

# Hawaii's DER Management Initiative

## Opportunities for Customer-sited Grid Services Delivery



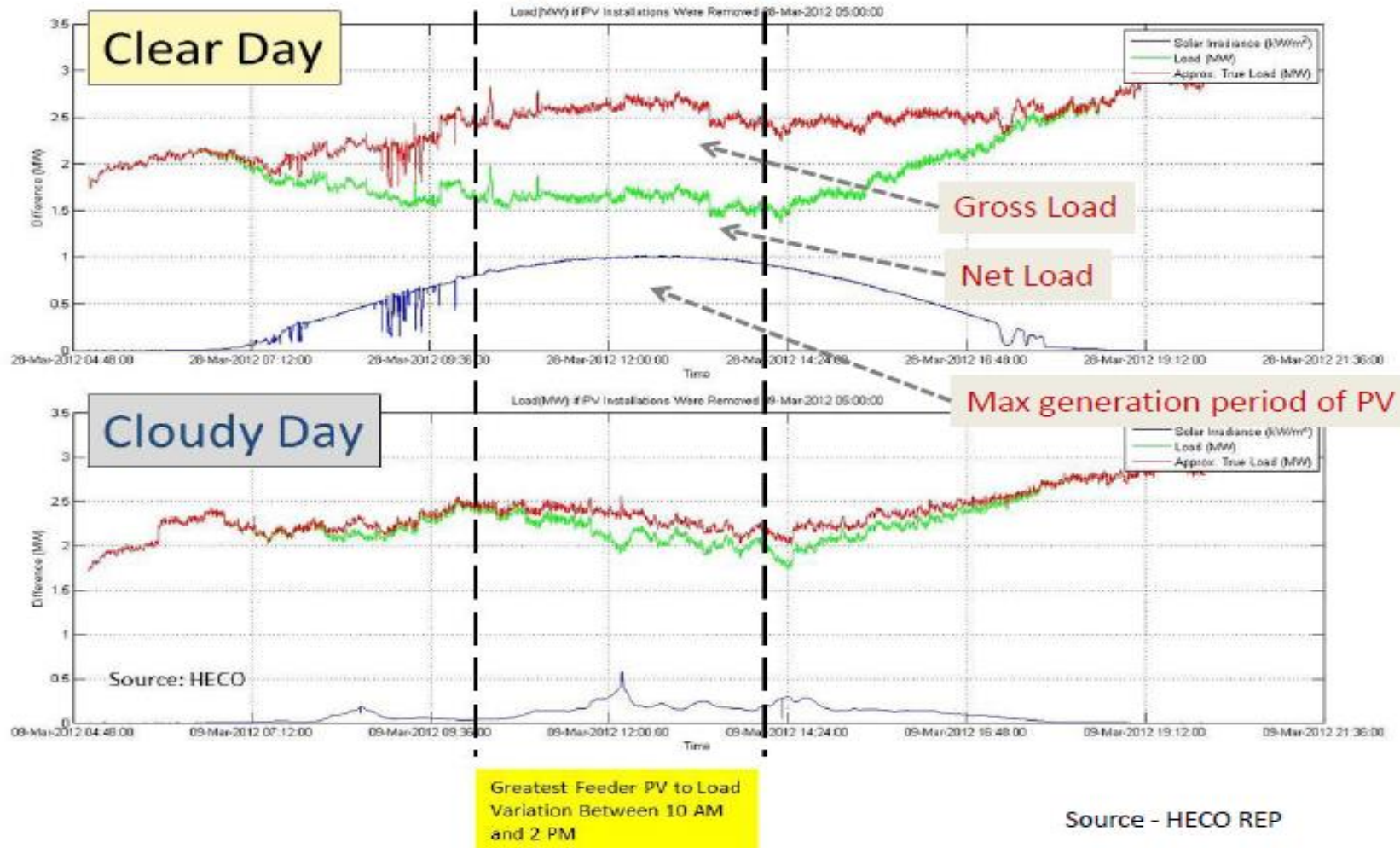
**Rich Barone**  
Manager, Demand Response  
Hawaiian Electric



Hawaiian Electric  
Maui Electric  
Hawai'i Electric Light

# Renewable Energy Challenges: System Stability

## Understanding Solar Impact on Feeder Load



# Risk: Minimum Loads

**PV reduces mid-day net loads**

**Generators running a production minimums**

- ◆ Inefficient
- ◆ Risk of tripping off

**Hidden loads create load balancing risks**



# Risk Management: Load Shifting

Load shifting can be event or pricing-based

These programs can persuade customers to increase their demand during peak times

- ◆ Water heaters, water and waste water tanks, Storage, EV's

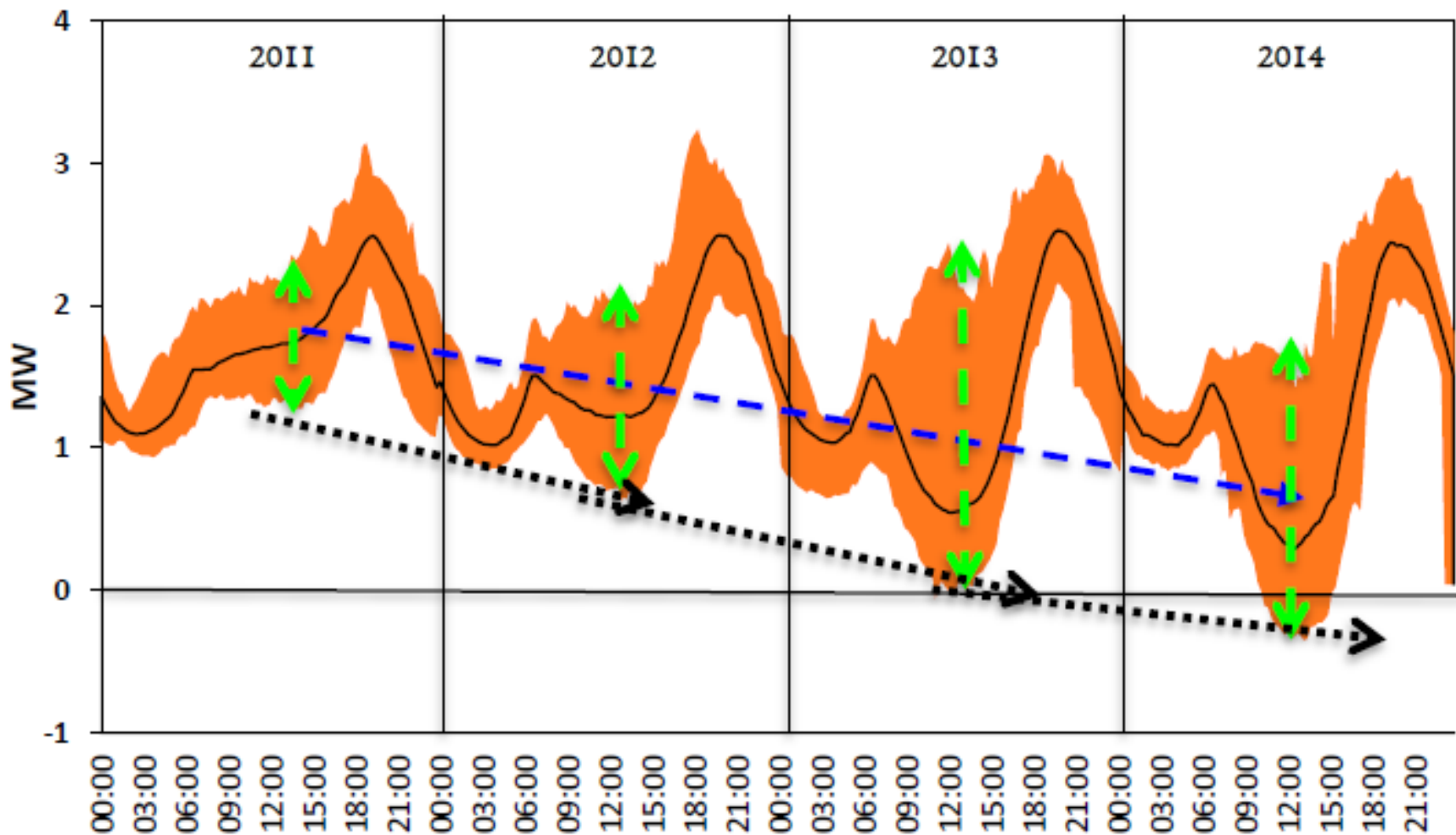




# Risk: Increased Variation on Circuit

More PV = more variability on circuit

Circuit variability drives the need for more Regulating Reserves



Hawaiian Electric  
Maui Electric  
Hawai'i Electric Light

Actual Annual Circuit Net Load (Residential Circuit)

# Risk Management: Regulating Reserve Program

- Variation in load can be compensated with increased regulating reserve (RR) resources
- Demand Response can provide RR
  - GIWH can react to 2 sec AGC data



# Building the Market: Grid Service Tariff Orientation

## 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.



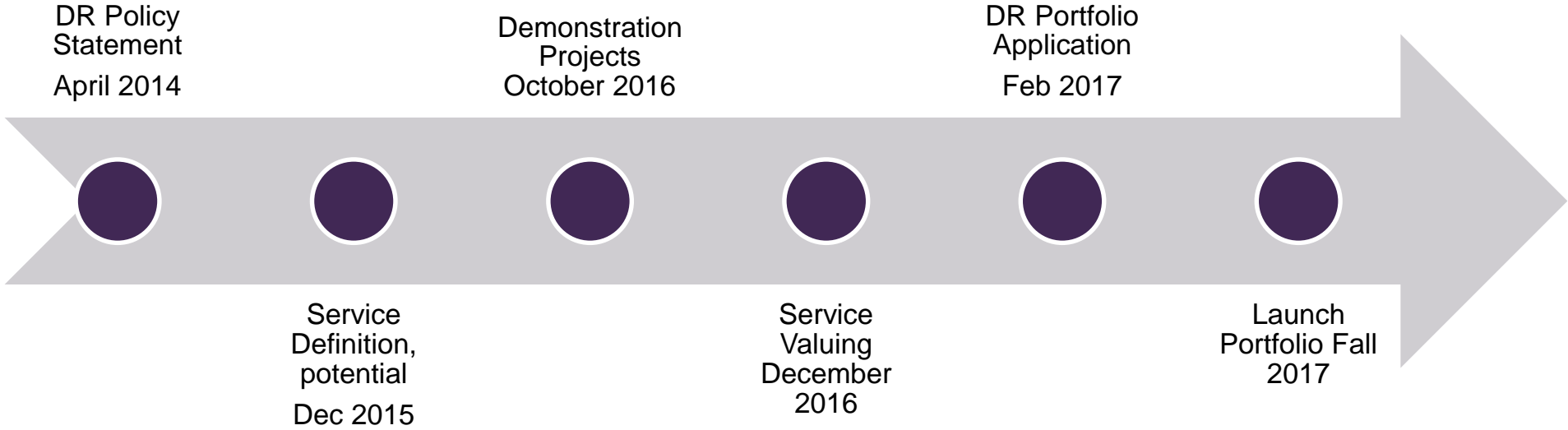
# Building the Market: Demonstration Phase

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





# Timeline



# Building the Market: Aggregators



## Gaging the potential for a Grid Services marketplace

- ◆ Grid Services RFP (May 2015)
  - Short-listed vendors
  - Demonstration projects
- ◆ Grid Services Purchase Agreement (GSPA)
- ◆ Rolling RFPs
- ◆ Long-term
  - Auction?



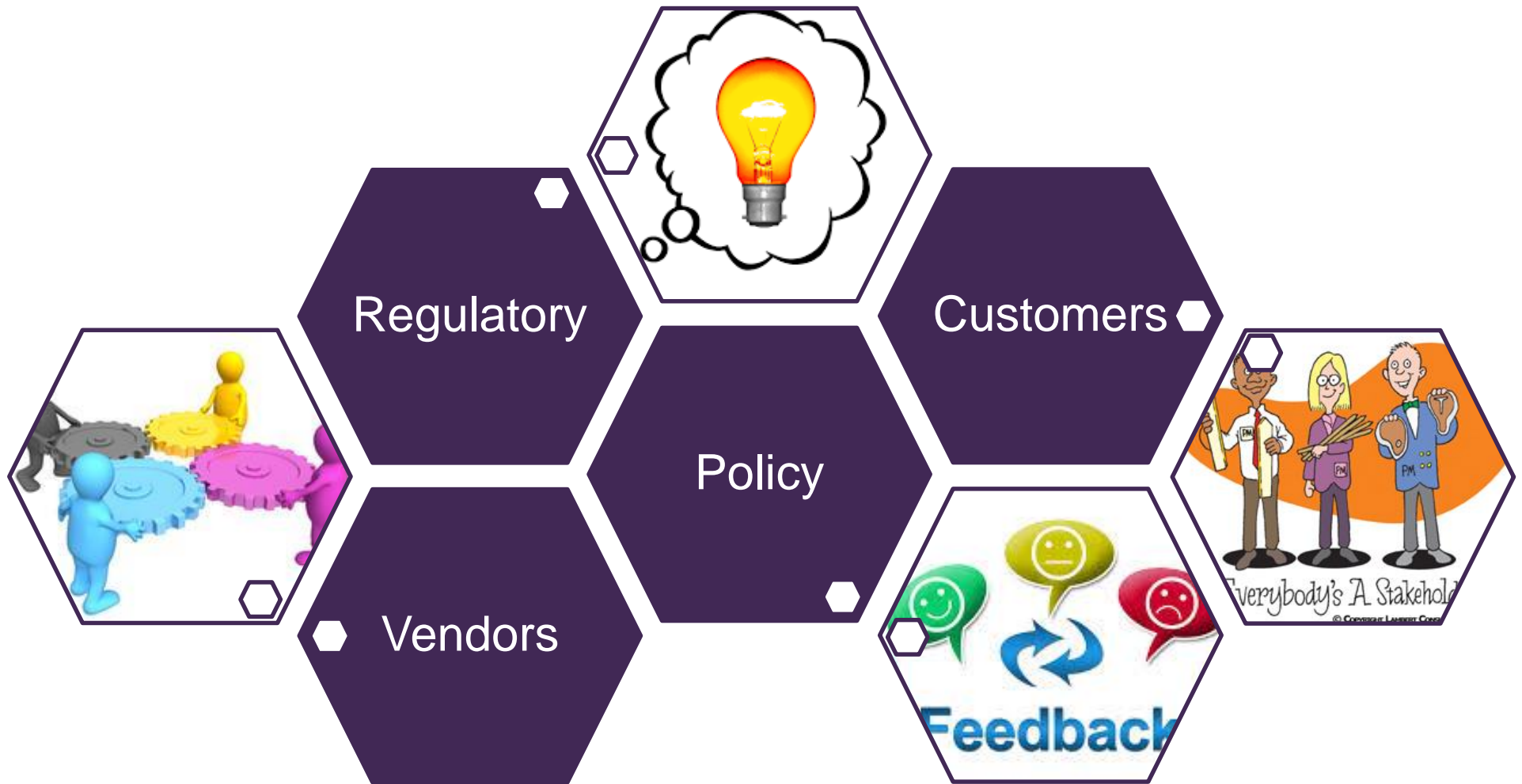
# Building the Market: Self-aggregators

## Large customers can self-aggregate and contract directly with Hawaiian Electric

- ◆ Typically work with a Technical Coordinator
- ◆ Customers include Board of Water Supply
- ◆ Department of Defense
- ◆ Department of Education
- ◆ University of Hawaii



# Building the Market: Stakeholder Engagement



# Hurdles

## Internal

- Operational uncertainty
- Planning-operations feedback loop
- Realization, verification ^ quantification of benefits

## External

- Market uncertainty
- Technical Uncertainty
- Proper value assignment





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