A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy

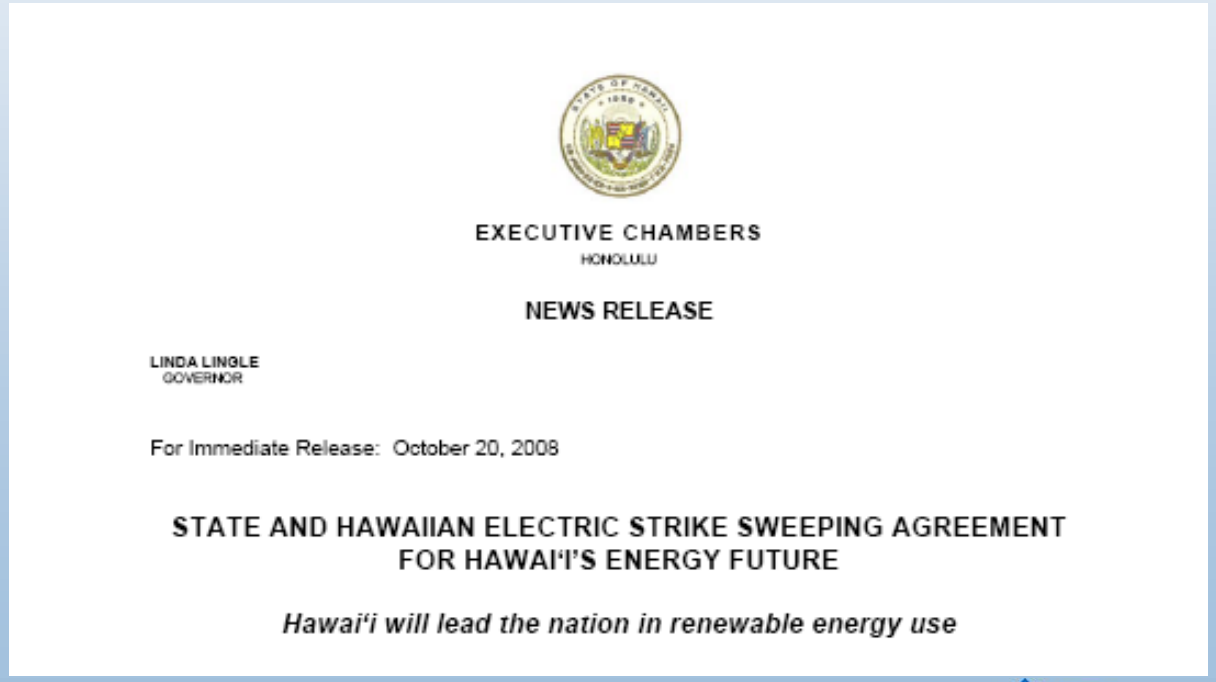
Hawaii Solar Integration Study Update

May 4, 2011

Dave Corbus
National Renewable Energy Laboratory

Hawaii Clean Energy Initiative
A Diversified Renewable Portfolio

- 40% Renewable Generation from Clean Energy by 2030
- Expanded DG and Load Reduction
- Biofuel Conversion, aggressive solar deployments
- Up to 400 MW Off-Shore Wind Energy to Oahu



EXECUTIVE CHAMBERS
HONOLULU

NEWS RELEASE

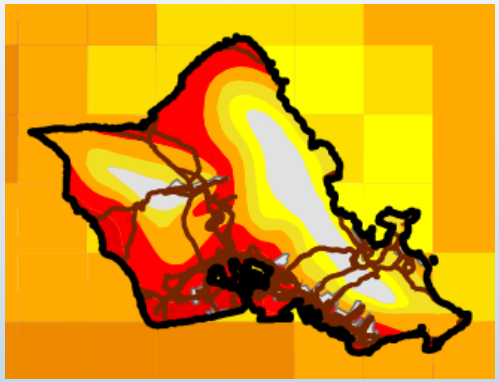
LINDA LINGLE
GOVERNOR

For Immediate Release: October 20, 2008

STATE AND HAWAIIAN ELECTRIC STRIKE SWEEPING AGREEMENT FOR HAWAI'I'S ENERGY FUTURE

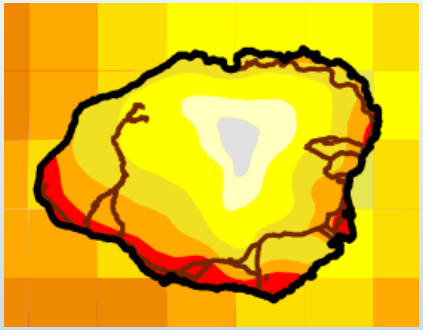
Hawai'i will lead the nation in renewable energy use

Overview of Solar Work in Hawaii



Dense network of solar measurement stations

Solar measurement stations across islands



High fidelity solar dataset

Oahu and Maui Solar Integration Study &Technical Review Committee

HECO, NREL and HNEI and others support integration analysis

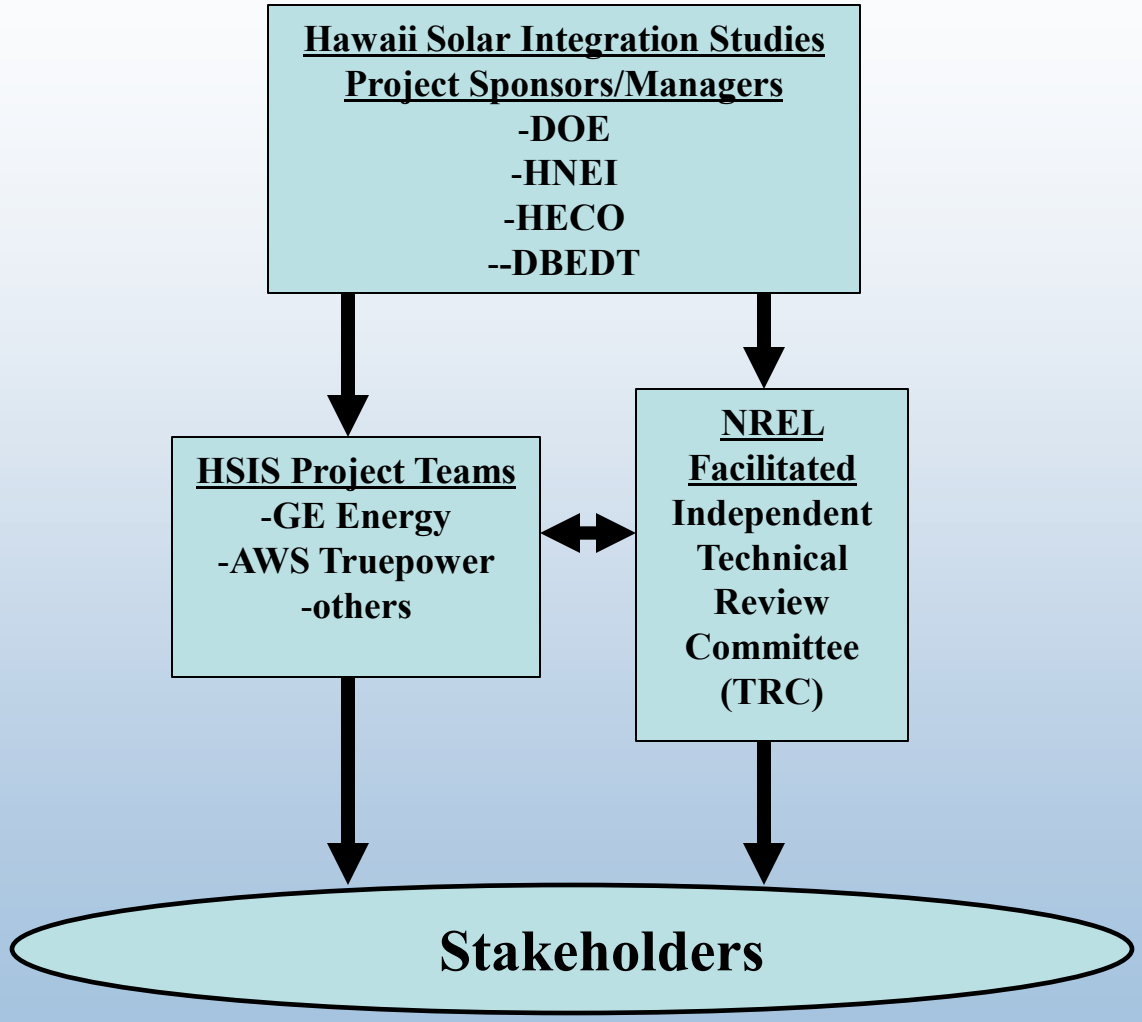
Lanai project and PV Transient Study

Kauai Solar Integration Study (Sandia)

HSIS Study Goal

The goal of the Hawaii Solar Integration Study (HSIS) is to help stakeholders, with special emphasis on the utility and the state, to understand the costs and operating impacts of significant amounts of solar power on their island electric grids and to help them in future planning.

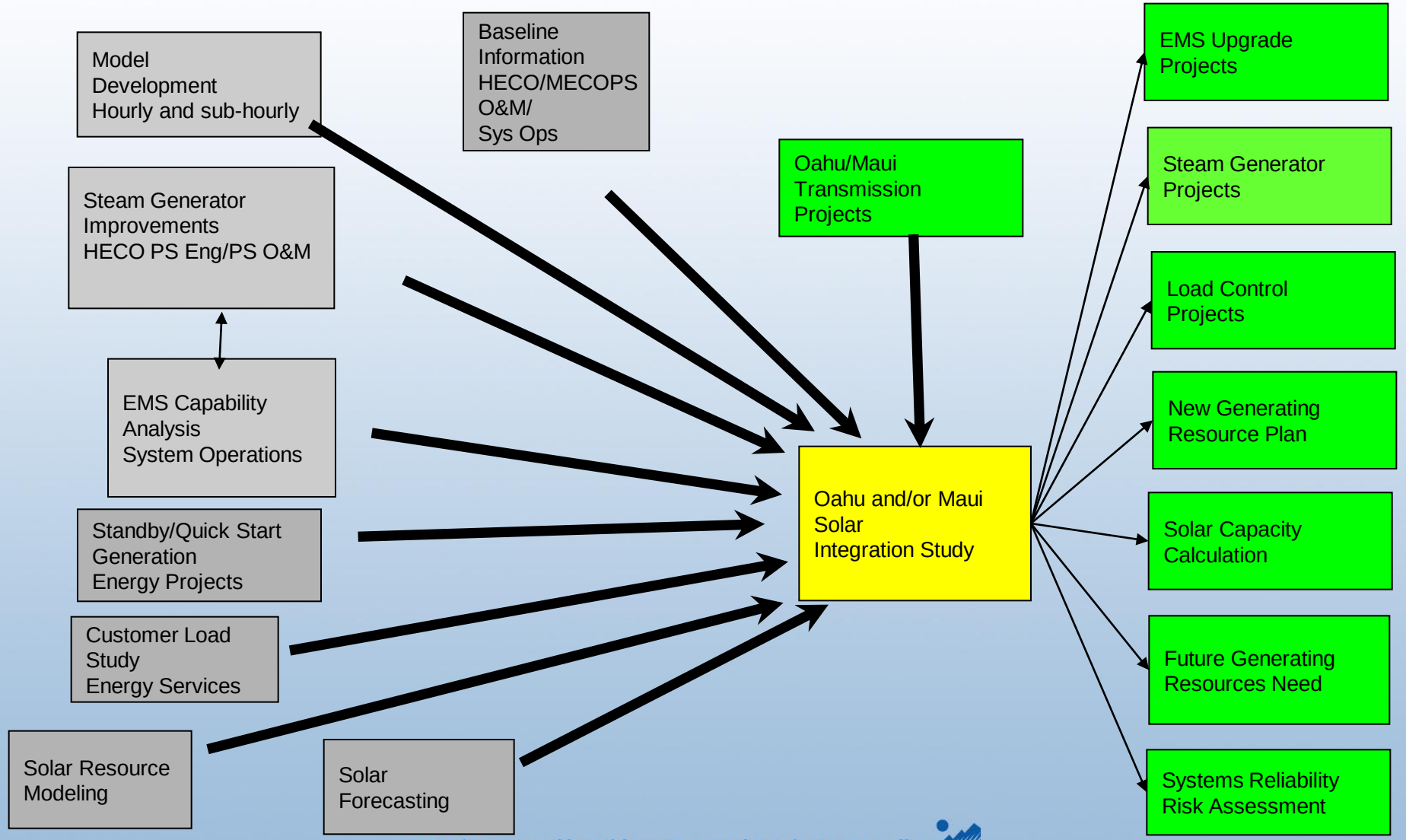
HSIS Study Organization



Study Objectives

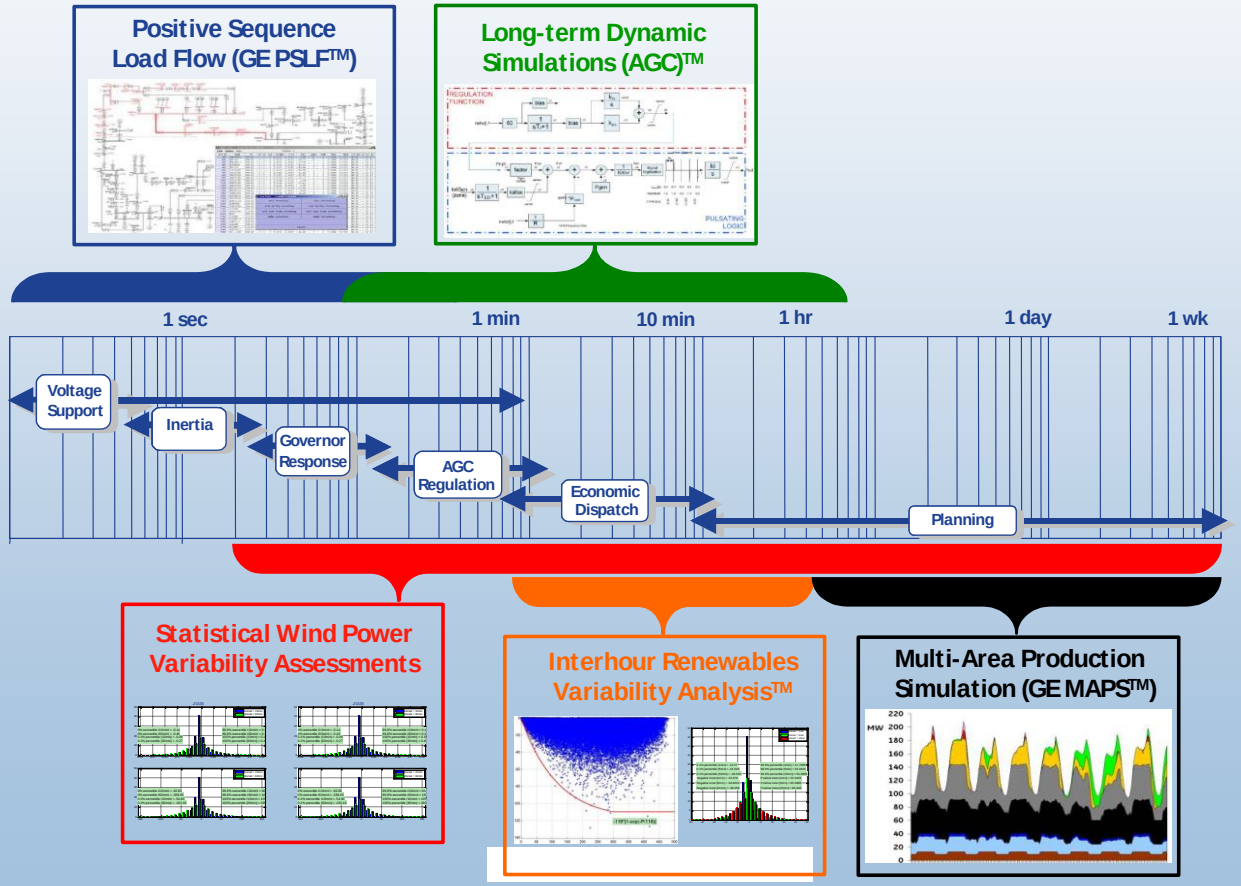
GE will enhance their existing models of the Oahu and Maui power systems, and leverage state-of the art solar data from the project team

1. Assess the levels of wind/solar energy delivered, emissions, and annual operating costs for specific distributed/centralized PV plant projects
2. Identify the operating characteristics (commitment/dispatch) of a system with high penetrations of solar power
3. Assess the dynamic performance of the systems with high contents of wind and solar power
4. Identify the challenges associated with reliable operation of a system with a very high content of wind and solar power
5. Identify operational strategies & new technologies that could help enable high penetrations of wind and solar power
6. Assess the impact of each approach across many timescales of system operation
7. Recommend strategies and requirements to increase wind and solar energy delivered, reduce adverse impacts on the thermal units and help ensure reliable system operation


Model Development Hourly and sub-hourly
Baseline Information HECO/MECOPS O&M/ Sys Ops
Oahu/Maui Transmission Projects
EMS Upgrade Projects
Steam Generator Improvements HECO PS Eng/PS O&M
Steam Generator Projects
Load Control Projects
EMS Capability Analysis System Operations
New Generating Resource Plan
Oahu and/or Maui Solar Integration Study
Standby/Quick Start Generation Energy Projects
Solar Capacity Calculation
Customer Load Study Energy Services
Future Generating Resources Need
Solar Resource Modeling
Solar Forecasting
Systems Reliability Risk Assessment

Hawaii Solar Integration Study - GE

Key objective: identify operational strategies & new technologies that could help enable high penetrations of renewable energy.



Key Study Outcomes

- Identify the operating characteristics across many timescales and the key challenges associated with high levels of solar on the Oahu and Maui grids
- Assess and quantify the impact of alternative solutions to enable high penetrations of wind and solar power
- Recommend strategies to help enable high levels of wind and solar power on the Oahu and Maui systems

Hawaii Clean Energy Initiative Technical Review Committee (TRC) Drivers

- "The parties agree to utilize an experienced technical resource, such as the National Laboratories to independently validate and review the appropriateness of the scope and depth of analyses envisioned for the Implementation Studies below"
  - "….Modifications and additions for existing Oahu and neighbor island AC transmission grids…..energy storage or flexible generation…… modifications needed on existing units …… changes to operational practices……"…etc.
  - "…The studies should be based upon a robust infrastructure design that maintains reliability levels consistent with industry practices….."

HSIS Technical Review Committee (TRC) Overview

- The primary focus of the TRC will be review and guidance of the solar grid modeling studies including methods, assumptions, and preliminary results
- We are anticipating 4-5 meetings of the TRC over the 15 month course of the project
- The TRC is a technical review group!
  - The TRC reviews and makes recommendations
  - Does not make decisions; Does not set policy or make policy decisions

HSIS Technical Review Committee (TRC) Overview

Members of the HSIS TRC include:

- BEW Engineering
- DOE Office of Energy Efficiency and Renewable Energy
- DOE Office of Electricity
- Electric Power Research Institute
- Hawaii Natural Energy Institute
- Sacramento Municipal Utility District
- Southern California Edison
- National Renewable Energy Laboratory
- Pacific Northwest National Laboratory
- Sandia National Laboratory
- US Army
- US Navy
- Utility Wind Integration Group
- Experts in Solar Power and Distributed Generation

Thanks!

David.Corbus@nrel.gov