

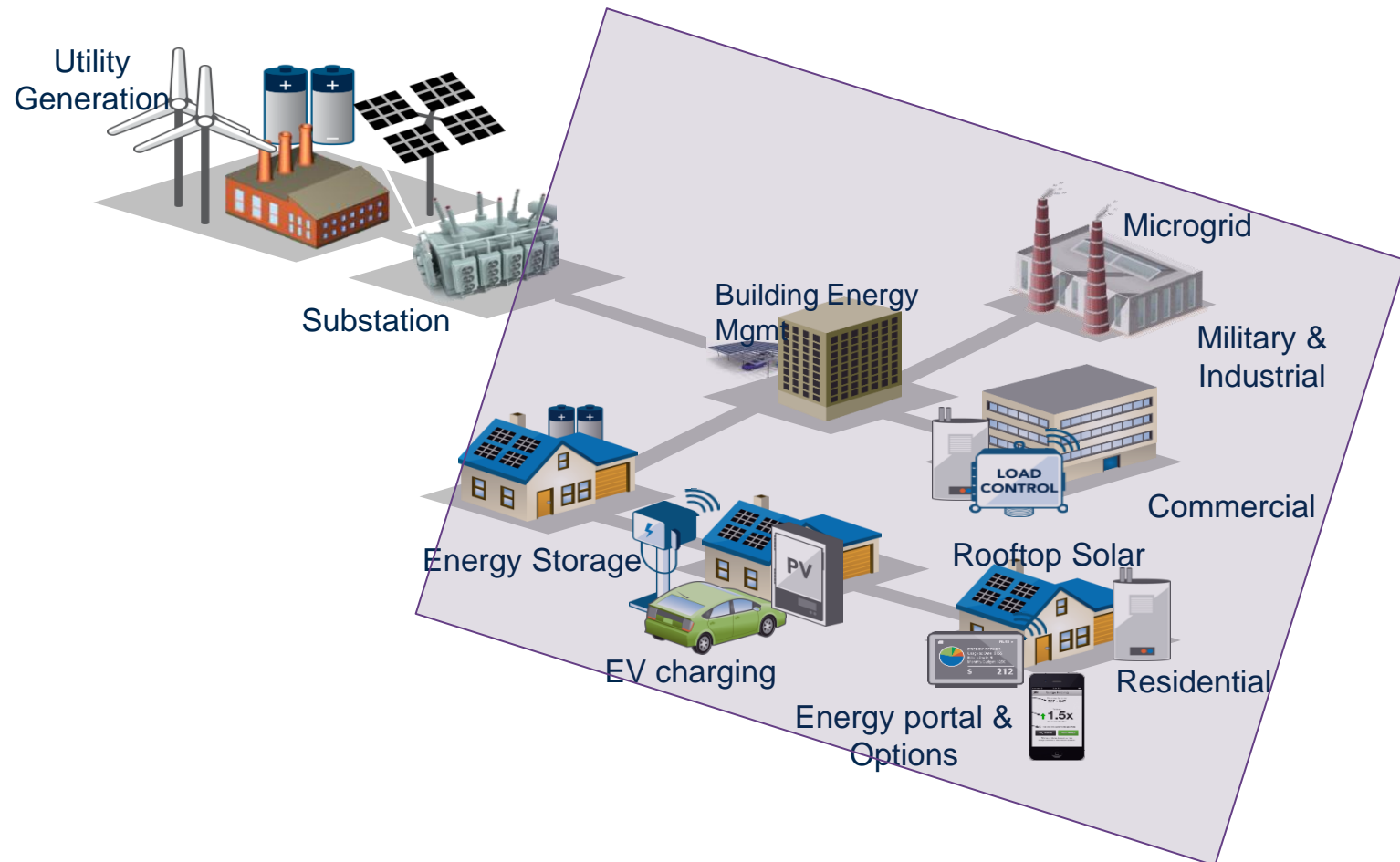


Hawaiian Electric
Maui Electric
Hawai'i Electric Light

DER and DR Landscape in Hawai'i

OpenADR DER Communications Workshop

Angie Eide, DR Program Engineer



Hawaiian Electric Companies

- ◆ 3 Operating Companies; 5 Islands
 - Hawaiian Electric: O'ahu
 - ~300,000 customers
 - Renewable energy: 19.4%
 - Customer sited solar: 411MW
 - Hawaiian Electric Light: Hawai'i Island
 - ~85,000 customers
 - Renewable energy: 54.2%
 - Customer sited solar: 81.5MW
 - Maui Electric: Lana'i, Maui, Molokai
 - ~71,000 customers
 - Renewable energy: 36.9%
 - Customer sited solar: 167.4MW



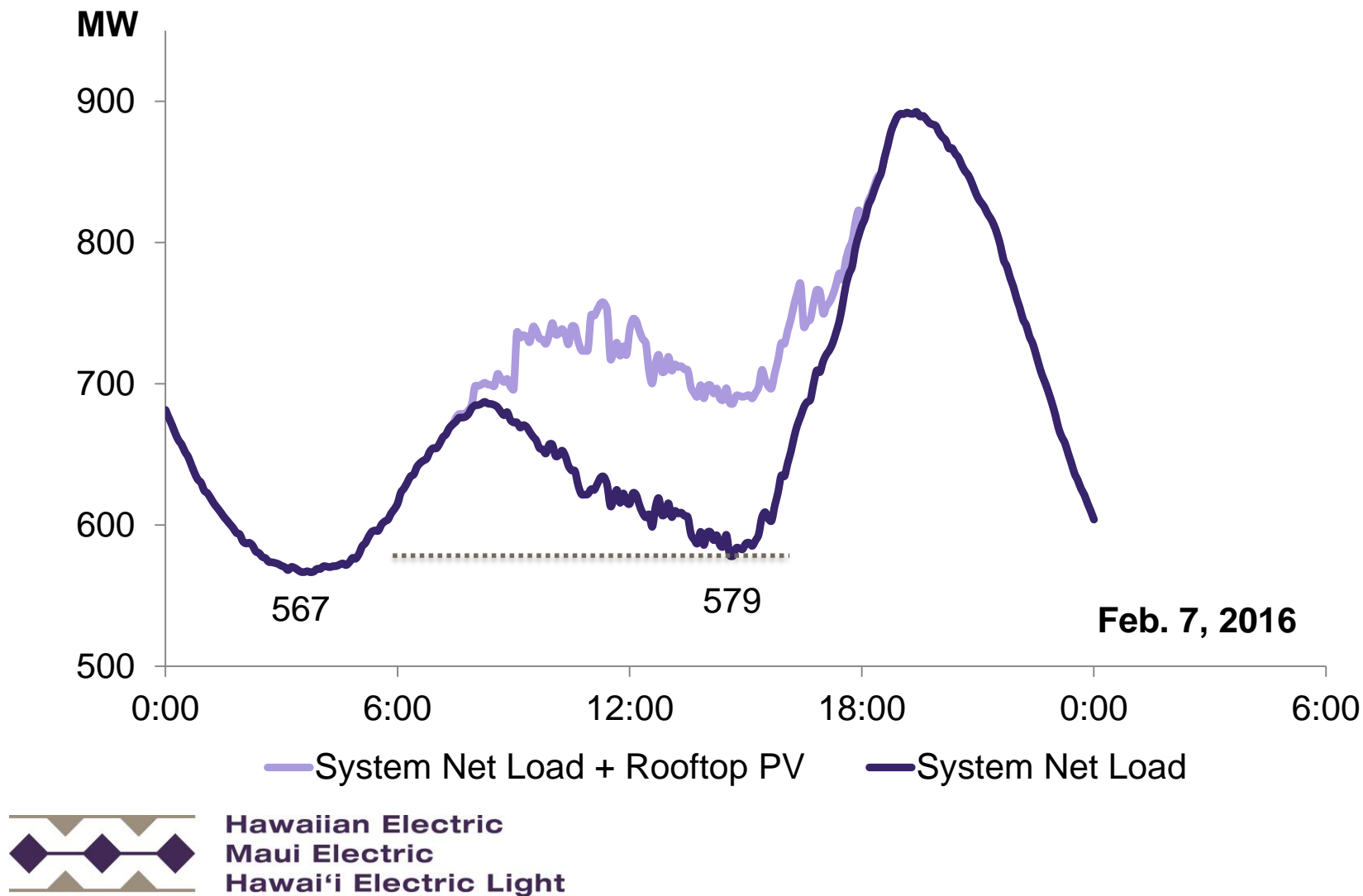
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A New Frontier: Regulatory Drivers

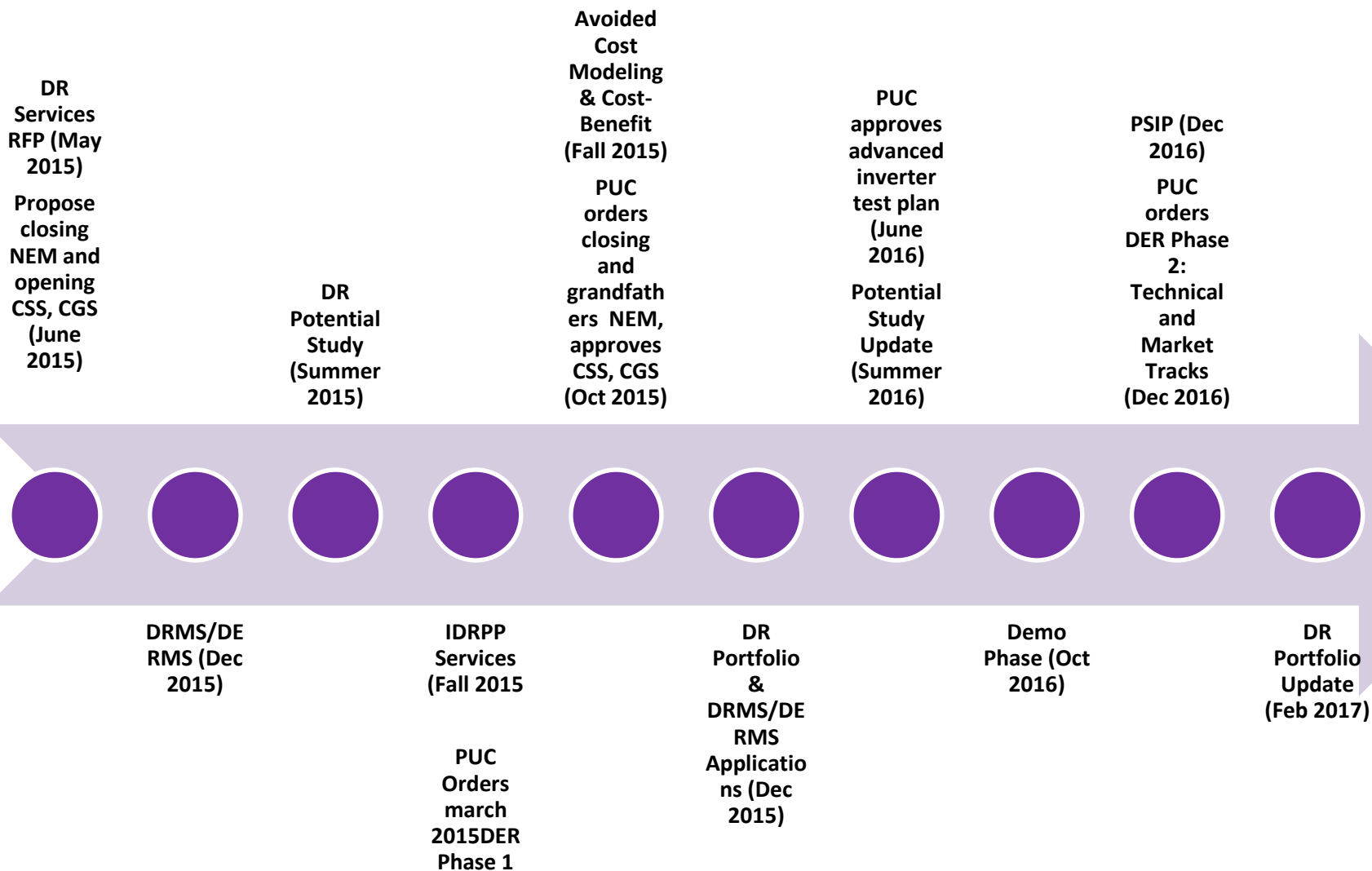
- ◆ Integrated Demand Response Portfolio Plan (IDRPP)
 - April 2014: Initial IDRPP Order
 - Consolidation of DR programs into an integrated portfolio
 - Role of DR to reduce curtailment of renewable (i.e. ancillary services)
 - Assess DR potential
 - More options for customers
 - 3rd party providers need to be investigated
 - Address cost effectiveness
- ◆ DER Policies
 - August 2014: DER Policies
 - For all Hawai'i utilities
 - Investigate various DER technical, economic, and policy issues
- ◆ New State Law
 - July 2015 announced 100% renewables by 2045



Operational Drivers: The Daytime Minimum Load Nearly Fell Below the Nighttime Minimum Load



Recent DR/DER History



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Building the Market: Proposed Grid Service Tariffs

Capacity Grid Service

Capacity: for dispatchable resources -the rating of the unit; for variable resources- the capacity that can be assured in the next 4 hours; for controlled load- the minimum of load under control during the 24-hour day.

Fast Frequency Response

Fast Frequency Response is needed to reduce the rate of change of frequency (RoCoF) to help stabilize system frequency immediately following a sudden loss of generation or load, proportional to the loss.

Regulating Reserve Grid Service

Regulating Reserves are maintained to respond to supply/demand imbalances over much shorter time frames, typically on the order of one to several seconds.

Replacement Reserve Grid Service

Replacement reserves replace the output of faster responding reserves (or restoration of shed loads) enabling their redeployment; meet sustained ramps and forecast errors beyond Regulating Reserve duration.



DR Market Model

Existing	DESCRIPTION	New	DESCRIPTION
Residential Water Heater & AC	<ul style="list-style-type: none"> Capacity and Fast Frequency Response Proprietary Communications Administered via Service Provider 	Aggregators	<ul style="list-style-type: none"> Contract with Hawaiian Electric to Deliver Grid Services OpenADR
Small Business Water Heater & AC		Self-Aggregators	<ul style="list-style-type: none"> Large Customers Contract Directly with Company Technical Coordinator OpenADR
C & I Fast DR	<ul style="list-style-type: none"> Capacity and Replacement Reserve OpenADR Administered via Service Provider 	Company Administer	<ul style="list-style-type: none"> Existing Programs New Programs Targets Not Fulfilled by Aggregators
Large C & I	<ul style="list-style-type: none"> Capacity and Fast Frequency Response Proprietary Communications Company administers directly 		



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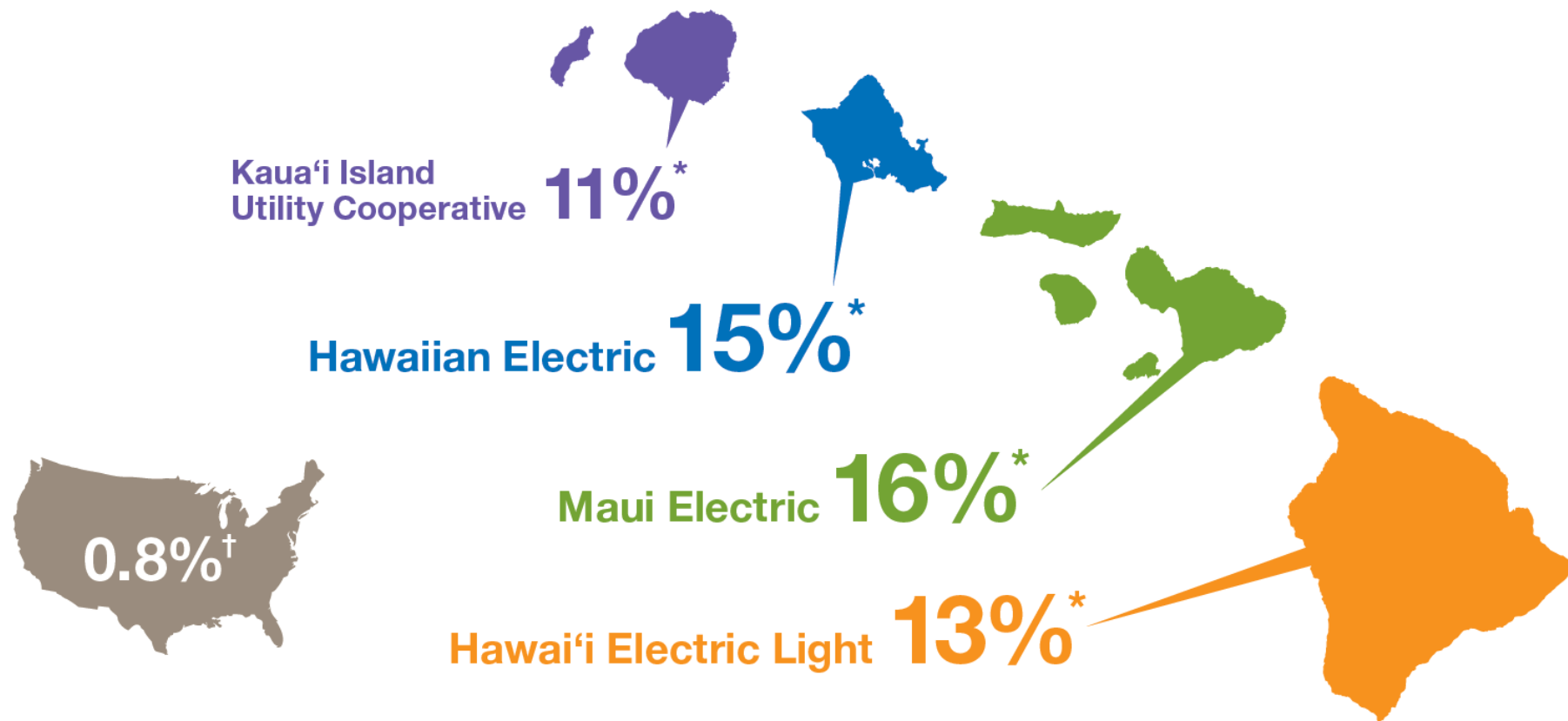
Demonstration Phase

Regulating Reserves 100 customers providing 730 kW	
Team A	95 customers, mix of commercial and residential (Oahu and Maui)
Team B	2 residential PV + Storage
Team C	1 C&I customer with storage, enabling devices
Team D	2 energy storage for large C&I customer
Fast Frequency Reserves 3 customers providing 135 kW	
Team B	2 residential PV + Storage
Team C	1 C&I customer with storage, enabling devices
Capacity (Load Shifting) 47 customers providing 101.5 kW	
Team B	10 residential PV + Storage
Team C	1 C&I customer with storage, enabling devices
Team E	30 customer self supply customers
Team F	5 small business customers with thermostat

Short listed Aggregators delivering a variety of Grid Services; most must certify as OpenADR VEN



DER Penetration



*As of 9/30/16. †As of 12/31/15.

National data courtesy of Smart Electric Power Alliance.

Nation-Leading Rooftop Solar Levels



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Programs That Drove Exponential Growth

Governed by Rule 14H for Interconnection to Distribution System

FOR USE	PROGRAM DESCRIPTION	FOR SELL	PROGRAM DESCRIPTION
Net Energy Metering (NEM)	<ul style="list-style-type: none"> Renewable Technology Systems ≤ 100 kW Excess Energy Credited at Retail Rate 	Feed In Tariff (FIT)	<ul style="list-style-type: none"> Renewable Technology Set Price per Tariff in 3 Tiers 20 Year Contracts Currently Closed to New Applicants
Standard Interconnect. Agreement (SIA)	<ul style="list-style-type: none"> All Technology All Sizes (Generally > 100 kW) Excess Energy not Credited Made for Offsetting Customer's Consumption 	Power Purchase Agreement (PPA)	<ul style="list-style-type: none"> Any Technology of Any Size Energy Sold to Utility Negotiated PUC Approval
Largest driver of exponential growth was NEM		Schedule Q	<ul style="list-style-type: none"> Systems ≤ 100 kW Energy Sold to Utility Avoided Cost Rate PUC Approval



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New DER Programs

	Grid Supply (“CGS”)	Self Supply (“CSS”)
System Size	Up to 100 kW	Up to 100 kW
Minimum Bill	\$25	N/A
Credits	Monthly true-up; credit fixed for two years	No export allowed
Technology	Approved interconnection	Advanced inverter + approved interconnection

◆ DER 2.0 Focus Areas

- Interoperability of Resources
- Registration of DER
- Retrofits for existing equipment
- Methods to Promote Compliance and Consumer Protection
- New Systematic and Programmatic Approaches for Integrating Additional DER

5 of 10 influenced by communications and infrastructure choices



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Mahalo!

