

MAUI SMART GRID PROJECT



U.S. DEPARTMENT OF
ENERGY



Hawaii Natural Energy Institute

University of Hawaii at Manoa



Maui Electric Company, Ltd.



Hawaiian Electric Company



imagination at work

GE Global Research

United States - India - China - Germany

GE
Energy



Sentech, Inc.



Maui Smart Grid Project Overview

- **Maui Smart Grid Project is a demonstration project funded through U.S. Department of Energy (DOE), Renewable and Distributed Systems Integration (RDSI) program**
 - **RDSI is a R&D program focusing on grid integration of distributed energy resources**
- **In 2007, the RDSI program issued an RFP for demonstration projects**
 - **HNEI-led team won one out of 9 awards - 80 applicants**
 - **Project total budget of \$15 million from 2009-2013**
 - **\$7 million DOE funds, \$8 million cost share with partners**



Project will Manage Distributed Energy Resources (DER) to Support Grid Operations



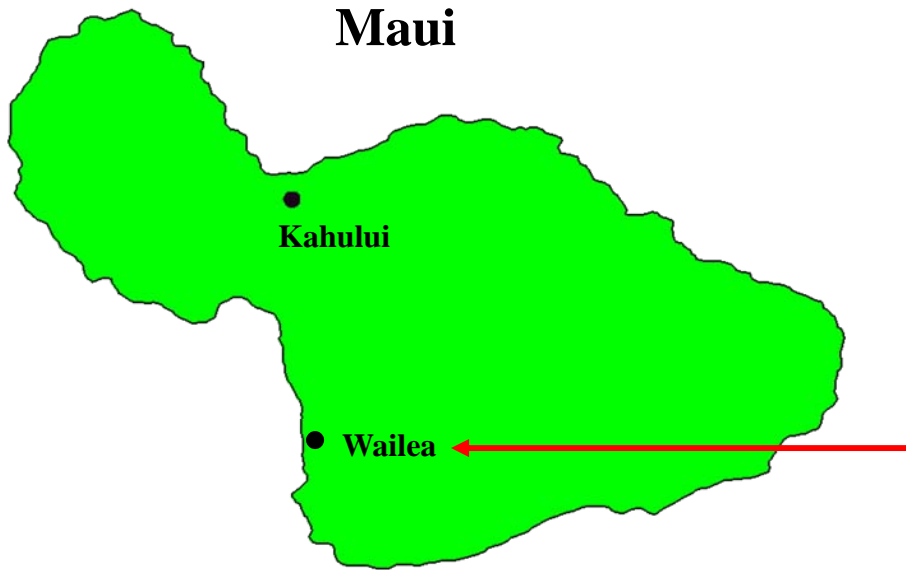
Maui Smart Grid Project Objectives

Distributed Resources for Transmission-level Support

- Reduce distribution circuit peak loading by >15%
 - By demand response, switching peak loads to energy storage, and reducing voltage
- Improve service quality
 - By using Integrated volt/var control, outage management
- Enable consumers to manage their energy use to minimize electric bills
 - By using customer portals and advanced home energy gateways for a few homes
- Support grid stability
 - Controllable loads, storage, and improved voltage/current information will improve grid stability
- Enable greater utilization of as-available renewable energy sources
 - By providing measurement and estimation of distributed PV to the utility operator



Project Located in Wailea, Maui



Basic System Facts:

MECO system peak load \approx 200MW

Firm generating capacity \approx 240 MW

Kaheawa Wind plant = 30 MW

Approx. 90 MW of potential renewables within project period

Project will use 2 circuits @ Wailea Sub.

Maui Meadows: 500+ homes

Other circuit with resorts and commercial



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Home Area Network (HAN)

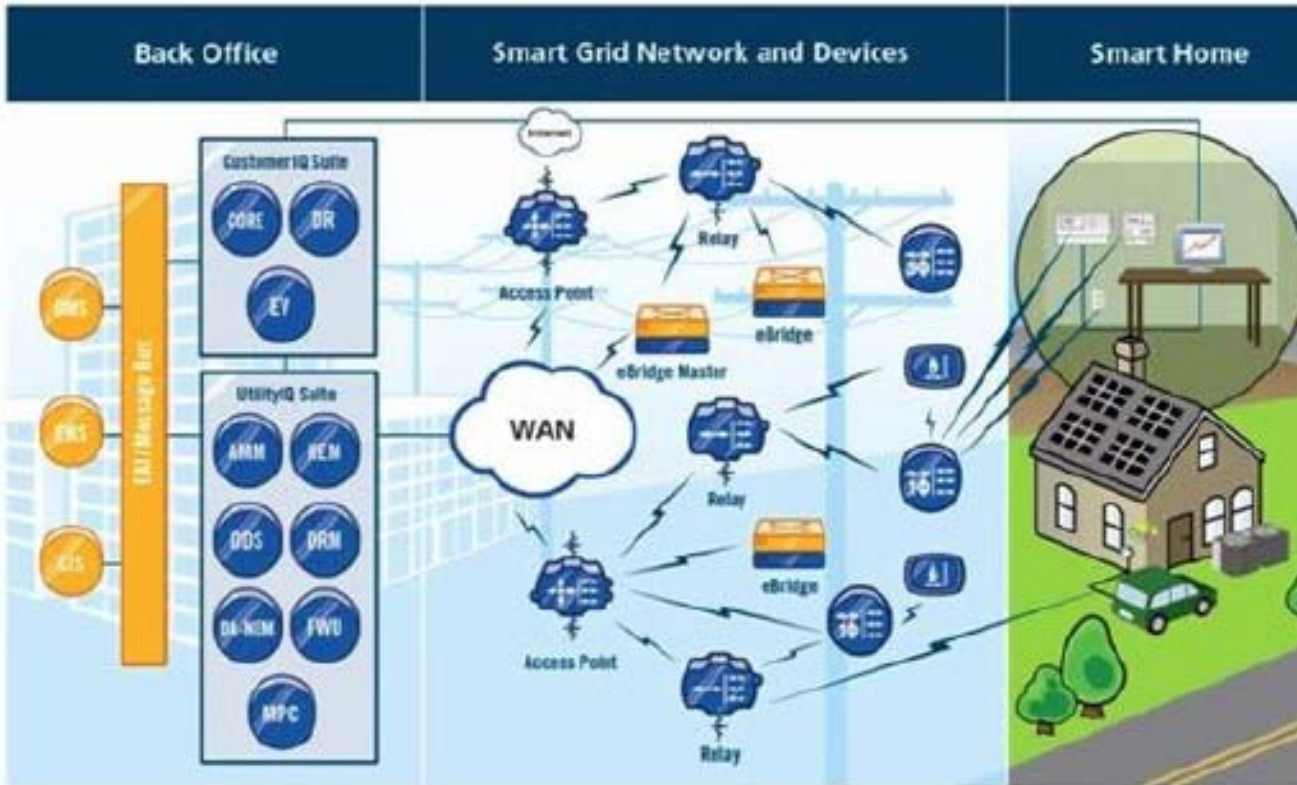
Residential consumer portal

- Monitor electricity usage & solar PV production
- Programmable thermostat, load control switches, and “Gateway”
- Demand response enabled comms for smart appliances
- **Communications:** Supports Ethernet, WiFi, Zigbee SEP 1.0
- **Interface:** In-home display or web interface



Advanced Metering Infrastructure (AMI)

Providing two-way communications to distribution system assets



Wireless mesh network

AMI supports:

- voltage monitoring
- demand response
- PV monitoring

Silver Spring Networks is technology provider for this system



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Demand Response Management System (DRMS)

Manage load during system events and peak load

1. Load reduction during peak periods

- Contribute to 15% peak load reduction on circuit 1517

2. Reduce load during system events

- Reducing load could substitute for reserve capacity

Utility Applications



Dispatch Optimization
Response Estimation
Aggregation/Disaggregation



Smart Meter

In-Home Applications

Smart
Thermostat (PCT)



Consumer Interface &
Energy Management



Future Apps: PV,
Storage, PHEV/EV



Demand Response
Appliances



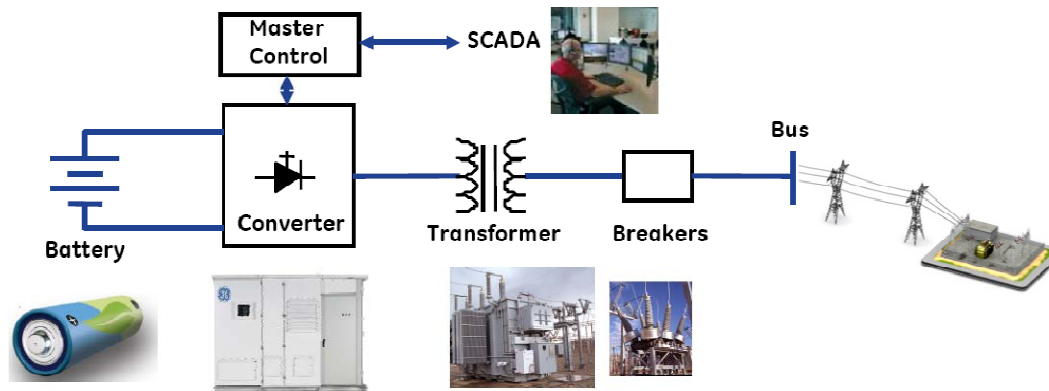
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Battery Energy Storage System (BESS)

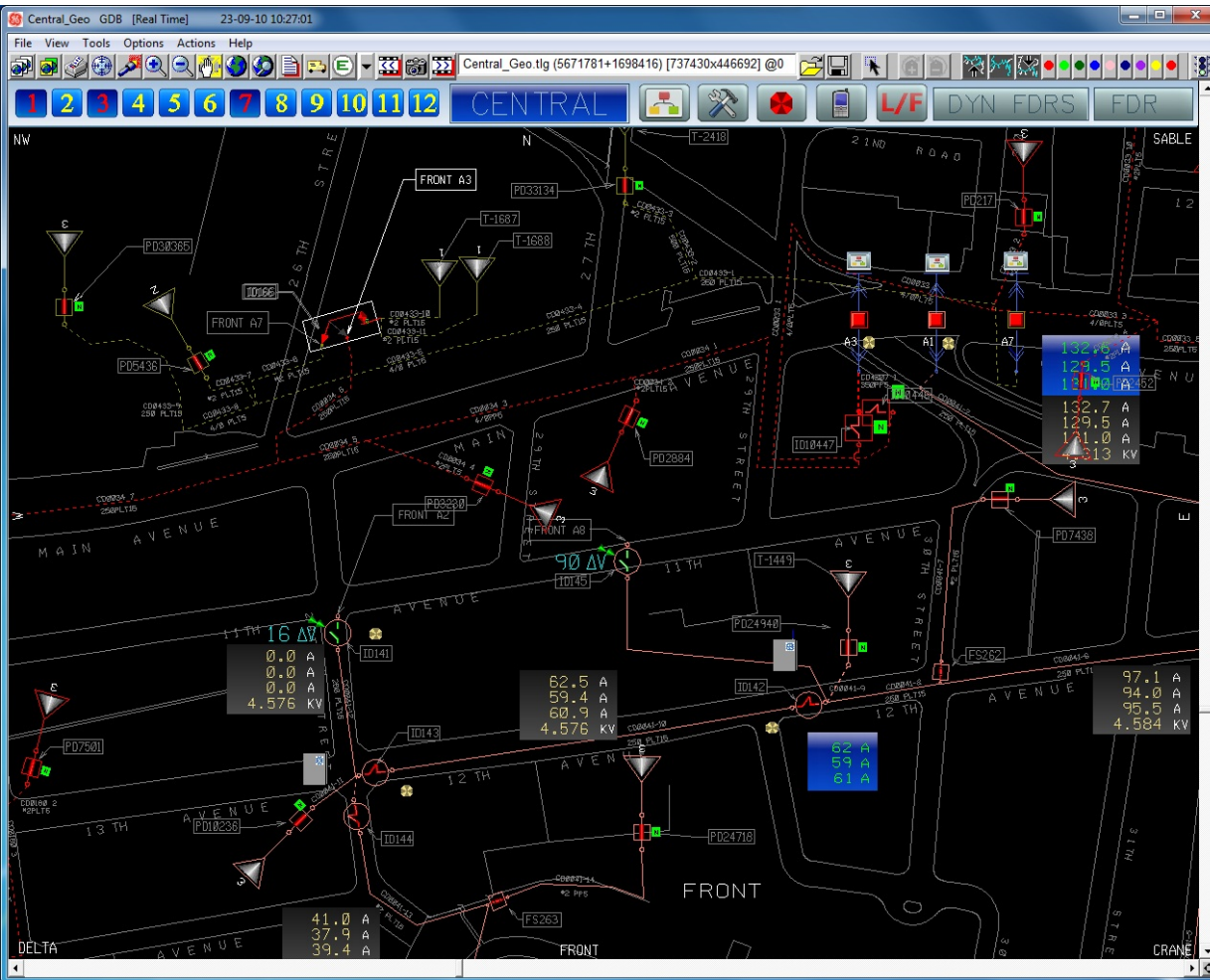
Multiple Benefits

1. BESS located at Wailea Substation
2. Manage peak load → Discharge for 1-2hr during peak
3. Voltage regulation → Manage variability caused by load and PV
4. Renewables Integration
 - Non-spinning reserve → Rapidly inject power, and bridge to fast-start generation.
 - Reduce wind curtailment → Charge off peak during excess energy periods



GENe Distribution Management System (DMS)

Centralized data management and control of distribution system assets



Visualize distribution system data

Dynamic load flow model

Volt/VAR optimization

Developing decision support “dashboard”

General Electric is technology provider for this system



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Maui Smart Grid Project Objectives

Distributed Resources for Transmission-level Support

	DMS	AMI, DRMS, and HAN	BESS
Reduce peak load	<ul style="list-style-type: none"> • Aggregate DER and provide dashboard control • Volt/VAR control 	<ul style="list-style-type: none"> • Enable direct load control • TOU prices (in future) 	<ul style="list-style-type: none"> • Discharge energy to reduce load
Improve service quality	<ul style="list-style-type: none"> • Provide visibility to operator • Improved outage mgmt • Volt/VAR optimization 	<ul style="list-style-type: none"> • Voltage monitoring validates DMS load flow 	<ul style="list-style-type: none"> • Can help manage voltage
Inform consumer decisions		<ul style="list-style-type: none"> • Communicate prices • Real-time display • Energy mgmt system 	
Grid stability	<ul style="list-style-type: none"> • Visibility on PV output • Aggregate DER and provide dashboard control 	<ul style="list-style-type: none"> • Real-time monitoring of PV • Enable load control 	<ul style="list-style-type: none"> • Discharge energy during system events
Increase RE utilization	<ul style="list-style-type: none"> • Provide reserve support (potentially reduce reserves) 	<ul style="list-style-type: none"> • Load shifting 	<ul style="list-style-type: none"> • Charge during off-peak



Project Timeline

	Budget Period 1		Budget Period 2		Budget Period 3			
	2009		2010		2011		2012	2013
	Q1, Q2	Q3, Q4	Q1, Q2	Q3, Q4	Q1, Q2	Q3, Q4	Q1	
DMS	Develop Functional Spec	Detailed design, Technology selection	Development, Testing, Outreach	Deploy on Maui	System Operation and Data Collection			
AMI, DRMS, HEMS, and Sensors								
BESS			RFP, Select vendor	Design and Build				



Cybersecurity and Community Outreach

- **Project team is working with MECO and HECO IT and Cybersecurity review team**
- **Developing detailed outreach plan w/ SSN Outreach staff**
- **Immediately implementing plan with staff from MECO, HECO, UH, and local leaders**



Hawaii-Okinawa Initiative Smart Grid Demonstration

- **Hawaii-Okinawa Initiative component of broader U.S.- Japan Cooperation on Clean Energy Technologies**
- **Smart Grid Demonstration Project has substantial interest on U.S. and Japanese sides**
- **Considerable exchanges between NEDO, DOE, HECO, MECO, State of Hawaii, and UH since last summer**
- **NEDO put out RFP in February 2011**
- **Final decision on Industry Consortium expected in May**
- **Japanese requesting coordination with current RDSI project**



Mahalo! Questions?



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