# **Overview on Hawaii Energy Status**

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# **National Rankings**



- 1<sup>st</sup> (Honolulu) per person installed solar PV (2017)
- 1<sup>st</sup> (Hawaii) energy performance contracting (2018)
- 3rd (Honolulu) total installed solar PV (2017)
  - 2<sup>nd</sup> (Hawaii) EV penetration (2016)
  - 12<sup>th</sup> (Hawaii) PV installed capacity (2017)

#### • Breaking Our Addiction to Oil – Most Oil-Dependent State

- Most oil dependent state in the U.S. imported 89% of our energy in 2016
- Pays the highest electricity rates in the U.S.
- Oil use for electricity generation down over 20% since 2008



Despite Appearance of Disagreement Between Major Constituencies, There Is Agreement on Many Key Points

- Hawaii is pushing towards a clean energy future for energy, environmental, and economic reasons
  - Hawaii imported 89% of its energy supplies in 2016 \$1.7 Billion worth!
- There is no "silver bullet": all energy choices require trade-offs on economic, operational, environmental, and cultural factors
- Decision-making must take into account:
  - Operational realities for maintaining reliability and resiliency
  - Financial well-being of utility, while keeping rate-payer costs down
- Public Policy continuously needs to be evaluated in light of changing technological, environmental, and economic conditions

# Hawaii Clean Energy Initiative (HCEI) Started in 2008 – Aspirational Goals Were Developed in 2015 and 2018

- Agreement between State, Hawaiian Electric, and US Department of Energy
  - Followed on existing Renewable Portfolio Standard legislation passed in 2003
- Called for reduction of fossil energy resource use of 70% by 2030
  - 40% derived from renewable energy production
  - 30% from increased energy efficiency
- In 2015, legislature changed renewable energy goal for electricity production to 100% by 2045
- In 2018, legislature developed goal of 100% non-fossil fuel vehicles by 2040

# HCEI – What Was Expected to Occur, But Did Occur

**Original HCEI was for a 2030 future – all sectors:** 

- 40% Renewables

- 30% improvement in energy efficiency

What didn't happen:

- Plan for 400 to 800 MW of wind on Molokai and Lanai connected by undersea cable to Oahu

- Improvement in transportation metrics

What was unexpected and did happen allowed state to easily meet goals:

- Plummet of solar cell and installation costs
- wind turbine technology improvements

## • Renewables Take Bite out of Fossil Fuel Use - Oil Use for Electricity Down Over 20% Since 2008



Source: Research & Economic Analysis Division, DBEDT

# Current State of Technology Deployment in Hawaii



#### • RPS: 2020 Goal of 30% to Be Met by HEI and KIUC



#### **PV Permits Issued on Oahu in Relation to Regulatory Changes**



Source: Honolulu DPP



# Number of building permits related to residential PV plus battery – Implies

Source: Honolulu DPP

HECO residential electricity sales on Oahu decreased 19.4% during last 10 years – BUT Potential for Growth Due to EVs, Digitization, etc. (in GWh)



Source: HECO

#### Grid and Societal Problem: BTM PV Growth May Be Seen as "Regressive Tax" on Lower Income Groups Who Must Pay Higher Prices for Maintaining the Grid



Source: Honolulu DPP; map by OP

Growth of BTM Solar Allows RPS Goals to be Met, But Leads to Grid Problems: Almost 721 MW (June, 2018) - Some "negative peaks" on distribution lines are greater in magnitude than demand peaks, with a number of lines at 250% generation vs. MDL

	Number of PV Systems			PV Capacity, MW		
	Number	% Residential	% Commercial	Capacity	% Residential	% Commercial
Hawaiian Electric	51,828	96%	4%	519	54%	46%
Hawaii Electric Light	12,192	94%	6%	93	65%	35%
Maui Electric	12,265	92%	8%	110	60%	40%
TOTAL	78,285			721		

#### Additional Problem: There Can Now Be More Generation than Load: Thermal Generation Operates at Below "min power" – pricing is negative!!



# Nature of Distribution Planning Has Evolved with Changing Technology and Regulation

- Plan orderly expansion of distribution system to serve new electrical load – "traditional" process required to provide power to customers
- Safely interconnect DER (PV, DR, EV, ESS, etc.) while maintaining power quality and reliability for all customers – relatively new process required to accept power from customers
  - Determine capability of distribution circuits to add BTM PV.
  - Model circuits based on daytime minimum loading with existing PV.
  - Add/scale PVs to circuits until voltage or thermal violation occurs.
  - Consider new technologies to support grid reliability: monitoring, communications, automated DR, two-way meters

## New Monitoring and Communications Systems Will Enable Load Shifting and Automated Demand Response



### Emerging IoT Systems Will Enable Improved Grid Management Using Demand Response Systems – Shape/Shift

- Manage peak capacity, reduce need for fast ramping resources, and minimize solar overgeneration
- Improve affordability of electricity
- Improve grid reliability
- Enable more renewables on grid by facilitating integration



- Open standardized DR interface
- Allows electricity providers to communicate DR signals directly to end uses and appliances
- Uses XML language and existing communications e.g., Internet



## Hawaii Is Also on Track to Meet Energy Efficiency Portfolio Standard Goals – in 2017, Energy Efficiency Added 4% to RPS



Source: Renewable Portfolio Standards Status Reports, 2008-2014 (Hawaii Public Utilities Commission)

# Hawaii Must Consider a Variety of Possible Scenarios for Technology Deployment



# **Scenarios Based on Number of Assumptions**

- Energy efficiency will achieve 2030 goal of 30% reduction in sales
  - Target of 40% to 45% by 2045
  - Problem is that efficiency initiatives are not controlled by utility, although demand response is
- Distributed energy resources will continue to grow
  - BTM generation
  - Supporting technologies for storage and automated demand response
  - Scenarios dependent on cost of storage and small-scale renewables
- There will be substantive addition of electric vehicles
  - State-owned fleets
  - Private electric vehicles

### Additional Hawaii Problem: Latest US Climate Report on Impacts of Climate Change on Energy – One Impact Is Flooding of Power Plants



#### Rather than Aiming at Aspirational Goals, Critical to Implement New Energy System Deployments Over Next Five to Ten Years

- Develop indigenous resources to reach original RPS 2030 targets
- Retain flexibility in regulation and utility business practices as key to adjusting to technological innovations and changes in technology prices
- Consider inter-relationships between various systems transportation, water, electricity
- Limit excessive aspirational legislation that that is "noble," but could impede eventual success
- Transformational and potentially disruptive investment decisions must consider unintended impacts on societal, cultural, energy, and grid costs