

Sempra Auwahi Wind & Energy Storage Presentation to UH Maui



November 11, 2011

Hawaii is a Leader in Renewable Energy

- Hawaii generates electricity from wind, solar, geothermal, biomass, and ocean energy
- Hawaii and the U.S. Department of Energy formed the “Hawaii Clean Energy Initiative” in 2008 to rapidly expand renewable energy use and replace fossil fuels
- Hawaii has the most aggressive Renewable Portfolio Standard in the U.S. 2030
 - *Hawaii has implemented a 40% Renewable Portfolio Standard by 2030*
 - *In comparison, the California RPS is “only” 33% by 2020*
- Hawaii is among the highest in MW of solar photovoltaics per capita in the U.S.
- Maui and the Big Island are among the highest in % of renewable MWh in the U.S.
- There are more than 10 energy storage projects in operation/development in Hawaii

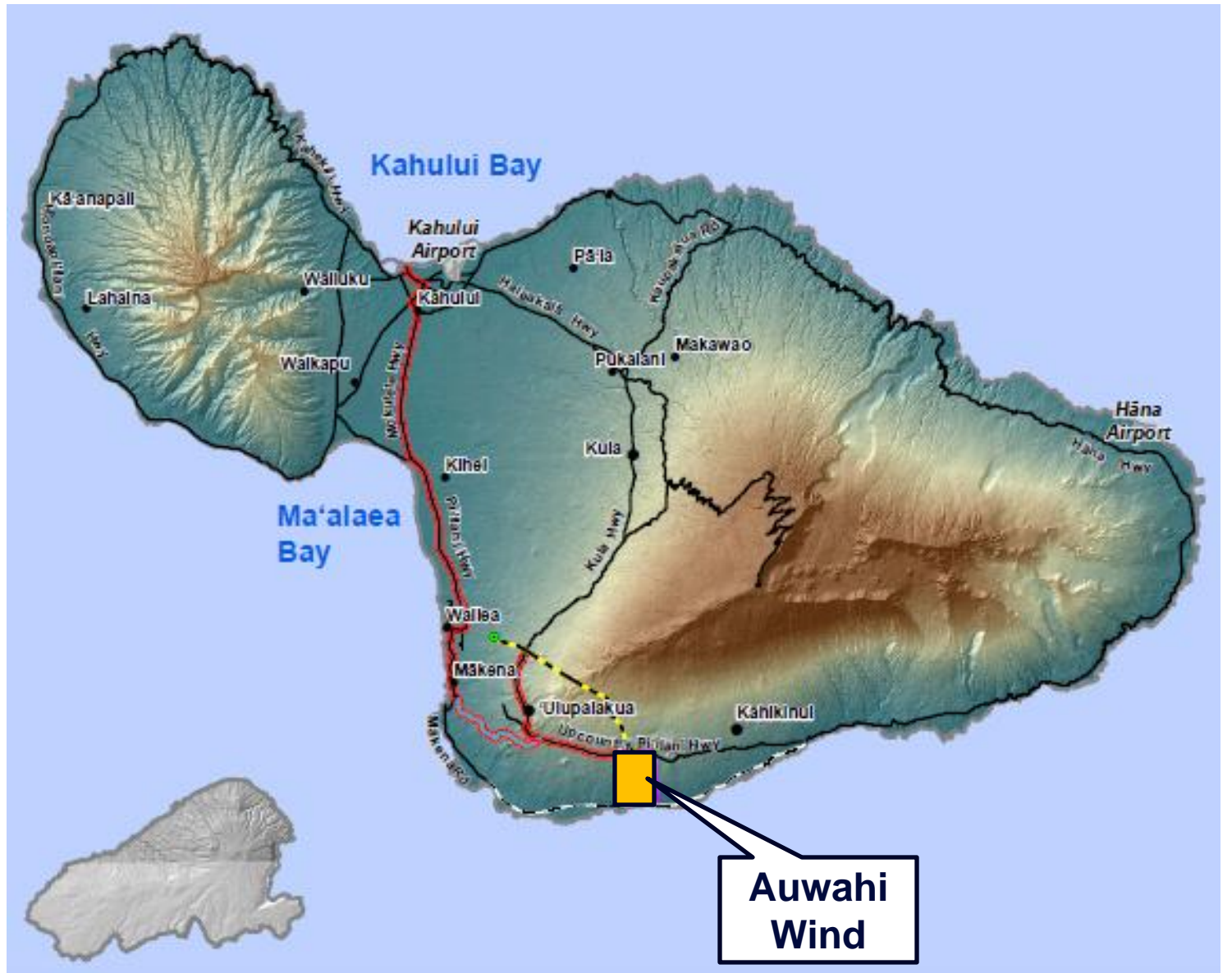
Sempra Background

- **Fortune 500 energy company based in San Diego, California**
- **Sempra Generation develops, owns, and operates gas, wind, and solar PV projects**
- **Sempra's 58 MW Copper Mountain Solar Project in Nevada is the largest operating solar PV project in the US**
- **Sempra's 150 MW Mesquite Solar is the largest currently under construction in Arizona will be the largest Solar PV project in the world**
- **Sempra Generation is currently developing the 21 MW Auwahi Wind & Energy Storage Project on Maui that is scheduled to enter operation by December 2012**
- **Sempra Generation has several additional wind and solar project opportunities in Hawaii that could enter operation within the next 2 to 5 years**

Auwahi Wind & Energy Storage Project

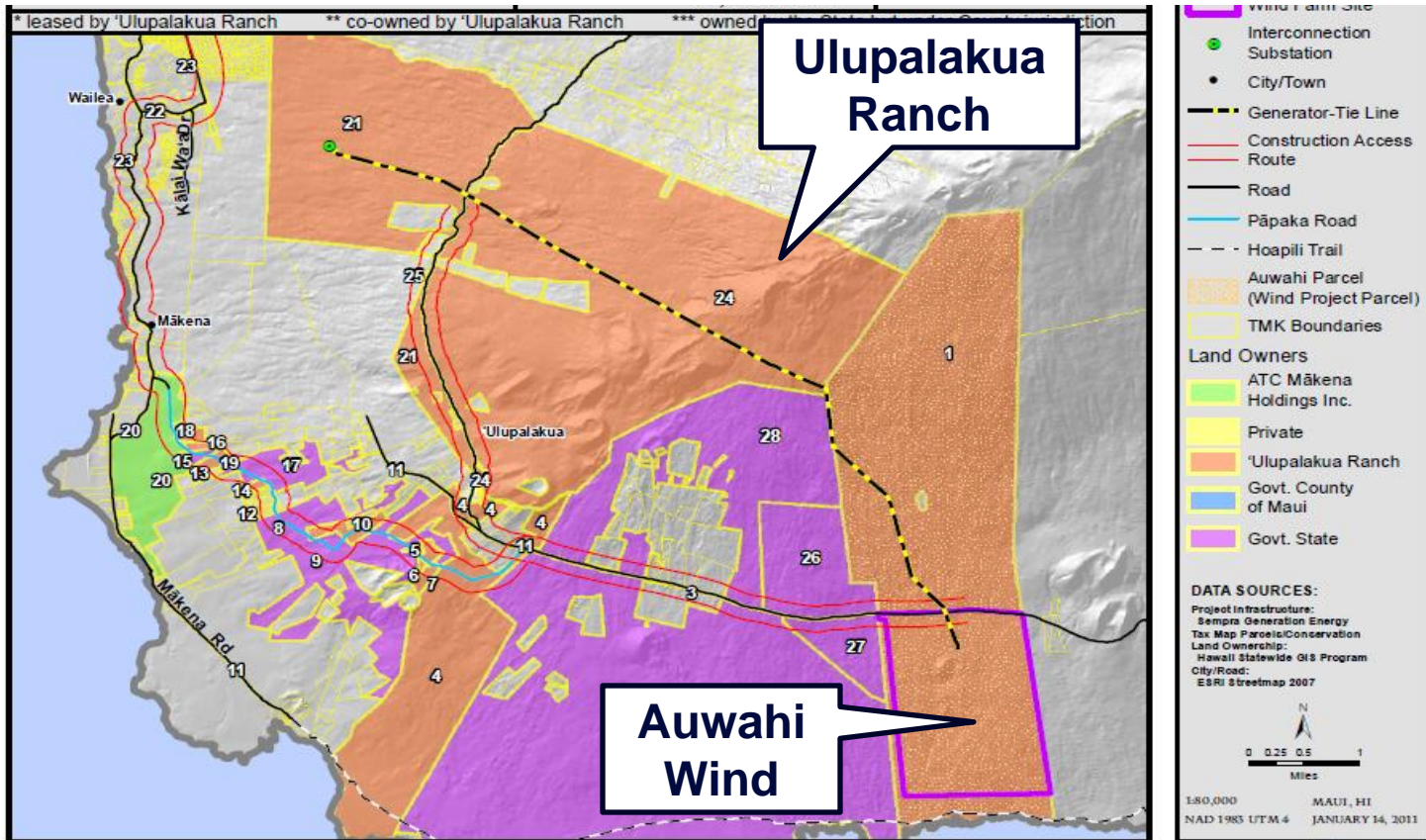
- **21 MW Wind Project with up to 15 MW x 10 MWh of Battery Storage**
 - Eight Siemens 3.0 MW Direct-drive Wind Turbines
 - Containerized batteries from either Xtreme Power or A123 Systems
 - 9-mile transmission line
 - Upgraded 4.5 mile access road
- **Acquired development assets from Shell Wind in October 2009**
- **Located on the Auwahi parcel of Ulupalakua Ranch in Southeast Maui**
- **Supply power to Maui Electric under a 20-year Power Purchase Agreement**
- **Final Permits by January 2012**
- **Start of Construction in March 2012**
- **Commercial Operation by December 2012**

Maui

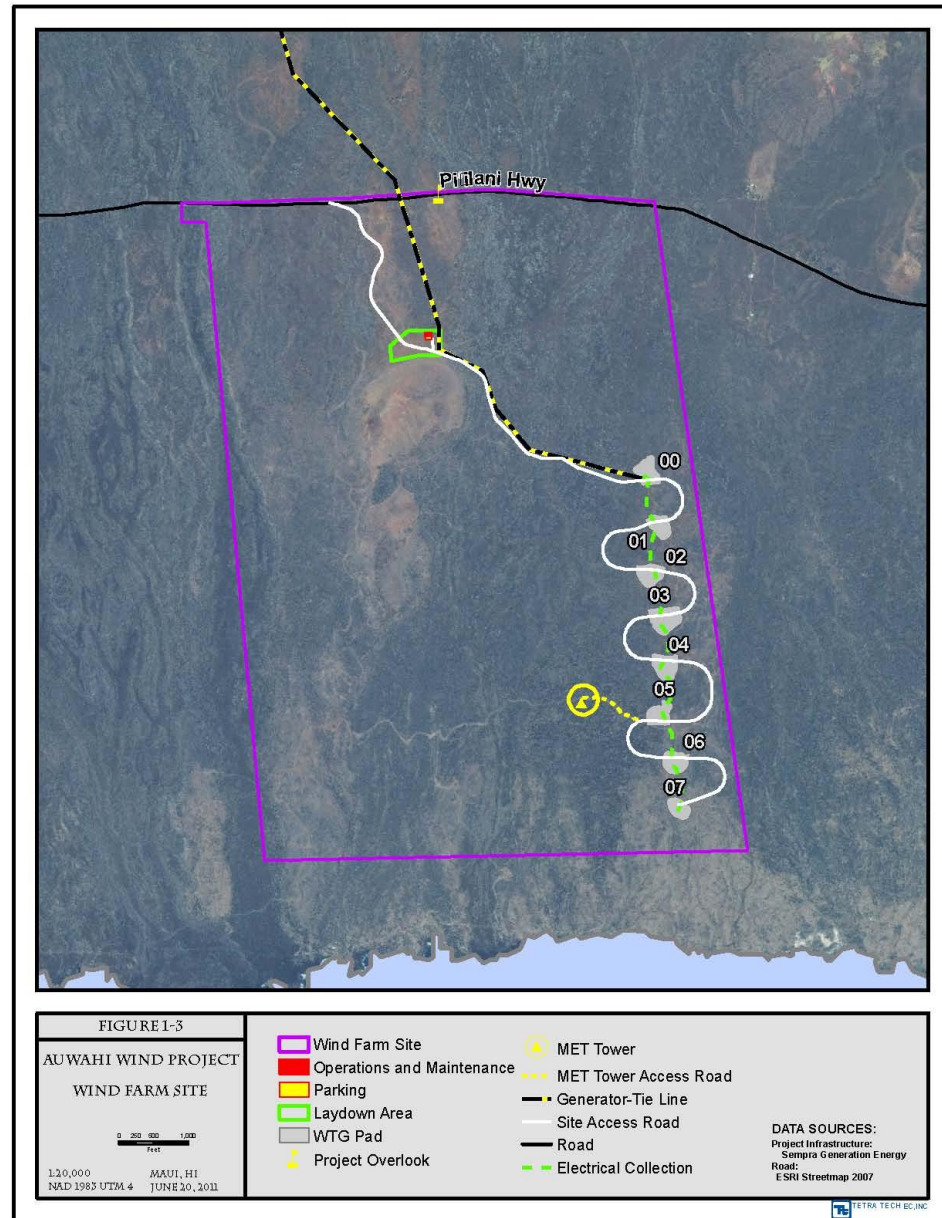


Ulupalakua Ranch

- 18,000 acre, 150-year old cattle ranch owned and managed by the Erdman family
- The Erdman family have a strong history of conservation and land stewardship
- Recently dedicated 12,000 acres of the ranch into permanent conservation



Auwahi Wind Project Site



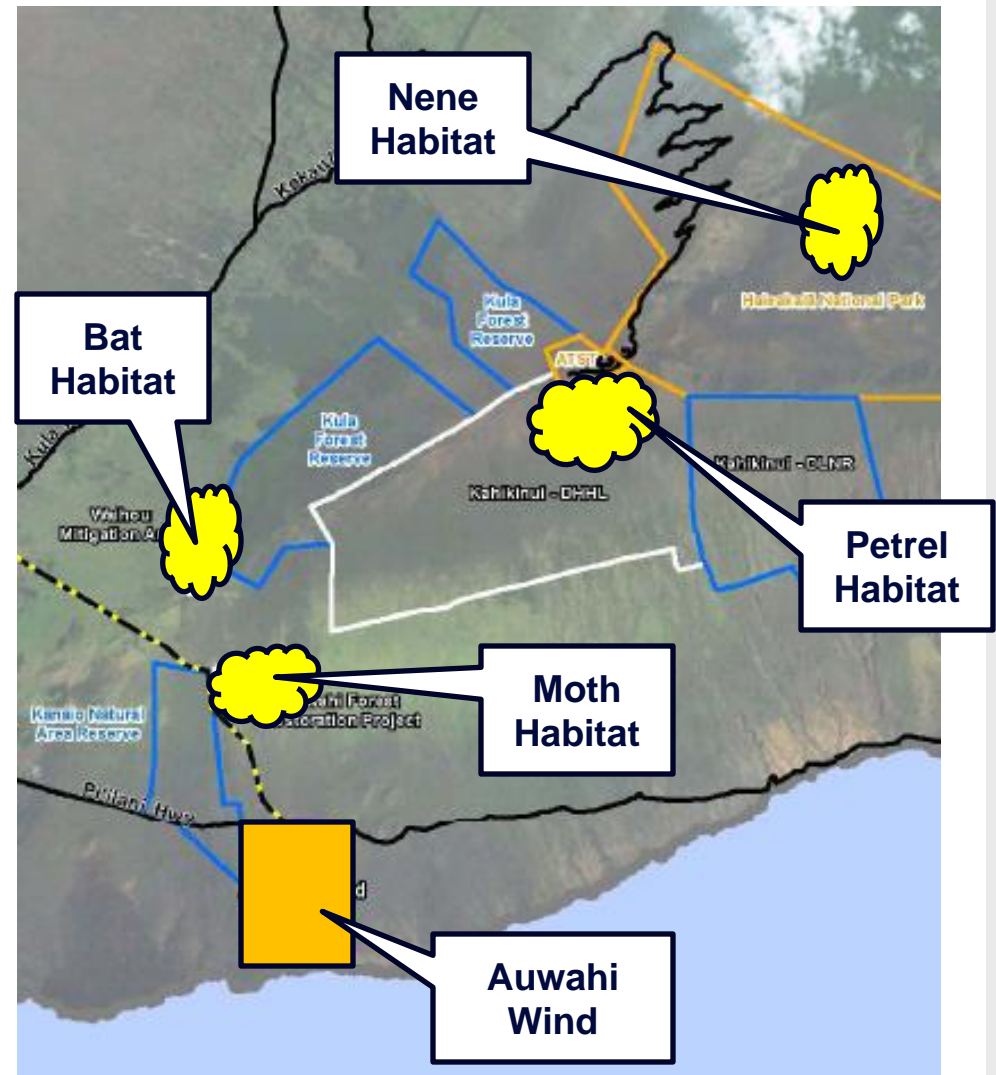
F:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MCD\HCP\Sempra_Auwahi_HCP_Fig1-3_WindFarmSite_11185_070711 - Last Accessed: 7/7/2011 - Map Scale correct at: A.NS1 A (8.5" x 11")

Auwahi Wind & Maui Electric

- **The Auwahi site has one of the best wind resources in the world**
 - 58% Net Capacity Factor (before curtailment) based on 3 years of on-site wind data from 3 met masts
 - Consistent easterly trade winds generate predictable production profile
- **Peak Production consistently occurs during mid-day through-out the entire year**
- **Maui Electric peak load is approximately 200 MW**
 - Auwahi will supply approximately 10% of Maui's peak load and 6% of annual load
 - Auwahi will supply enough energy for approximately 10,000 Maui homes
- **Batteries will be used to smooth and stabilize variability in the wind power**
- **Auwahi will be curtailed at night when Maui Electric's load drops down to 70 MW**
- **Curtailment is expected to be reduced over time due to Maui Electric load growth**

Habitat Conservation Plan

- Provides Legal Authorization for “Incidental Take” of State & Federal protected species
 - Hawaii Incidental Take Permit
 - US Incidental Take License
- Offsets the impact of Incidental Take by restoring native habitat
- Impacted Species
 - Hawaiian Petrel
 - Hawaiian Hoary Bat
 - Blackburn Sphinx Moth
 - Hawaiian Nene
- Proposed Mitigation Projects
 - Protection of habitat from cows, goats, pigs, cats, and mongoose
 - Reforestation of pastures
 - Research on impacted species



Archeological & Cultural Assessment

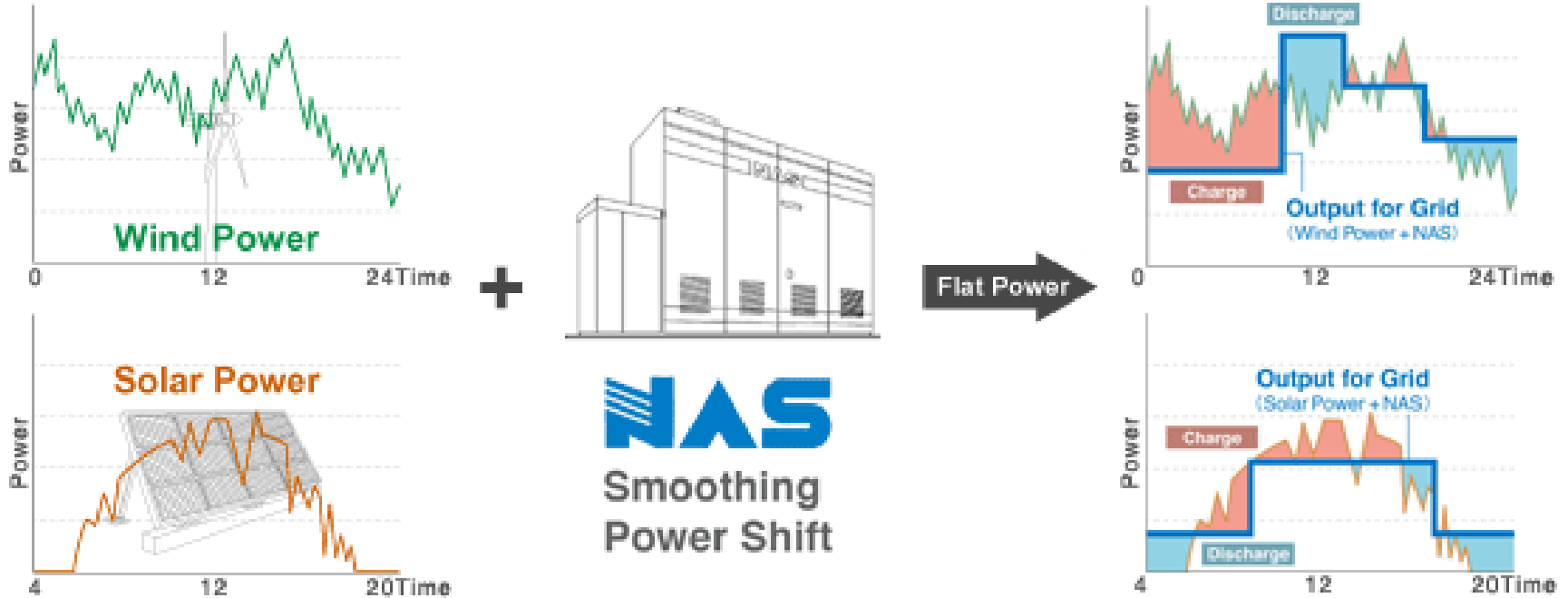
- All significant Archeological & Cultural features will be avoided in construction
- An extensive Archeological & Cultural Survey has been completed along with a Data Recovery Plan
- The site has been in cattle ranching for 150 years and has been substantially degraded
- Archeological analysis indicates the site was inhabited by native Hawaiians from 1400 to 1700
- Numerous structures have been found on the site including 5 “hieus” (religious platforms)



Project Milestone Schedule

- **PPA Approved by Hawaii PUC** **June 15, 2011**
- **Draft Habitat Conservation Plan Published by State of Hawaii** **July 22, 2011**
- **Final Environmental Impact Statement Approved by Maui County** **August 9, 2011**
- **LNTP to order Equipment** **September 2011**
- **SMA and CUP Permits Approved by Maui County** **November 8, 2011**
- **Final Permits, NEPA EA & HCP Approval, and Sempra Board FNTF** **January 2012**
- **Start of Construction** **February 2012**
- **Start of Turbine Erection** **August 2012**
- **Commercial Operation Date** **December 2012**

Power Smoothing & Energy Shifting



Value of Energy Storage

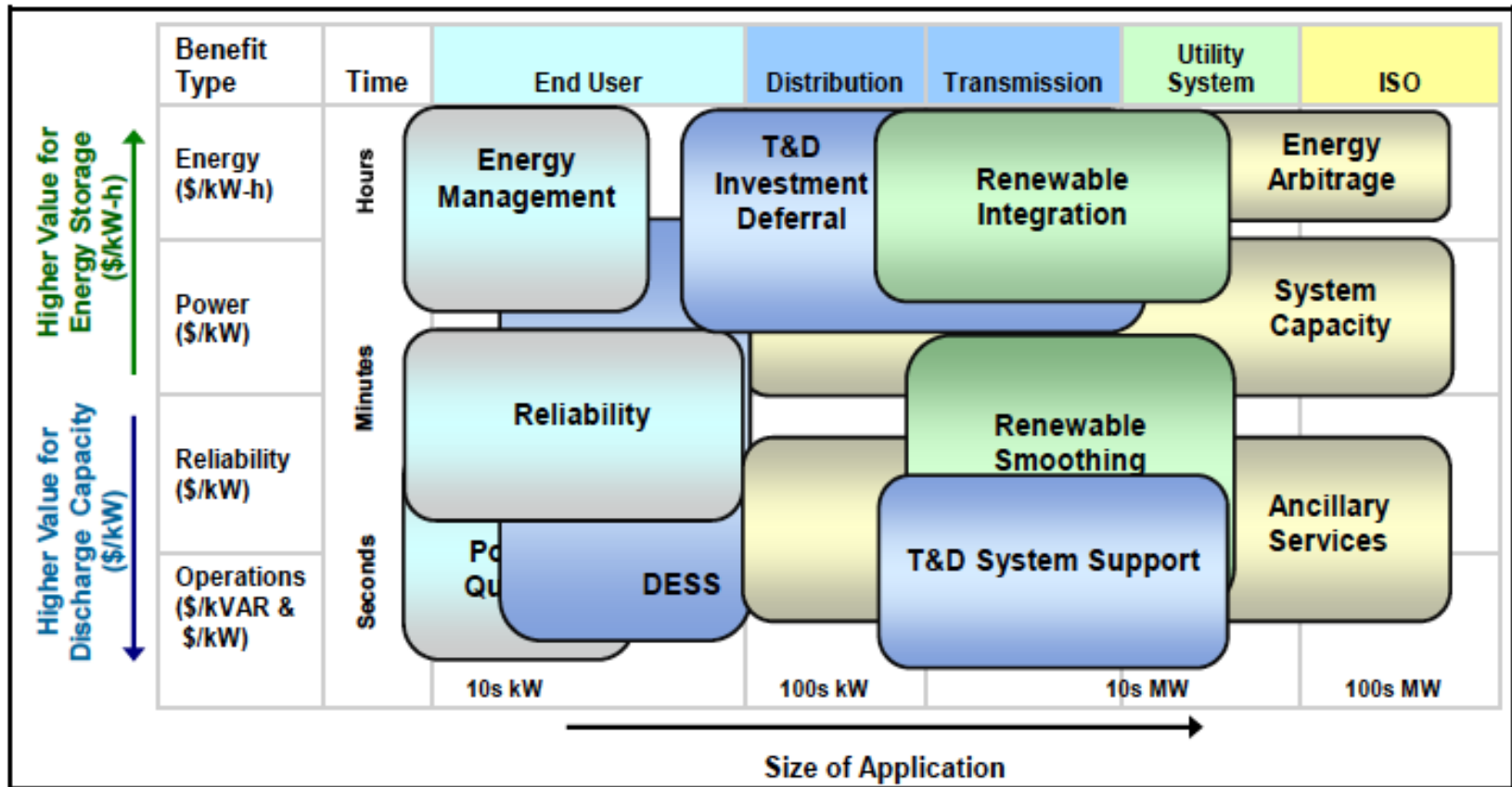
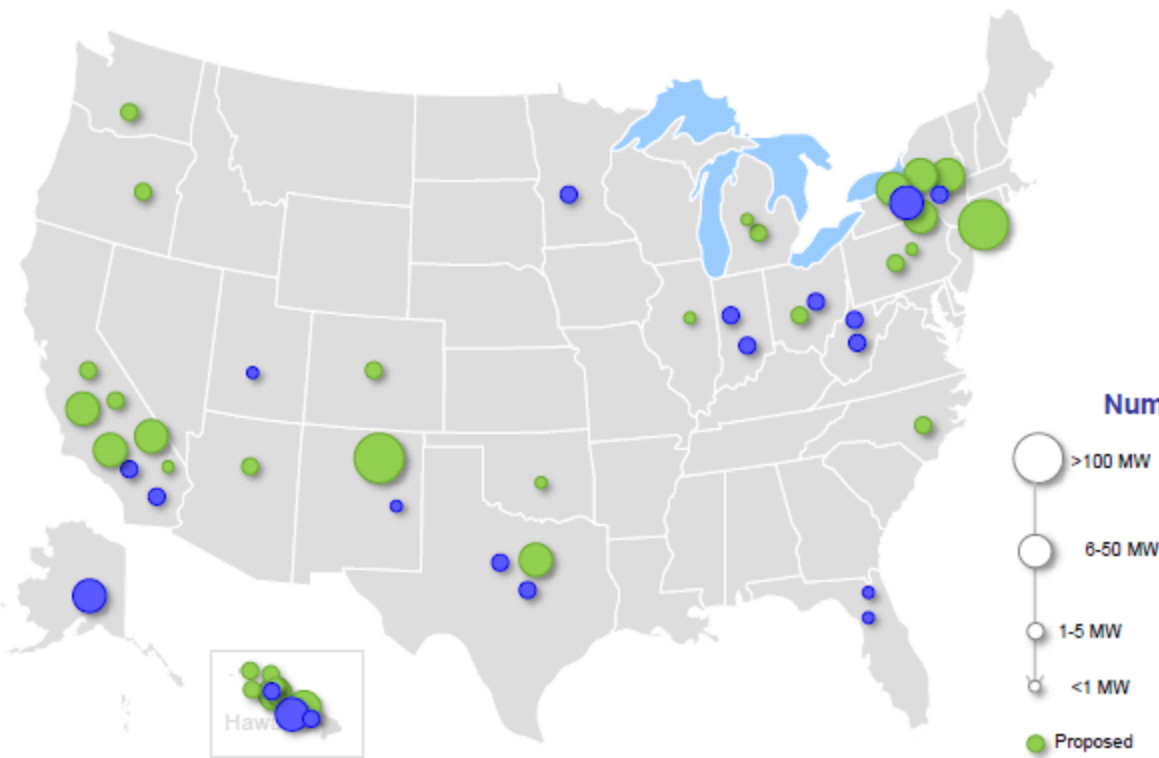


Figure 2-1
Operational Benefits Monetizing the Value of Energy Storage

US Utility-Scale Battery Storage Market Surges Forward

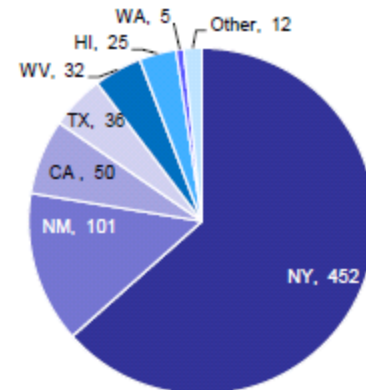
Regional Utility-Scale Battery Activity

Planned and Operating Battery Projects in the US (>500 kW)

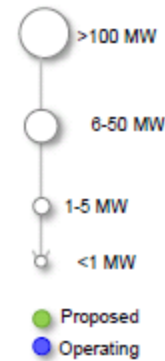
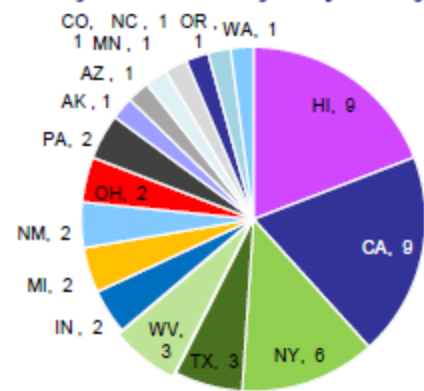


Note: Only shows battery projects >500 kW in size
 Source: IHS Emerging Energy Research

Planned Battery Capacity By State (MW)

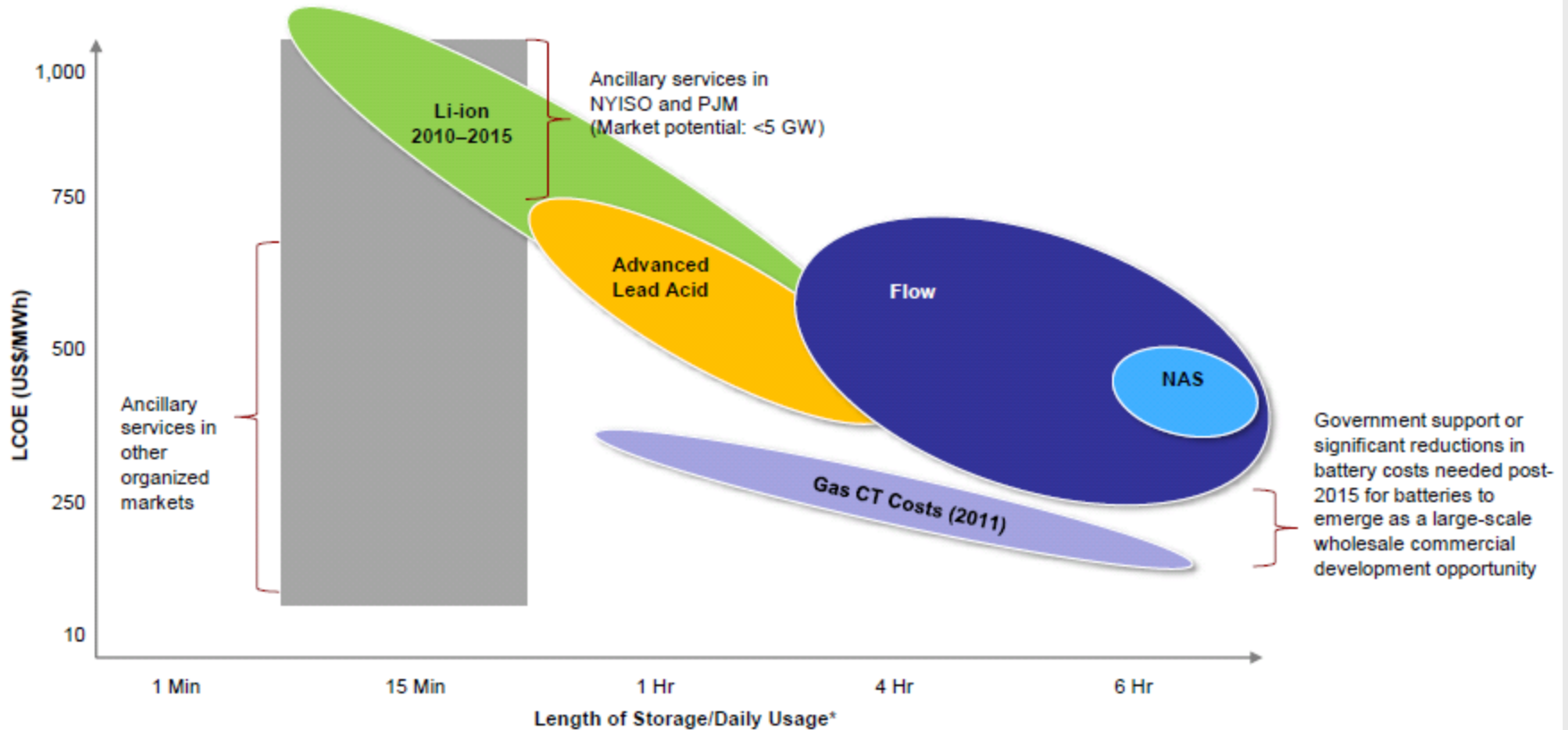


Number of Utility-Scale Battery Projects by State



New York, Hawaii, and California are attracting the most battery project activity, driven by a combination of federal government funding, regulatory shifts, renewables growth, and state policy support

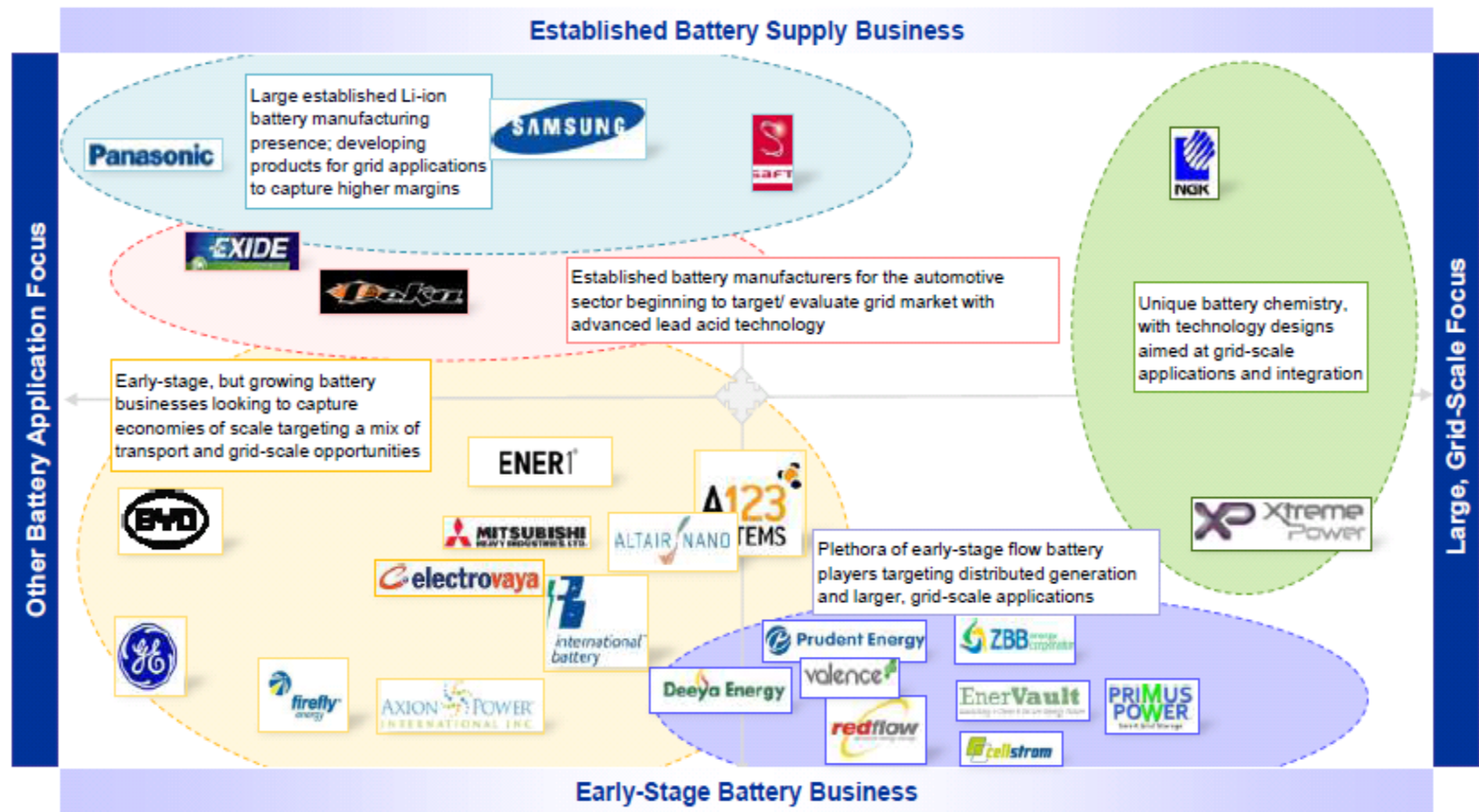
Battery Costs Relative to Renewable Integration Benefits



Note: Costs are indicative based on project-level data for grid-scale applications. *Daily usage refers to gas CT costs
 Source: Companies, IHS Emerging Energy Research

Batteries are expected to remain uneconomic for most applications in the absence of funding support, or until costs fall at least an additional 50% beyond projections in 2015

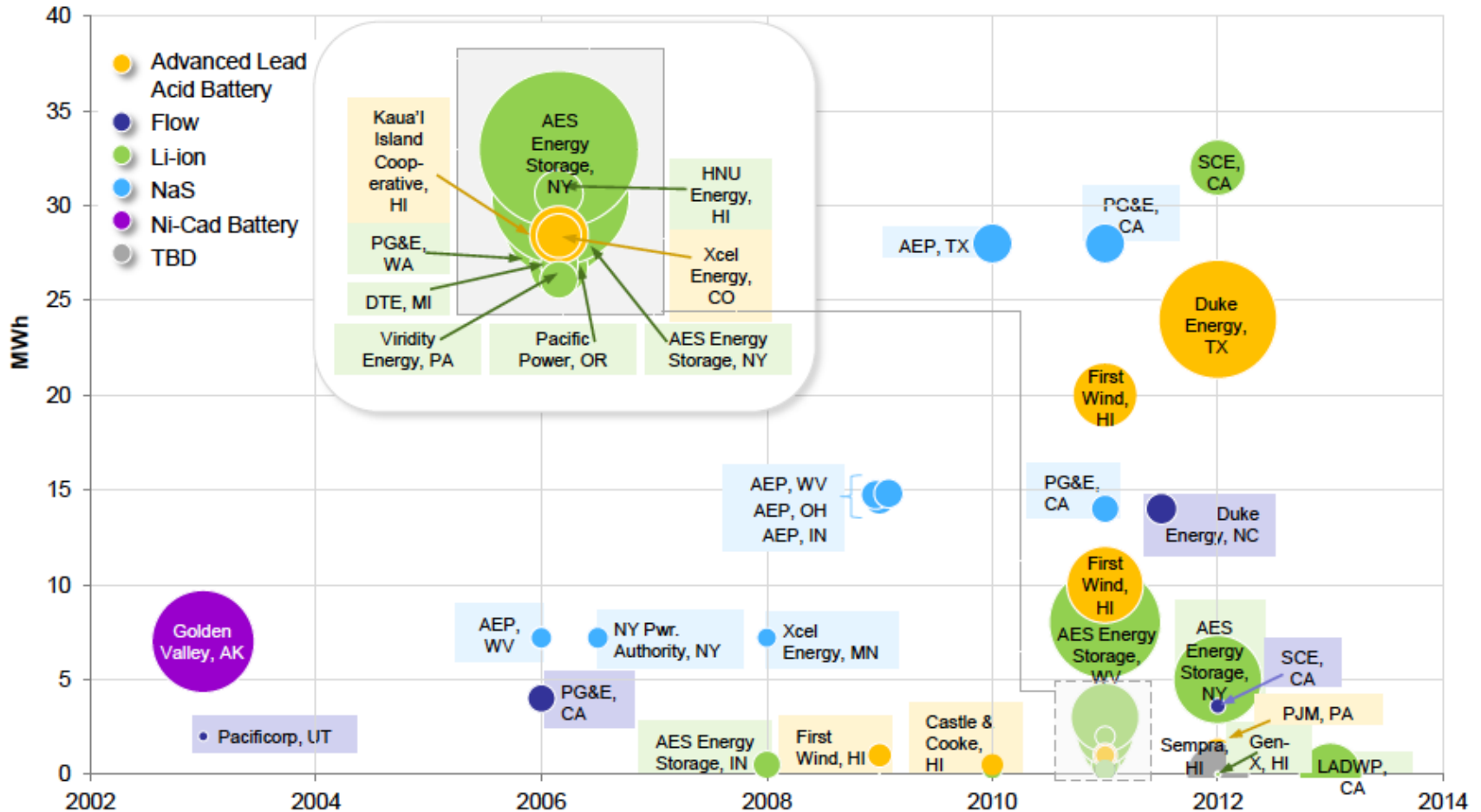
Positioning of Leading Battery Manufacturers Eyeing the Utility Market



Source: IHS Emerging Energy Research

More than 25 battery manufacturers at varying stages of maturity are targeting the utility segment

Project Status by Technology



Source: IHS Emerging Energy Research

Hawaii Battery Projects

Project Name	Location	Capacity	Developer	Battery Supplier	Battery Technology	Service	Online
Kahaloa Wind Project	Kahaloa, Maui	1.8 MW (1 MWh)	First Wind	General Power	Dry Cell	Wind smoothing, curtailment mitigation	2009
EDUC Battery Storage Project	Kaunoi	1.8 MW	EDUC, HGEI	General Power	Dry Cell	PV smoothing	2011
First Wind Kahaloa Project	Kahaloa, Oahu	1.8 MW (20 MWh)	First Wind	General Power	Dry Cell	Wind smoothing, curtailment mitigation, voltage regulation	2011
Lanai 100 Solar PV Project	Lanai	1.125 MW (20 MWh)	Castell & Coaker	General Power	Dry Cell	PV ramp rate control	2011
Waialeale High PV Penetration Circuit	Waialeale, Oahu	1 MW (20 MWh)	HECO	ABB Power	Lithium Ion	PV smoothing, voltage regulation	2011
Hawai Renewable Partners Wind Farm BESS Demonstration	Hawai, Hawaii	1 MW	Hawai Renewable Partners	ABB Power	Lithium Ion	Wind smoothing, curtailment mitigation	2011
HECO/Hawai KEMO Demonstration	Hawai, Hawaii	100 kW	HECO	ABB Power	Lithium Ion	Wind/solar integration	2012
HECO BESS	TBD, Hawaii	100 MW (200 MWh)	HECO	TBD	TBD	Frequency and voltage regulation	2012
Kahaloa Wind Project 2	Kahaloa, Maui	20 MW (20 MWh)	First Wind	General Power	Dry Cell	Wind smoothing, curtailment mitigation, frequency regulation	2012
HGEI Energy BESS Demonstration	Kaunoi, Maui	1 MW	HGEI	International Battery	Lithium Ion	PV smoothing	2012
MREI (Maui Renewable)	Kahaloa, Maui	TBD	HECO	TBD	TBD	Curtailement reduction	2012
Auahi Wind Project	Maunaloa, Maui	TBD	Sempra	TBD	TBD	Wind smoothing	2012
DOE HGEI Maui Smart Grid Project	Wailea, Maui	1 MW (1 MWh)	HECO	ACC	Lithium Ion	PV integration	2013
Hawai Japan Smart Grid Project	Kaunoi, Maui	TBD	TBD	TBD	TBD	Electric vehicle charging, community storage	2014

Source: Hawaii Clean Energy Initiative, HECO, IHS Emerging Energy Research

Utility-Scale Battery Energy Storage



NGK NaS Battery Array



A123 2 MW Li Battery Array



98 MW Wind/32 MW Storage Project, WV-US
(in construction)



Reserve Capacity for Utilities and LSEs

98 MW Wind/32 MW Storage Project, WV-US *(in construction)*

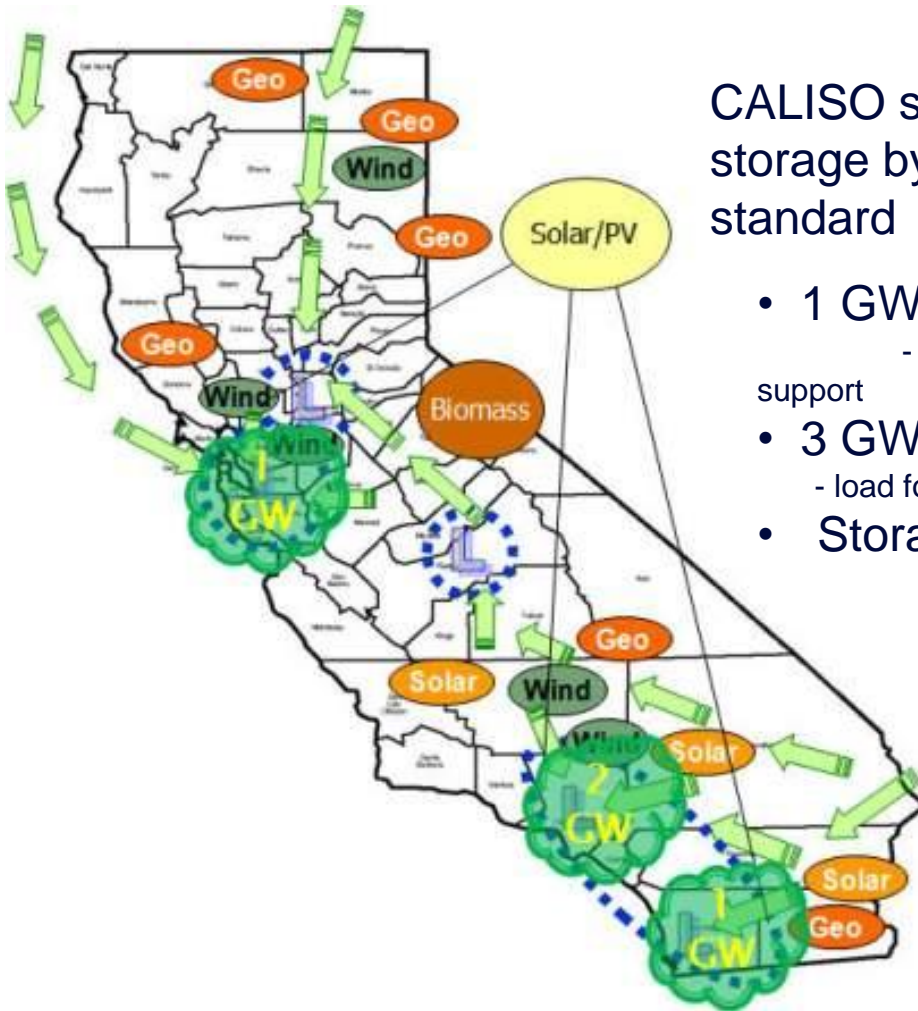


Reserve Capacity for Utilities and LSEs

30 MW Sea Water Pumped Hydro Okinawa, Japan



Utility-Scale Energy Storage in California



CALISO study estimates need for 4,000 MW of storage by 2020 to meet the 33% RPS standard

- 1 GW 25 min 4C discharge
 - freq regulation, spinning reserve, & reactive power support
- 3 GW 2-4 hr 0.25 C discharge
 - load following, peak supply
- Storage Portfolios Standard?

Mahalo!

Questions?



Mitch Dmohowski, Director, Sempra Generation