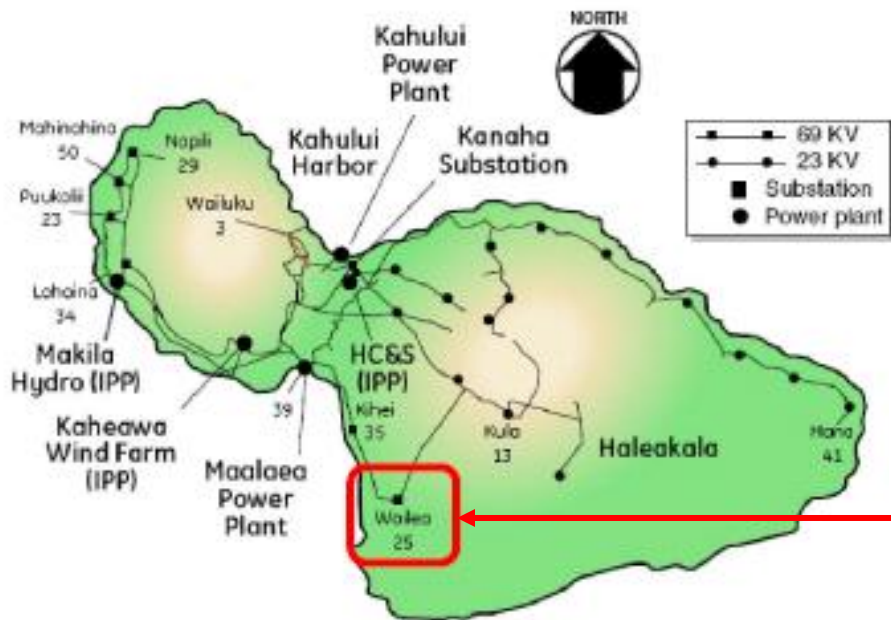
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MAUI SMART GRID PROJECT – Project Objectives

Develop and demonstrate a distribution automation solution that integrates dispatch of distribution assets and bulk power assets to achieve system-level benefits.

- Reduce distribution peak loading by 15% or more**
- Enable greater utilization of as-available renewable energy sources**
- Improve service quality through integrated volt/var control**
- Enable consumers to better manage energy use to lower electric bills and utilize on-site renewable energy**
- Support grid stability (regulating and spinning reserves)**

Overview of Maui Smart Grid Project Site



Basic System Facts:

MECO system peak load \approx 200MW

Fossil fuel and biofuel capacity = about 250 MW

Kaheawa Wind plant = 30 MW

Petroleum provided 77% 2007 gen

Utility challenges:

Limited staff and resources

Limited visibility in distribution system

Growing penetration of renewables

Project Will Demonstrate Three Smart Grid Functions to Achieve Objectives

Integrated Volt/VAr Control (IVVC) - Minimize Losses and Control Voltage Profile

Features	Benefits
Conservation voltage reduction	Reduce load and manage renewables
Transmission-level VAr support	Support transmission system w/ dist-system resources
Voltage matching for phase imbalance	Reduce MECO manpower to balance phases
Voltage matching for circuit switching	MECO can better manage abnormal system events
Reactive power control of PV	Improve dist-system voltage profile

Equipment used:

GE ENMAC DMS, MECO cap banks/LTC, PV inverters

Project Will Demonstrate Three Smart Grid Functions to Achieve Objectives

Demand Management - Optimize consumption and enable direct load control

Features	Benefits
Optimal load connect/disconnect	Enable MECO to use DSM to manage peak demand and renewable variability
Load aggregation	Provide real-time estimate to MECO of available load for connect/disconnect
Load disaggregation	Automate load reduction commands
Load estimation	Improve MECO's Load estimates based on dist-system data and historical data

Equipment used:

GE Smart Meters, GE Home Energy Manager/Smart Appliances, HECO Load Control “Energy Scout” equipment, GE ENMAC DMS

Project Will Demonstrate Three Smart Grid Functions to Achieve Objectives

Distributed Energy Resources (DER) Management -

Provide MECO greater visibility in dist-level resources

Features	Benefits
Real-time PV voltage and power measurement with disconnect capability	Improve MECO's planning for spinning reserve and unit commitment
Real-time forecast and wind plant production from wind plant (KWP)	Provide MECO with information to improve management of spinning reserve

Equipment used:

GE Smart Meters, PV inverters, Wind forecast module

MAUI SMART GRID PROJECT – Technical Challenges

Develop a *general* Smart Grid architecture that:

Incorporates legacy equipment (with proprietary protocols)

Avoids overwhelming or reducing control capabilities of the system dispatcher

Integrates system components with *secure* communications systems

Maui SMART GRID - Benefits

DOE

- Demonstrate distribution management system for microgrids
- Develop general architecture integrating multiple Smart Grid functions

State of Hawaii

- Reduce petroleum use and emissions
- More renewable energy

MECO

- Improve grid stability
- Reduce use of petroleum and emissions
- Better power quality
- Incorporate more as-available renewable energy
- Integrate generation dispatch, IPP, demand response, AMI, distribution management, outage response functions

IPP

- Sell more energy

Customer

- Improved service quality (voltage management)
- More options for customers to lower their energy bills

Maui SMART GRID – Successes to date

Identified demonstration site after original substation construction was delayed due to economic downturn

Data collection and model development

Progress on architecture design – cooperation of utility (planning, operations, customer services), customers, independent power producers, vendors

- **HNEI is moderator / referee**
- **Nobody sent to the penalty box for fighting yet**
- **We are indeed arriving at a solution that meets all stakeholders' objectives**

Maui SMART GRID – Where are we now?

Planning Stage Nearing Finish

- **Selecting functions, feeders, substations, customer premises, communications**
- **Choosing equipment and integration/interconnection points**

Design Stage in Progress

- **Smart Grid architecture and control hierarchy**
- **Information flows and communication links**
- **Functional specification of the demonstration**
- **Incorporating MECO and HECO demand response, AMI, AGC, etc. functions**

Product Development Starting

- **Adapting existing equipment, applications (e.g., ENMAC, IVVC)**
- **Developing and validating feeder models**
- **Beginning development of one of the residential responsive load options – GE Residential Energy Management optimizer with smart appliances**

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**Thank You
Any Questions?**



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