Policy and Regulatory Workshop Overview

SECOND NELHA ENERGY STORAGE CONFERENCE

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Acknowledgment

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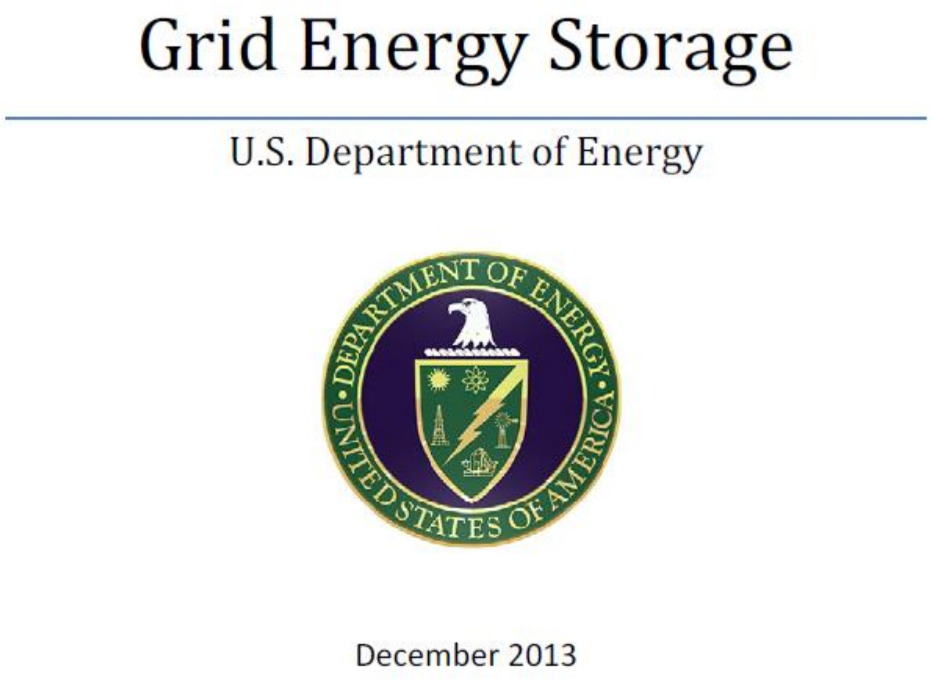
Energy Storage Program Summary

The Department of Energy's Grid Energy Storage report (2013) identified a four-pronged strategy to overcoming the barriers to energy storage deployment:

- Cost-competitive energy storage technology development;
- Validated reliability and safety;
- Equitable regulatory environment; and
- Industry acceptance.


Grid Energy Storage

U.S. Department of Energy

December 2013

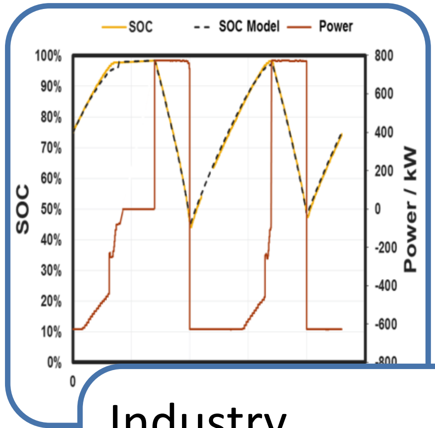
Energy Storage Program Task Areas

Technology Development

- New battery chemistries
- Improved power electronics
- Flywheels, CAES, capacitors, etc.

Reliability & Safety

- Independent system testing
- Validation of life-cycle testing
- Standards implementation



Industry Acceptance

- Demonstration projects
- Techno-economic analysis
- Analytical tool development

Regulatory Environment

- Document policies
- Review IRP processes
- Inform the policymaking process

Policy and Regulatory Workshop Agenda

- Objective: To share work that the Energy Storage Program has done on policy and regulatory topics of interest to the Hawaii PUC.

- What we heard: As energy storage investments ramp up on the islands, what do regulators need to know to make sure that those projects are safely interconnected, and how can those investments be leveraged to improve system resilience?

- Three speakers:
  - Charlie Vartanian – Interconnection
  - Jeremy Twitchell – Planning and resilience
  - Sarah Newman – Energy Resilience Measures Tool

Session Goal

Desired outcome: Two-way learning.

How can the Energy Storage Program help inform the policymaking process in Hawaii?

How can Hawaii's leadership inform future Energy Storage Program research and outreach?

Planning for Resilience

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Pacific Northwest National Laboratory

NELHA Energy Storage Conference

Agenda

Presentation Goals: Establish a common understanding of resilience and then discuss Hawaii's resilience goals – and how the lab can help.

- Reliability and Resilience
- Economics of Resilience
- Discussion
  - Identifying Metrics
  - Principles of Microgrid Design
  - Ratemaking

Reliability and Resilience

Problem Statement:

"Reliability" is a objective concept, defined by multiple metrics and standards that can be readily incorporated as planning objectives.

"Resilience" is more subjective, lacking specific metrics and standards or even an agreed-upon definition. Absent tangible objectives, it is difficult to incorporate resilience into the planning process.

As a reference point, the DoE Quadrennial Energy Review (2017) defines resilience as "the ability of a system or its components to adapt to changing conditions and withstand and rapidly recover from disruptions."

Bulk power system reliability – A snapshot of NERC requirements:

- Transmission planning: n-1, n-1-1, n-2
  - What happens when a component of the bulk power system (generator, transmission line, etc.) is unavailable?
  - What happens when that outage causes another outage?
  - What happens when two components are out?
- Remedial Action Scheme (RAS): What is the utility's plan for each of those contingencies?
  - Switching, load shedding, protective relays, etc.
- Important note: Reliability standards are firm requirements that a utility must meet at the least cost. Absent policy intervention to establish specific standards, resilience is a goal that is pursued subject to cost effectiveness tests, and there is no uniform method for determining the cost effectiveness of resilience investments.

IEEE Standard 1366-2012 defines distribution system reliability through 13 metrics, four of which are commonly used by utilities in reliability reporting:

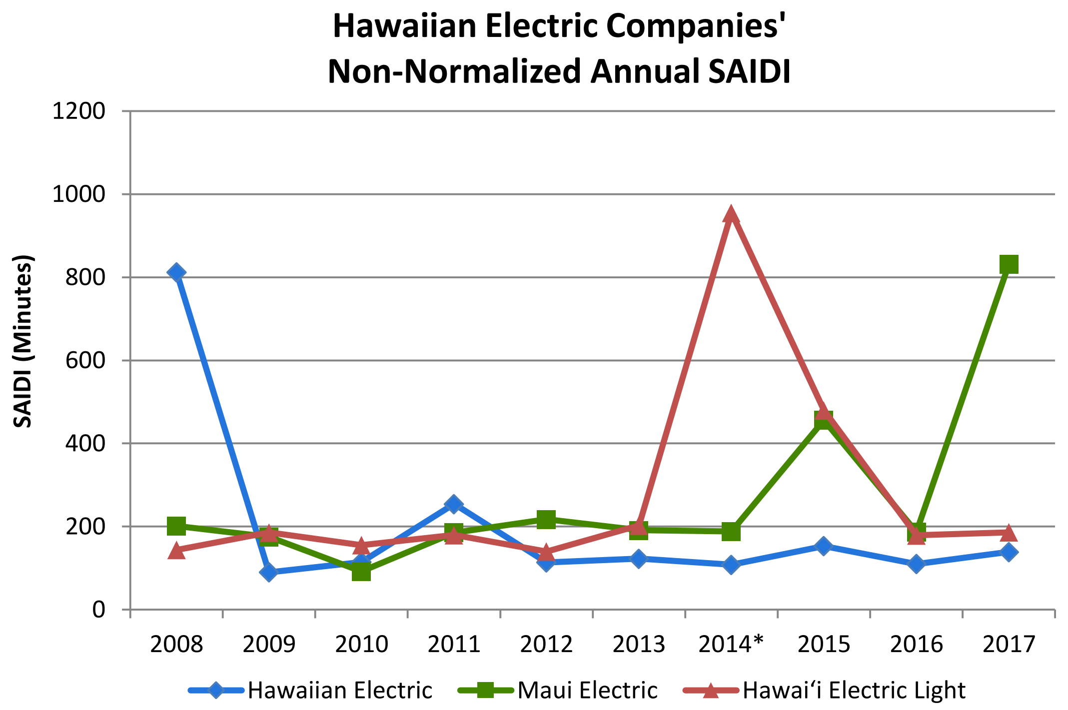
- System Average Interruption Frequency Index (**SAIFI**): how often does the average customer experience an outage?
- System Average Interruption Duration Index (**SAIDI**): how long is the average customer experiencing service outage?
- Customer Average Interruption Duration Index (**CAIDI**): Among customers who experienced an outage, how long were they without service?
- Average Service Availability Index (**ASAI**): Throughout the year, what was the percentage of hours in which the average customer had service?

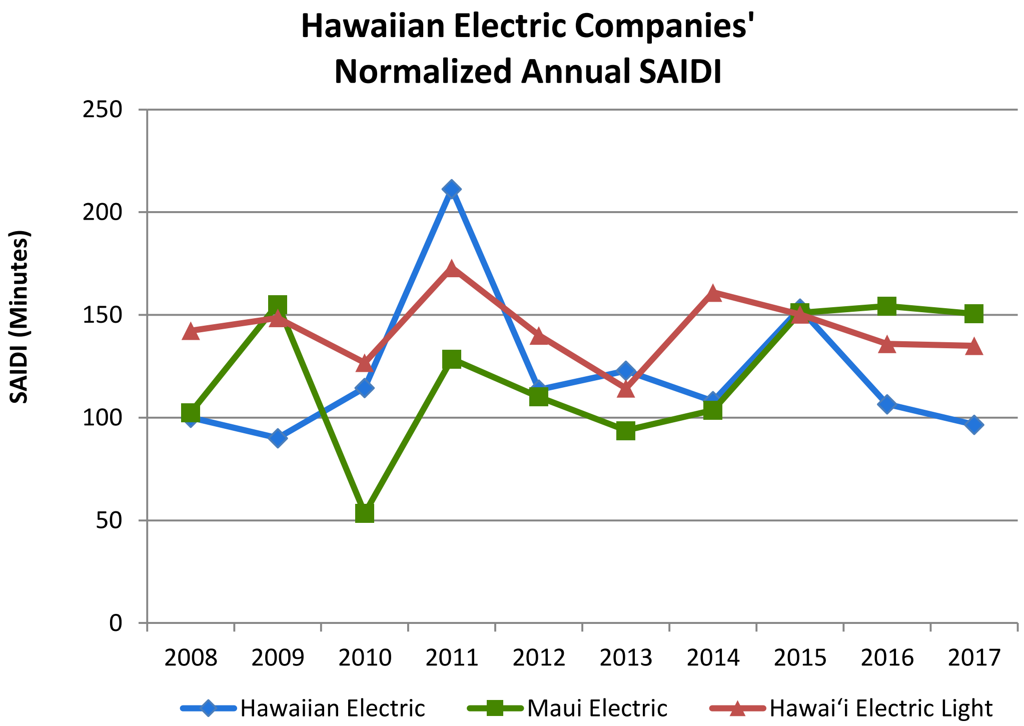
IEEE 1366-2012 also defines two circumstances excluded from normal distribution system reliability reporting:

- **Major Event Day:** Defined as a day in which SAIDI values are 2.5x higher than the daily average over the previous five years.
- **Catastrophic Day:** Identified, but not defined. Because such events vary, there is no objective means of identifying them. IEEE recommends that regulators and utilities identify catastrophic events on a situational basis.

Omitting major event and catastrophic days ensures that reliability metrics measure the system under normal operating conditions. Including them would drive up baselines and obscure reliability issues. But omitting them also removes a significant amount of customer outages from the reporting process.

The difference between normalized and non-normalized metrics:





HECO

The impact of normalization:

HECO SAIDI Scores, 2017

	Non-normalized	Normalized	Difference
Hawaiian Electric	138.65	96.58	30%
Maui Electric	831.18	150.62	82%
Hawai'i Electric Light	186.14	135.05	27%

If we want to increase resilience, this is where we start

The Economics of Resilience

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- Resilience, as a standalone application, is expensive and rarely needed.
  - Reliability standards frequently justify the construction of rarely used resources. Absent similar standards, resilience projects must pencil out from a cost-benefit standpoint.
- Resilience investments must provide other value-add services to the grid.
  - Offsetting benefits needed to pass a cost-effectiveness test
  - Creates opportunity for microgrids that can provide multiple services
- Costs must be assigned based on benefits.
  - Who benefits from improved resilience? Is it a system property, or does it benefit local customers? How do you make that determination, and if it's both, how do you split the costs between local customers and all customers?

Discussion: Identifying Metrics

Questions for consideration:

- What major events has the utility experienced?
  - High winds, lightning, equipment failure
- What are the potential major events?
  - Earthquakes, tsunamis
- Where are the critical loads?
  - Shelters, command centers, hospitals
- How long do those loads need to be sustained?
  - Hours, days, weeks

Key Takeaway

Define success first: What are the resilient outcomes that planning should pursue?

Discussion: Principles of Resilience Planning

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Questions for consideration:

- Who will own the assets?
  - Utility? Customer? For larger investments, such as a microgrid, is hybrid ownership appropriate? If private or hybrid, do customers have access to necessary utility facilities (wires)?
- Who are the stakeholders?
  - Customers, consumer advocates, independent providers?
- Structure
  - What are the desired services? How should assets be interconnected and communicate with the grid to achieve those services?

Key Takeaway:
Like any distributed resource, the optimal configuration will vary by location.

Discussion: Ratemaking

Questions for consideration:

- Who will pay?
  - Utility/ratepayers? Participating customers? Split?
- How will services be monetized?
  - Customer and third-party ownership with supporting tariffs? How can ancillary services be identified and valued?
- Ownership
  - A utility may be able to most efficiently capture the full range of values of a resilient asset, but public policy and consumer preferences may push for customer ownership. What are the tradeoffs? Is joint ownership viable?

Key Takeaway:
Absent an organized market, proper rate and tariff design are necessary to unlock additional values of resilient assets.

Activities in Other States

- Washington
  - In reliability reports, utilities must identify worst-performing circuits and improvement plans.
- Florida
  - Since 2006, Florida utilities have been required to file annual grid hardening reports. Reports cover vegetation management, system GIS development, outages, and undergrounding.
- Pennsylvania
  - Utilities can file long-term infrastructure plans and, if approved, impose a distribution system improvement charge to fund the investments.
- Utility-Specific Programs
  - PSE&G (NJ), PEPCO (MD)

If you have any other thoughts, please reach out!

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