

A Postcard from the Future

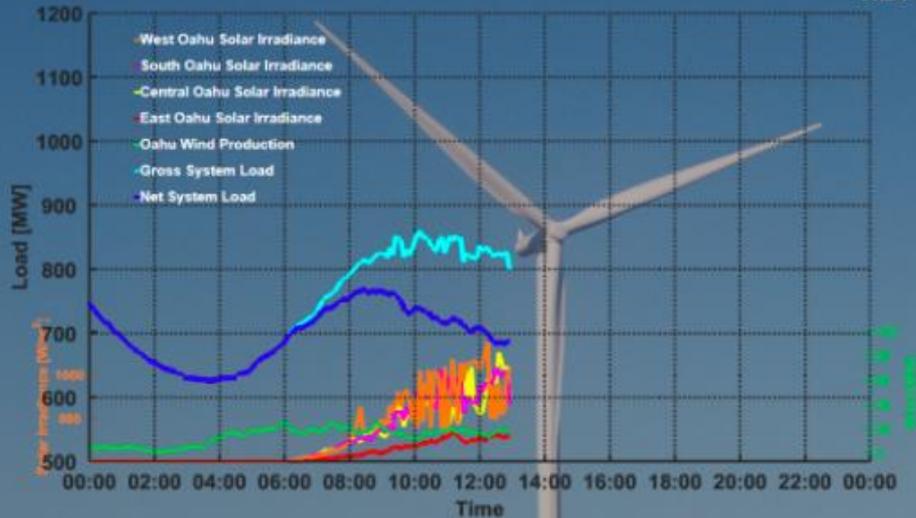
IRENA Innovation Week
Plenary II: Systemic Innovation

Hermina Morita
Former Chair of the Hawaii Public
Utilities Commission
Former Chair of the State House
Committee on Energy & Environmental
Protection

Renewable Watch - Oahu

May 07, 2016

1:24 PM



Current Renewable Power Production (by regions)

West Solar MW: 5.04 Central Solar MW: 22.33 Wind MW: 20.28
 East Solar MW: 14.05 South Solar MW: 70.29

North Solar information to be included at a later time.

Information

Renewable Watch shows at a glance the levels of solar and wind power generated on Oahu and how that energy varies throughout the day.

Below Are Descriptions of What is Currently Displayed:

Net System Load: System Load Served By Hawaiian Electric Company

Gross System Load: Net System Load + Load Served By Behind the Meter PV

West Oahu Solar Irradiance: Solar Irradiance [W/m²] Measured in West Oahu

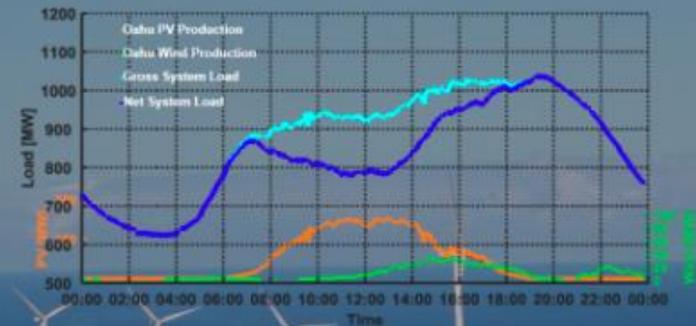
South Oahu Solar Irradiance: Solar Irradiance [W/m²] Measured in South Oahu

Central Oahu Solar Irradiance: Solar Irradiance [W/m²] Measured in Central Oahu

East Oahu Solar Irradiance: Solar Irradiance [W/m²] Measured in East Oahu

Oahu Wind Production: Wind Power Production on Oahu

Renewable Watch - Previous Day



Today

83/72 °F
Mostly sunny

Tomorrow

82/71 °F
Partly cloudy with isolated rain showers.

Monday

81/71 °F
Partly cloudy with isolated rain showers



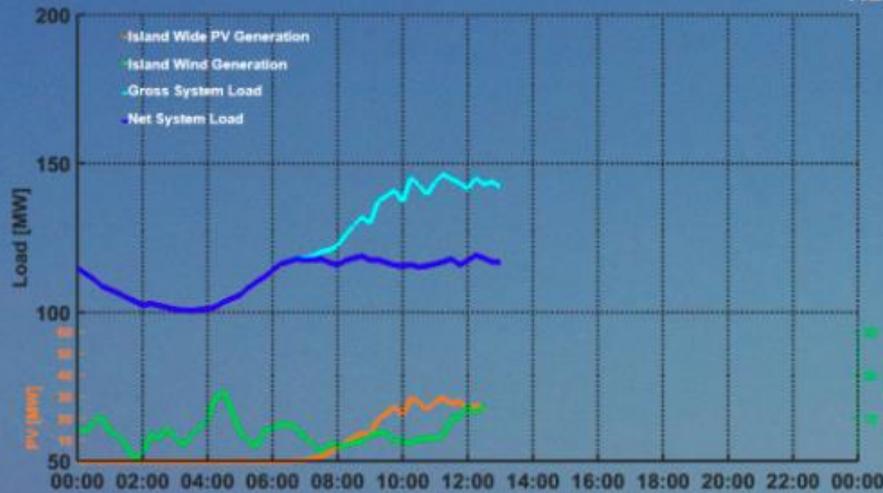
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conditions. It illustrates how different the net system load served by the utility can change throughout the day with changing

Renewable Watch - Hawai'i Island

May 07, 2016

1:24 PM



Information

Renewable Watch shows at a glance the levels of solar and wind power generated on Hawai'i Island and how that energy varies throughout the day.

Below Are Descriptions of What is Currently Displayed:

Net System Load : System Load Served By Hawai'i Electric Light Company.

Gross System Load : Net System Load + Load Served By Behind the Meter PV.

Island Wide PV Generation: PV Power Generation throughout Hawai'i Island.

Island Wind Generation: Wind Power Generation on Hawai'i Island.

Current Renewable Power Production

Island Wide PV [MW]

25.4

Island Wind [MW]

11.8

Today

84/66 °F

Partly cloudy with isolated rain showers.

Tomorrow

83/65 °F

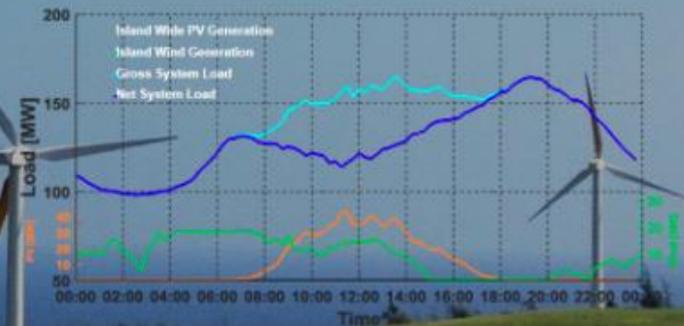
Mostly cloudy with rain showers likely.

Monday

83/65 °F

Overcast with occasional rain showers.

Renewable Watch - Previous Day

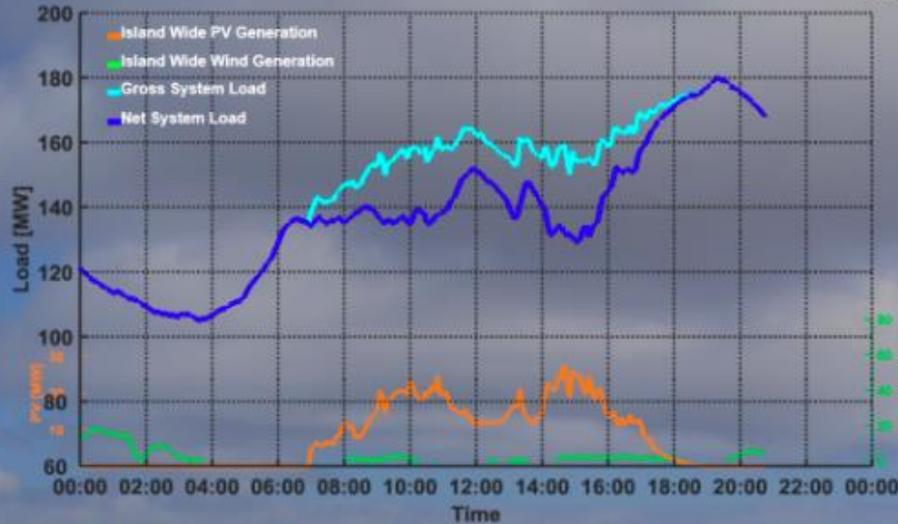


Use Link Title for Caption

"Renewable Watch" or "REWatch" display is updated daily and shows system information as well as wind and solar production

Renewable Watch - Maui

May 07, 2016
1:24 PM



Current Renewable Power Production

Island Wide PV [MW]

0

Island Wide Wind [MW]

4.5

Today

86/67 °F
Mostly cloudy with rain showers likely.

Tomorrow

84/65 °F
Mostly cloudy with scattered rain showers.

Monday

84/66 °F
Partly cloudy with scattered rain showers.

Information

Renewable Watch shows at a glance the levels of solar and wind power generated on Maui and how that energy varies throughout the day.

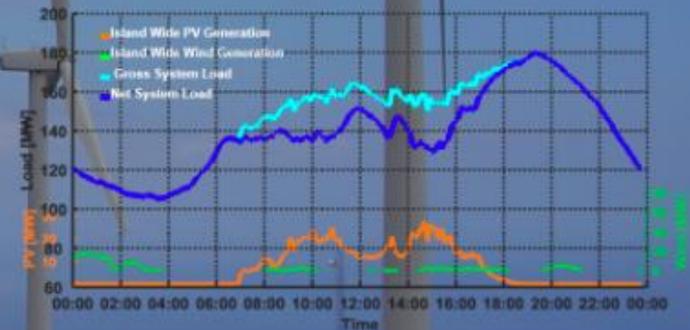
Below Are Descriptions of What is Currently Displayed:
Net System Load : System Load Served By Maui Electric Company.

Gross System Load : Net System Load + Load Served By Behind the Meter PV.

Island Wide PV Generation: PV Power Generation throughout Maui

Island Wind Generation: Wind Power Generation on Maui

Renewable Watch - Previous Day

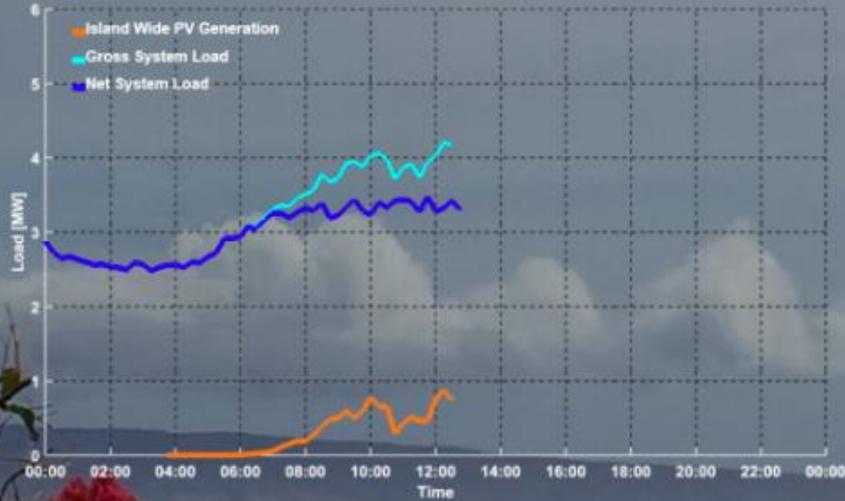


Use Link Title for Caption

Renewable Watch - Lanai

May 07, 2016

1:05 PM



Current Renewable Power Production

Island Wide PV [MW]
NaN

Today

75/66 °F

Overcast with occasional rain showers.

Tomorrow

75/65 °F

Partly cloudy with isolated rain showers.

Monday

75/65 °F

Partly cloudy with isolated rain showers.

Information

Renewable Watch shows at a glance the levels of solar power generated on Lanai and how that energy varies throughout the day.

Below Are Descriptions of What is Currently Displayed:

Net System Load : System Load Served By Maui Electric Company.

Gross System Load : Net System Load + Behind the Meter PV + LSR.

Island Wide PV Generation: PV Power Generation throughout Lanai + LSR.

Renewable Watch - Previous Day



Renewable Watch - Molokai

May 07, 2016

1:15 PM



Current Renewable Power Production

Island Wide PV [MW]
NaN

Today	Tomorrow	Monday
80/67 °F Partly cloudy with scattered rain showers	80/67 °F Partly cloudy with isolated rain showers	79/68 °F Partly cloudy with scattered rain showers

Information

Renewable Watch shows at a glance the levels of solar power generated on Molokai and how that energy varies throughout the day.

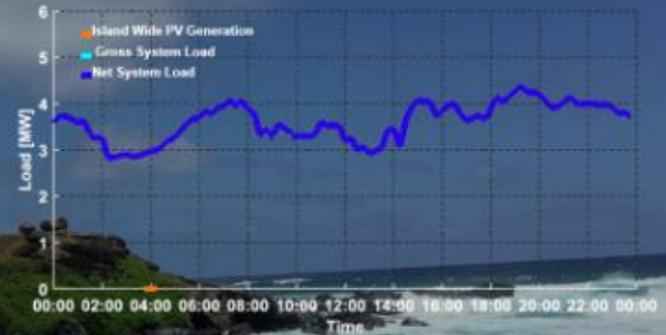
Below Are Descriptions of What is Currently Displayed:

Net System Load : System Load Served By Maui Electric Company.

Gross System Load : Net System Load + Behind the Meter PV.

Island Wide PV Generation: PV Power Generation throughout Molokai.

Renewable Watch - Previous Day

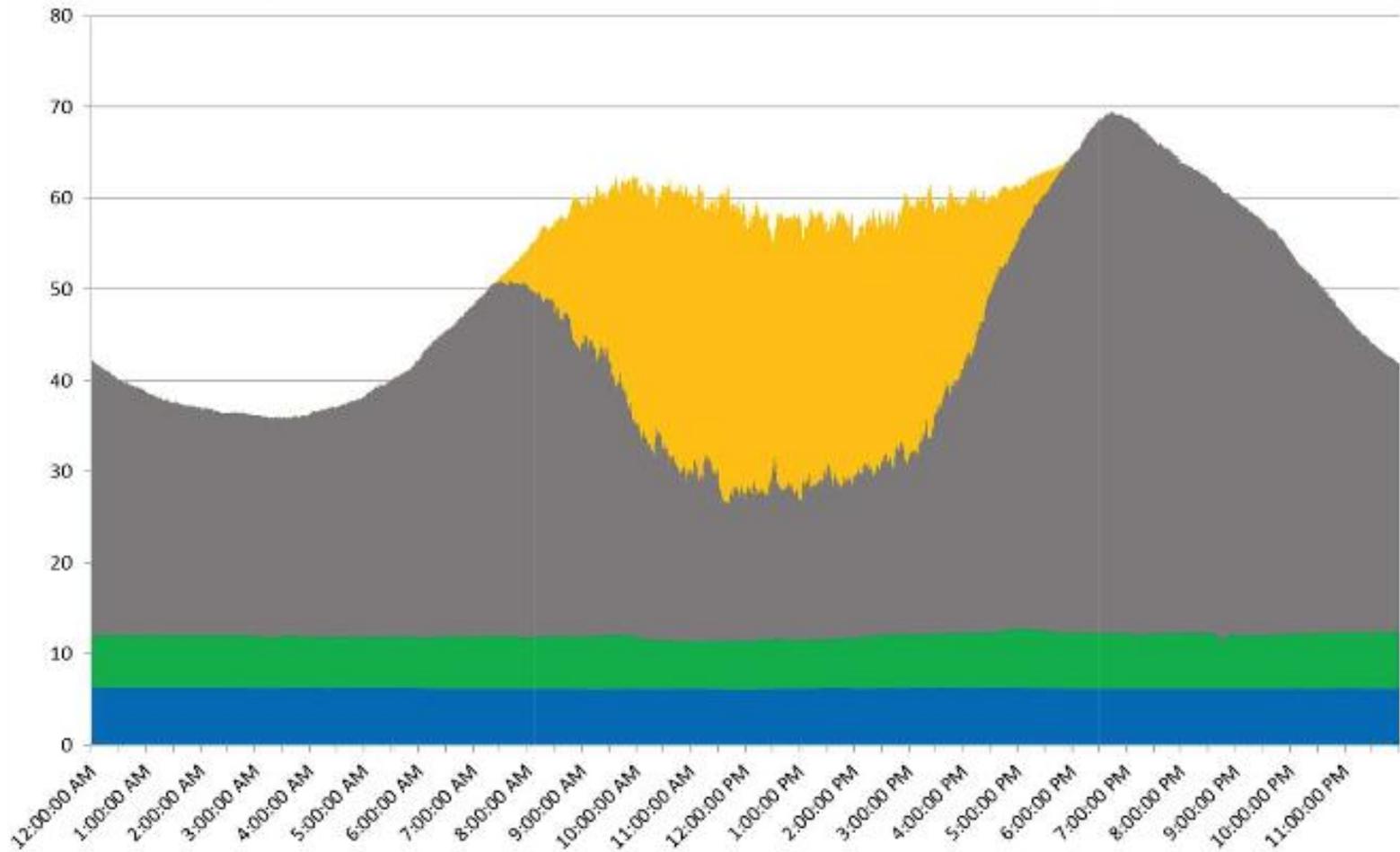


KIUC Weekly Average Dispatch - Now

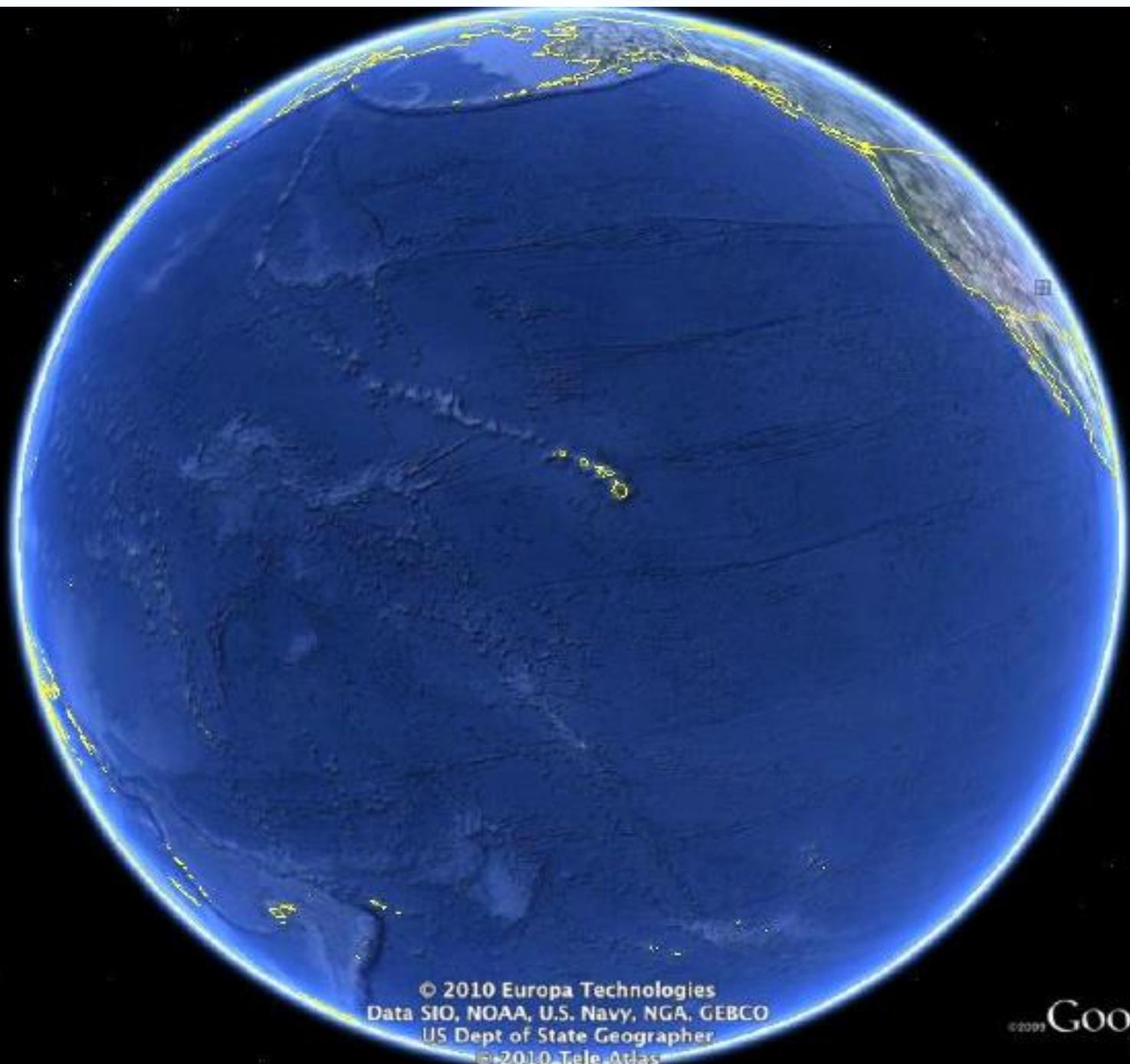
Average of... Average ... Average... Average o...

Val...

■ Average of Hydro ■ Average of Bio ■ Average of Oil ■ Average of Solar



T. ▾



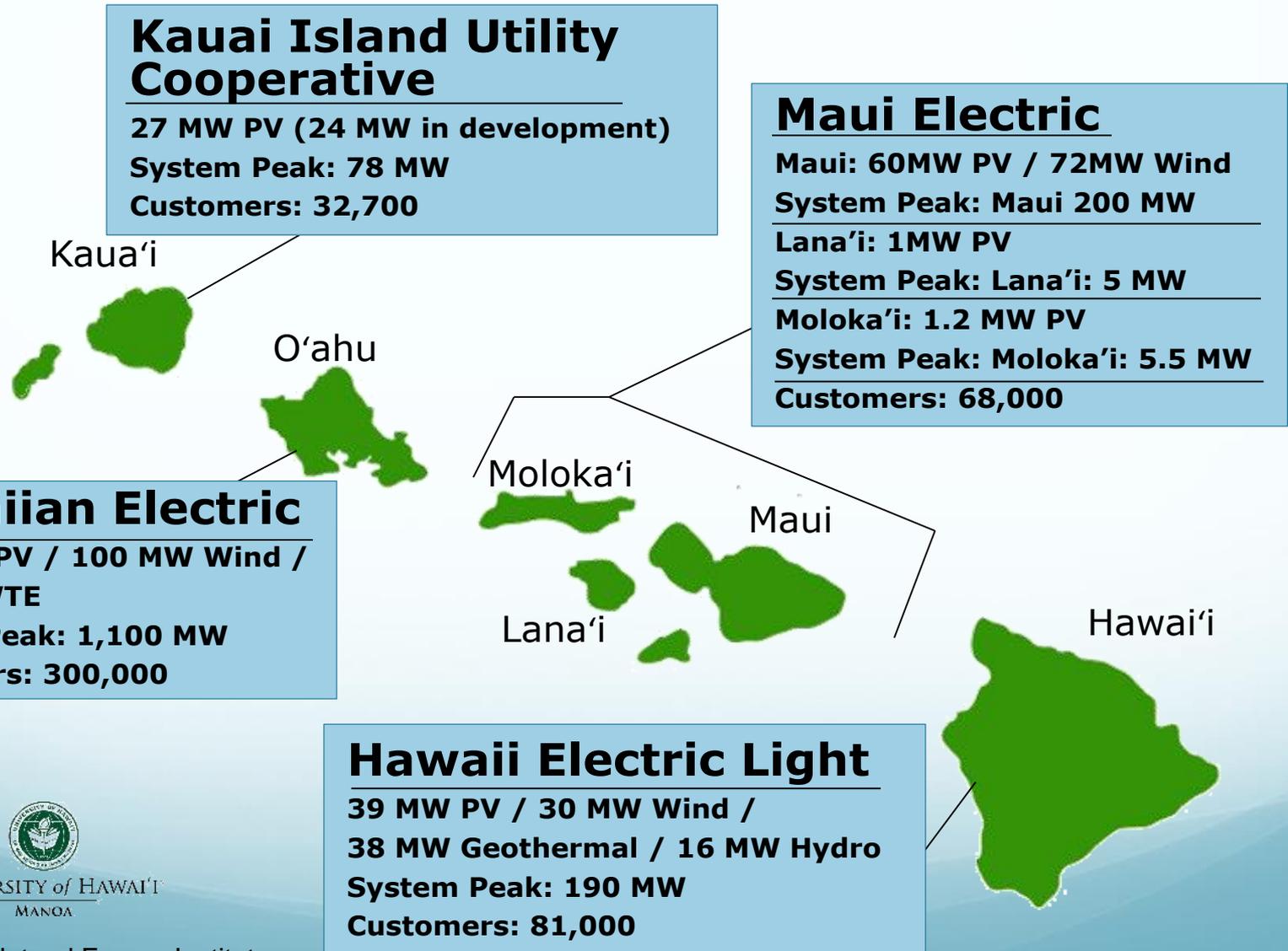
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
US Dept of State Geographer
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Figure 1

Hawaii Electric Systems

4 electric utilities; 6 separate grids

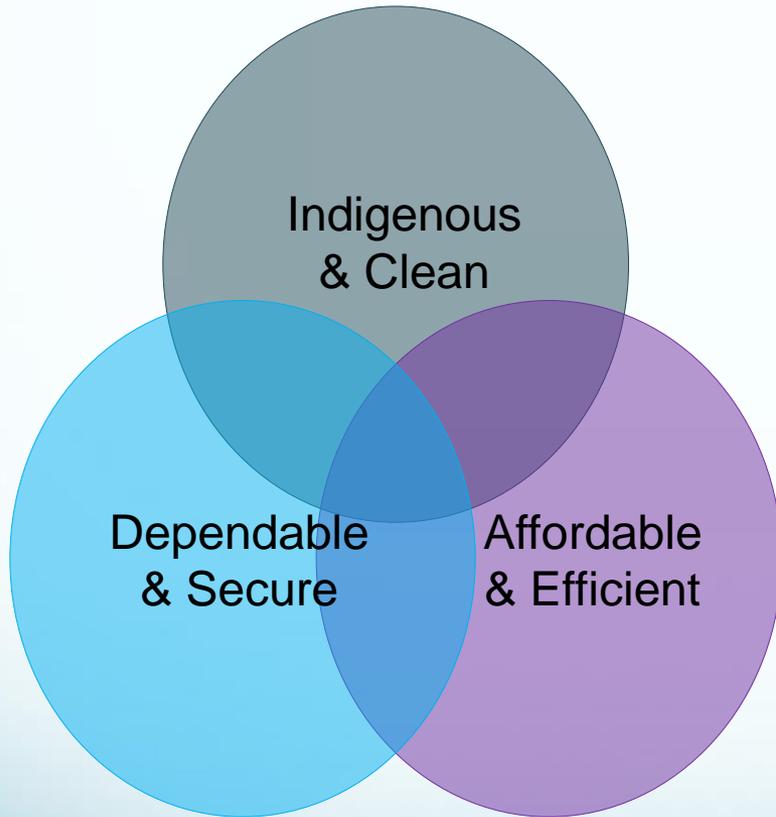


Source: Hawaii Natural Energy Institute

Hawaii's Energy Policy

Hawaii Revised Statutes, Chapter 226-18

Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:



- **Dependable, efficient, and economical** statewide energy systems capable of supporting the needs of the people (1978);
- **Increased energy self-sufficiency** where the ratio of **indigenous** to imported energy is increased (1978);
- Greater **energy security** in the face of threats to Hawaii's energy supplies and systems (1981); and
- **Reduction, avoidance, or sequestration of greenhouse gas emissions** from energy supply and use (2000).

Driving & Implementing Energy Policy

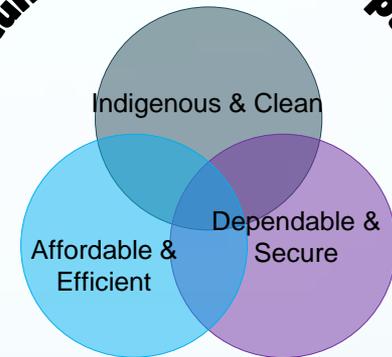
Act 99,2012

Diversify, optimize
& minimize the use
of fossil fuels

INTEGRATION
Maximize utilization & efficiency of
all assets

=

Community Values & Acceptability



HRS 226-18

PUC Decisions &
Orders/Inclinations
-Decoupling
-Performance Based
Regulation

RPS

Diversify, optimize & increase
the use of renewable resources
(100%)

EEPS

Electricity use reduction
(30%)

Renewable Energy Income
Tax Credit
Net Energy Metering

Implementing & Sustaining Hawaii's Energy Policy

DBEDT

(Chapters 196 & 201N, HRS)

- Director the Energy Coordinator HRS 196-3
- Policy & Economic Analysis
- Permit Coordination & Facilitation HRS 201N

DBEDT

Public Utilities Commission (Chapter 269, HRS)

- Regulation of Electric Utilities
- Renewable Portfolio Standards, HRS 269-92
- Energy Efficiency Portfolio Standards, HRS 269-96
- Public Benefit Fee, HRS 269-121

Hawaii Energy Policy
Goals & Objectives
HRS 226-18

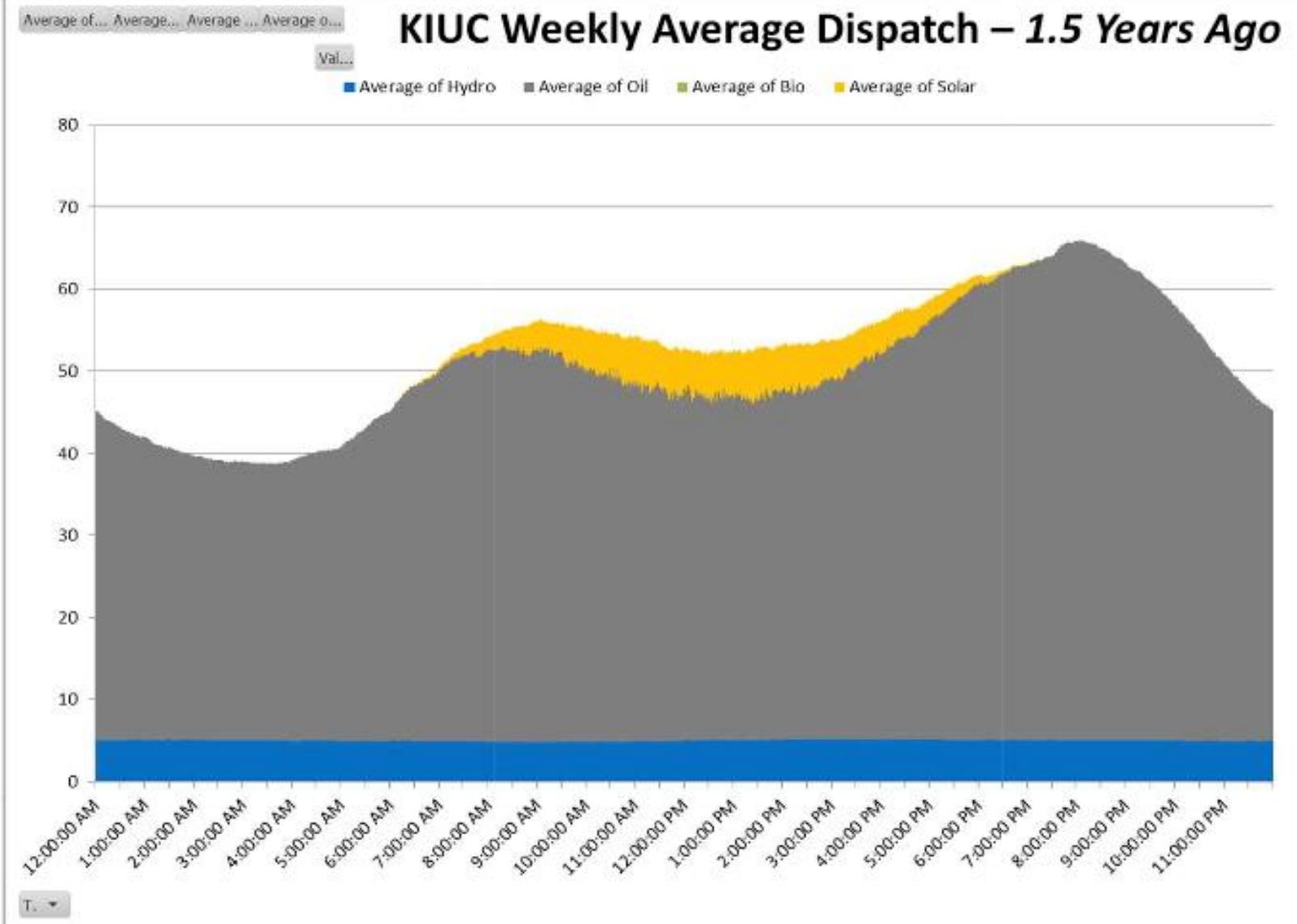
HNEI

PUC

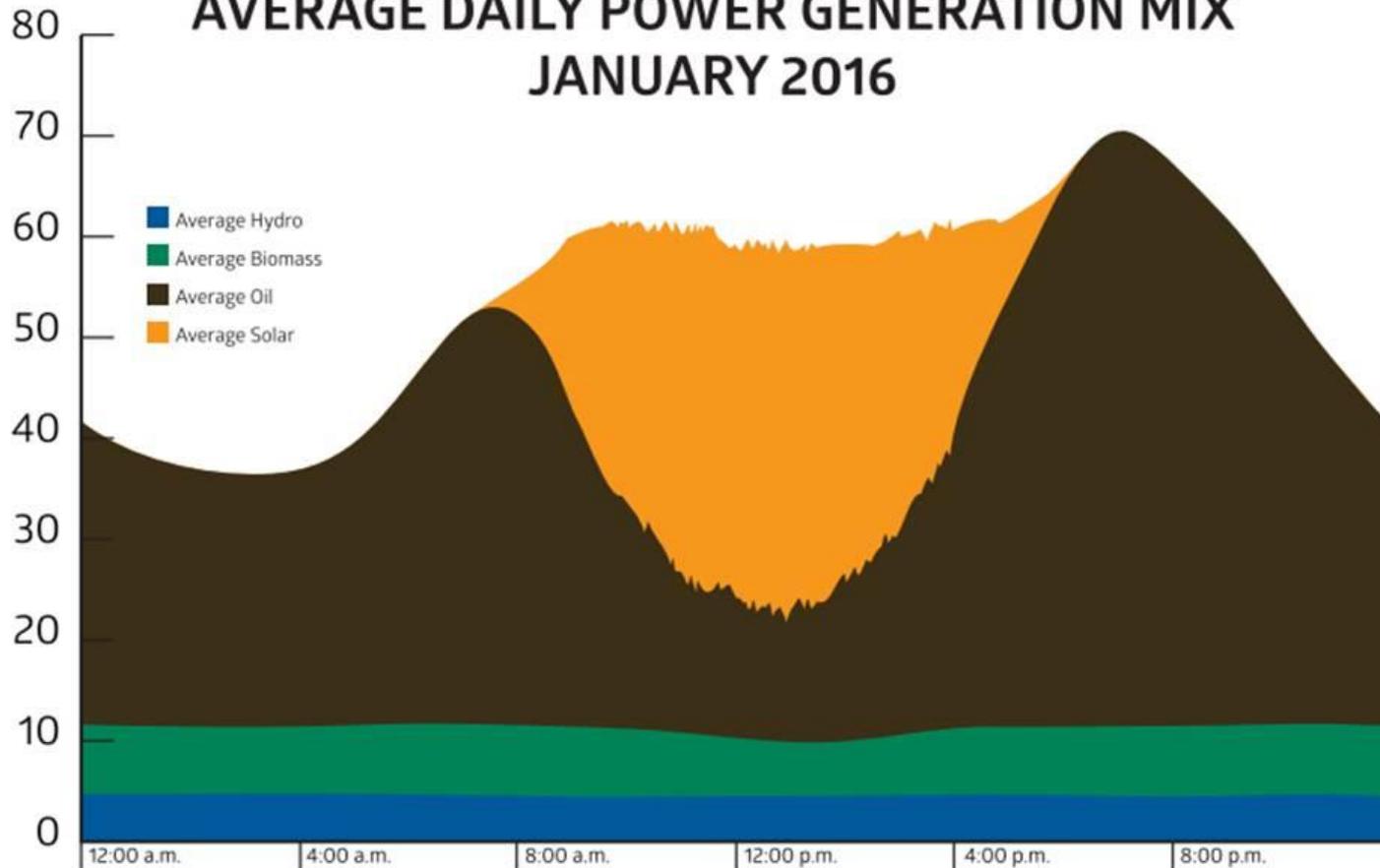
Hawaii Natural Energy Institute (Act 253, SLH 2007)

- Research & Development
- Technology Validation

KIUC Weekly Average Dispatch – 1.5 Years Ago



AVERAGE DAILY POWER GENERATION MIX JANUARY 2016



KIUC – January 2016

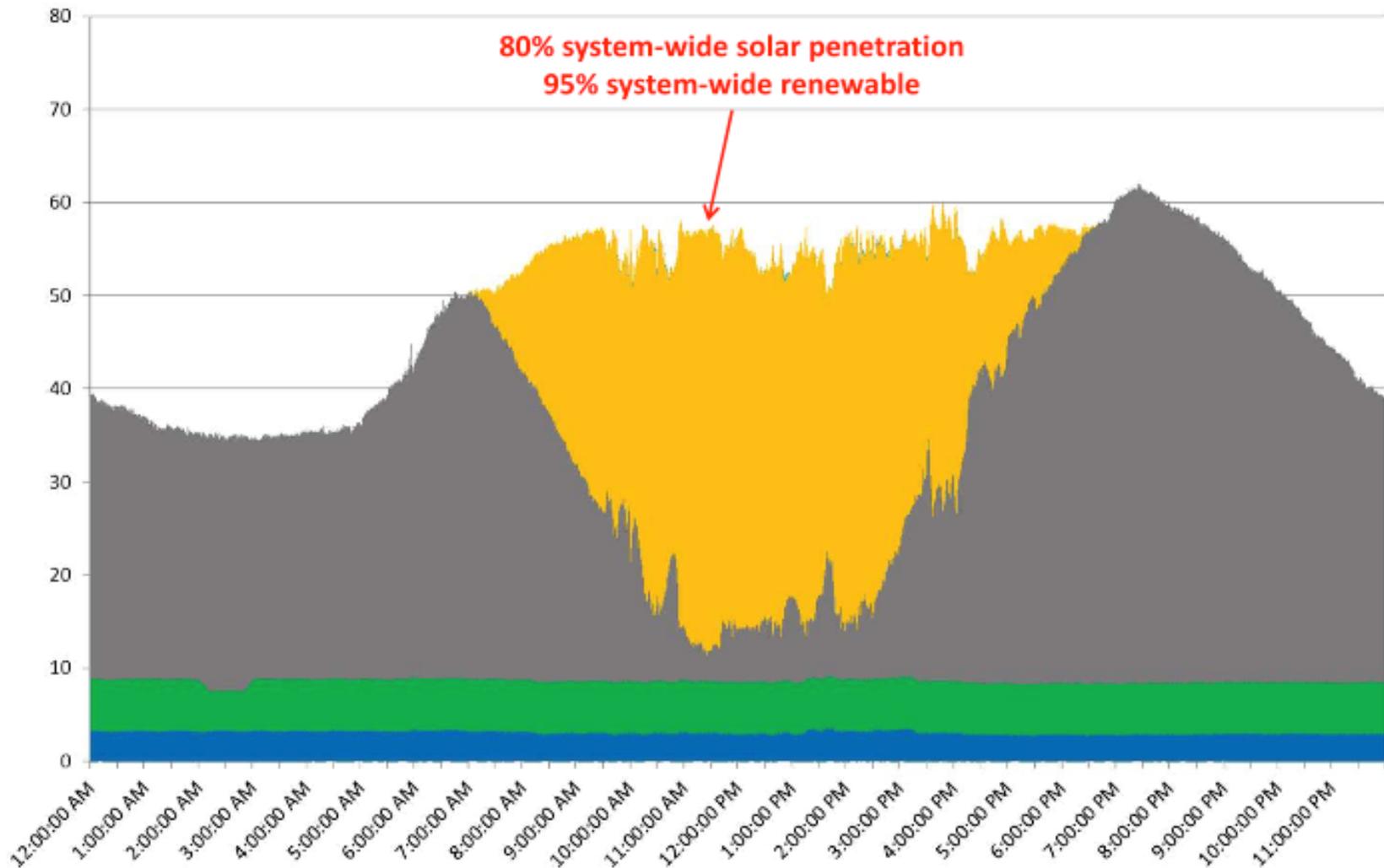
- Jan. 13: Total of 61 minutes at or above 90% renewables with 59 MW of demand and an average resource mix of 71% solar, 8% hydro, 11% biomass, 10% diesel;
- Jan. 16: Total of 34 minutes at or above 90% renewables with 57 MW of demand and an average resource mix of 73% solar, 8% hydro, 9% biomass, 10% diesel;
-
- Jan. 17: Total of 34 minutes at or above 90% renewables with 53 MW of demand and an average resource mix of 72% solar, 8% hydro, 10% biomass and 10% diesel;
- Jan. 18: Total of 5 minutes at or above 90% renewables with 58 MW of demand and an average resource mix of 77% solar, 6% hydro, 7% biomass and 10% diesel.

Average of... Average ... Average... Average o... Average o...

KIUC Dispatch - 3/4/2016

Val...

■ Average of Hydro ■ Average of Bio ■ Average of Oil ■ Average of Solar ■ Average of BESS



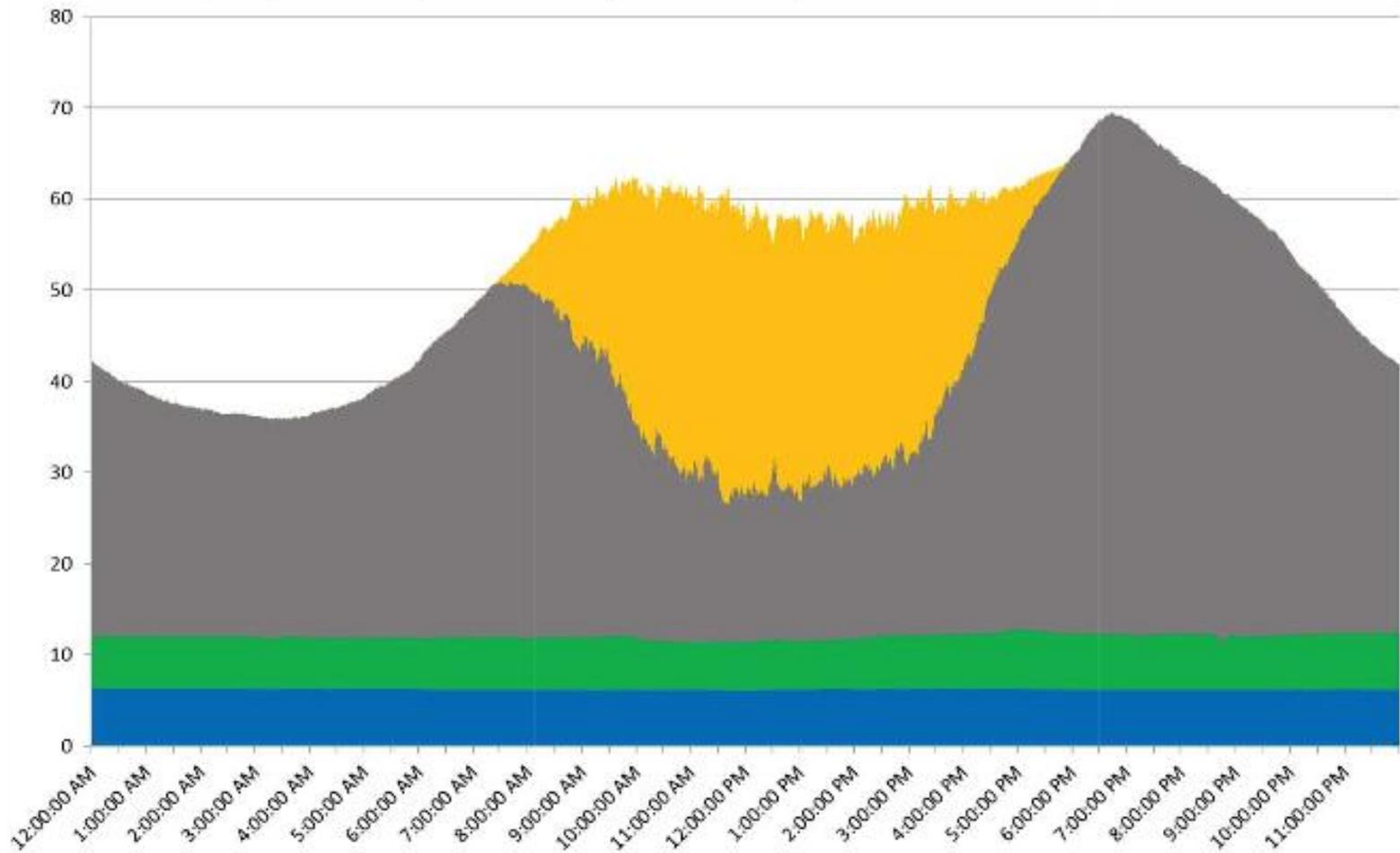
1. ▾

KIUC Weekly Average Dispatch - Now

Average of... Average ... Average... Average o...

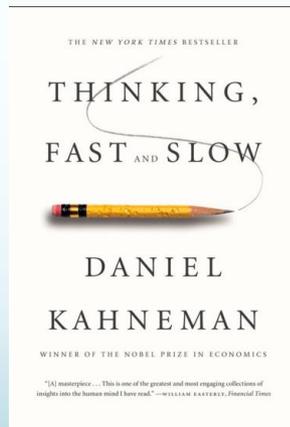
Val...

■ Average of Hydro ■ Average of Bio ■ Average of Oil ■ Average of Solar



T. ▾

Establishing an organizational culture that acknowledges the urgency and cultivates the discipline, mindset and skill sets necessary to survive and thrive in a rapidly changing environment.



The acquisition of skills requires a regular environment, an adequate opportunity to practice, and rapid and unequivocal feedback about the correctness of thoughts and actions. When these conditions are fulfilled, skill eventually develops, and the intuitive judgments and choices that quickly come to mind will mostly be accurate.

Quote from Thinking, Fast and Slow by Daniel Kahneman

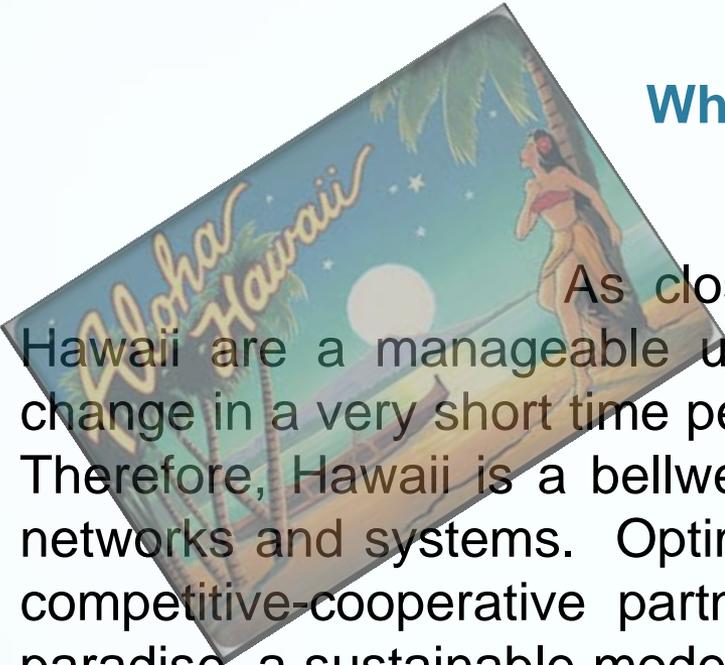
What can Hawaii share from its experience in moving towards a clean energy transformation?

- Do not focus solely on the generation side of the equation, a transformation requires a multi-prong, systems approach
- Adopt a “no-regrets” strategy moving forward (reduce demand and carefully scrutinize new capital investments)
 - Energy efficiency, building codes, demand response
 - Maximize and optimize your existing low cost carbon generators and renewable generators
- What’s needed are technical and affordable solutions, therefore the regulatory process must accommodate problem solving in a less legal and political way with good staff and resources
- When decoupling electricity sales from revenue requirements include performance standards (moving from traditional ratemaking to performance based regulation)
- The regulator and utility leadership must be in sync to lay the ground work for the business model for the electric utility of the future

What are Hawaii's biggest challenges

- Maintaining political will or avoiding political interference
- Changing the business model of the electric utility and current culture within the utility
- Where to make the best infrastructure investments for the future given rapid technology advancements
- Current tax credits subsidizes most expensive options
- Current low cost of oil, Governor's reluctance to consider LNG

What will the postcard from Hawaii say?



As closed and bounded systems, the islands of Hawaii are a manageable unit of study of complex systems that can change in a very short time period compared to a larger, continental area. Therefore, Hawaii is a bellwether of what is to come for bigger electric networks and systems. Optimistically, the postcard will beckon one to a competitive-cooperative partnership within a seamless electric system paradise, a sustainable model that can be exported throughout the world. Or the postcard will heed warnings from an electric system dystopia where the commons have been ravaged solely for short-term gains. I hope for the former.

Hermina

Morita

“Designing Regulation Around Technology Innovation: Experiences from Hawaii”

Infrastructure Risk Management: Assessing and Managing Dynamic Exogenous Risk