

Energy Policy of the State of Hawaii

Update on the World's Leading Energy Transition Model



Mark B. Glick

Specialist, Energy Policy & Innovation

Hawaii Natural Energy Institute, Univ. of Hawaii at Manoa

May 9, 2019

Jeju, South Korea



Hawaii Natural Energy Institute

Hawaii Natural Energy Institute (HNEI)

*School of Ocean and Earth Science and Technology
University of Hawaii at Manoa (UHM)*

- Founded as organized research unit in 1974, established in statute in 2007 – serves as the State’s lead on energy resource and technology development seeking solutions to renewable generation, transportation fuels, grid integration, and energy policy
- 4 major funding sources; UHM, Barrel Tax, Extramural, Applied Research Laboratory– alternative energy via HNEI recognized as core competency for the UH Advanced Research Laboratory
- Diverse staff including engineers, scientists, lawyers; students and postdoctoral fellows, combining research excellence & deep experience:
 - Our policy team features a former PUC Commissioner & State Energy Administrator – GridSTART features >120 years cumulative utility experience
 - Two of the three current PUC Commissioners were hired directly from HNEI

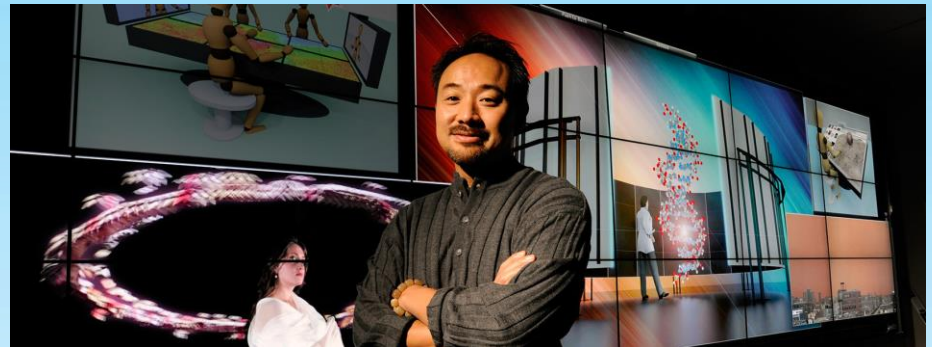


Hawaii Natural Energy Institute

Strategic Focus

Hawaii Innovation Initiative

- Research, Development, Testing & Evaluation
- Analysis
- Policy Guidance
- Workforce Development



Programs & Alliances to Replicate and Expand

- Asia Pacific Regional Energy Systems Analysis (APRESA) supported by the Office of Naval Research - to develop resilient renewable energy systems in the Asia Pacific
- Islanded Grid Resource Center 2.0 in collaboration with Maine's Island Institute & the Renewable Energy Assistance Project of Alaska

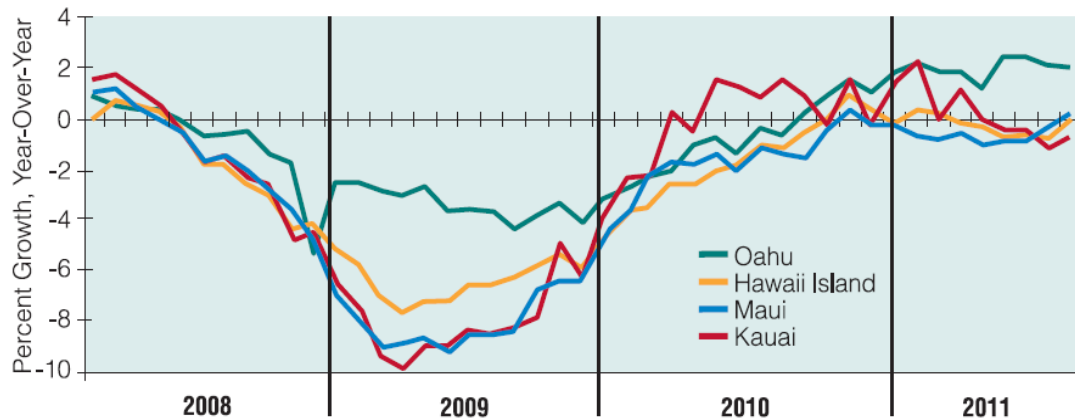


Hawaii's Economic Recession (2008-09)

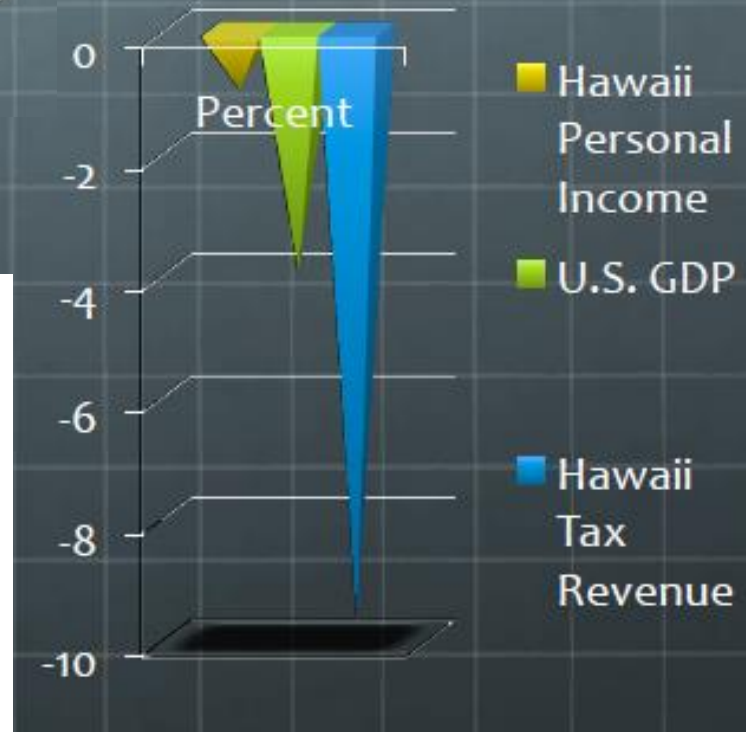
Decline in Hawaii and U. S. Economy and Hawaii Tax Revenues FY 2009

- Freefall in tax revenue & job growth

CHART 1 • JOB GROWTH, BY COUNTY, 2008-11



Source: State Department of Labor & Industrial Resources



Source: Lawrence Boyd, Univ. of Hawaii 2011



Hawaii Natural Energy Institute

“The Hawaii Clean Energy Initiative”
An Energy Transformation Partnership



Hawaii Natural Energy Institute

A Comprehensive Approach

RPS (Binding RE Targets)

EEPS (Efficiency Goals)

Regulatory (Regulatory Framework & Oversight)

Analysis (Planning, Design & Optimization)

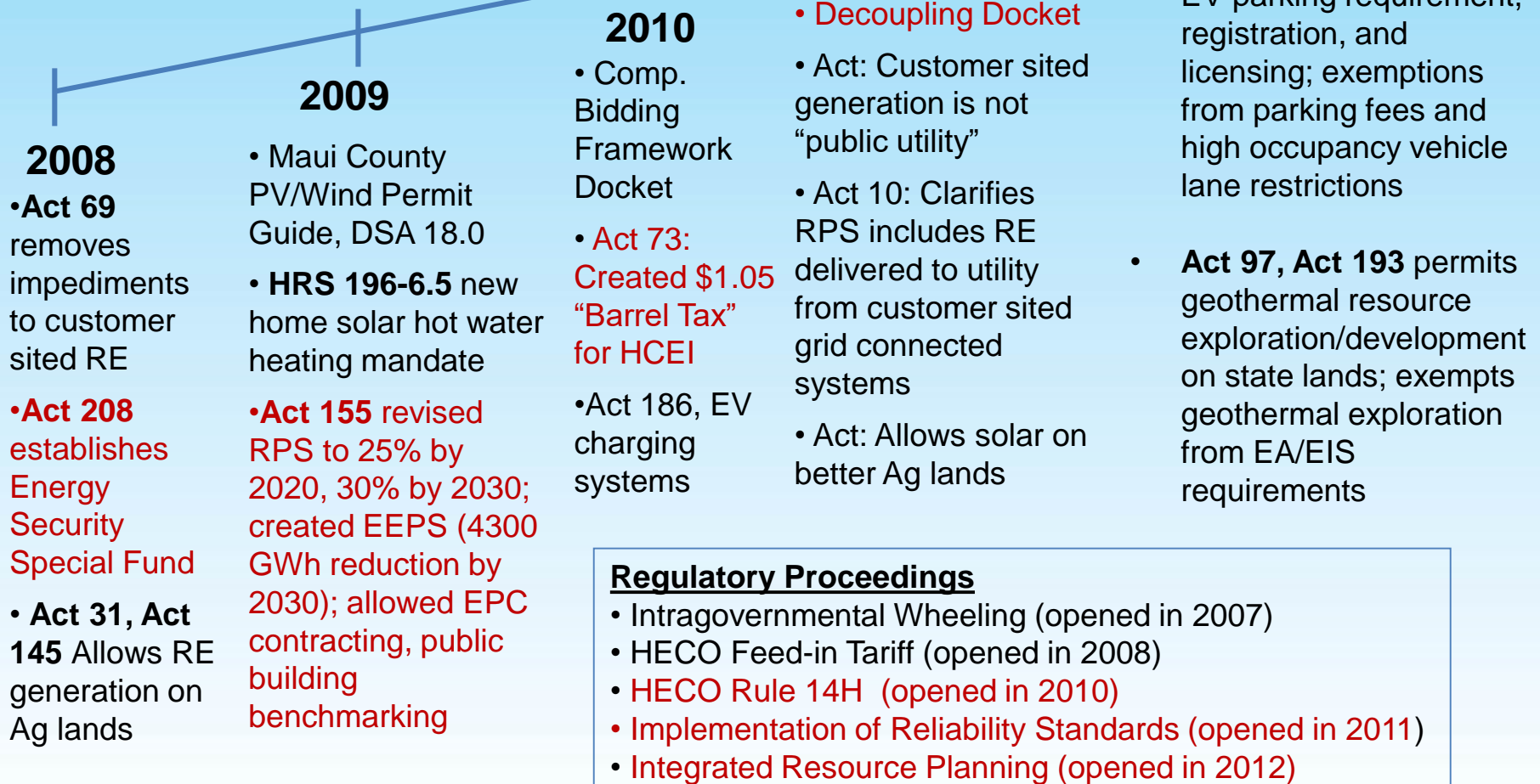
RD&D (Technology & Innovation Economy)

- **100% RPS**
- **4,300 GWh**
- **Dockets**
- **Design**
- **Test Bed**



Initial Energy Policy Measures

US DOE/Hawaii Agreement, State of Hawaii/HEI Companies Energy Agreement Renewable Portfolio Standards (RPS)



Hawaii's Energy Transformation Policies

2013

- **Act 37** Authorizes PUC policy to accelerate retirement of utility fossil generation
- **Act 211** Establishes regulatory financing structure for rate reduction bond financing for RE
- **Act 261** Exempts landlords & lessors who install RE systems from definition of “public utility”
- **Act 262** Wind energy facility decommissioning

2014

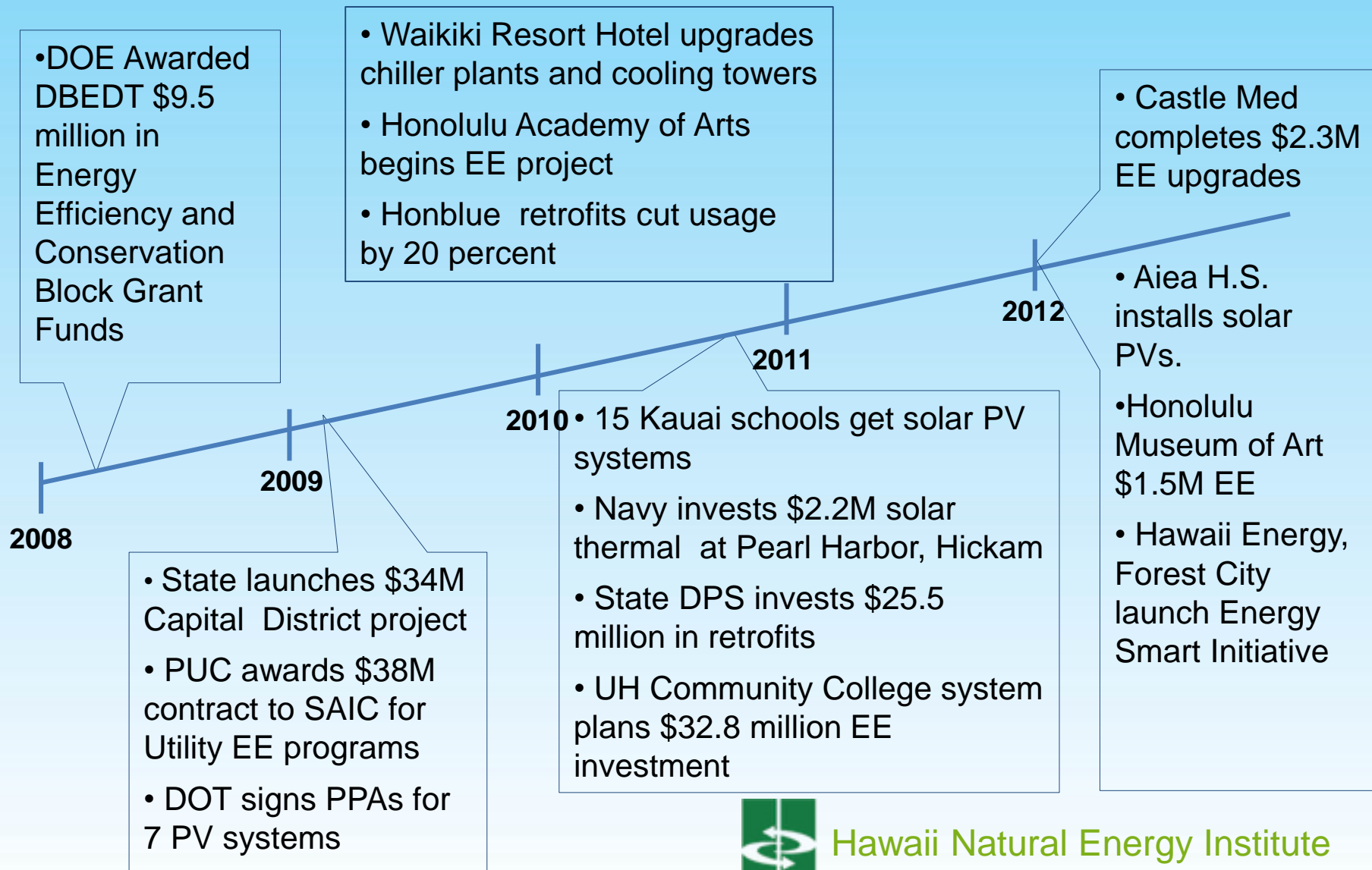
- **Act 52, Act 55** Permits solar energy facilities on ag land
- **Act 106** Solar energy devise roof warranty
- **Act 107** Aligns barrel tax as a resource strategy for the state's 2030 clean energy goals
- **Act 109** Amends PUC principles for the modernization of the electric grid
- **Act 164** State Building Code (modifies, revises and clarifies)

2015

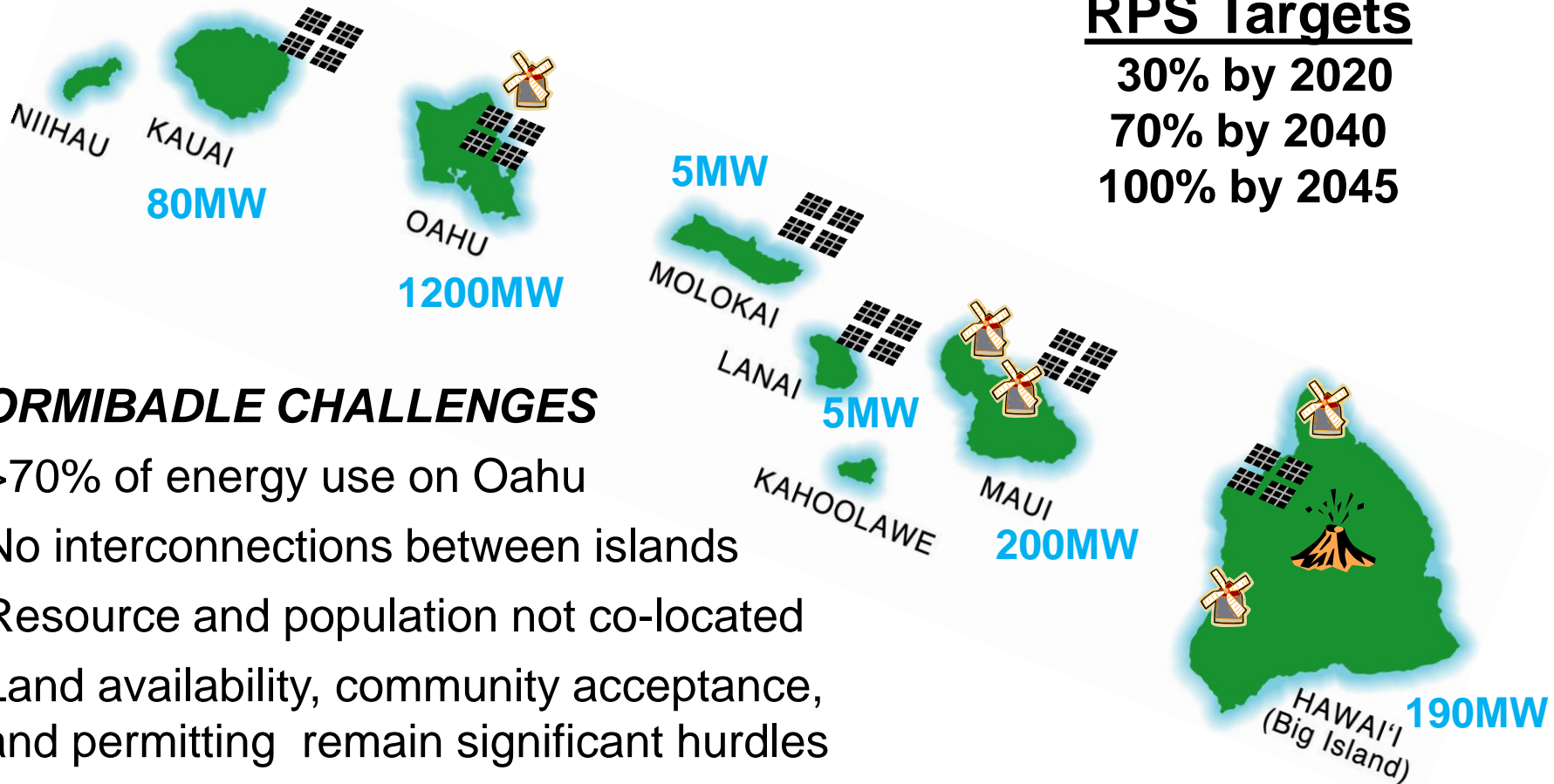
- **Act 97** 100% RPS (electricity sector) by 2045
- **Act 98** Establishes a Hydrogen Implementation Authority
- **Act 99** Requires the University of Hawaii to become a net zero user of energy
- **Act 100** Community-based renewable energy program
- **Act 185** Applies barrel tax to other fossil fuels
- **Act 201** On-Bill Program



Examples of Reducing Energy Demand



Affecting Change on Six Isolated Grids



FORMIBADLE CHALLENGES

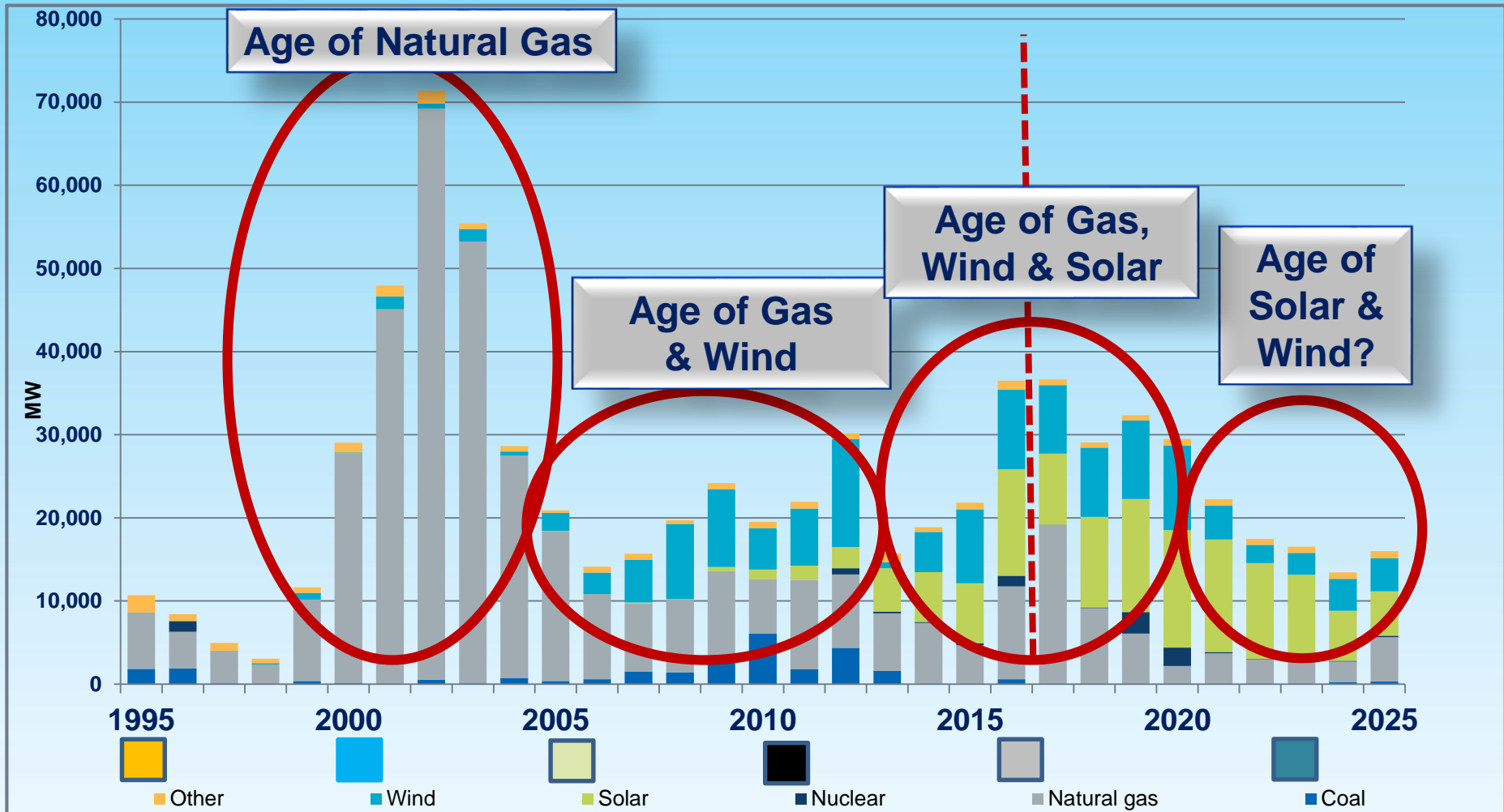
- >70% of energy use on Oahu
- No interconnections between islands
- Resource and population not co-located
- Land availability, community acceptance, and permitting remain significant hurdles

Meeting RPS goals requires innovation and community commitment



Capacity Additions - Quadrennial Energy Review

(2nd Installment)

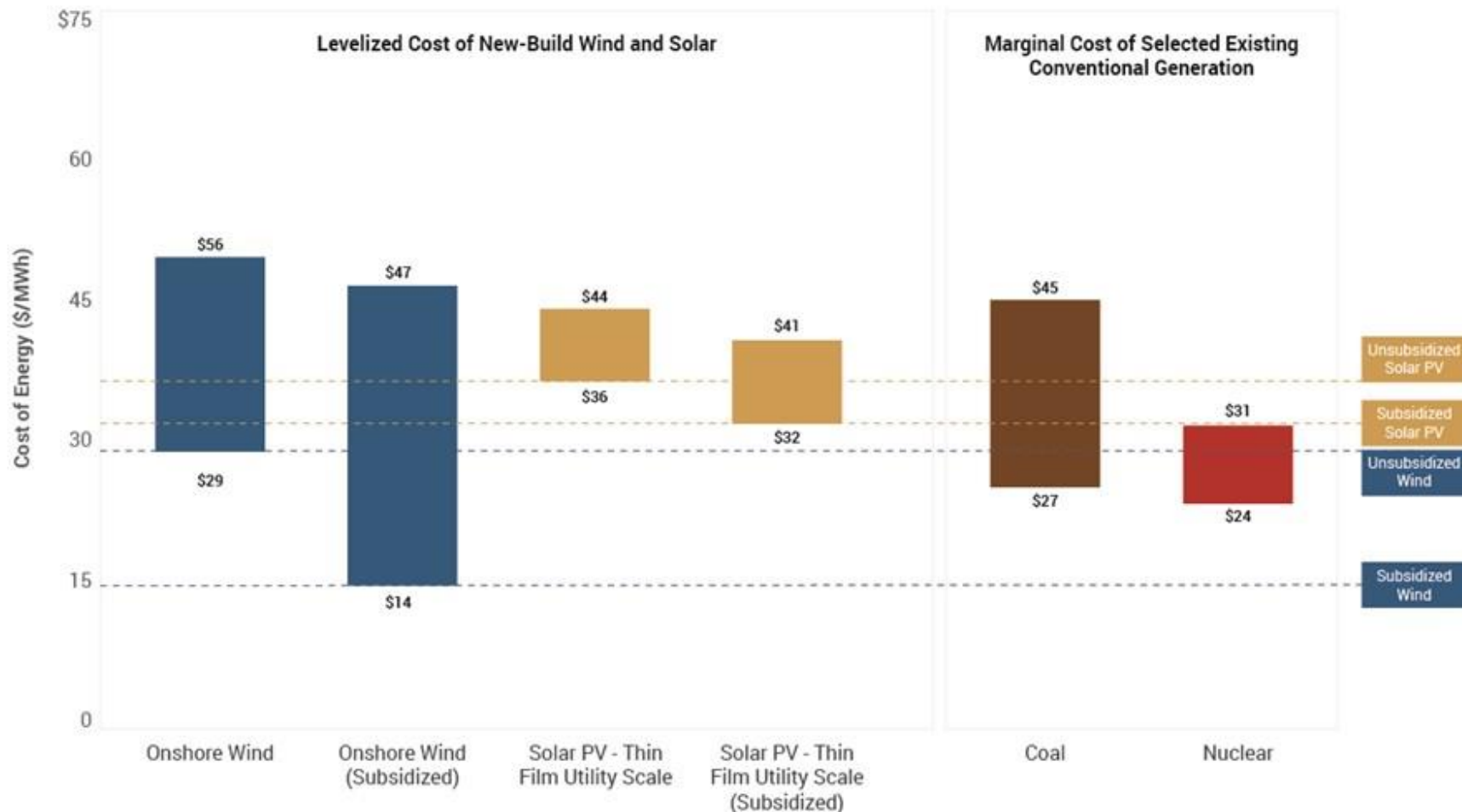


Notes: Additions exclude coal-to-natural gas or biomass conversions.

Source: IHS and ABB Velocity Suite

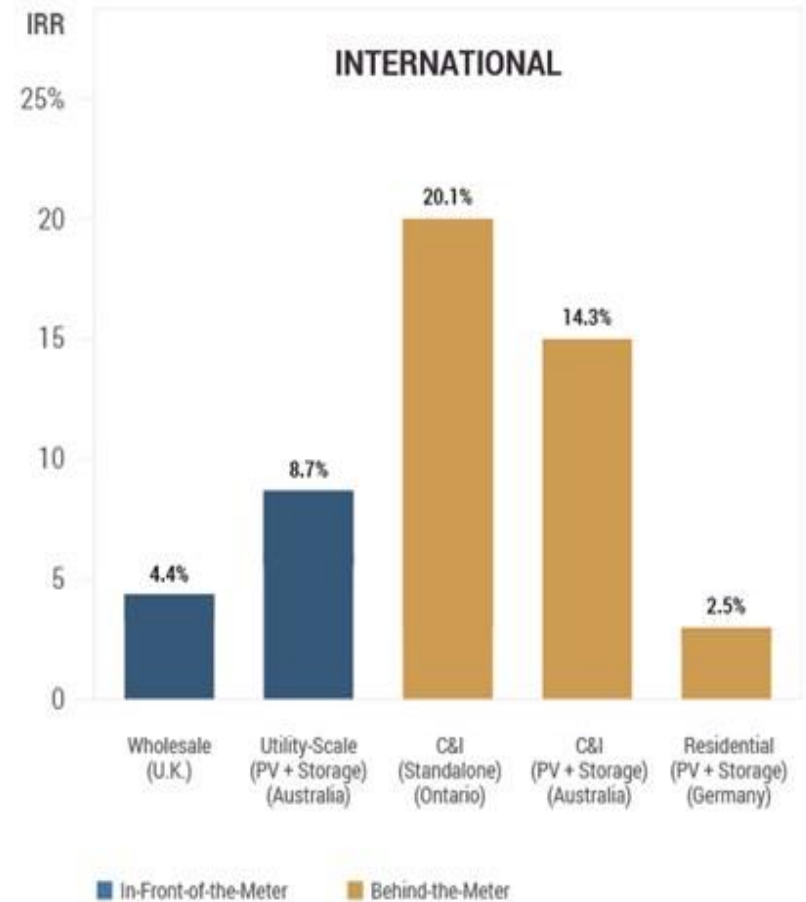
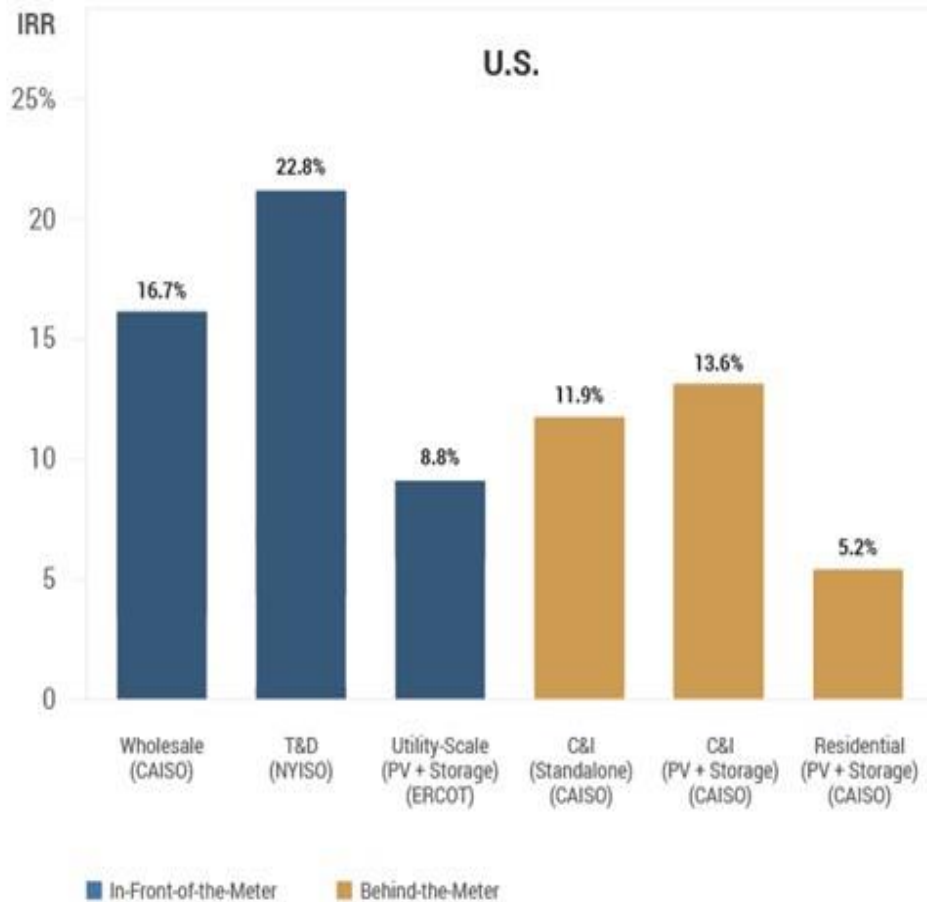
© 2016 IHS

Declining Cost Curves for Renewable Energy



Source: Lazard Ltd.

Levelized Costs for RE & Storage – US / World



Source: Lazard Ltd.

Recent PV Plus Storage PPAs in Hawaii

Project name	Island	Developer	Size	Storage	Cost per KWh
Waikoloa Solar	Hawaii	AES	30 MW	120 MWh	\$0.08
Hale Kuawehi	Hawaii	Innergex	30 MW	120 MWh	\$0.09
Kuihelani Solar	Maui	AES	60 MW	240 MWh	\$0.08
Paeahu Solar	Maui	Innergex	15 MW	60 MWh	\$0.12
Hoohana	Oahu	174 Power Global	52 MW	208 MWh	\$0.10
Mililani I Solar	Oahu	Clearway	39 MW	156 MWh	\$0.09
Waiawa Solar	Oahu	Clearway	36 MW	144 MWh	\$0.10

Oil: 1y **\$0.14** 5y **\$0.16** - max **\$0.25**

Source: Richard Wallsgrove

On Renewable Integration...

THE WALL STREET JOURNAL.

“there’s no better place
to look than Hawaii”



Hawaii Natural Energy Institute

Tax Incentives – Credits (USA / Hawaii)

Federal Energy Credit

30 Percent Credit on Qualifying Assets

- Nonrefundable
- Reducing in Future Years

26% in 2020, 22% in 2021 and 10% in 2022

Hawaii Renewable Generation Credits

Hawaii Renewable Energy Technologies Income Tax Credit ("RETITC")

- 35 Percent Credit of the Actual Cost or the Cap Amount
- 24.5 Percent (Refundable) Credit

Results in 30 Percent Reduction in the Eligible Credit and
Effects the Cap

Possible Federal Income Recognition of Credits

(data from the Solar Energy Industries Association)

State	Cumulative Solar Electric Capacity per Capita (Watts/person)	Rank	Solar Electric Capacity Installed During 2013 per Capita (Watts/person)	Rank	Cumulative Solar Electricity Capacity (MW)	Rank	Total Solar Electricity Capacity Installed During 2013 (MW)	Rank
Arizona	275	1	109	1	1,821	2	724	2
Hawaii	243	2	107	2	341	7	150	6
Nevada	161	3	17	9	450	5	47	12
California	148	4	72	3	5,661	1	2,760	1
New Jersey	136	5	27	6	1,211	3	240	5
New Mexico	113	6	22	7	236	10	46	13
Delaware	82	7	14	10	53	21	9	23
Massachusetts	66	8	37	4	442	6	244	4
Colorado	63	9	12	11	331	8	61	10
North Carolina	57	10	33	5	557	4	328	3

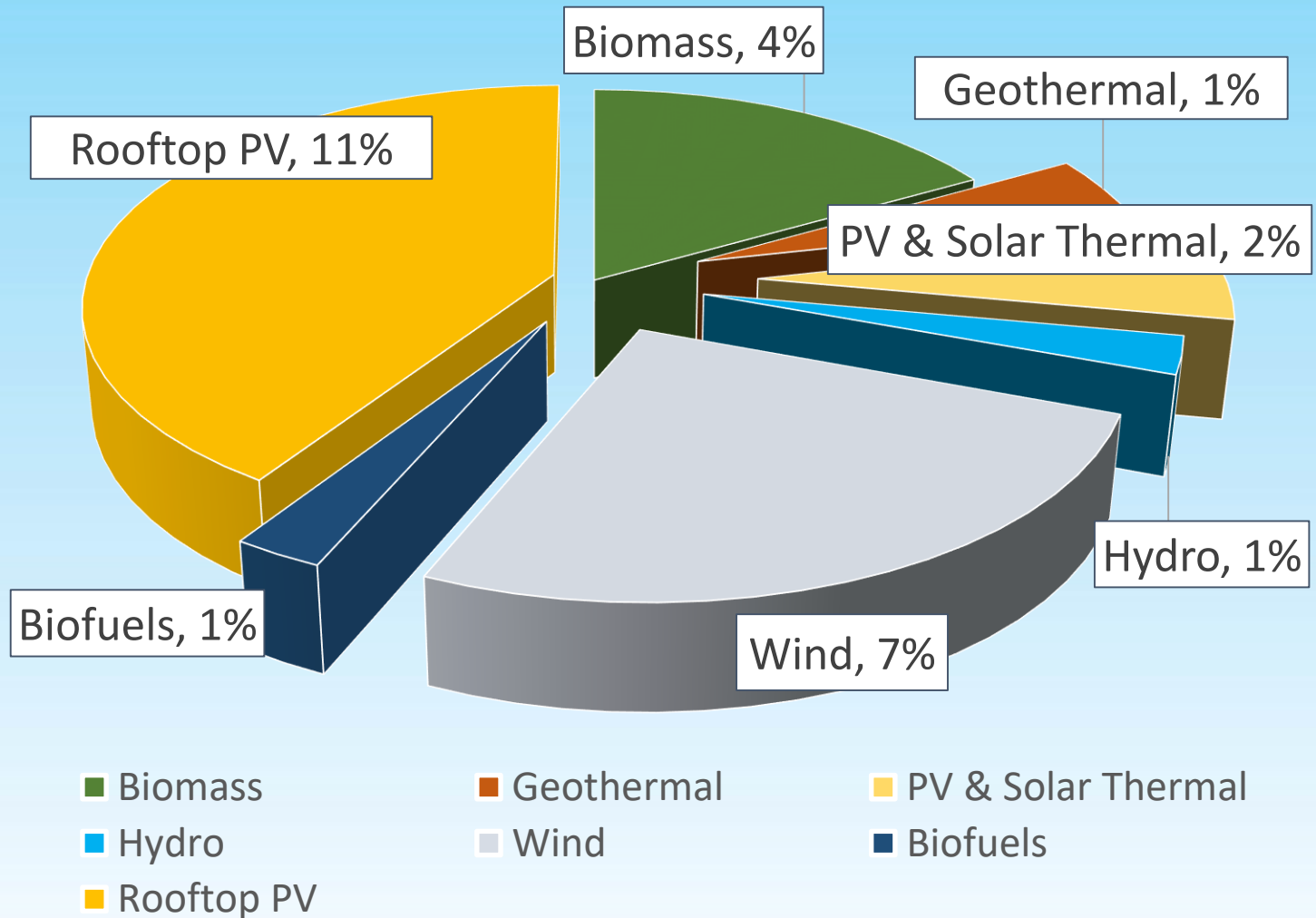
Hawaiian Electric Companies – 2018 RPS Status Report

27% Total

22% HECO
(Oahu –
Honolulu)

44% HELCO
(Hawaii
Island)

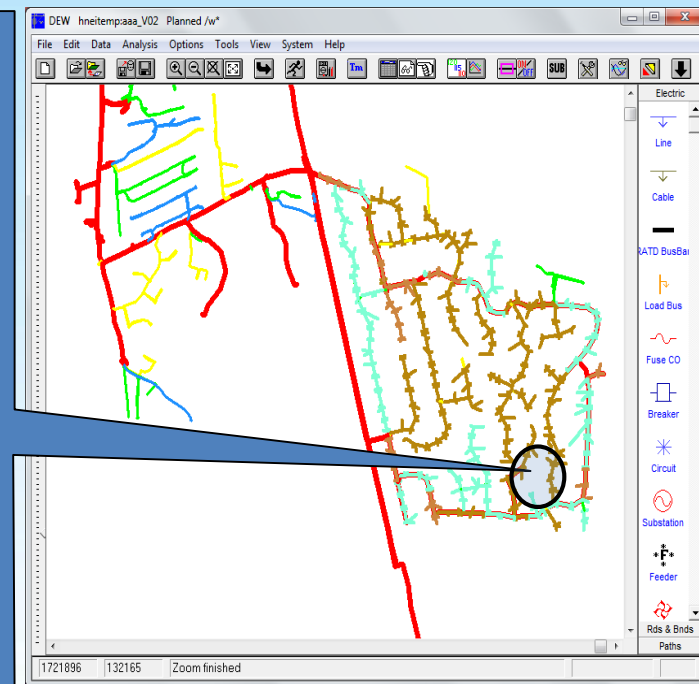
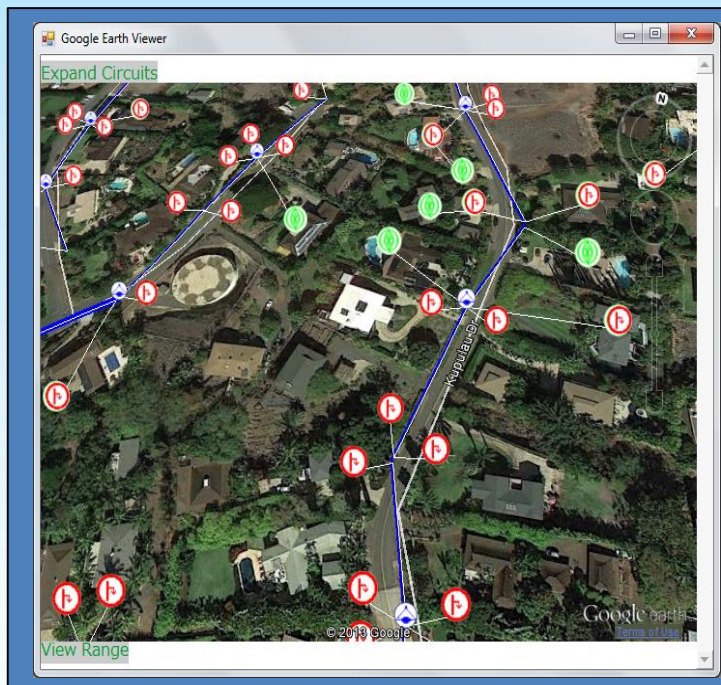
38% MECO
(Maui,
Molokai,
Lanai)



Next Steps – Support Policy with Analysis

Analysis to Inform State Energy Policy & Utility Operations

- Analyses cited in Utility Commission decisions and numerous recommendations have been adopted
- New methods to assess system risk across all hours of year
- Integrating analyses across multiple time-scales to better understand high-penetration renewable grids



Hawaii as a Test Bed – Strategic Alliances

- South Korea and Hawaii - 2015 MOU between Hawaii and Korea Institute of Energy Technology Evaluation and Planning (KETEP) to cooperate in the development of green energy technology
- HNEI and SNU assembled a team that received KETEP International Energy Collaborative R&D Program grant to conduct a feasibility study on microgrid platforms at 3 potential Hawaii sites.
- HNEI formed a six-party alliance to apply for the 2nd step – via KETEP Mission Innovation grant funding
- The alliance won a KETEP grant to build advanced microgrid in Hawaii in a project that concludes in June of 2021.

ENCORED



SEOUL
NATIONAL
UNIVERSITY



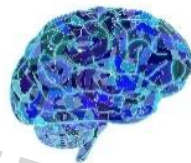
Mission Innovation - Hawaii-Korea Microgrid

Deployment and Operation of “Smart” Microgrid Featuring Distributed Resources with Resilience in Off-grid Events

- Apply big data / reinforcement learning based prediction and optimization algorithms
- Development of system scalability through local EMS interworking
- Design & deploy power trading model and service

- Coordinated control for DG, diesel back-up generator, PV+ESS to maximize off-grid operation time
- Real-time Simulator (RTDS) based system simulation and algorithm verification
- Includes microgrid optimal design methodology

- Microgrid system design & on-site engineering for PV, ESS, Control system
- Install & operate AI-based cloud/local EMS
- Analysis of empirical results on economical value and system stability



AI-Based
Cloud EMS



Off-Grid
Operation



Microgrid System
Operation



Business Model

- Integration of law and regulation in Hawaii
- Guidelines for microgrid business models
- Creation of a replicable, localized new energy service model

Supporting Hawaii's drive for 100% renewable energy through deployment of locally optimized microgrid operation technology

Final Note: Policy & Technology Transfer

Asia Pacific Regional Energy Systems Assessment (APRESA)

- Multiyear funding by the Office of Naval Research to develop partnerships with international partners including universities and other research organizations
- Objective is to enhance the reliability, stability, and resilience of the energy systems in select locations throughout the Asia-Pacific region.
- Take lessons learned from Hawaii experience to stimulate energy self sufficiency
- Focus on grid integration, fuels (i.e., biomass and biofuels), energy efficiency, water-energy nexus, and policy.
- Helping Vietnam develop its RPS policy & implementation plan, largely based on Hawaii's experience.



Thank you!



HNEI

Mark B. Glick
Specialist on Energy Policy
01-808-956-2339
mbglick@hawaii.edu
www.hnei.hawaii.gov