

Advancing Renewables: Lessons Learned in Hawaii (So Far)

Presented by:

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*EIA - Renewable electricity:
State-level issues and perspectives*

Where we are...



Hawaii Electric Systems – 4 Electric Utilities; 6 Separate Grids; % Renewable

Kaua'i Island Utility Cooperative

System Peak: 78 MW

52.6 MW PV / 7 MW Biomass / 9 MW Hydro
(+6.6 MW PV Under Review)

Installed PV: 67% of System Peak

Kaua'i

17%

O'ahu

15%

Moloka'i

Maui

34%

Lana'i

Hawai'i

47%

% Renewable

Maui Electric

Maui System Peak: 202 MW

74 MW PV / 72 MW Wind

(+40 MW PV Approved or Under Review)

Installed PV & Wind:

72% of Sys. Peak

Lana'i System Peak: 5.1 MW

2.53 MW PV (50% of Sys. Peak)

Moloka'i System Peak: 5.6 MW

2 MW PV (36% of Sys. Peak)

Hawaiian Electric

System Peak: 1,206 MW

329 MW PV / 99 MW Wind 69 MW WTE

(+138.5 MW PV & Wind Approved to Install / +88.5 MW PV Under Review)

Installed PV & Wind:

35% of System Peak

Hawai'i Electric Light

System Peak: 192 MW

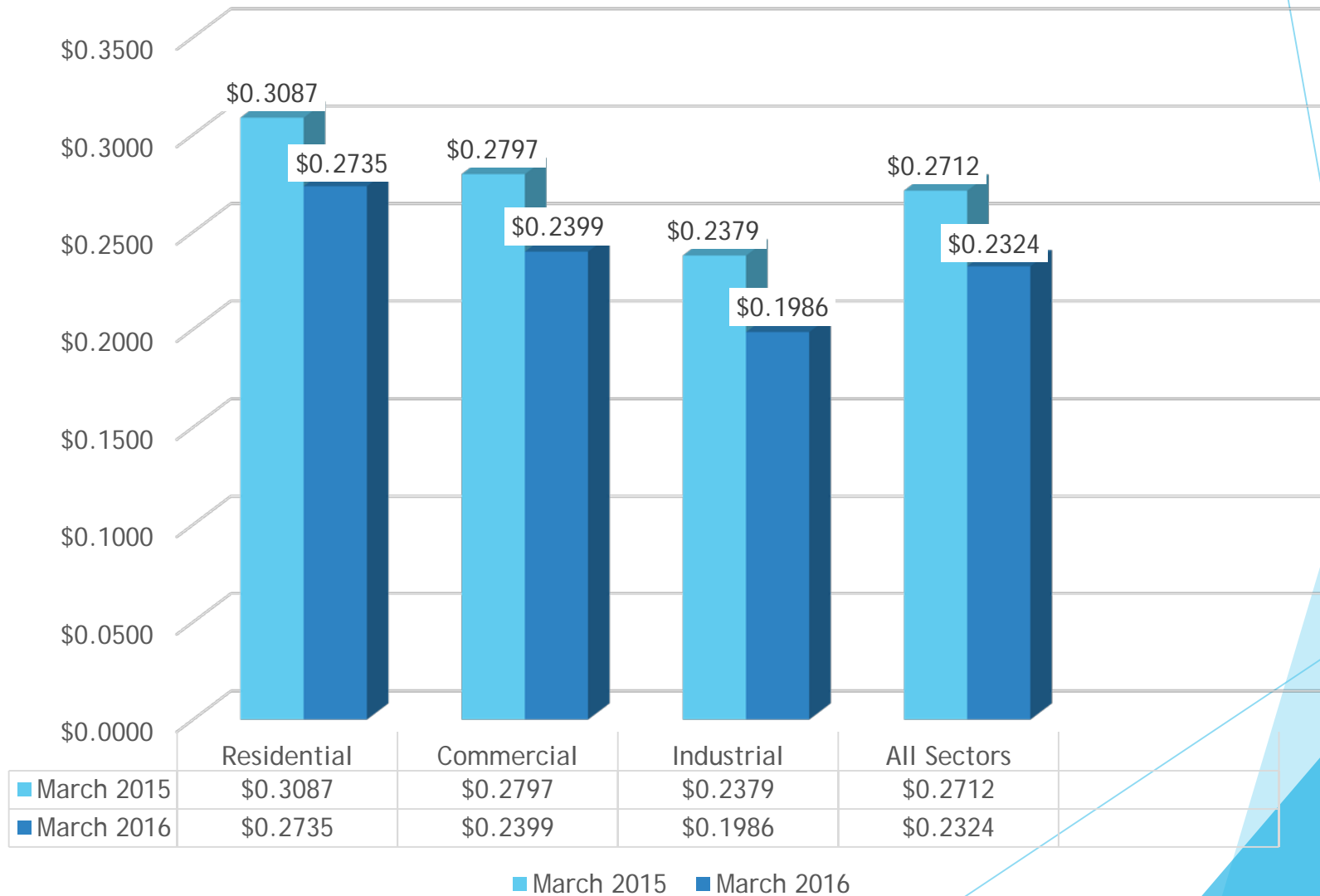
75 MW PV / 30 MW Wind /
38 MW Geothermal / 16 MW Hydro

(+31 MW PV Approved or Under Review)

Installed PV & Wind:

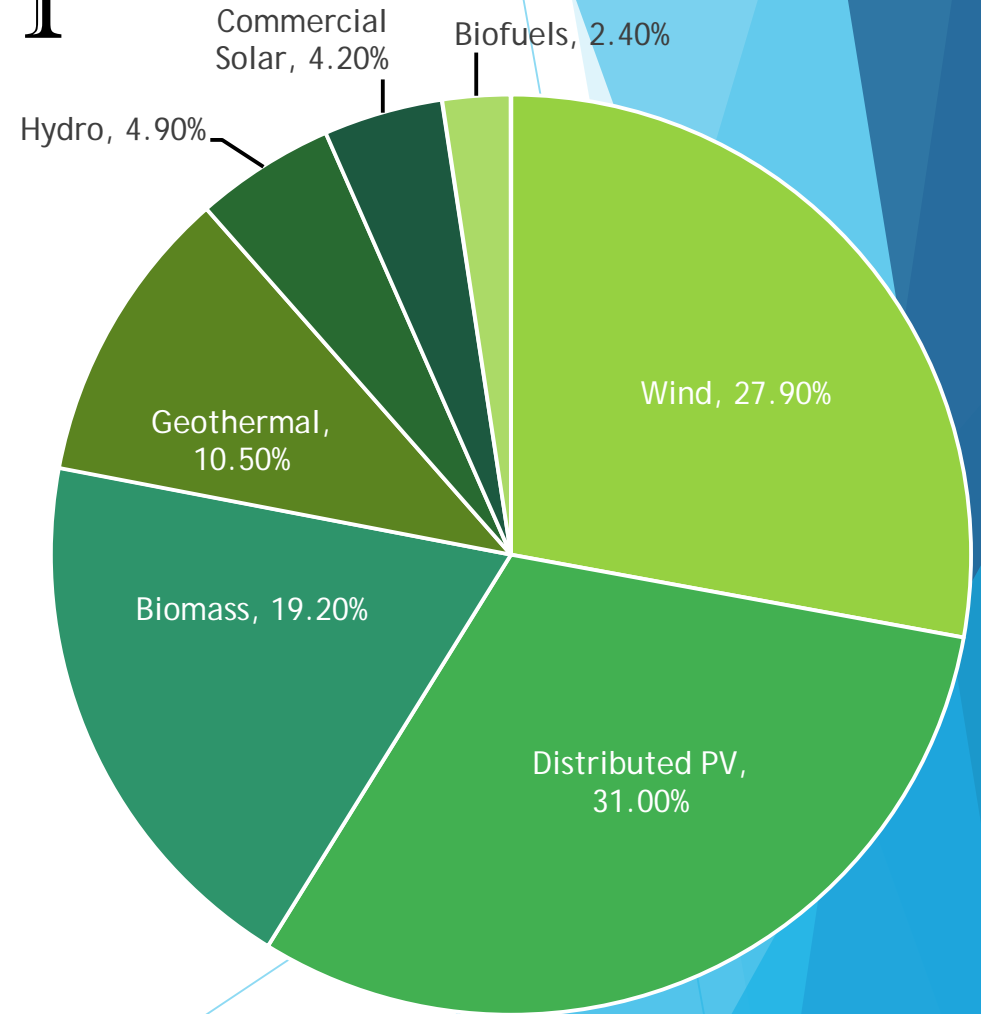
55% of System Peak

Hawaii Retail Electric Rates 2015 – 2016 ¢/kWh



Hawaii Is A Leader In Renewable Integration - 1

- ▶ In 2015, statewide renewable generation equaled 2198.8 GWh:
 - ▶ Wind – 27.9%
 - ▶ Distributed PV- 31.0%
 - ▶ Biomass – 19.2%
 - ▶ Geothermal – 10.5%
 - ▶ Hydro – 4.9%
 - ▶ Commercial Solar – 4.2%
 - ▶ Biofuels – 2.4%
- ▶ At end of 2015, 22% of total GWh, still 70% imported oil fired generation



Hawaii Is A Leader In Renewable Integration -2

- ▶ Hawaii leads the nation in the penetration of residential rooftop solar PV systems:
 - ▶ Over 77,000 residential customers (17%) have rooftop solar PV systems installed or approved
- ▶ By necessity, Hawaii is at the forefront of integration issues associated with these high – and growing – penetration levels

Hawaii Renewable Portfolio Standards

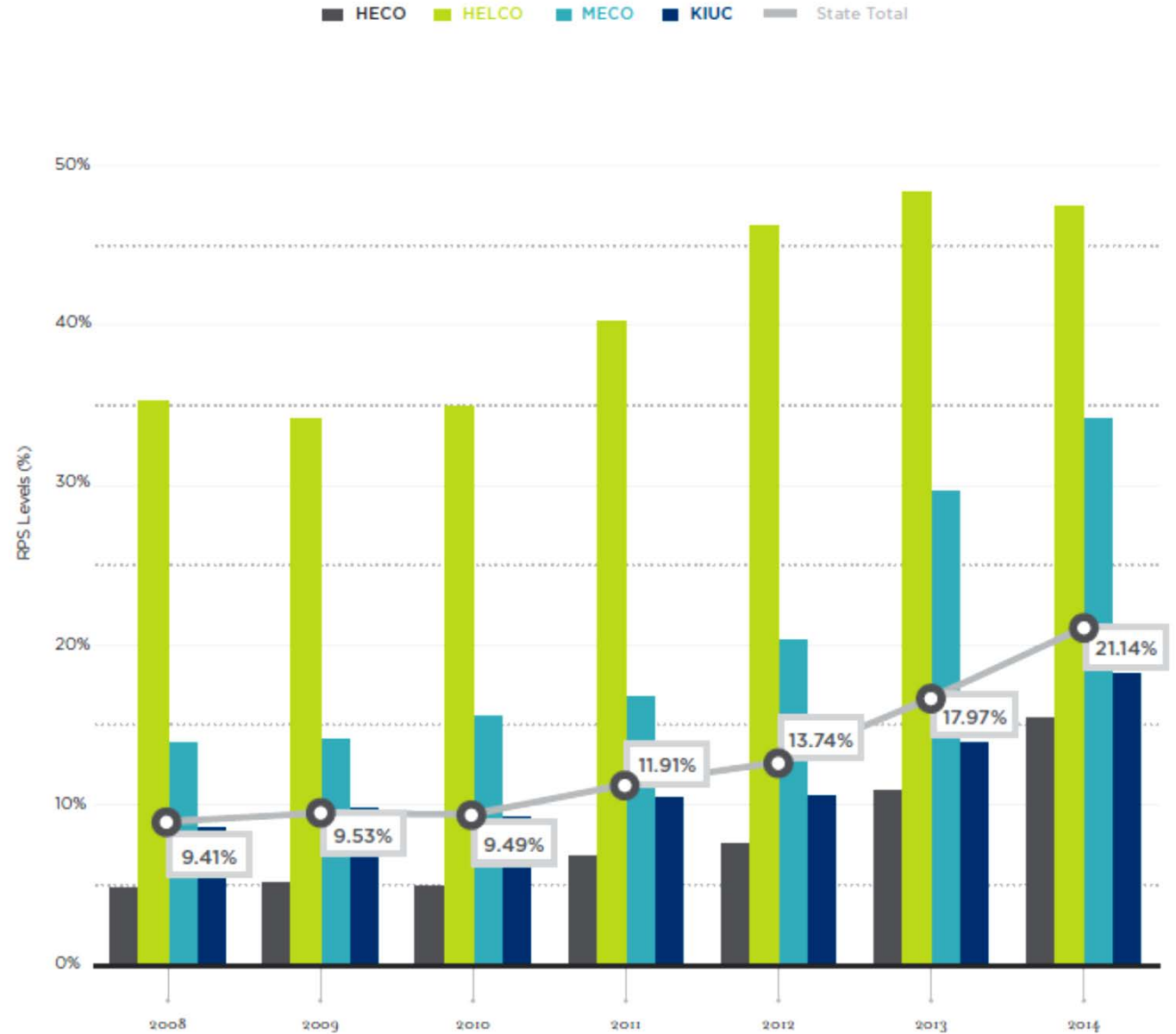
2020 – 30%

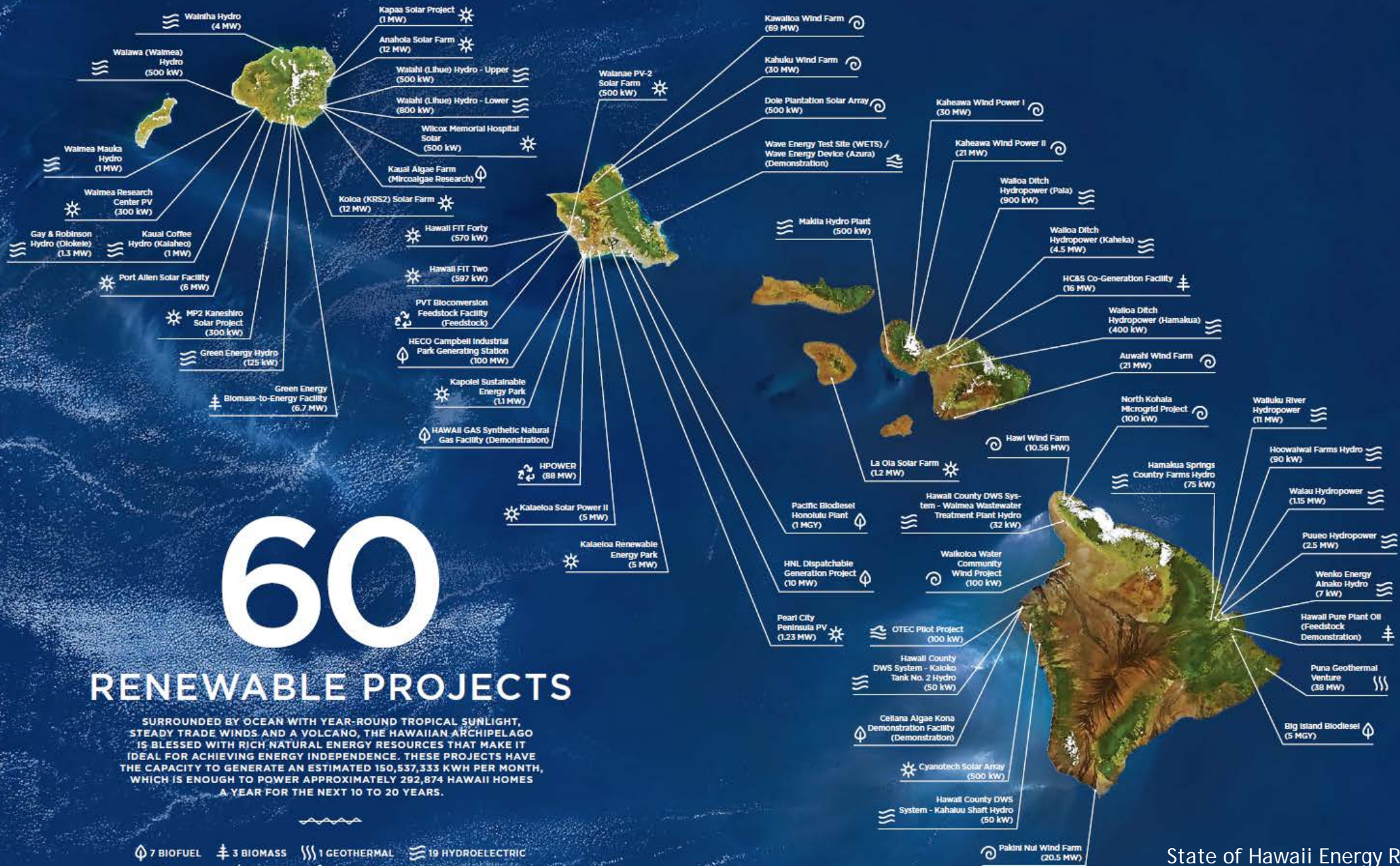
2030 – 40%

2040 – 70%

2045 – 100%

70%/100% - Unless unable to acquire sufficient RE resources compared to economics of fossil fuel resources





60

RENEWABLE PROJECTS

SURROUNDED BY OCEAN WITH YEAR-ROUND TROPICAL SUNLIGHT, STEADY TRADE WINDS AND A VOLCANO, THE HAWAIIAN ARCHIPELAGO IS BLESSED WITH RICH NATURAL ENERGY RESOURCES THAT MAKE IT IDEAL FOR ACHIEVING ENERGY INDEPENDENCE. THESE PROJECTS HAVE THE CAPACITY TO GENERATE AN ESTIMATED 150,537,333 KWH PER MONTH, WHICH IS ENOUGH TO POWER APPROXIMATELY 292,874 HAWAII HOMES A YEAR FOR THE NEXT 10 TO 20 YEARS.

- ☘ 7 BIOFUEL
- ⚓ 3 BIOMASS
- 🌋 1 GEOTHERMAL
- 🌊 19 HYDROELECTRIC
- 🌊 2 OCEAN
- ☀️ 17 SOLAR
- ♻️ 2 WASTE-TO-ENERGY
- 🌀 9 WIND

Hawaii Is Facing New Technical, Economic, and Policy Challenges Now

- ▶ High percentage of daytime load (> 50%) is frequently provided by wind and solar on some islands
- ▶ Demand for rooftop solar remains high
- ▶ Individual circuits at or approaching 250% of minimum daytime load

How we got here...



Many Pieces To The Renewable Puzzle

Selected Pieces – Statutes:

- ▶ 1996 – First NEM Statute
- ▶ 2001 – Renewable Energy Portfolio Standards – Updated 2015
- ▶ 2006 – Public Benefits Fund established
 - ▶ Used to support clean energy technology, energy use reduction, and demand side management
- ▶ 2009 - Energy Efficiency Portfolio Standards,
- ▶ 2011 – On Bill Financing - payment for renewable energy system or energy efficient device through assessment on customers bill
- ▶ 2012 – Reliability Standards & Interconnection Protocols
 - ▶ PUC may set standards
- ▶ 2013 – Grid Modernization
 - ▶ Commission shall consider the value of improving electrical generation, transmission, and distribution systems and infrastructure within the state using advanced grid modernization technology

Many Pieces To The Renewable Puzzle

Selected Pieces – Commission Orders - 1:

- ▶ April 2014 – Four orders plus “Inclinations”:
 - ▶ Rejection of IRPs, issuance of “Inclinations on the Future of Hawaii’s Electric Utilities”
 - ▶ Articulates the vision, business strategies and regulatory policy changes required to align the utilities’ business model with customers’ changing expectations and state energy policy
 - ▶ Utilities need to move with urgency to modernize the generation system on each island grid, “delays are lost savings opportunities
 - ▶ New transmission projects must consider whether there are non-transmission alternatives (“NTAs”)
 - ▶ Distribution system must have the capability to act both as (1) a delivery service and (2) an aggregator of customer-sited distributed energy resources that benefit the customer and the grid.

Many Pieces To The Renewable Puzzle

Selected Pieces – Commission Orders - 2:

- ▶ First Power Supply Improvement Plan - purpose of the PSIP is to determine a reasonable power supply plan for each utility that can serve as a strategic basis and provide context to inform important pending and future resource acquisition and system operation decisions, so as to:
 - ▶ Lower and stabilize customer bills;
 - ▶ Integrate a diverse portfolio of cost-effective renewable energy projects;
 - ▶ Operate each island grid reliably and cost-effectively with substantial quantities of variable renewable energy resources.
- ▶ Demand Response Policy Statement – policy guidelines for continued operation and expansion of DR

Net Energy Metering In Hawaii

Summary

- ▶ NEM participation increased by over 60 times the cap originally established by the Legislature
- ▶ NEM Capacity is now:
 - ▶ 30% of HECO System Peak
 - ▶ 42% of HELCO System Peak
 - ▶ 53% of MECO System Peak
- ▶ NEM program customers account for almost 20% of all customers on HECO and MECO systems

NEM Cap Increases

- ▶ 1996 –
0.1% of peak demand
- ▶ 2001 –
0.5 % of peak demand
- ▶ 2008 –
1.0% of peak demand
- ▶ 2011 –
NEM caps eliminated:
15% per distribution
circuit threshold adopted

Net Energy Metering In Hawaii - 1

- ▶ 1996 – total rated generated capacity limited to 0.1% of peak demand
- ▶ 2001 – Limit raised to 0.5% of peak demand
 - ▶ Credits – full retail rate – The net energy metering calculation shall be made by measuring the difference between the electricity supplied to the ECG and the electricity generated by NEM systems in a given month, with carry over unused credits annually
- ▶ 2005 – Statute amended – PUC may increase:
 - ▶ total rated generating capacity produced by ECGs to an “amount above” 0.5% of peak demand
 - ▶ maximum generating capacity that ECGs may have to an amount greater than 50kW
- ▶ 2006 - PUC initiates investigation to determine whether to permit these increases

Cumulative NEM MW (All Islands)

2001
0.2 MW

2005
0.37 MW

2006
1 MW

Net Energy Metering In Hawaii - 2

- ▶ 2008 – by statute, PUC may modify:
 - ▶ The total rated generating capacity produced by ECGs provided that a percentage reserved for residential and small commercial customers
 - ▶ maximum capacity for residential and small commercial ECGs
 - ▶ Senate Committee Report states:
 - ▶ “Further study is necessary to prevent detrimental customer subsidization and system safety impacts”
 - ▶ “the PUC requires the flexibility to evaluate and set the thresholds for the total rated generating capacity... applicable to NEM”

Cumulative
NEM MW
(All Islands)

2007
2.41 MW

2008
7 MW

Net Energy Metering In Hawaii - 3

- ▶ 2008 – PUC approves stipulations that increased:
 - ▶ maximum generating capacity from 0.5% to 1.0% of peak demand
 - ▶ maximum size of ECGs to 100 kW for HECO Companies, but kept at 50 kW for KIUC
 - ▶ PUC found that stipulation should allow for growth in NEM for a reasonable period
 - ▶ Utilities directed to evaluate and report the effects of further increases

Net Energy Metering In Hawaii - 4

- ▶ 2011 – PUC approves stipulations:

- ▶ For the HECO Companies:

- Eliminates NEM total rated generating capacity caps in favor of a 15% per distribution circuit threshold for distributed generation (“DG”) penetration

- ▶ For KIUC:

- Limits NEM rate to a fixed \$0.20 per kWh and adjusting caps so as to allow up to 2 MW in aggregate for facilities from 50 kW kW up to 200 kW, and 1 MW for facilities smaller than 50 kW

- ▶ NEM program closed June 3, 2014, three years after tariff approved; approximately 0.8 MW of total subscribed capacity

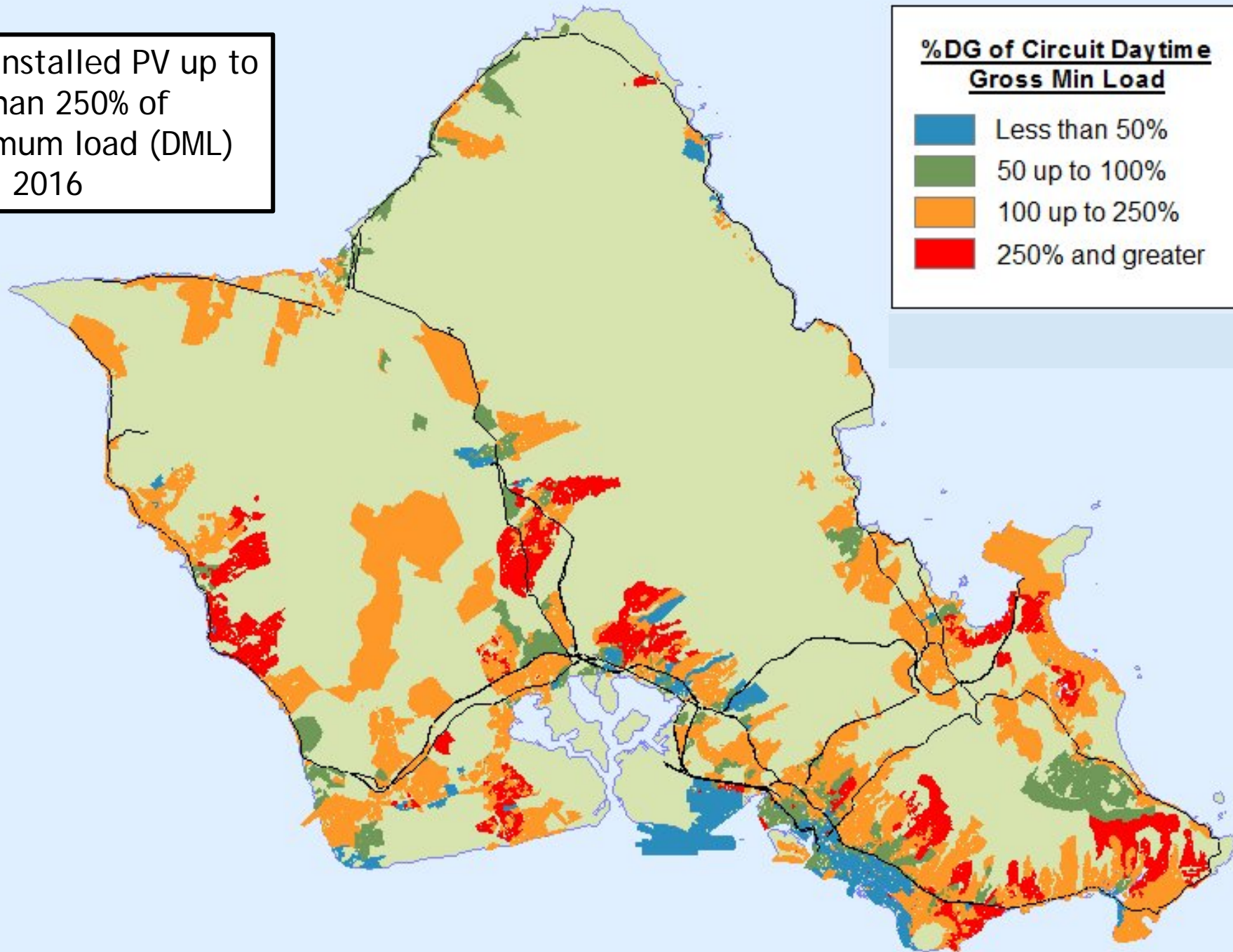
Cumulative
NEM MW
(All Islands)

2009
15 MW

2010
27 MW

2011
58 MW

Circuits with installed PV up to and greater than 250% of daytime minimum load (DML) as of June 20, 2016



Decision and Order No. 33258

Filed October 12, 2015 - 1

- ▶ Closes NEM Program to new customers –
“simply not designed for DER deployment at the scale experienced today”
- ▶ PUC allowed expansion far beyond original cap in conjunction with increased knowledge and mitigation of some technical challenges
- ▶ NEM now represents between 30% and 53% of each of the HECO Companies’ peak load

Decision and Order No. 33258

Filed October 12, 2015 - 2

- ▶ Challenge facing the State is to ensure that DER continues to grow in such a way that it benefits all customers as transition to 100% renewable
- ▶ NEM program has fulfilled core objective of “jumpstarting” adoption of renewable energy
- ▶ Existing NEM customers and those in queue are grandfathered – existing agreements shall be honored, but no additional capacity may be added to existing systems
- ▶ Next step in this ongoing process is the creation of two new programs – self supply and grid supply options

Cumulative
NEM MW
(All Islands)

2001
0.2 MW

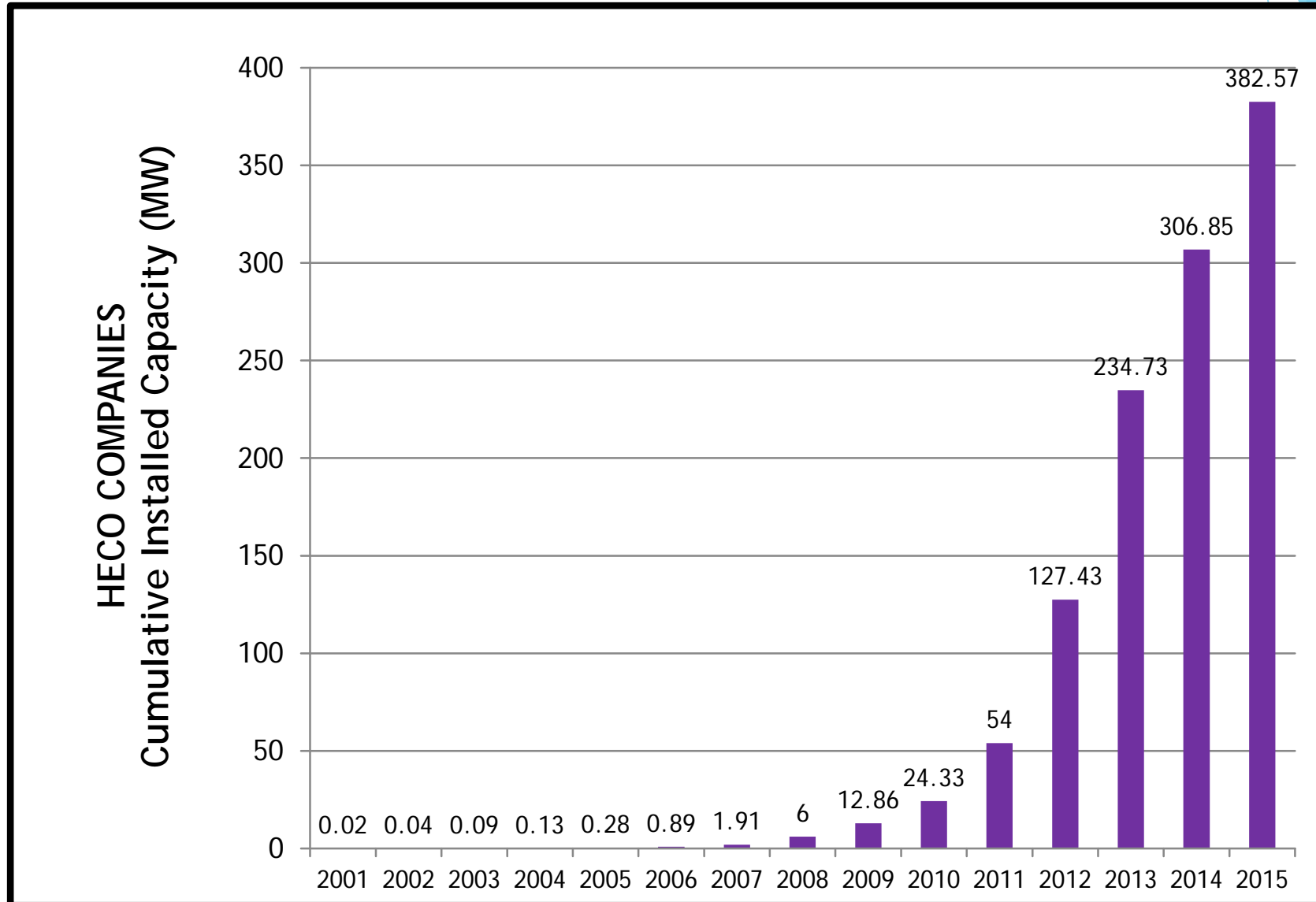
2012
132 MW

2013
240 MW

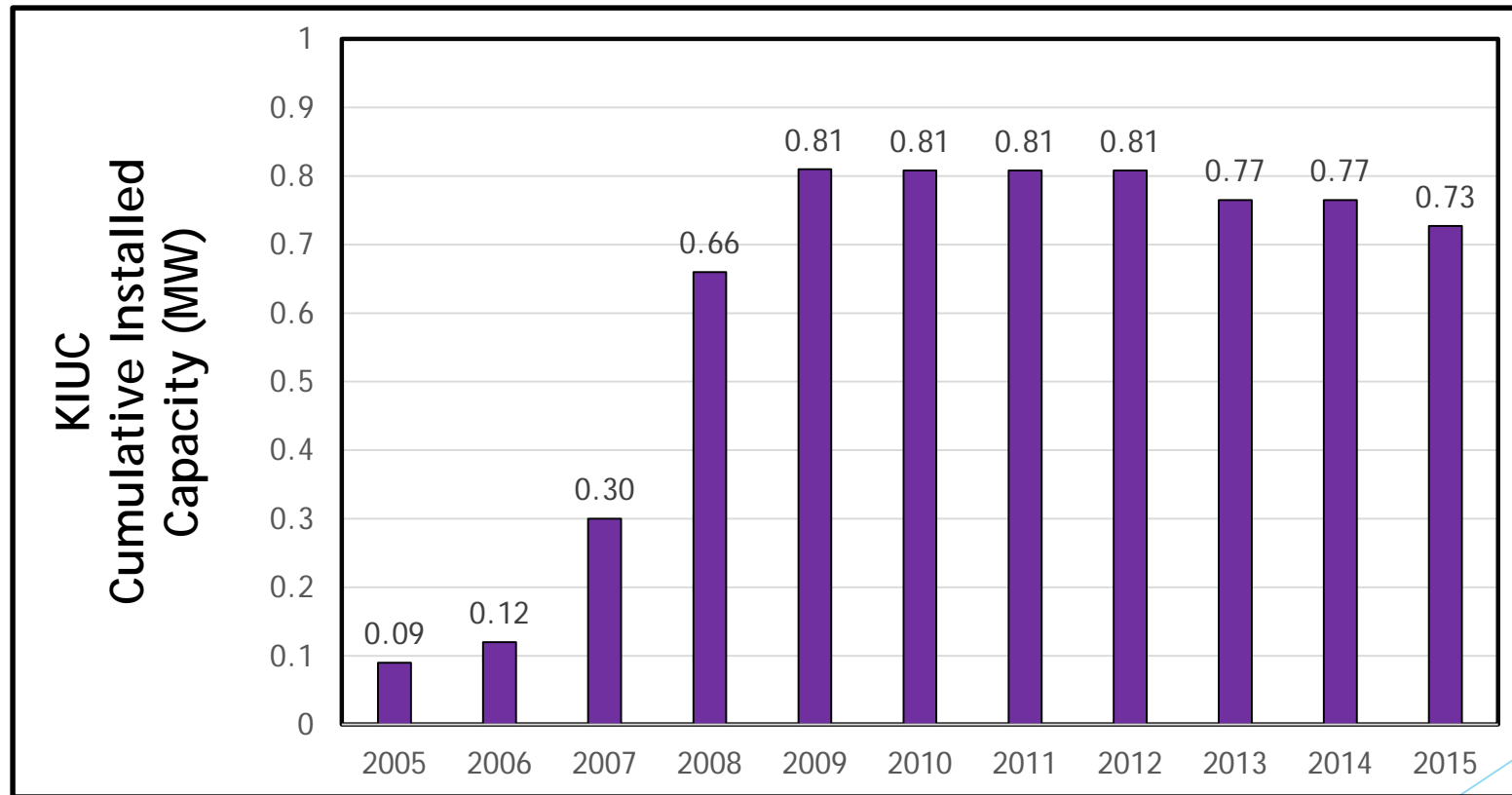
2014
313 MW

2015
383 MW

Installed NEM Capacity (MW) – HECO Companies



2015 Installed NEM Capacity (MW) - KIUC



Where are we headed...



Ongoing Efforts To Complete The Puzzle

- ▶ Ongoing dockets concerning:
 - ▶ Power Supply Improvement Plans
 - ▶ Distributed Energy Resources – technical and policy issues
 - ▶ Demand response
 - ▶ Time Of Use rates
 - ▶ Smart meters
 - ▶ Grid improvements
 - ▶ Implementation of Community Based Renewable Program
 - ▶ Interim NEM replacements: Grid Supply and Self Supply Options

Grid Supply Option - 1

- ▶ Customers have option to export excess energy to the grid in exchange for energy credit against bill
- ▶ Functionally similar to NEM, but rate not tied to retail electricity price
- ▶ Price = 12 month average on peak avoided cost as of June 2015
 - ▶ Commission finds this is a reasonable approximation of the relative value of energy supplied to the grid
- ▶ Interim measure to enable continued beneficial deployment of DER in Hawaii

	Grid Supply Credit Rate
Oahu	15.07¢
Hawaii	15.14¢
Maui	17.16¢
Lanai	27.88¢
Molokai	24.07¢

Grid Supply Option - 2

- ▶ Prudent to establish an initial cap on the availability of the grid supply option – unconstrained growth is not in the public interest given the finite capacity of each island’s grid to accommodate uncontrolled export of energy during mid-day hours
- ▶ Caps: 25 MW_{ac} for HECO,
 5 MW_{ac} each for MECO & HELCO
- ▶ Despite comments that grid supply would not be popular:
 - ▶ Maui cap has been reached
 - ▶ May 16, 2016 – coalition of PV suppliers and others files motion to increase the caps – action pending

Self Supply Option

- ▶ A non-export solution for PV customers allowing them to use PV to meet their energy needs and a limited amount of inadvertent export to the grid
- ▶ Systems under this option to be approved on a fast track basis
- ▶ Allows utility and customer to agree in writing for customers to deliver power
- ▶ Utilities must document need for any additional equipment or modifications to existing equipment
- ▶ Essentially invites a combination of PV and battery storage

Lessons Learned In Hawaii - 1

- ▶ Transformation to renewables involves many interests and parties: legislators, regulators, utility operators, third parties
- ▶ Ultimately, market forces (customer choice), new technologies, and declining costs will drive the scope and scale of the transformation
- ▶ It is important to embrace new technologies, but “everything new becomes old again,” so expect set backs
- ▶ Diversified portfolios are (still) necessary to ensure affordable rates – renewable & fossil fuels, distributed energy & utility scale renewables

Lessons Learned In Hawaii - 2

- ▶ Hawaii experienced:
 - ▶ Exponential growth in PV installations which, for a variety of reasons, exceeded ability to manage interconnections and costs
 - ▶ Created a boom/bust cycle for installers – interconnection approvals slowed due to safety, reliability, and operational concerns
 - ▶ Some major issues (many more now and to come):
 - ▶ How to provide utility customers with choices *and* enable utilities to serve non-DER customers at reasonable costs
 - ▶ How to migrate from “dumb” to “smart” DER
 - ▶ How to effectively establish and manage a flexible generation, transmission, and distribution system

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For additional information, please contact

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Additional Material

Background - 1

- ▶ 1996 – Hawaii Revised Statute (“HRS”) 269-16.21
 - ▶ Limit - total rated generated capacity under NEM limited to 0.1% of peak demand
- ▶ 2001 – Recodified as HRS 269-101 to 269-111
 - ▶ Limit – 0.5% of peak demand
 - ▶ Credits – full retail rate – The net energy metering calculation shall be made by measuring the difference between the electricity supplied to the ECG and the electricity generated by the EGC in a given month, with carry over unused credits annually
- ▶ 2004 – Statute amended to include “governmental entities” as eligible customer-generators (“ECGs”)
 - ▶ Increased metered capacity for residential and commercial ECGs from 10 kW to 50 kW

Background - 2

- ▶ 2005 – Statute amended – PUC may increase:
 - ▶ total rated generating capacity produced by ECGs to an “amount above” 0.5% of peak demand
 - ▶ maximum generating capacity that ECGs may have to an amount greater than 50kW
- ▶ 2006 – PUC initiates investigation to determine whether to increase:
 - ▶ total rated generating capacity produced by ECGs to above 0.5% of peak demand
 - ▶ Maximum generating capacity above 50 kW

Background - 3

- ▶ 2008 – Statute amended - PUC may modify:
 - ▶ total rated generating capacity produced by ECGs provided that a percentage reserved for residential and small commercial customers
 - ▶ maximum capacity for residential and small commercial ECGs
- ▶ 2008 – Senate Committee Reports:
 - ▶ “Further study is necessary to prevent detrimental customer subsidization and system safety impacts”
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Background - 4

- ▶ 2008 – PUC approves stipulations that increased:
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