2012 Smart Grid Program Peer Review Meeting

DOE RDSI Maui Smart Grid Project

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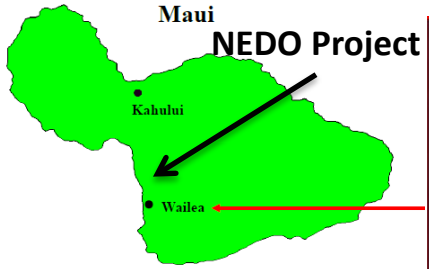
DOE RDSI Maui Smart Grid Project

Managing Distribution Energy Resources (DER) for Transmission- and Distribution-Level Benefits

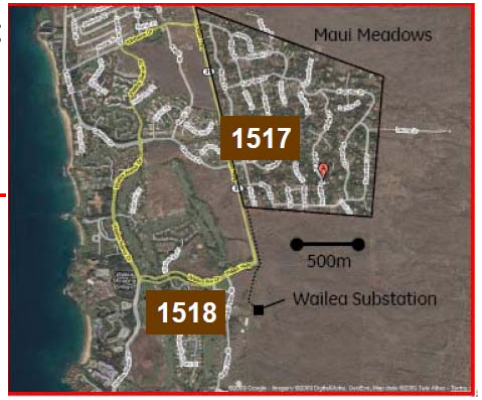
OBJECTIVES	
D, T	Reduce distribution circuit loading and transmission congestion
D	Help consumers better manage energy use
D	Improve service quality
D, T	Use more as-available renewable energy resources (wind and solar PV)
D	Demonstrate flexible, expandable, architecture compatible with legacy systems



200 MW island system

- **72 MW wind**
- **15+ MW solar PV**

DOE RDSI Demonstration Site



Life-cycle Funding ($k)

FY09 – FY13 Project Budget	
DOE: Cost Share:	$ 6,995 $ 7,383
Total:	**$ 14,383**

TECHNICAL SCOPE

Advanced Metering Infrastructure (AMI)
- load research
- power quality monitoring

Home Area Network (HAN)
- customer energy use feedback
- PV monitoring
- demand response

Battery Energy Storage System (BESS) - 1 MW, 1 MWh
- manage peak demand
- integrate renewable energy

Distribution Management System (DMS)
- Volt-VAR control
- distribution monitoring (V, I)
- outage mgmt.
- manage DER

Needs and Project Targets

Project's challenge is to determine whether the capabilities of the Smart Grid can improve utility operations and customer service, and if so, at what cost and benefit.

Objective	Key Utility Needs	Smart Grid Project Targets
Integrate Renewables	Grid stability with variable resources	DER as substitute for conventional reserves
	Limited visibility of distributed RE	Use AMI to monitor distributed PV and voltages
	Increasing curtailment	Use BESS and AMI to capture curtailed energy
Inform Consumer Energy Use	Monthly bill primary source of information	New displays provide near real time data
	New rates being implemented (tiered and TOU)	Help inform consumers on pricing information
Improve Service Quality	Limited outage and voltage violation detection in distribution system	Use AMI to detect outages and improve response
		Use AMI to detect voltage violations
		DMS volt-Var control and load flow to reduce losses
Reduce Peak Load by 15%	Peaking units very expensive on Maui	BESS and DR provide new resources
	Limited load research data	AMI/HAN data measure appliance load profiles and help develop DR strategies
	Coordinating use of DER	DMS helps manage DER with other system resources

Technical Approach

MAIN PROJECT TASKS

Planning/ Initial Design	Detailed Design / Testing	Implementation / Installation	Data Collection, Analysis, Evaluation
• Set project objectives • Select Substation / Feeder • Obtain Baseline Data	• Functional Requirements • System Architecture & Data Flows • Vendor Selection • Technical Review • Factory Acceptance Test	• Contracting/agreements • Equipment Installation o AMI, HAN, BESS, DMS • System integration	• Baseline Data • Metrics / data collection • DOE Reporting • Equipment (decommissioning/ extension)

Outreach & Engagement (Customers, MECO Employees, HI Stakeholders, U.S. Energy Sector)

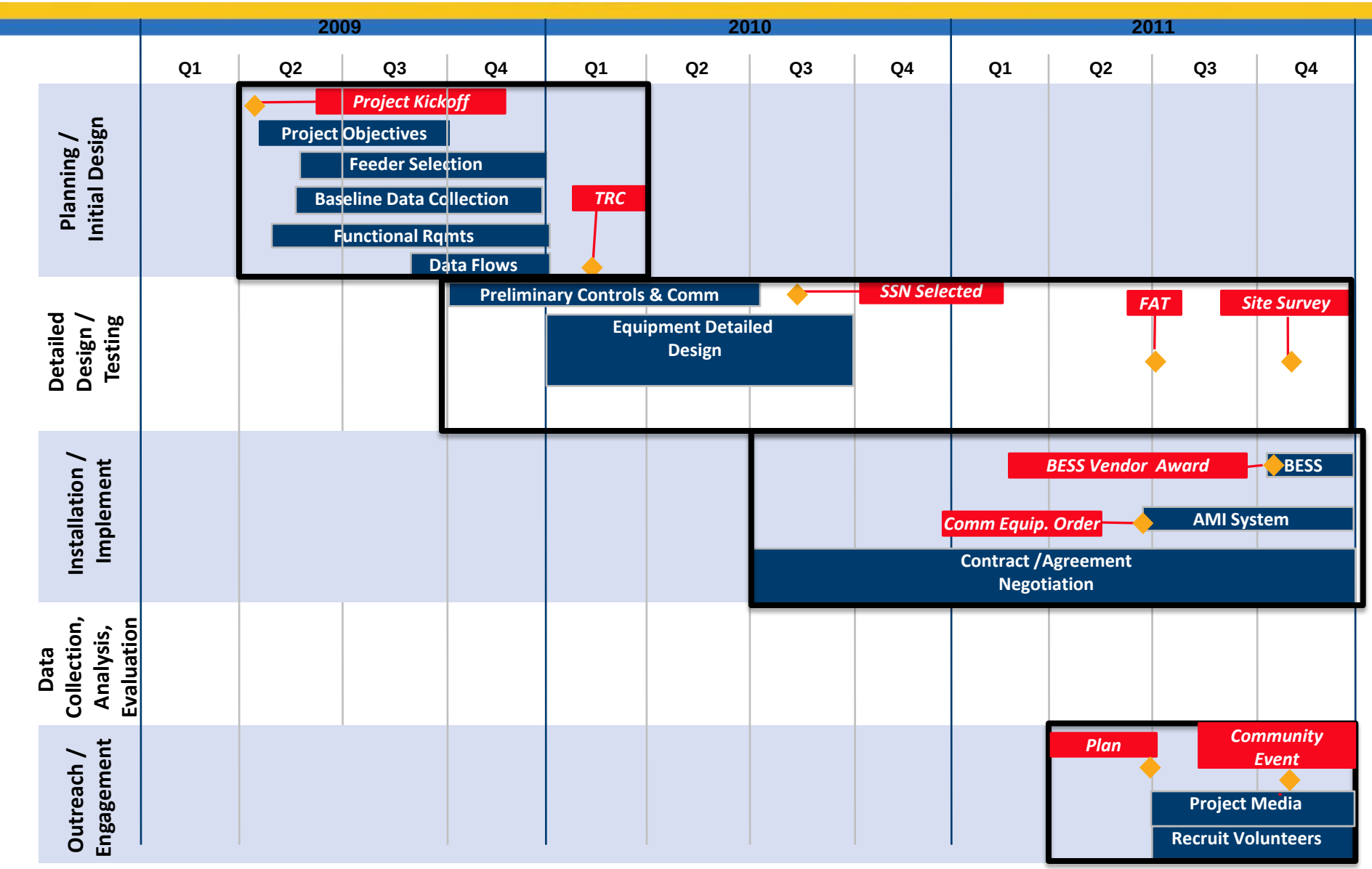
	Volunteer/Community Outreach	MECO Employees	DOE & other Stakeholders
Develop and approve Outreach Plan	• Letters to local residents • Community meetings • Local media stories • Project website • Project newsletter • Recruit and enroll volunteers • Ongoing outreach & support	• Employee training • Inform staff on project and goals	• Press releases/ media on project • DOE Reporting • Presentations to Hawaii stakeholders (e.g., PUC) • Spoke at Asia-Pacific Economic Cooperation (APEC) Summit

Technical Approach

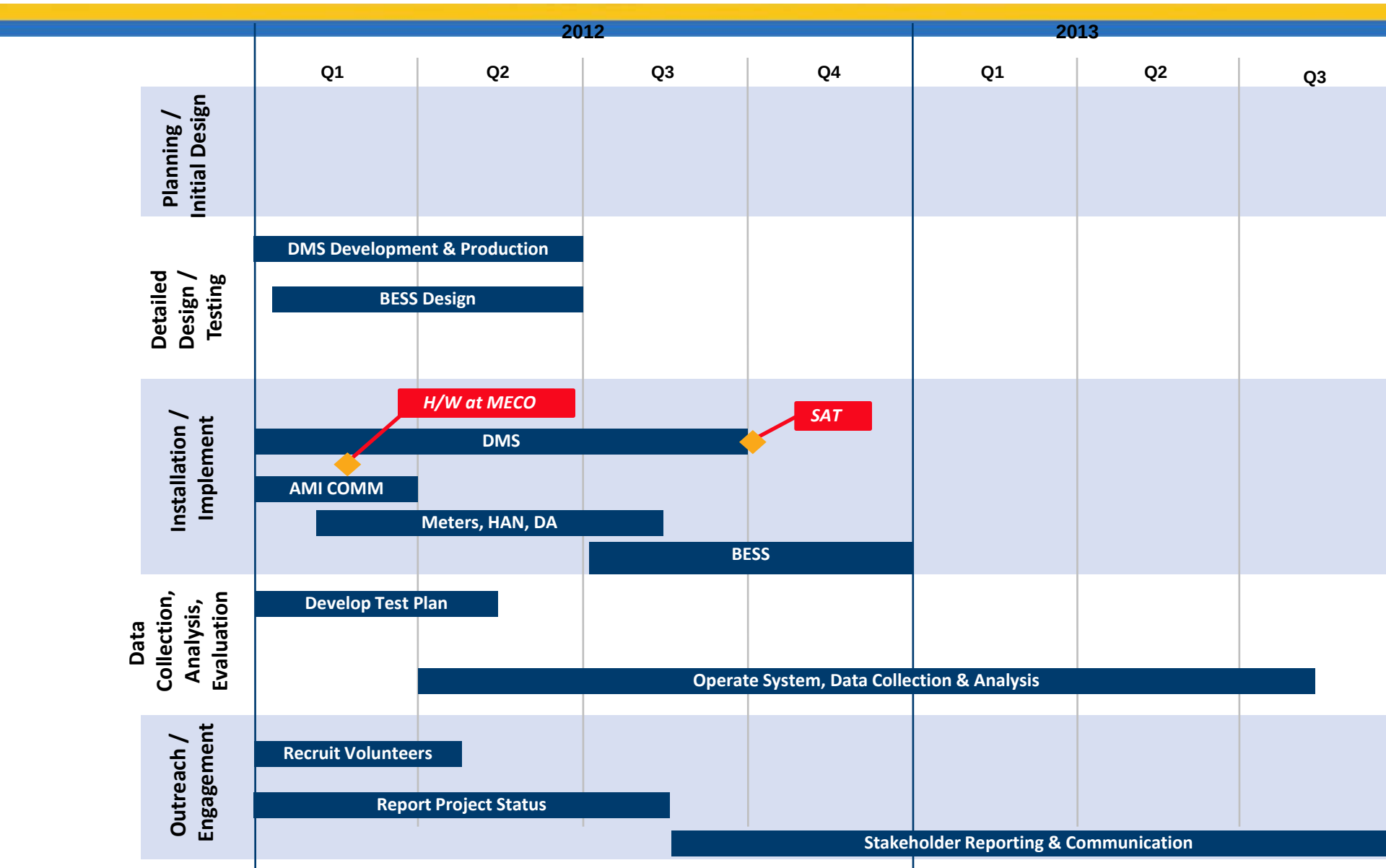
CHALLENGES AND INNOVATIVE ASPECTS

Technical Challenge	Approach to Overcome Challenge
System integration/ Managing technology risk	• Clearly define interfaces, areas of responsibility • Utilize products with prior commercial experience • Incremental approach, specifically with controls and automation • Select products most compatible with legacy systems • System manages distribution resources similarly to how utility manages generation sources (e.g. unified displays, model structure for DER)
Cyber-Security (customer, MECO)	• Compatibility with existing best practices, policies, procedures • Vendors with proven record of implementing utility scale metering / smart grid projects
Public Outreach/Stakeholder Engagement	• User-centric approach to outreach • Comprehensive customer outreach and education; solicit customer input/feedback • Metrics and benefits plan to quantify true value to customer

Technical Accomplishments (FY 2009 - 2011)



Technical Accomplishments (FY 2012 - 2013)



Technical Accomplishments

Key Lessons Learned

- Clearly define functional requirements and technical specifications

- Develop flexible architecture that is expandable in functionality – can include functions not yet developed

- Engage all project stakeholders (internal and external) from the beginning

- Outreach and education critical to project success
  - User-centric approach
  - MECO employees are ambassadors to the community and ALL must be knowledgeable about the project (not just technical aspects)
  - Smart Grid functions deliver tangible benefits stakeholders
  - Enlist participation by local stakeholders (Economic Development Board, County Government, environmental groups, Maui Community College)

Related projects leveraging DOE RDSI Maui Smart Grid Project

- NEDO - $37M additional Japanese investment in Smart Grid
  - will be testing Hitachi-supplied equipment in project footprint

- DOE SEGIS Smart Inverter Project - SSN and Fronius key technology partners

Significance and Impact

Item	Current Practice	Broader Applicability of Smart Grid Project
High penetrations of as-available renewables	Limited distribution visibility Manage variability with conventional generation	• Improve distribution monitoring • DER dispatch to manage renewables • Compatible with constraints on system operator • TRC review to ensure applicability to mainland
Systems Integration	Limited mgmt. of distribution resources	• New & legacy equipment • New & legacy functions and applications • Multi-vendor solution
Outreach and Stakeholder Engagement	Stakeholder uncertainty about smart grid	• Quantifiable stakeholder benefits (customer, MECO) • Utility / customer partnership • Customer feedback mechanisms • Communicate manageable and actionable information to customer

Interactions & Collaborations

Hawai‘i Natural Energy Institute (HNEI) of University of Hawaii
Project Manager & Principal Investigator

Maui Electric Company (MECO)
Host utility; Project design, system operator interface, SCADA integration; Co-funding with substation/feeder construction, BESS

Hawaiian Electric Company (HECO)
Co-host utility; Power systems engineering, cyber security

Maui Economic Development Board (MEDB)
Education and outreach to community

Maui County
Community outreach; AMI on county pumping loads

University of Hawaii - Maui College
Energy audits and training; participant support

SRA International (SRA/Sentech)
Requirements definition; system integration; test protocol

Silver Spring Networks (SSN)
Vendor for AMI, HAN, DR platform; Customer outreach support

Alstom
Vendor for DMS; SCADA integration support

NEDO/Hitachi
Coordinate with Japan-US Island Grid Project

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