Kaua'i Island Utility Cooperative

Your Touchstone Energy® Cooperative

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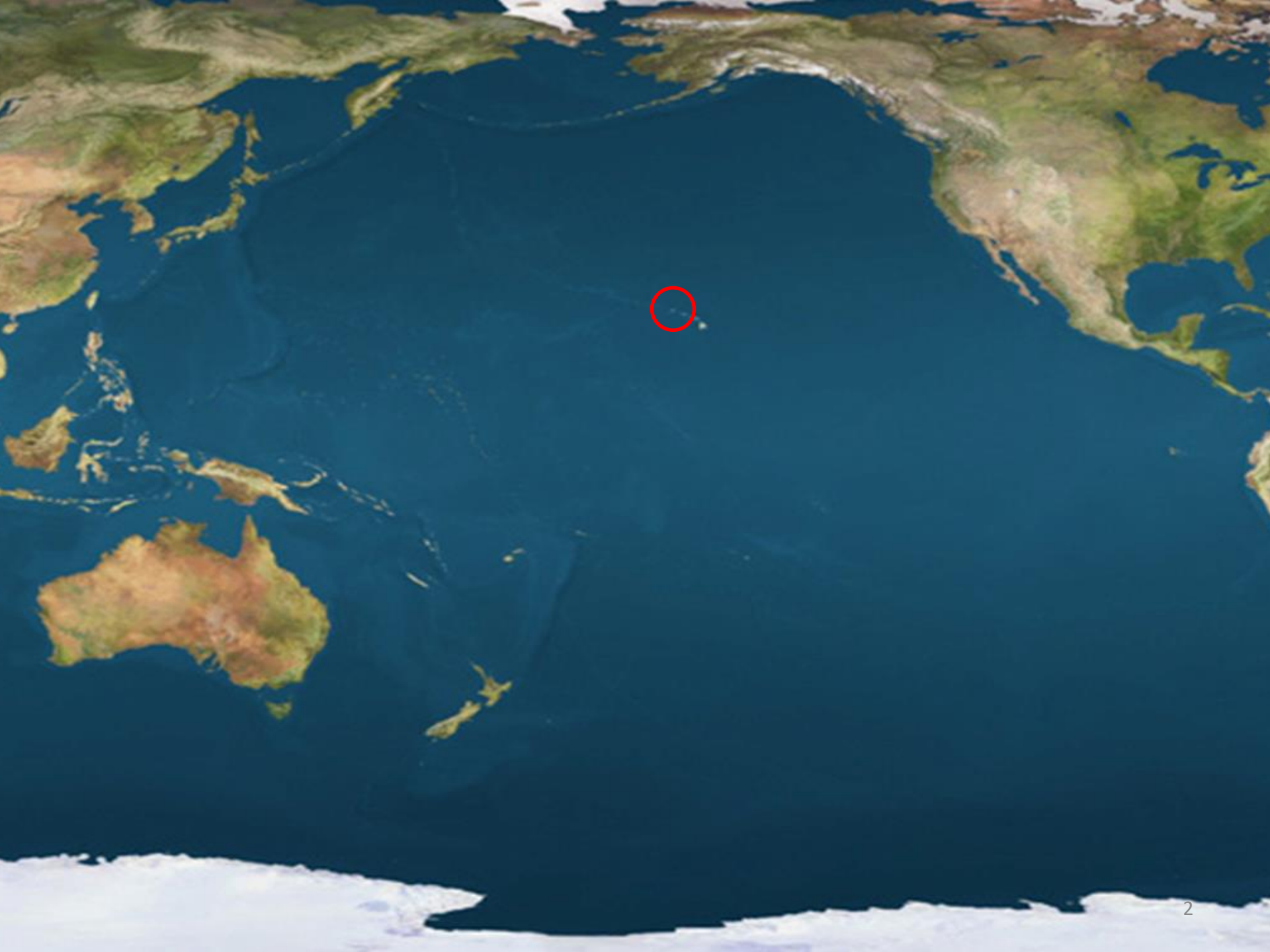


Hawaii Energy Facts

- Hawaii was the first state to set a deadline for generating 100% of its electricity from renewable sources, which is required to be achieved by 2045
- In 2017, Hawaii's mild climate contributed to the state having the lowest residential sector energy consumption in the nation
- Solar power provided half of Hawaii's renewable generation in 2017, primarily because of the growth of distributed rooftop solar photovoltaic electricity generation, which has nearly doubled since 2014
- Hawaii is one of seven states with utility-scale generation from geothermal energy. In 2017, 3.2% of Hawaii's net electricity generation came from geothermal energy
- Hawaii's heavy dependence on imported petroleum for electricity generation and its isolated island grids contribute to the state having (among) the highest U.S. retail power prices

https://www.eia.gov/state/?sid=HI#tabs-4

Kauai Statistics

- 70,475 resident population (5% of Hawaii)
- Consistent visitor load (+25,000)
- 550 sq mi (10% of Hawaii)
- Member-owned Electric Cooperative
- High rates due to oil-dominated power supply (31-37 cents/kWh last 3 years)
- Low residential energy use due to stable climate (501 kWh per month avg residential)

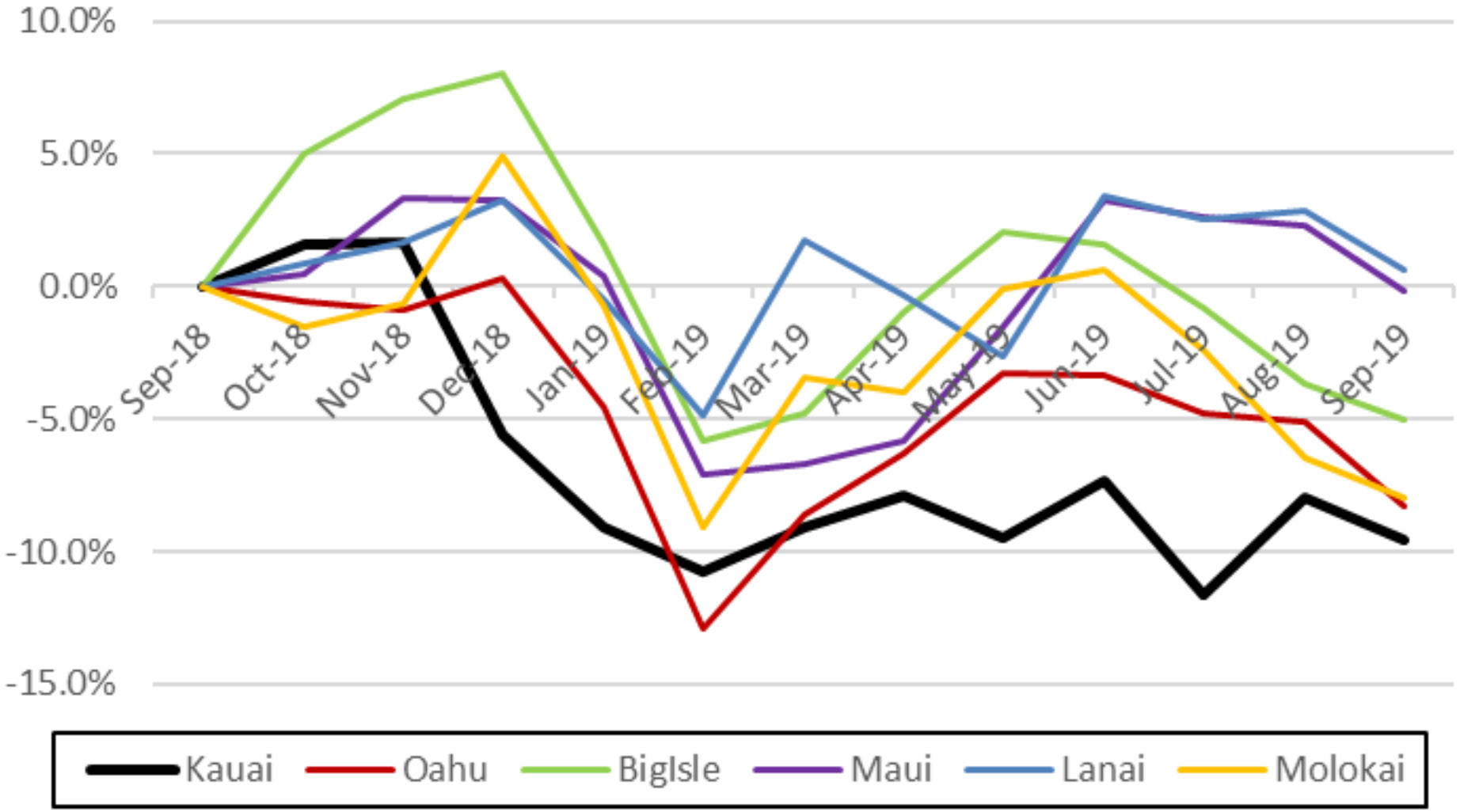
KIUC Grid Statistics

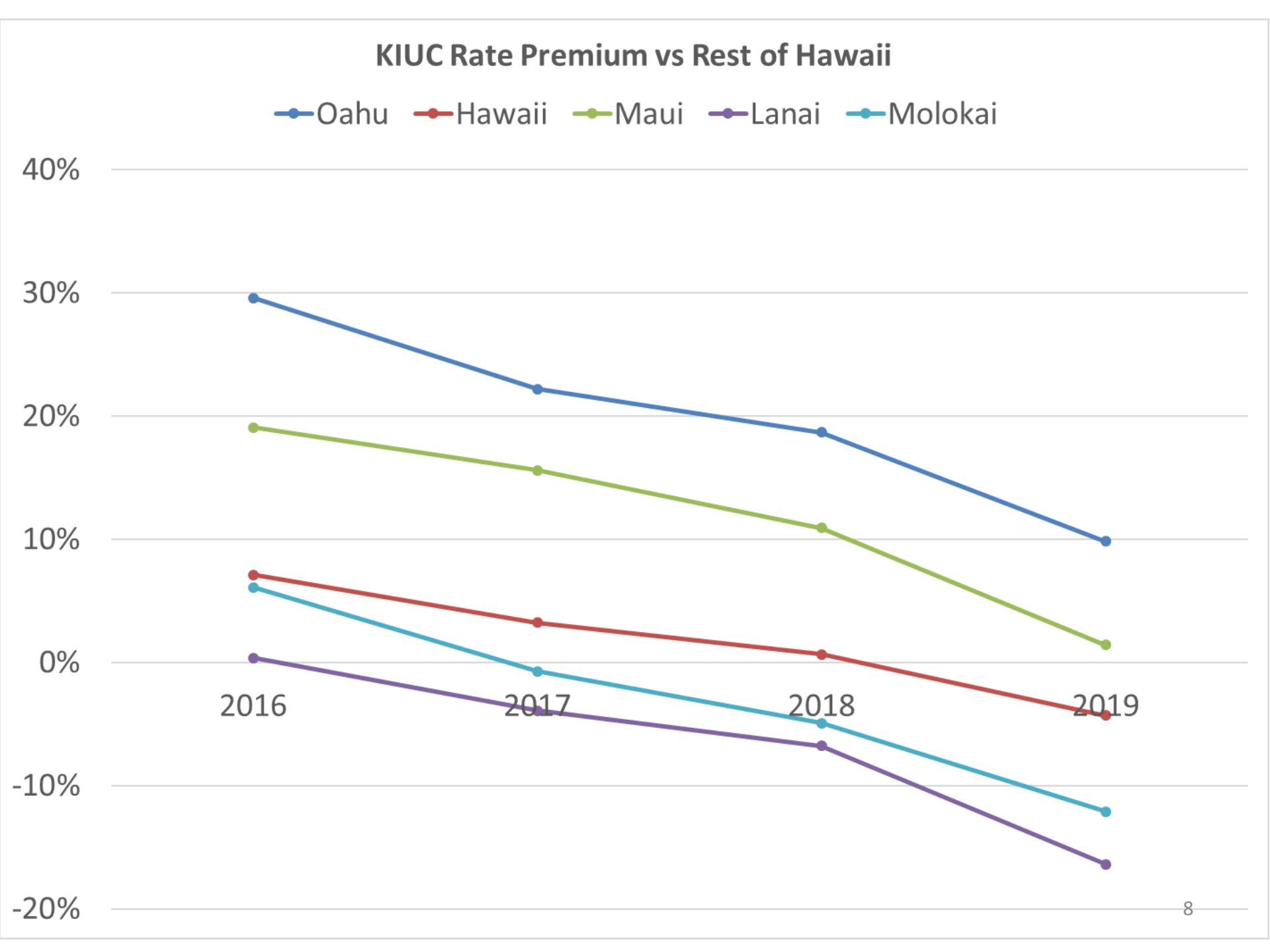
- Completely islanded, vertically integrated
- 171 miles 69 kV-rated transmission
- 1,311 miles 12.47 kV distribution
- 35-79 MW daily demand profile
- 80 MW all-time peak (Aug 2019)
- 117 MW oil-fired generation capacity
- 96 MW solar (31 MW customer-owned)
- 16 MW hydro
- 7 MW biomass
- 40 MW / 160 MWh Battery Energy Storage

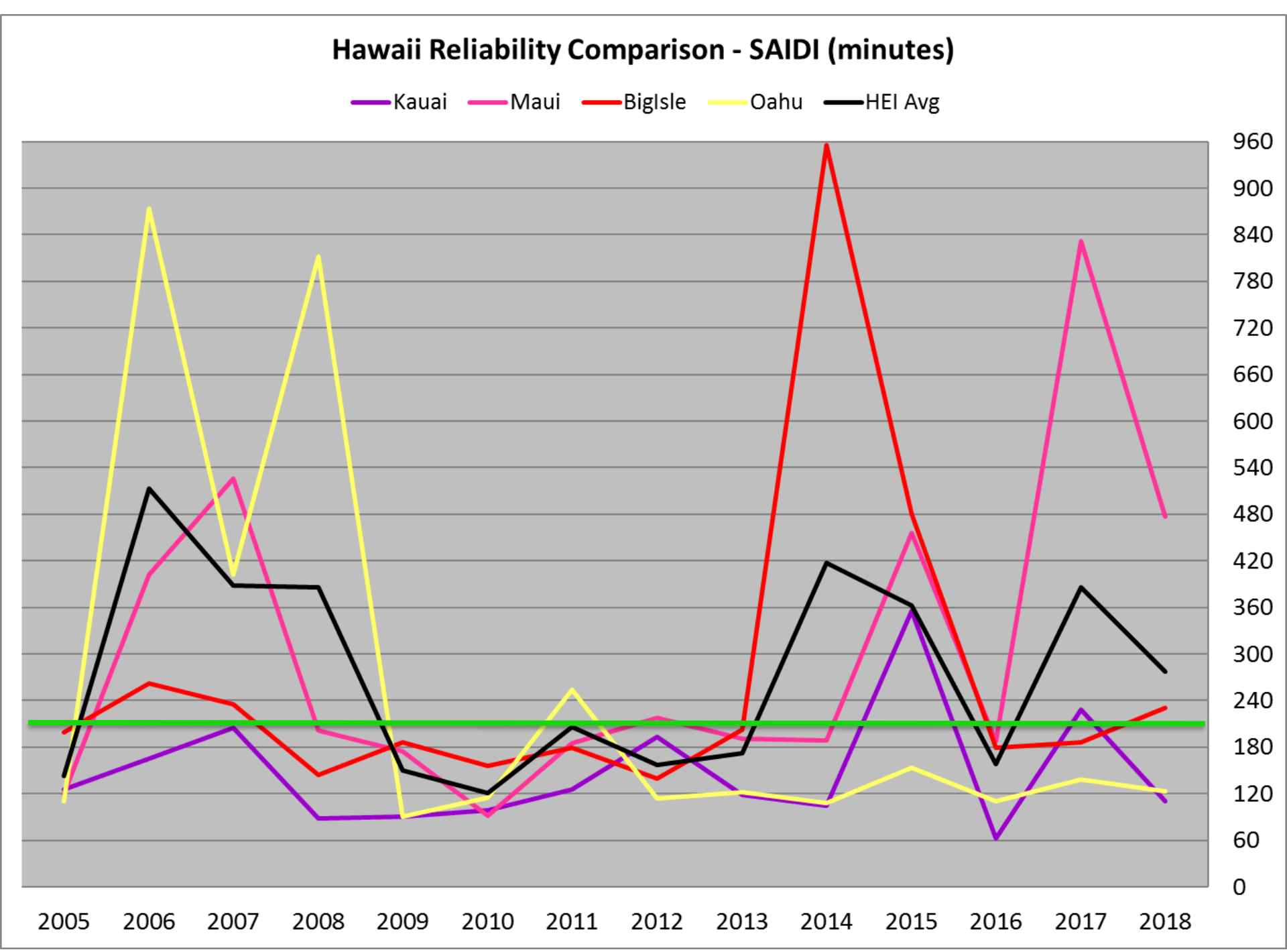
KIUC Power Supply Goals

- Generate at least 70% of electricity by using cost effective renewable resources by 2030
- Manage technology/price risk by adding renewables at no more than 20% of Kauai's electric usage in any single project
- Hold controllable cost increases at or below inflation
- Maintain system reliability at 99.96% or better availability

One Year 500 kWh Cost % Change




KIUC Rate Premium vs Rest of Hawaii
Oahu
Hawaii
Maui
Lanai
Molokai
40%
30%
20%
10%
0%
-10%
-20%
2016
2017
2018
2019


Hawaii Reliability Comparison - SAIDI (minutes)
Kauai
Maui
BigIsle
Oahu
HEI Avg
960
900
840
780
720
660
600
540
480
420
360
300
240
180
120
60
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

What is Renewable Energy (RE)?

Energy from sources that are naturally replenishing but flow-limited; renewable resources are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.

https://www.eia.gov/energyexplained/?page=renewable_home

Major Types of RE

- *Biomass*
  - Wood and wood waste
  - Municipal solid waste
  - Landfill gas and biogas
  - Ethanol
  - Biodiesel
- *Hydropower*
- *Geothermal*
- *Wind*
- *Solar*

https://www.eia.gov/energyexplained/?page=renewable_home

Hawaii State RE Mandate

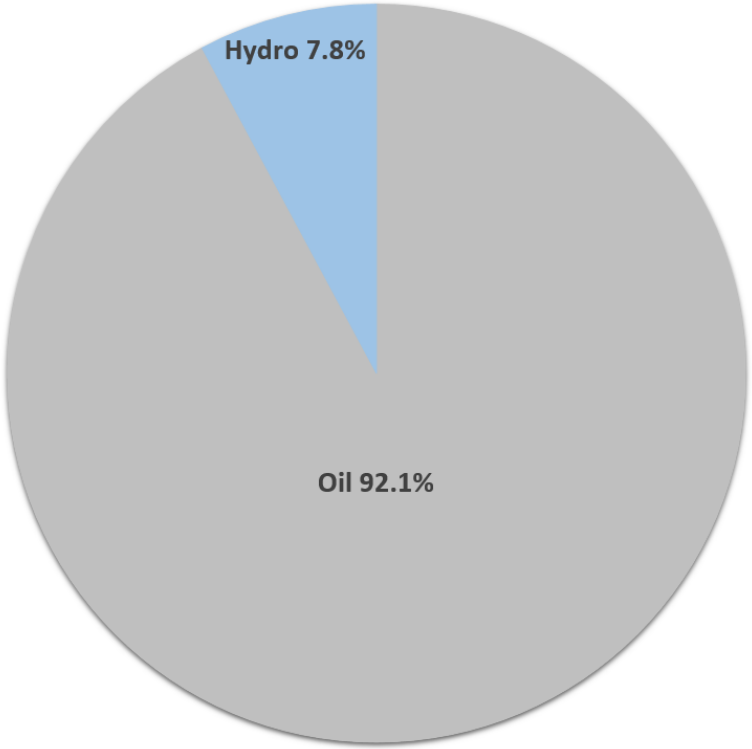
Became law in June 2015:

- 30% by 2020
- 40% by 2030
- 70% by 2040
- 100% by 2045

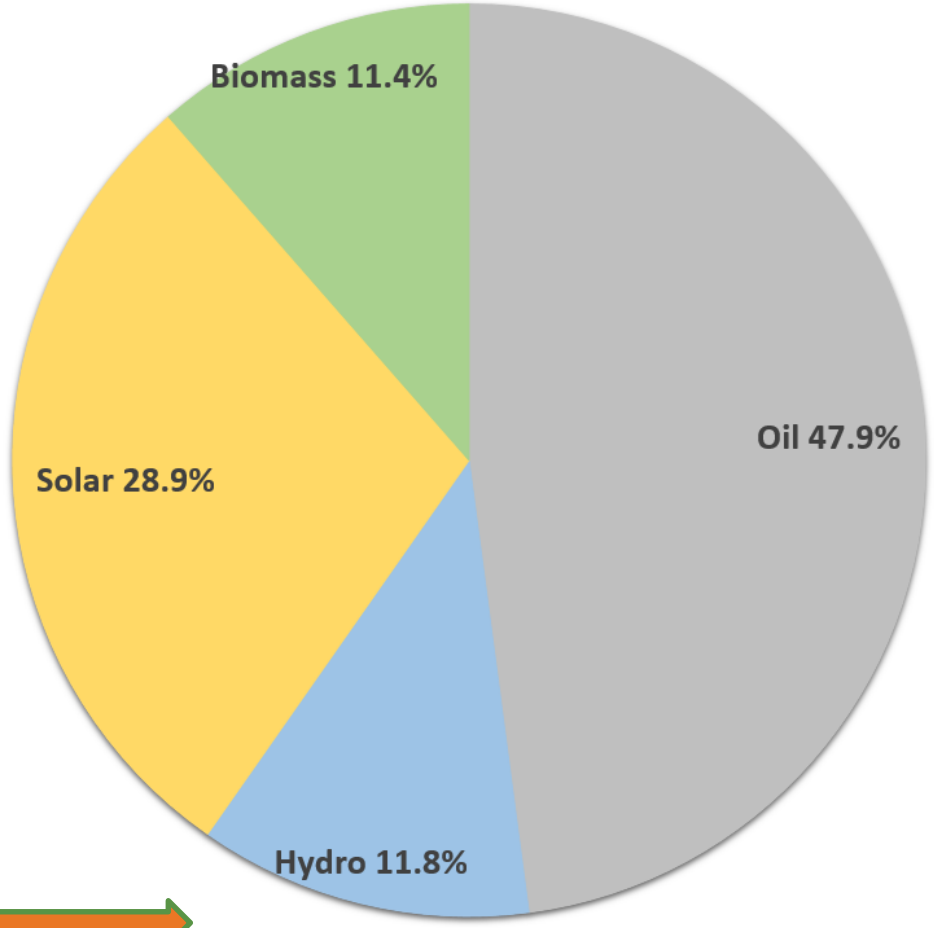
In Hawaii, a coalition of environmental advocates and the solar industry pushed the passage of a bill requiring 100% renewable energy by 2045

KIUC RE Progress and Impacts

2010 Power Supply



2019 Power Supply

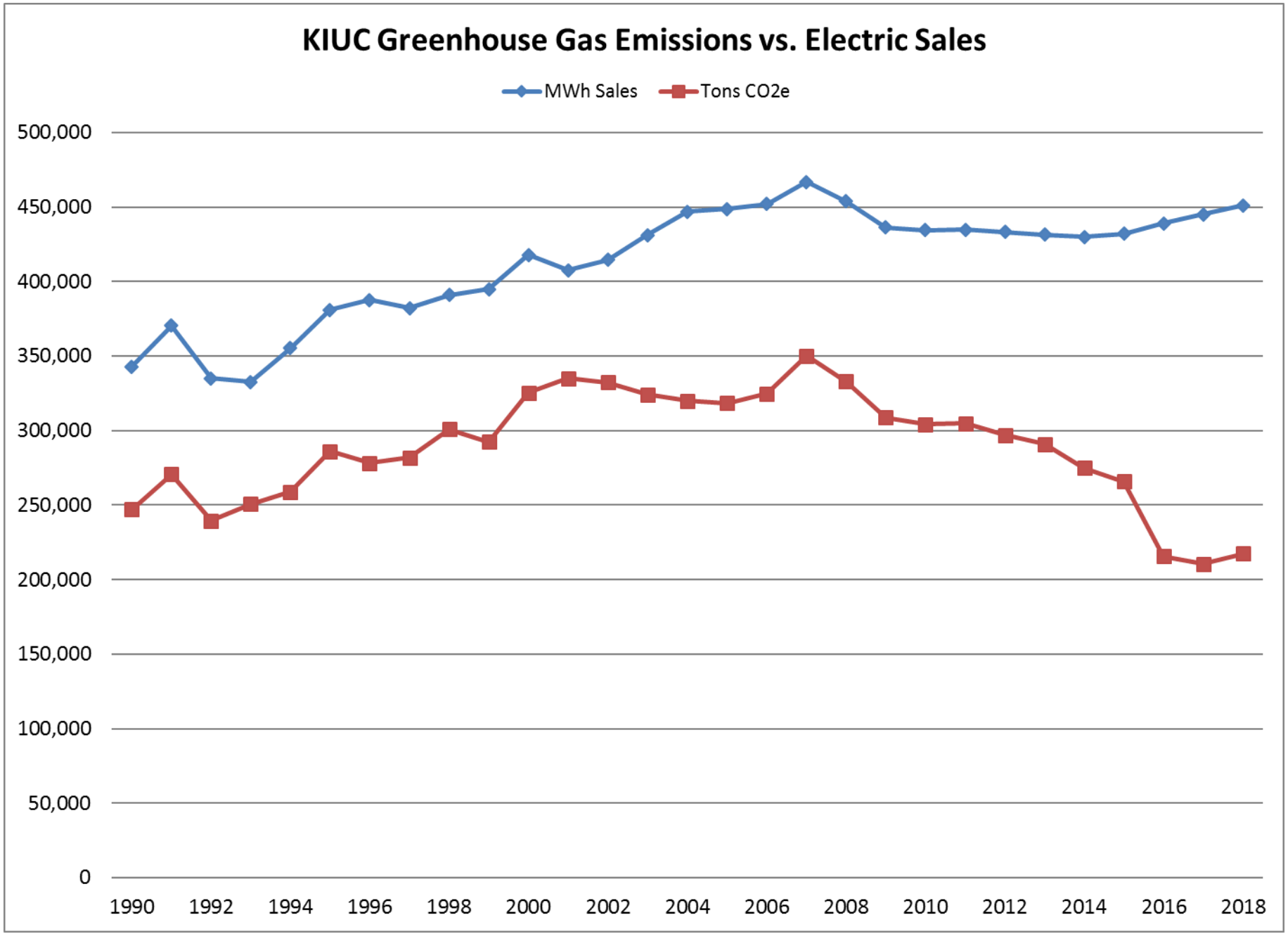


0% fixed cost
$69 million oil
$4 million renewable

+4% kWh sales growth
Same total cost

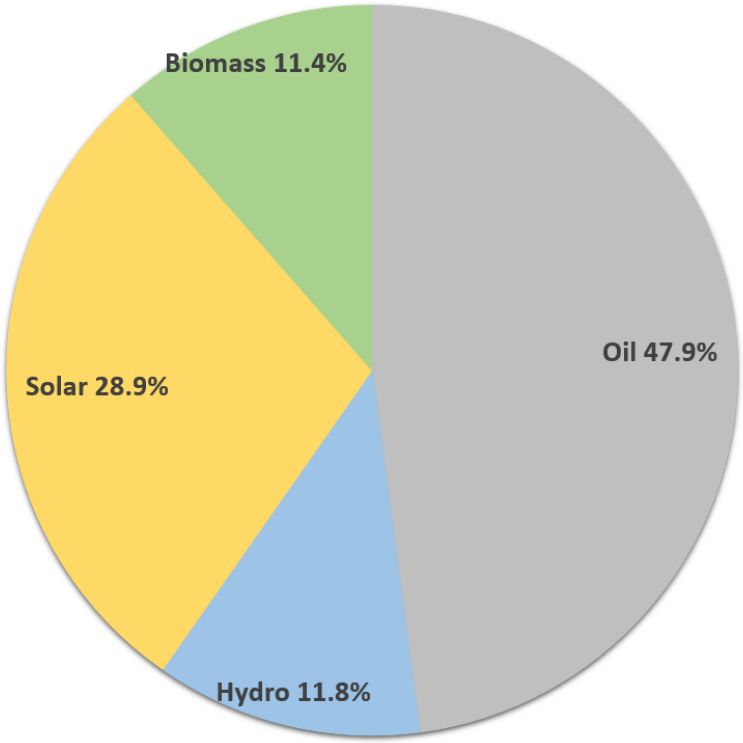
52% fixed cost
$31 million oil
$42 million renewable

Reducing Kauai's Greenhouse Gas Emissions

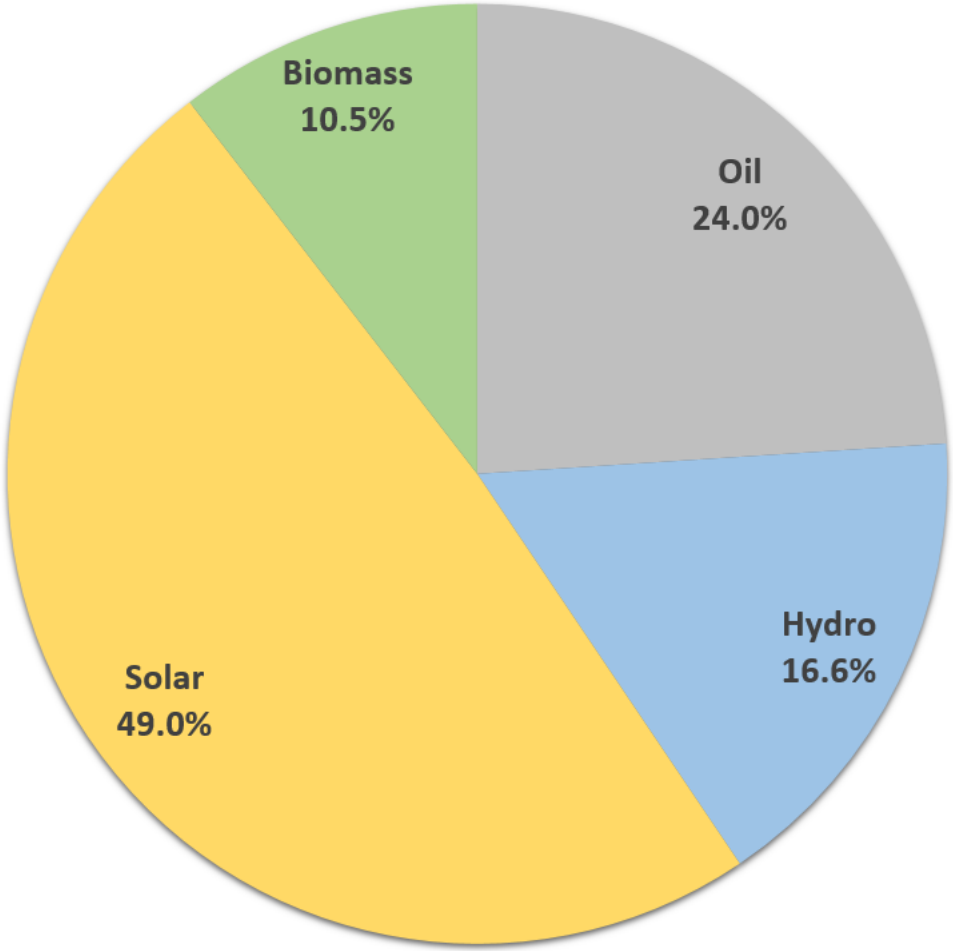


KIUC RE Projection

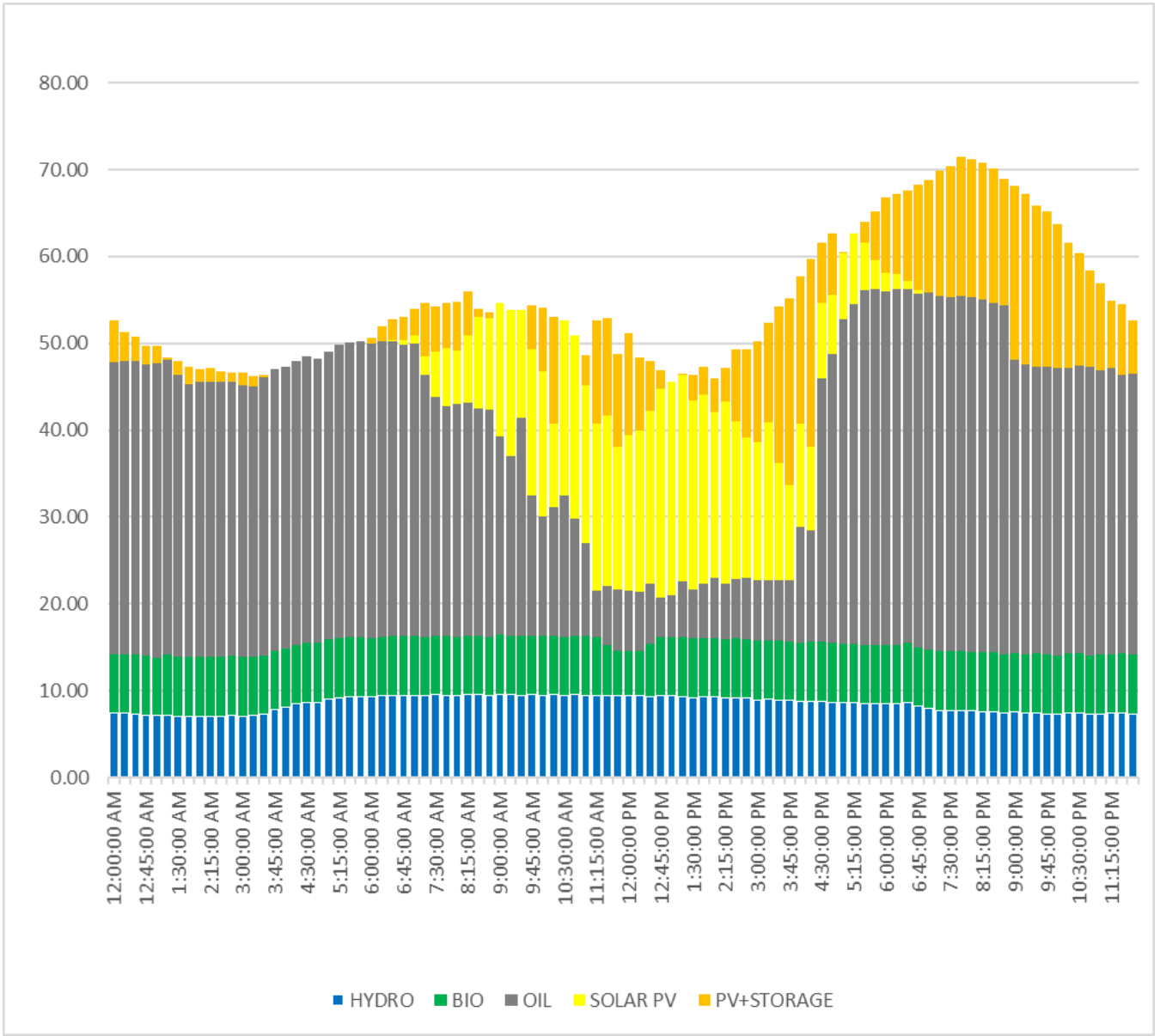
2019 Power Supply



2025 Power Supply



July 20, 2019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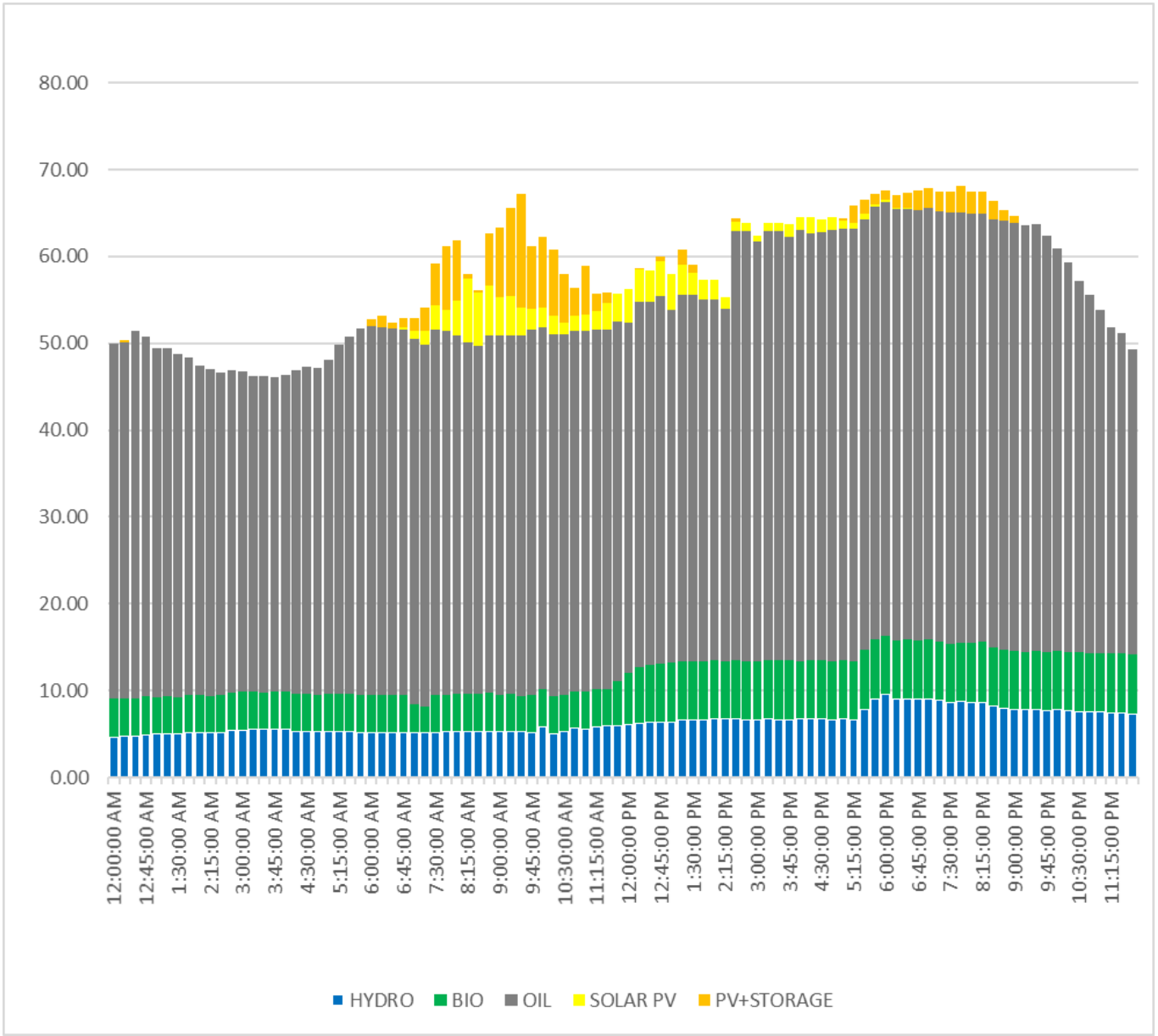
HYDRO
BIO
OIL
SOLAR PV
PV+STORAGE

July 22, 2019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BIO
OIL
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PV+STORAGE

Hawaii State RE Mandate

KIUC's Progress:

✓ 30% by 2020 (*achieved 2016*)

✓ 40% by 2030 (*achieved 2016*)

- 70% by 2040 (*expected 2025 – dependent on West Kauai Energy Project*)
- 100% by 2045 (*???*)

What about the rest of the State?

Fuel Sources	Hawaiian Electric (Island of Oahu)	Hawaii Electric Light (Island of Hawaii)	Maui Electric (Islands of Maui, Molokai, and Lanai)
Oil	63.15%	63.72%	68.19%
Coal	17.51%	0	0
Biofuel	0.82%	0	0.07%
Biomass	0	0	0
Geothermal	0	8.61%	0
Hydro	0	4.88%	0.27%
Solar	10.61%	11.33%	12.00%
Solid Waste	5.22%	0	0
Wind	2.69%	11.46%	19.47%
TOTAL:	100%	100%	100%
Total from Renewable Resources	**19.34%**	**36.28%**	**31.81%**

https://www.hawaiianelectric.com/clean-energy-hawaii/clean-energy-facts/about-our-fuel-mix

Considerations on 100% RE

- *Hawaii is unique; solutions must recognize this*
  - We have no transmission inter-ties, resulting in limited ability to balance supply and demand
  - We have no ability to develop cheap energy sources that make the bulk of the world's electricity market (coal, gas, nuclear, large hydro)
  - We have economy of scale challenges that the continental grid does not have
  - Land is limited and expensive, and most renewables require lots of land

Considerations on 100%

- *Within Hawaii, each island is unique, and there is no one Hawaii-wide solution*
  - Kauai's grid is 1/3 the size of Maui or Hawaii, and 1/12 the size of Oahu, eliminating many options that require larger scale (biomass, MSW, OTEC)
  - Biomass on Kauai is expensive
  - Geothermal not possible on Kauai (nor Oahu)
  - Less desirable wind regimes and more threatened or endangered bird species prevent wind on Kauai
  - This leaves us with two options: **solar and hydro**

It takes the whole island