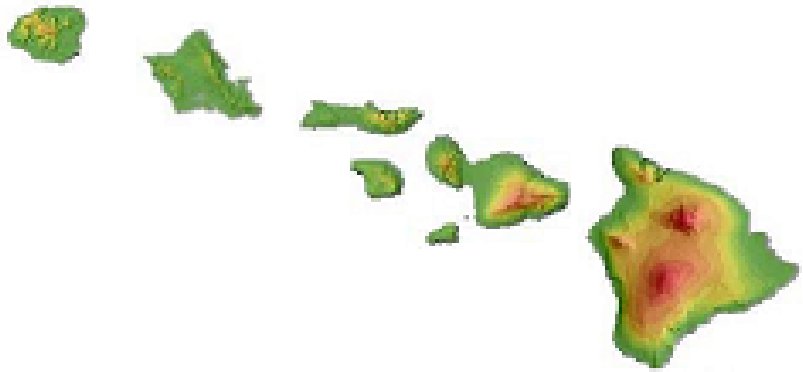
Seeing is Believing!
Tools for Renewable Integration



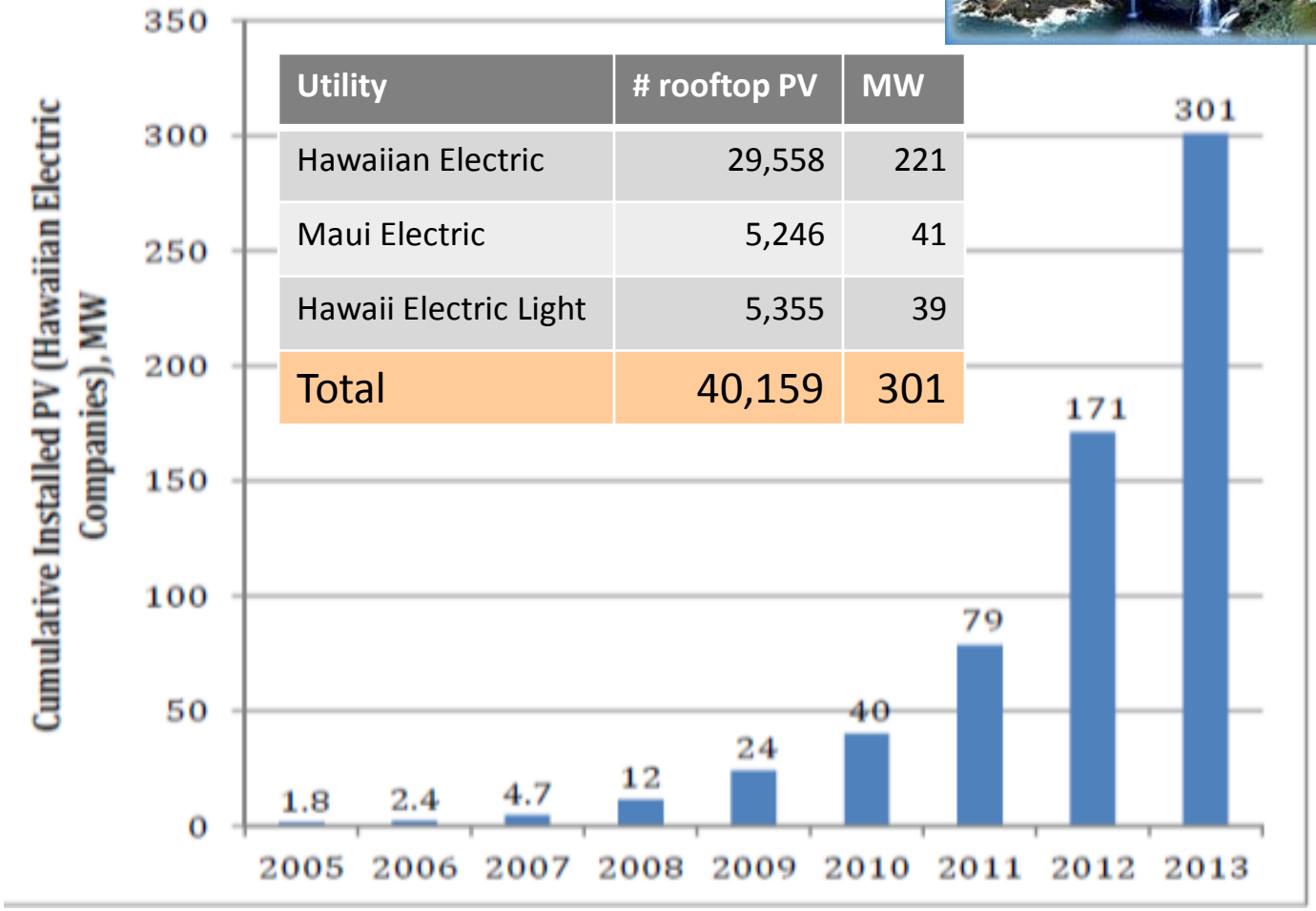
Dora Nakafuji

DistribuTECH

San Antonio, TX
January 28, 2014

Hawaiian Electric
Maui Electric
Hawai'i Electric Light

Where are we Today in Hawaii?



Utility	# rooftop PV	MW
Hawaiian Electric	29,558	221
Maui Electric	5,246	41
Hawaii Electric Light	5,355	39
Total	40,159	301

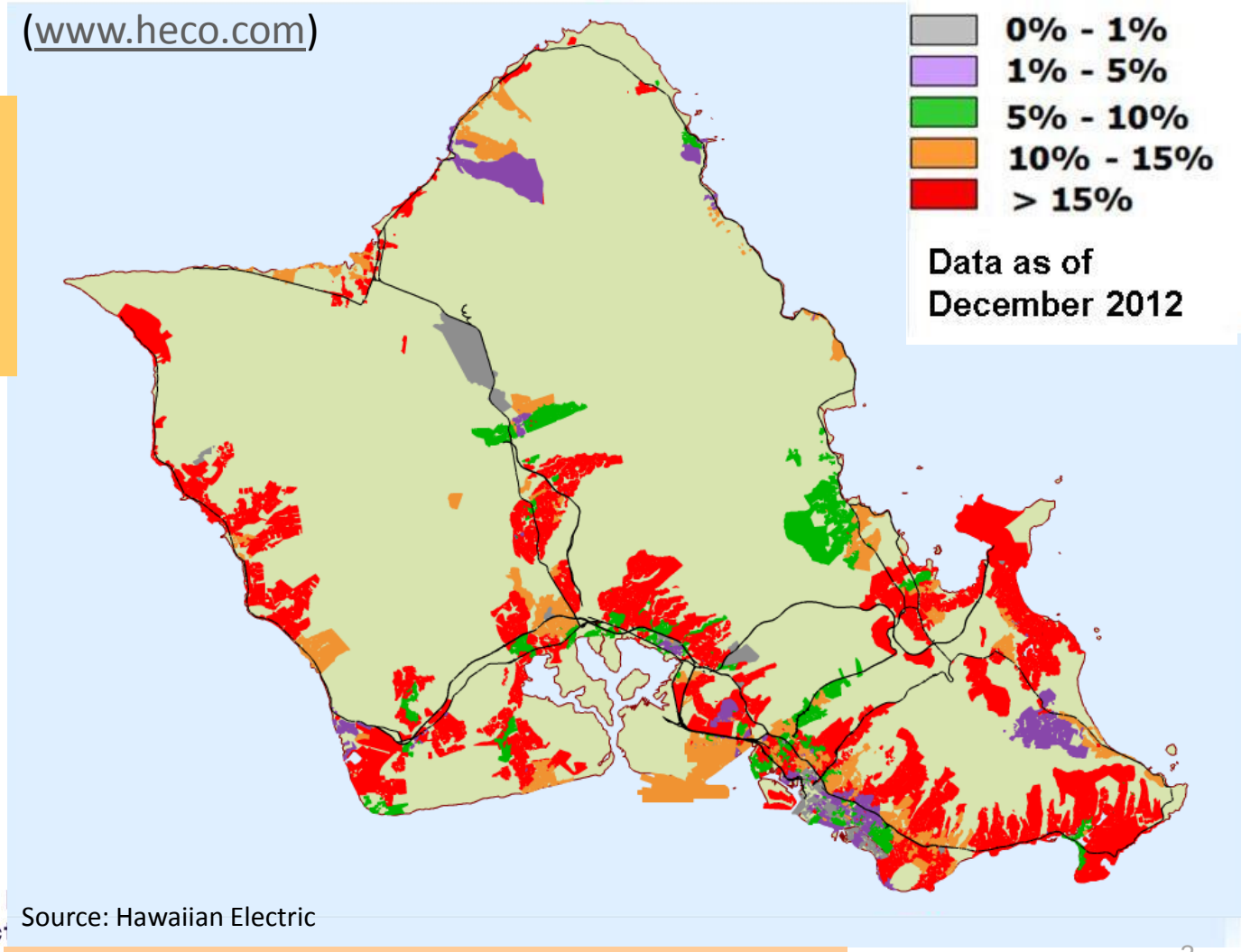
- RPS - 40% renewables from electricity, 70% total (includes transportation)
- Energy efficiency standard of 30 by 2030 (3,400 GWh)
- **HECO – 17%, HELCO – 42%, MECO – 26%**

Hawaiian Electric
Maui Electric
Hawai'i Electric Light

Locational Value Map (LVM) – Visual Tracking of DG Penetration Levels

HECO Locational Value Maps Trending Penetration Levels

(www.heco.com)



Source: Hawaiian Electric

Red areas indicate circuits with > 15% PV penetration

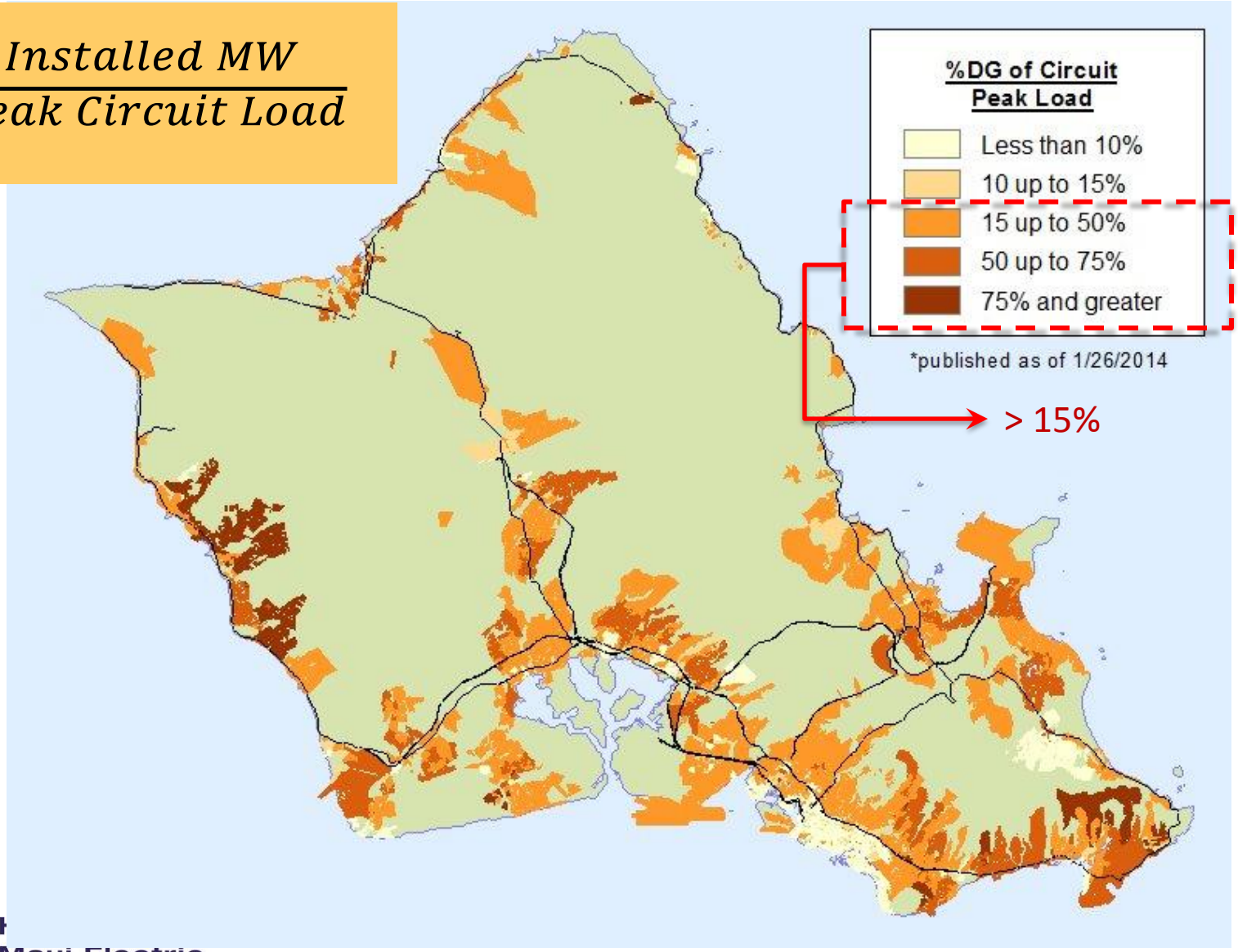
BENEFITS

- Visual tracking of DG penetration
- Location specific
- Consistent customer interface

Hawaiian
Maui Elec
Hawai'i El

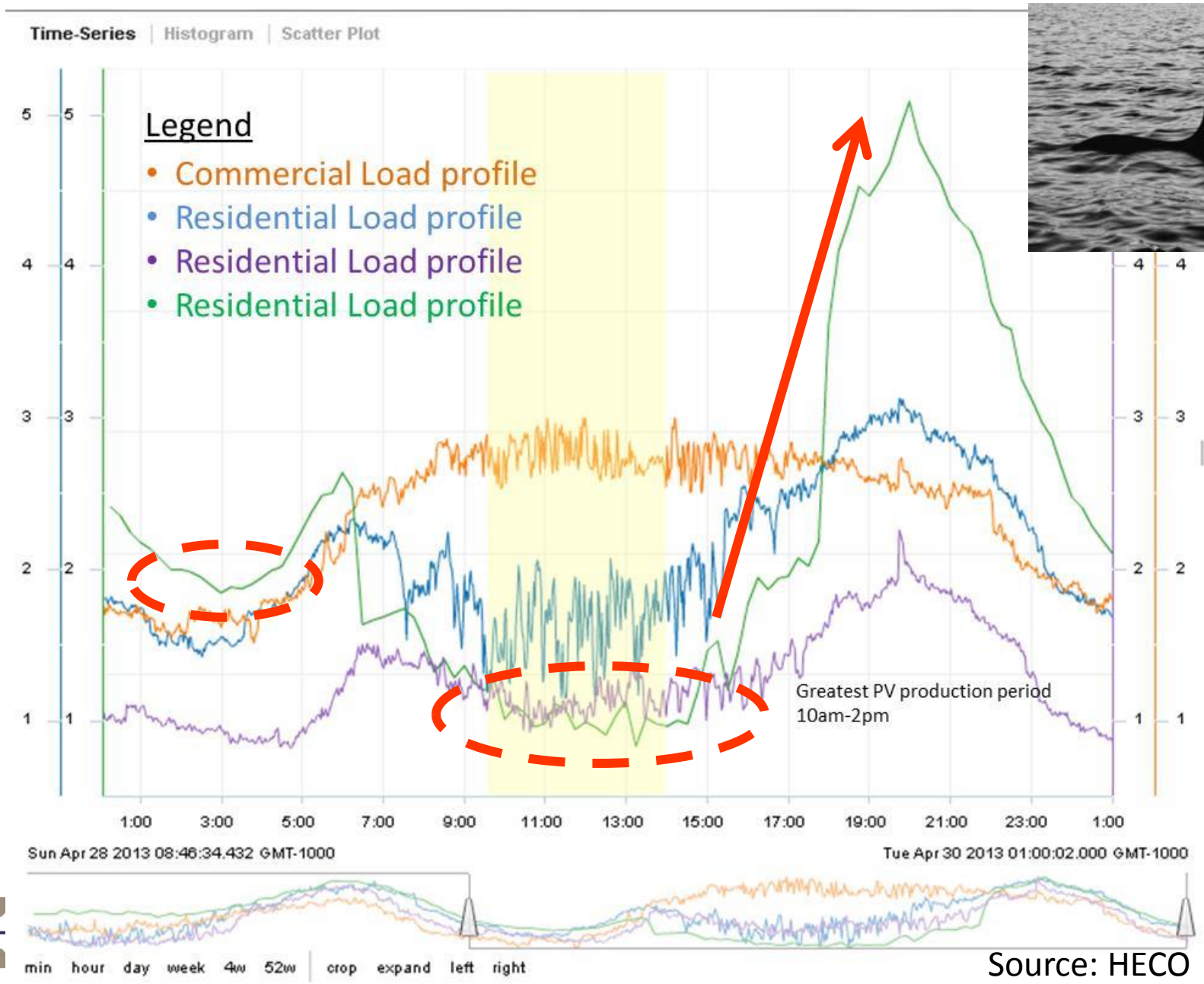
Peak Map

$$\% \text{ Pen} = \frac{Installed\ MW}{Peak\ Circuit\ Load}$$



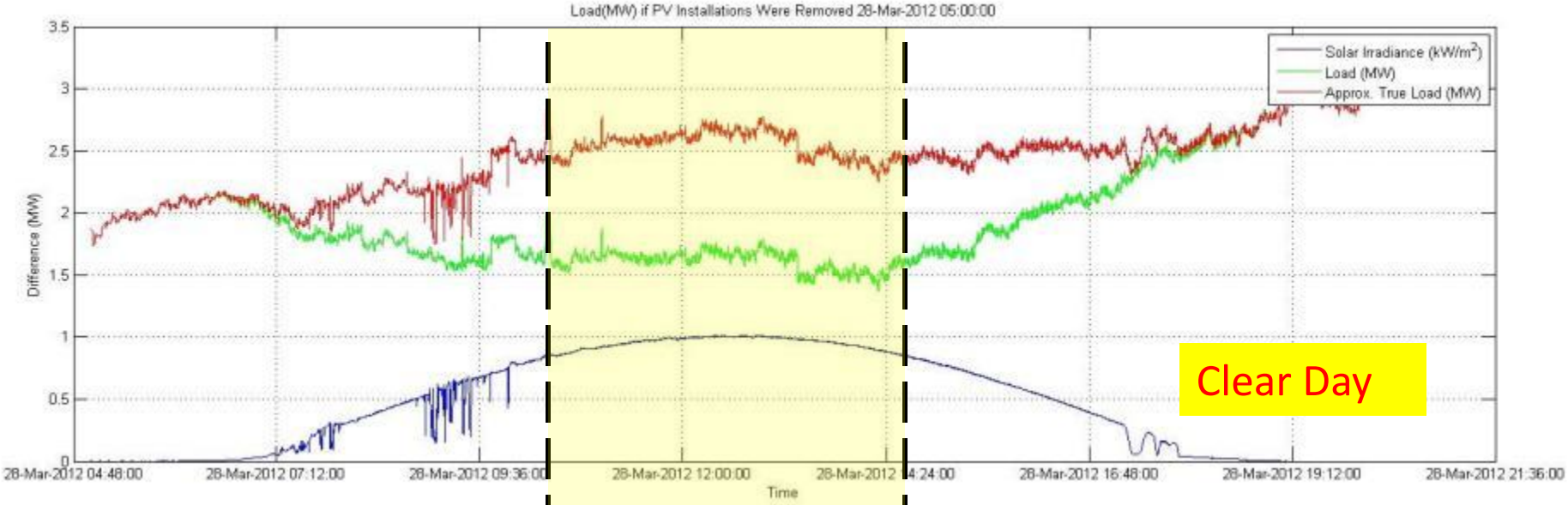
Maui Electric
Hawai'i Electric Light

Trending Hi-Pen Circuits (12kV) – Loch Ness Profile

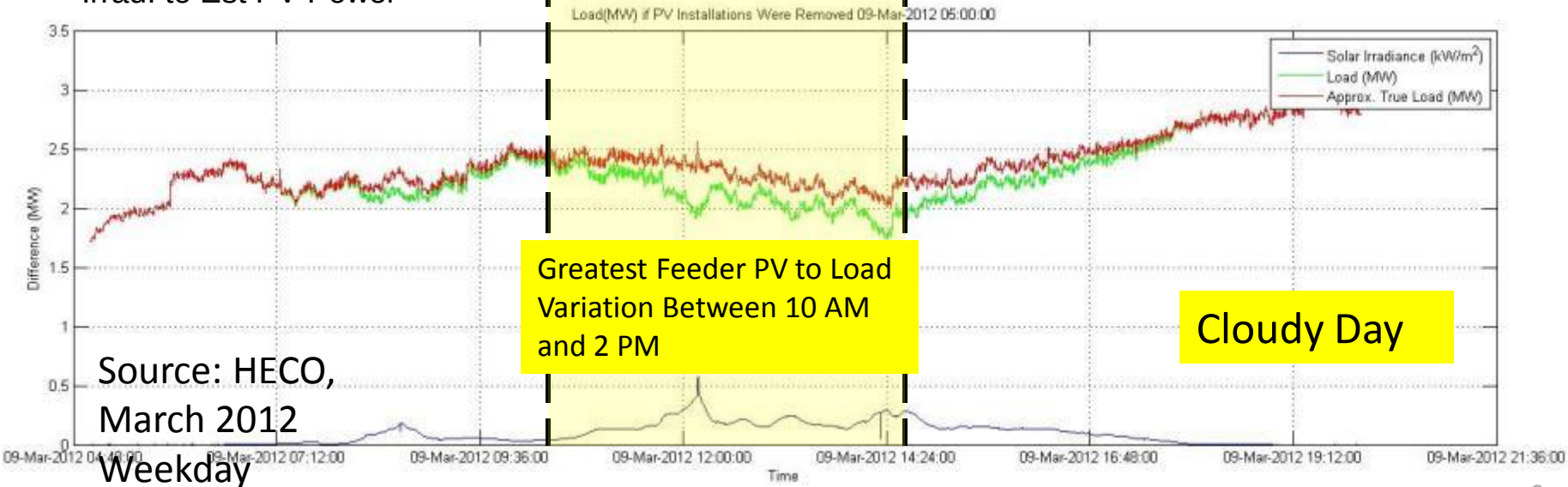


Source: HECO

Need to "See" Solar Impact on Feeder Loads (Net vs Gross)



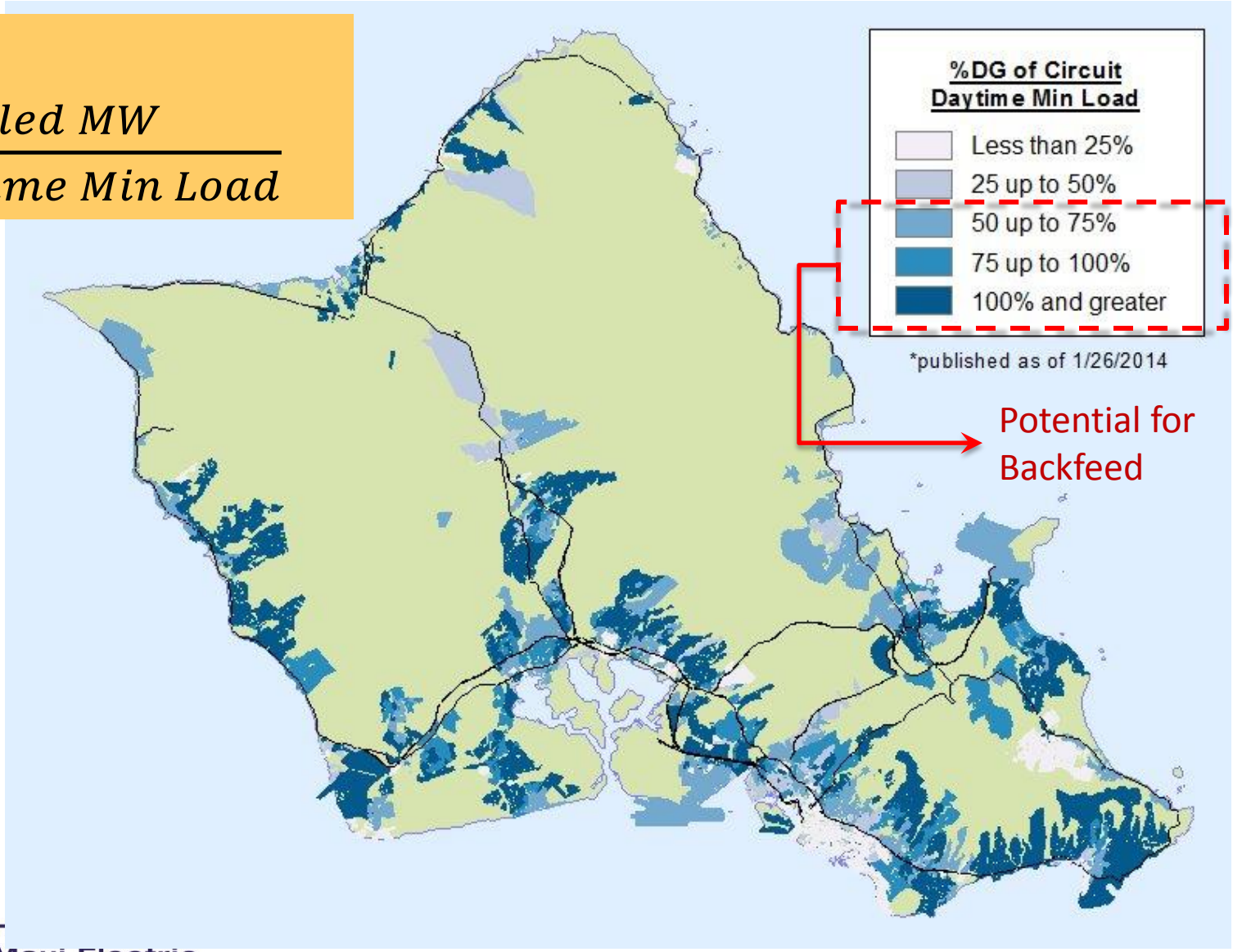
Irrad. to Est PV Power



Source: HECO, March 2012 Weekday

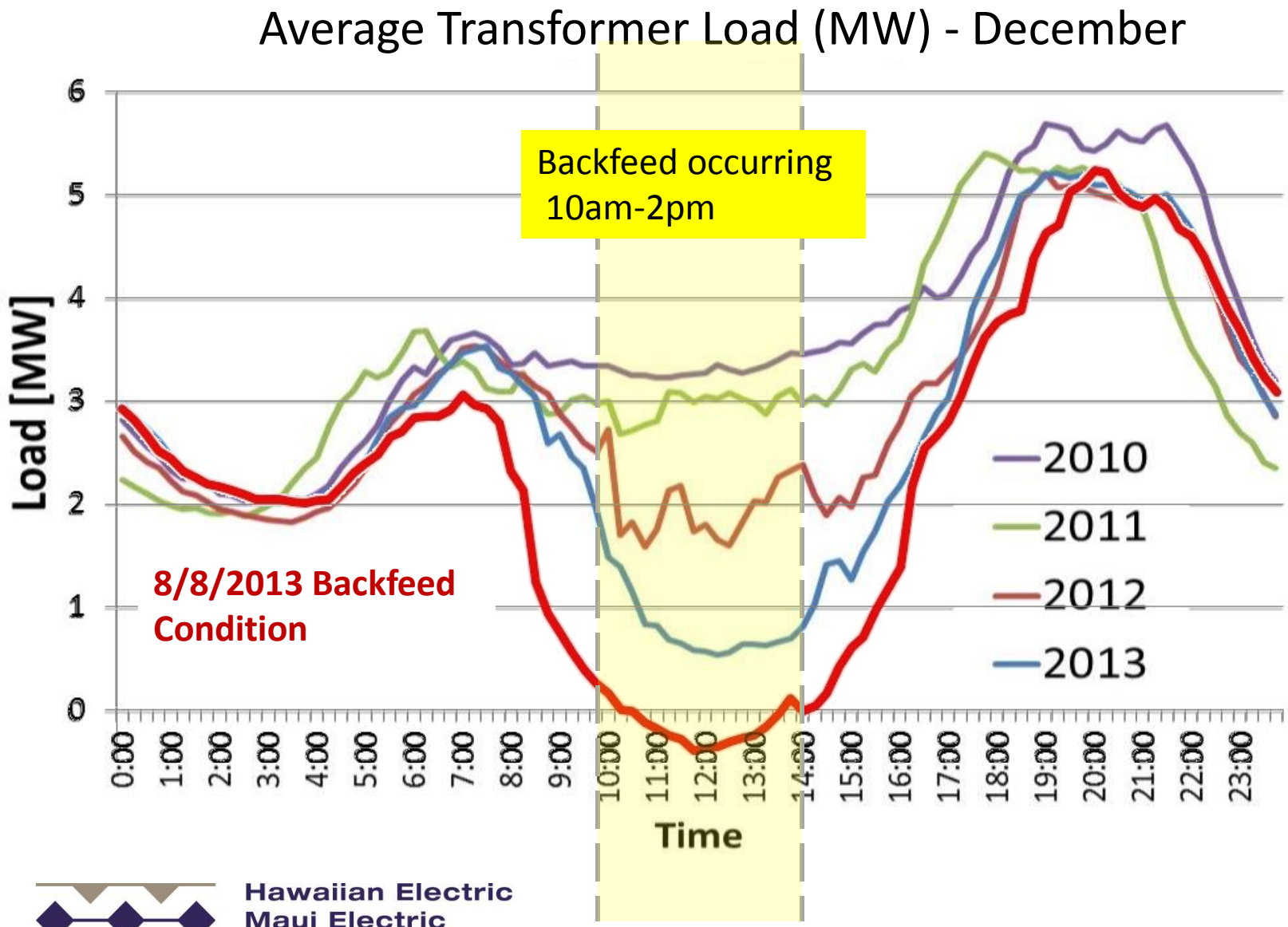
Daytime Minimum Load Map

$$\% \text{ Pen} = \frac{\textit{Installed MW}}{\textit{Gross Daytime Min Load}}$$



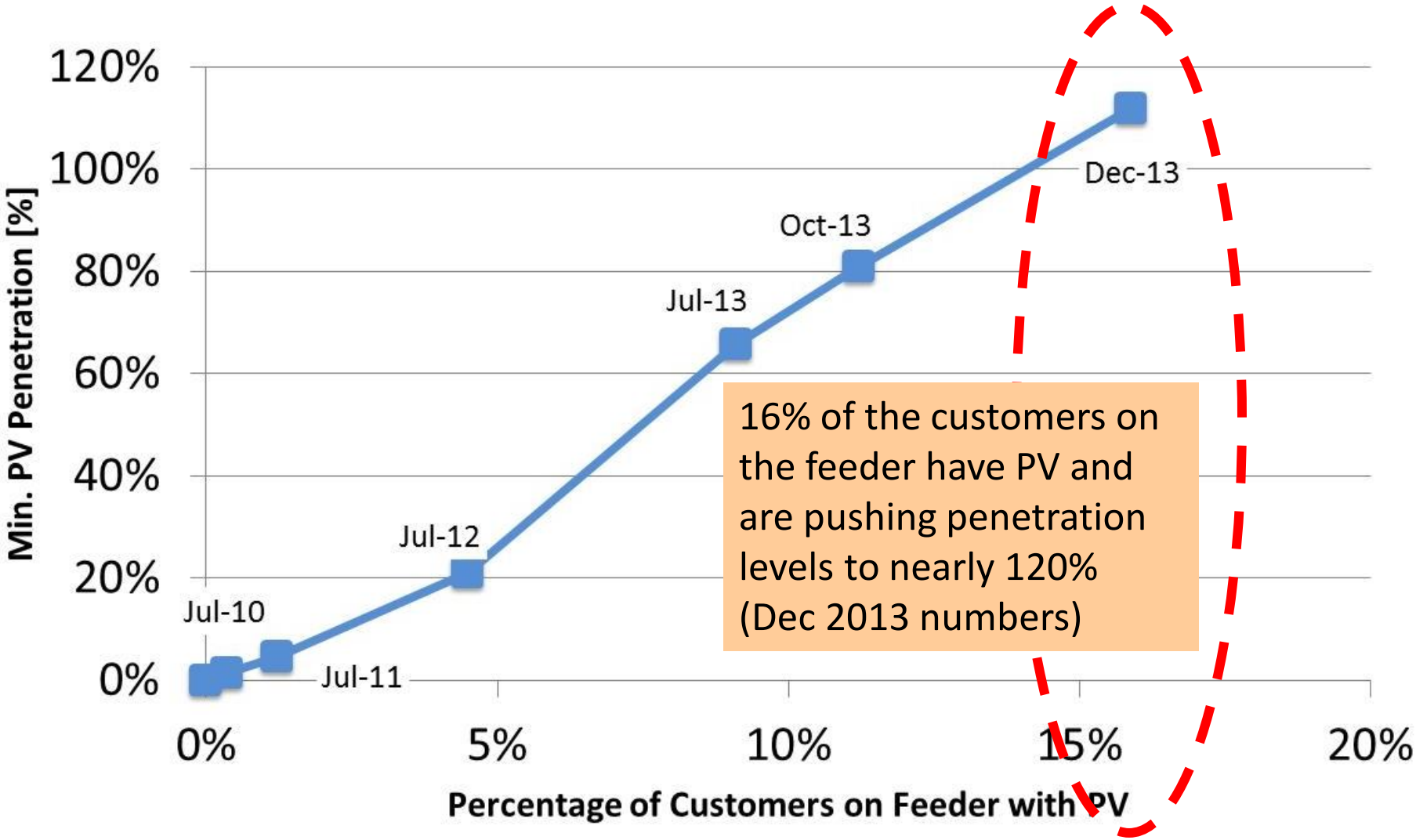
Maui Electric
Hawai'i Electric Light

Tracking Change – 46kV Level



Hawaiian Electric
Maui Electric
Hawai'i Electric Light

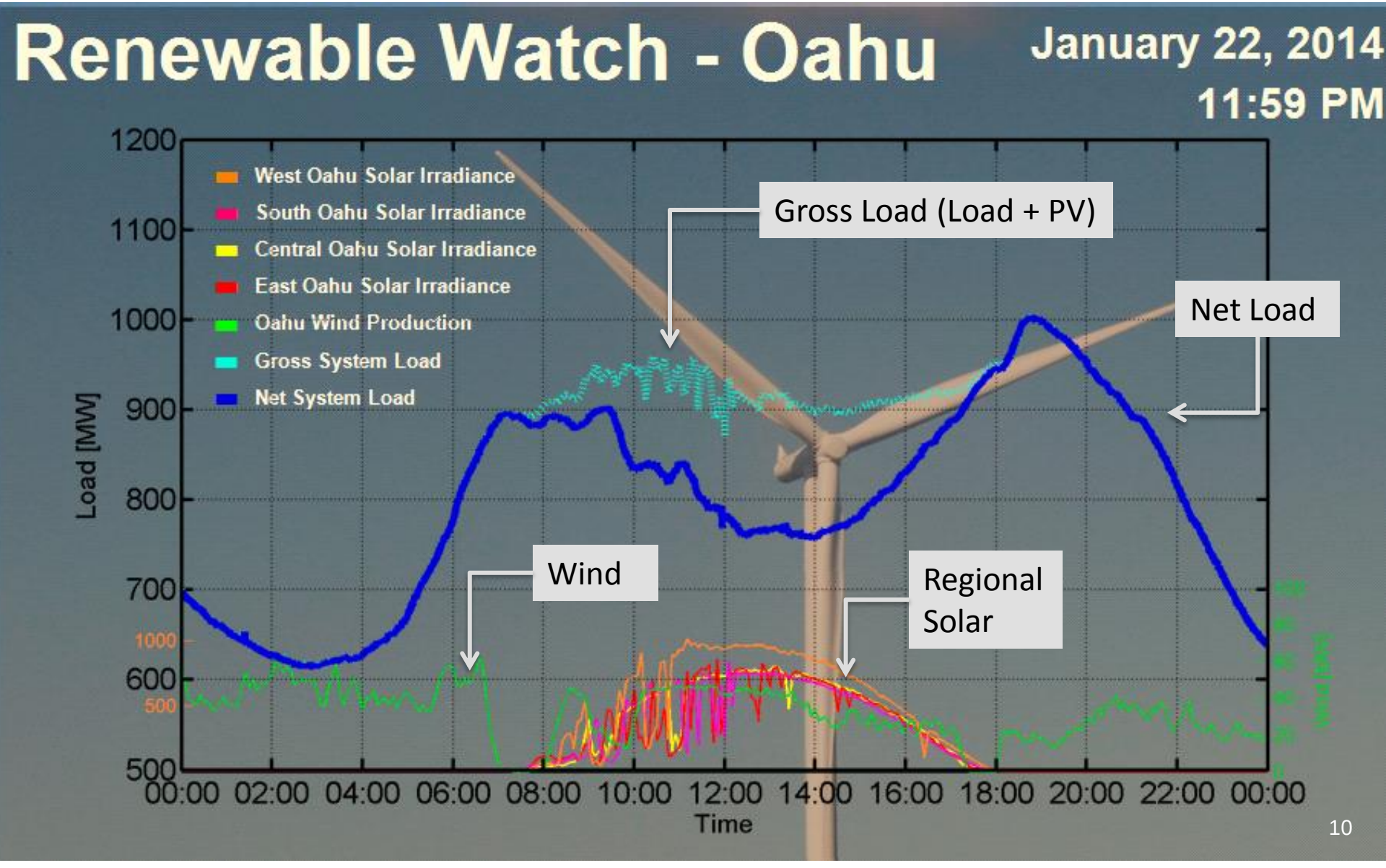
of Customers to PV Penetration



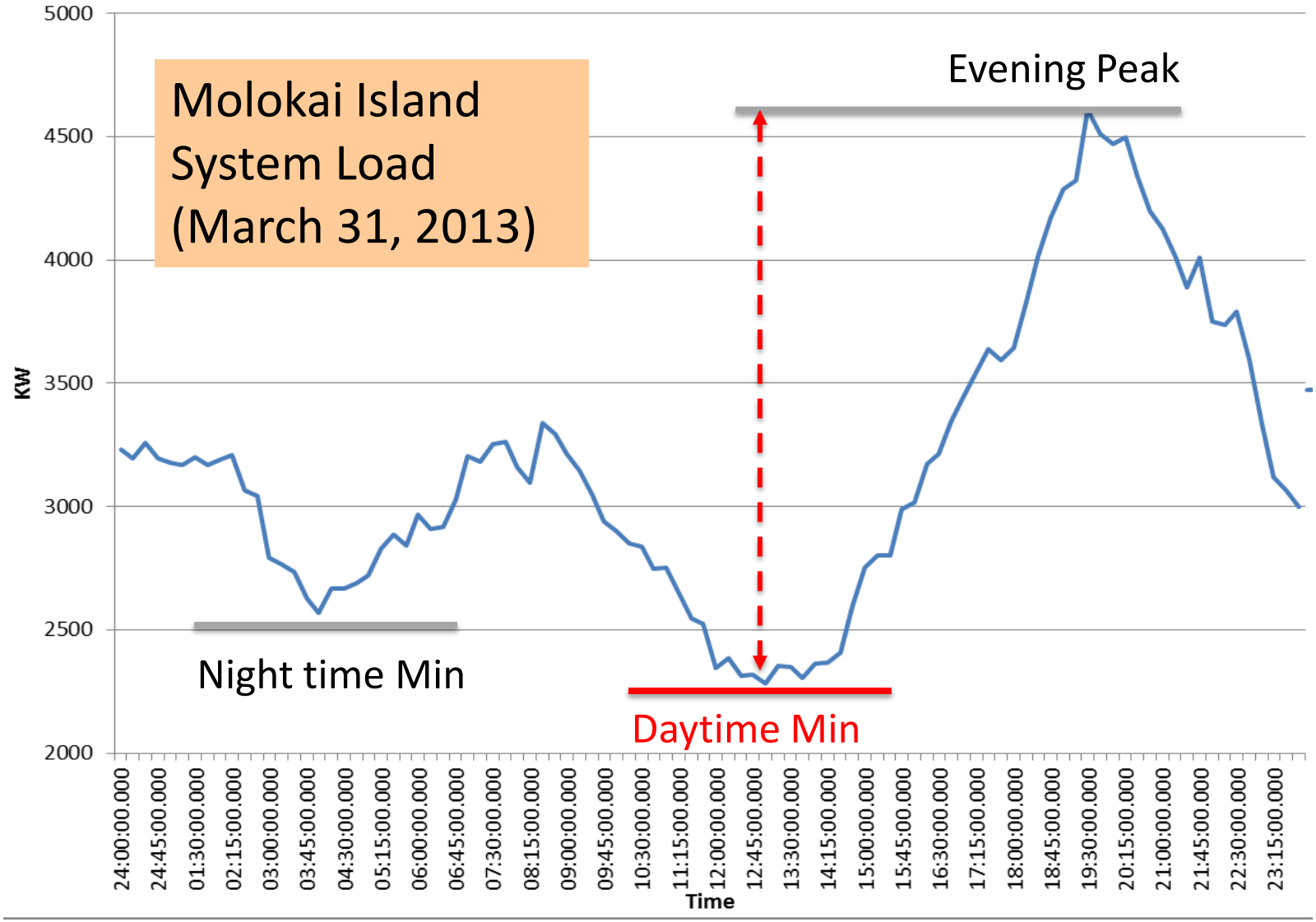
16% of the customers on the feeder have PV and are pushing penetration levels to nearly 120% (Dec 2013 numbers)

Hawaiian Electric
Maui Electric
Hawai'i Electric Light

REWatch – Keeping An Eye on Our Changing System Load



Tracking System Load



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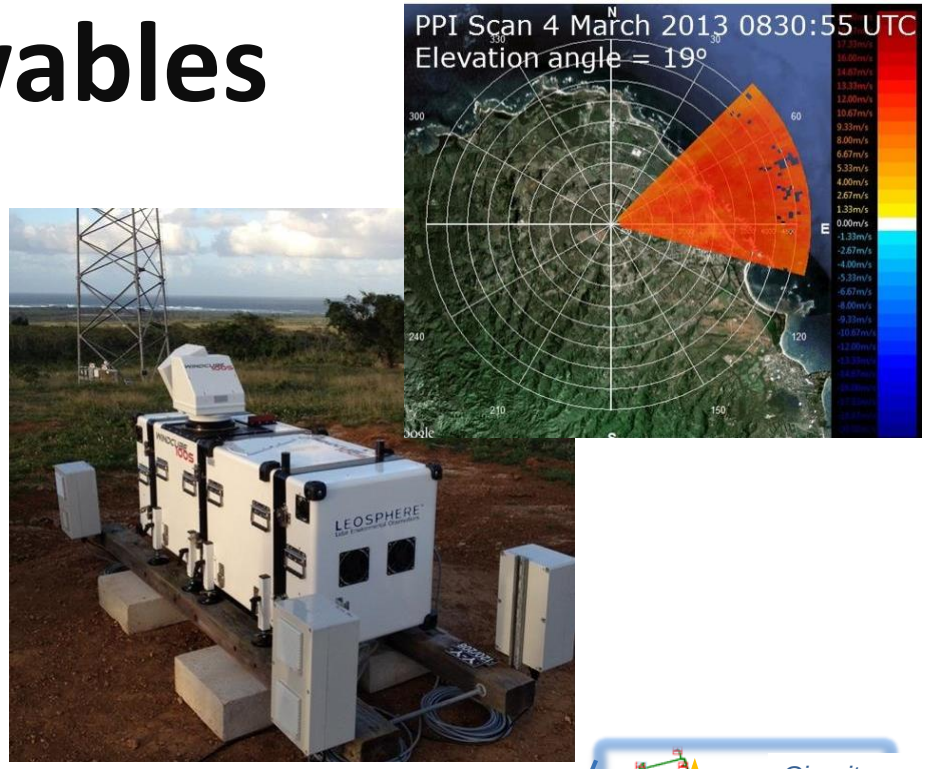
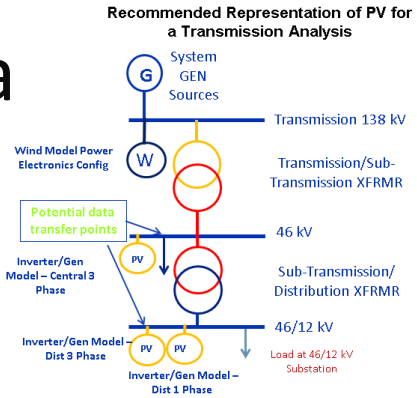
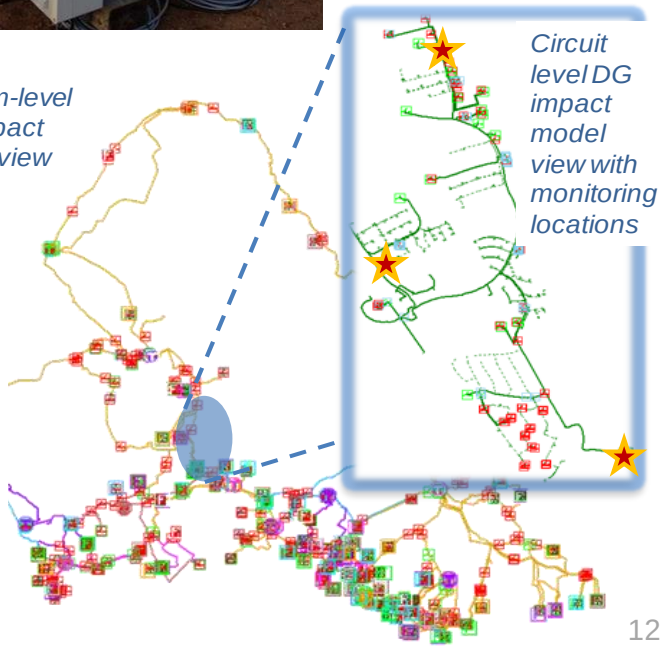
Maui Electric
Hawai'i Electric Light

Integrating Renewables

- Location Matters
- Seasonality Affects Load (Wet & Dry)
- Need new modeling tools and field data
- Manage Probabilistic vs deterministic data







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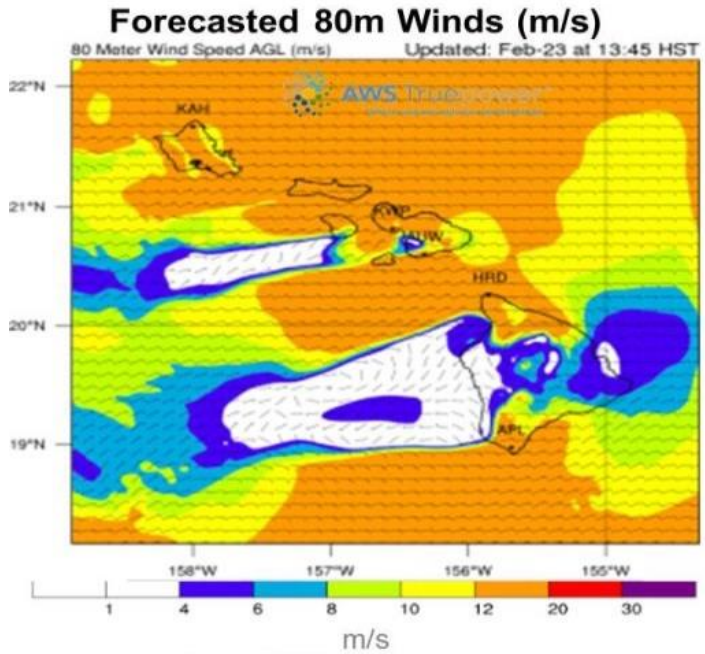
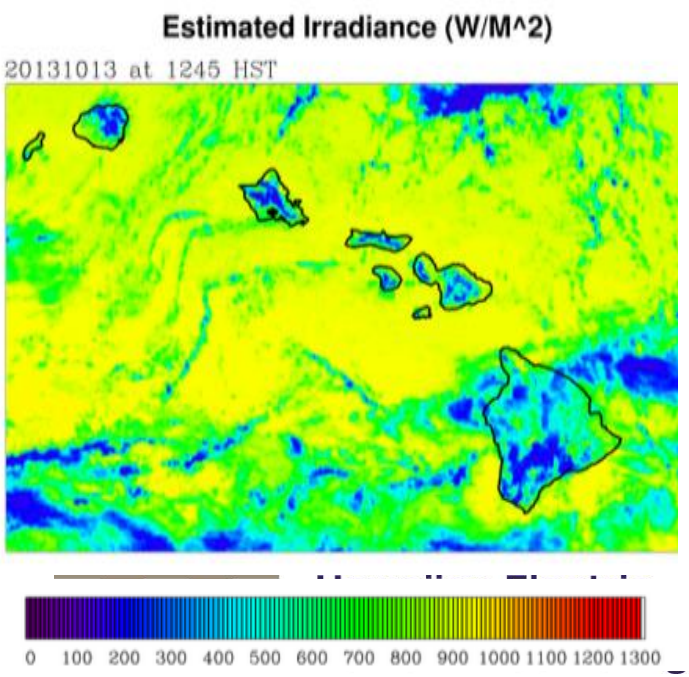
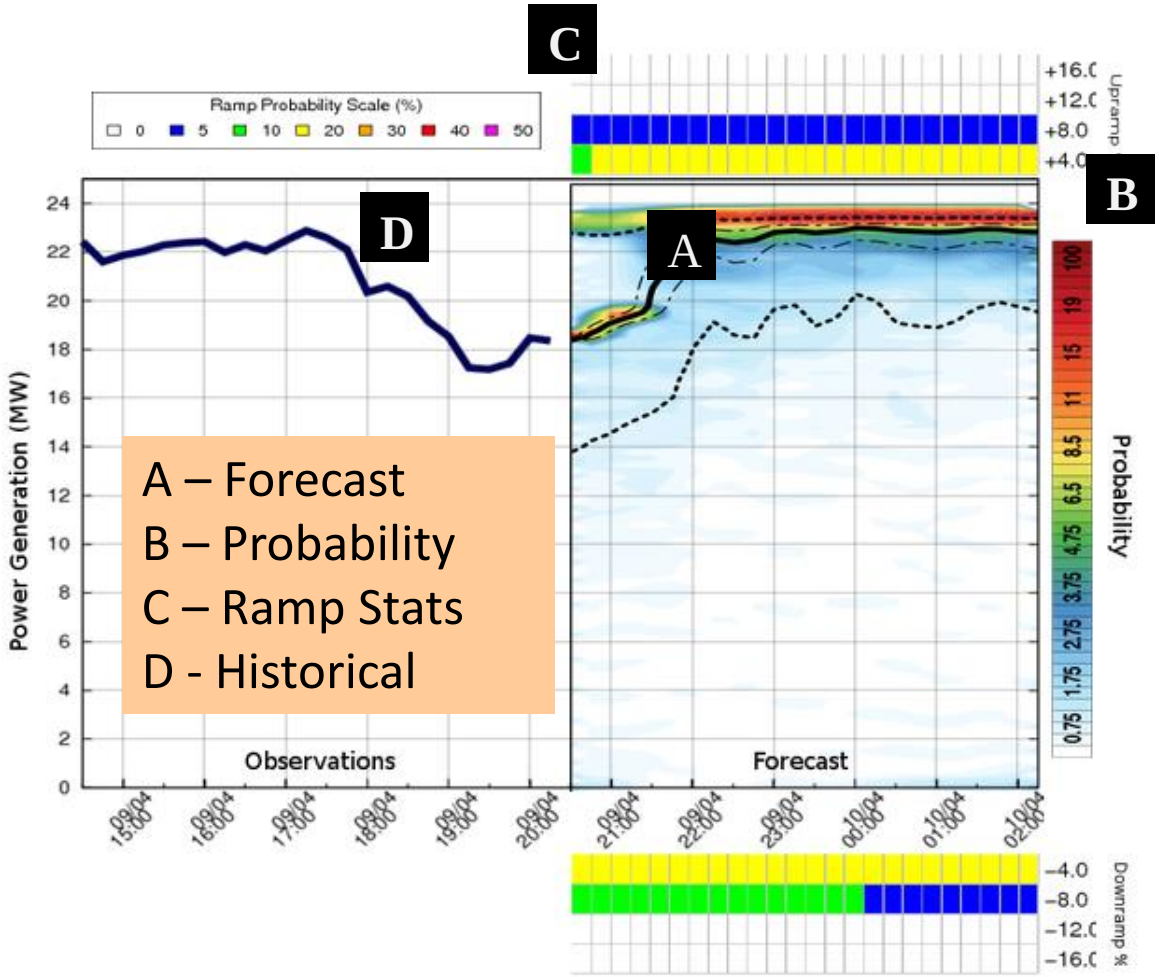
Maui Electric
Hawai'i Electric Light

SWIFT View of Island Winds & Solar

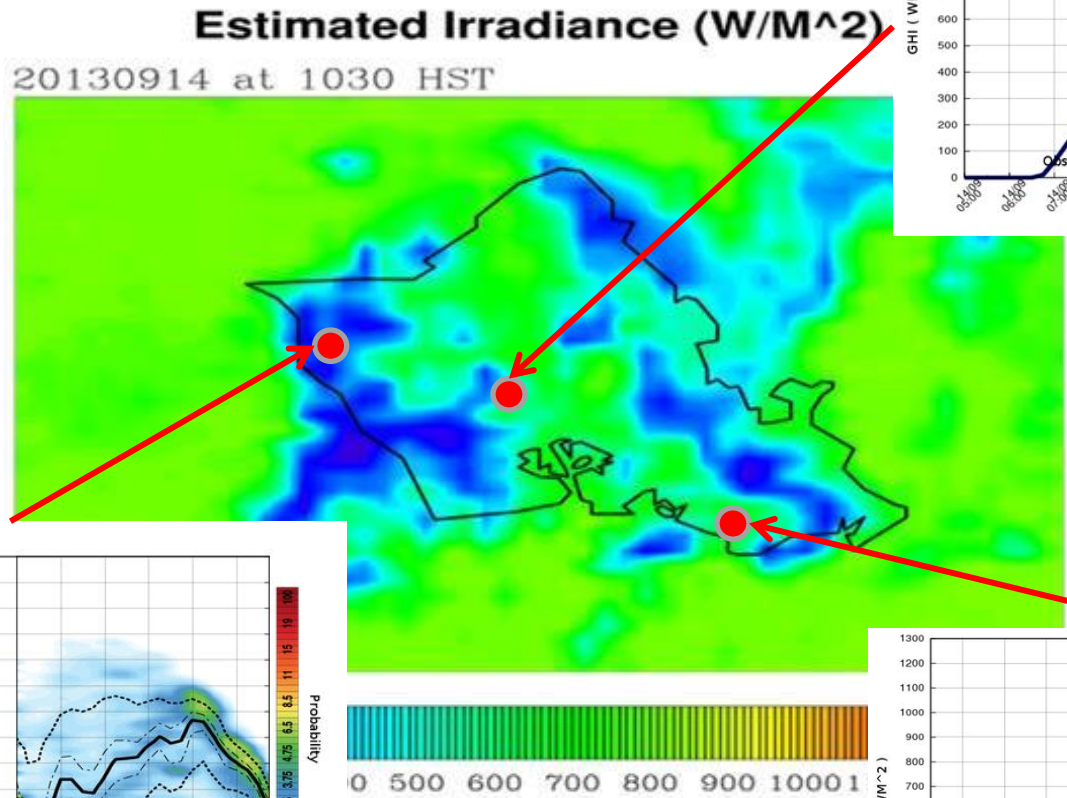


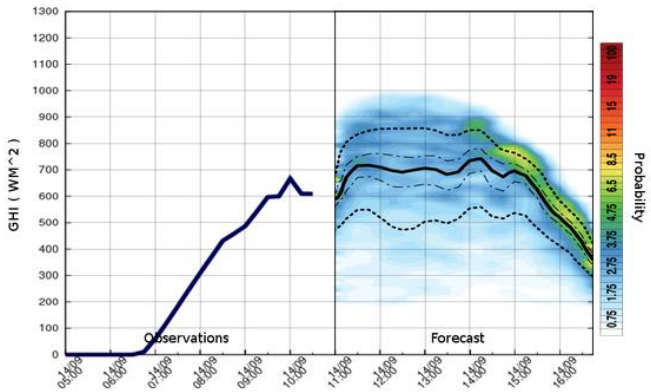


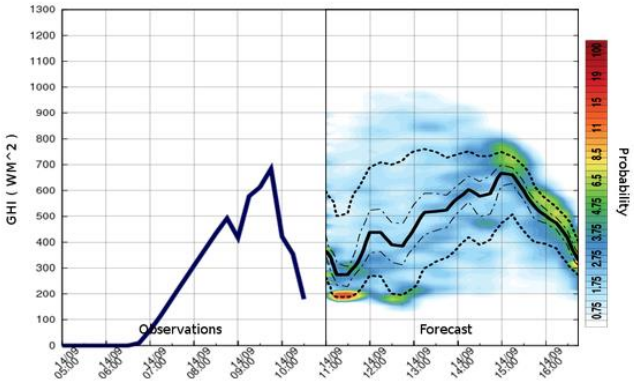


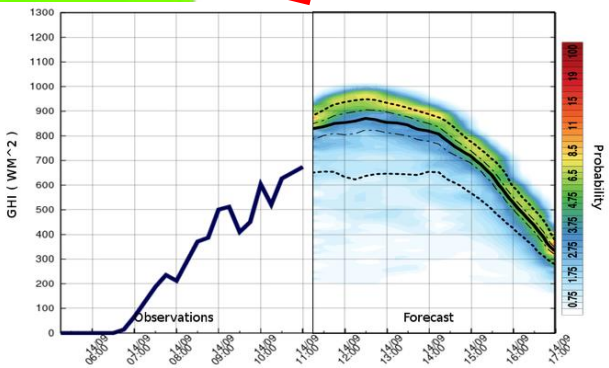
See How Clouds Affect Generation by Location

Short-term (15min to 6 hr) Forecast by Substation





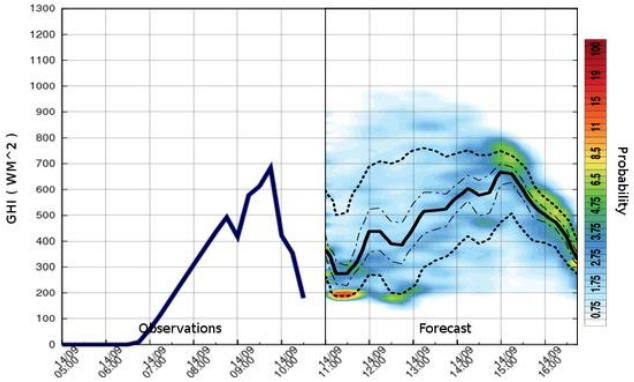




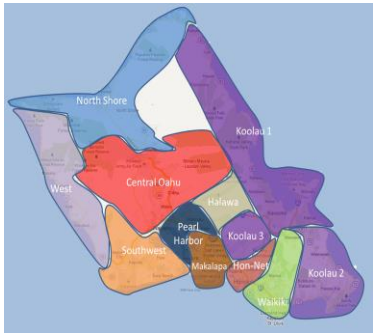
Hawaiian Electric
Maui Electric
Hawai'i Electric Light

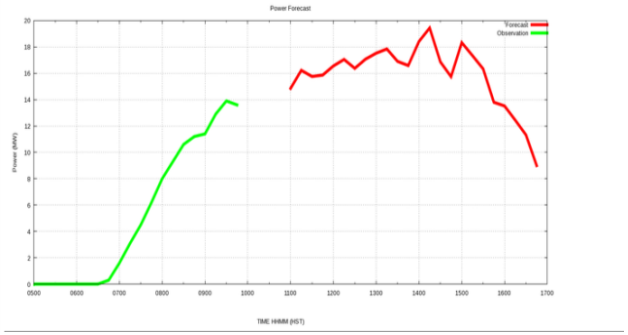
Solar Generation Aggregation Method

- <u>Substation:</u> forecasts at 12kV substation as building blocks
- <u>Region:</u> substations aggregated up to 12 regions
- <u>System:</u> regions aggregated to Total System View

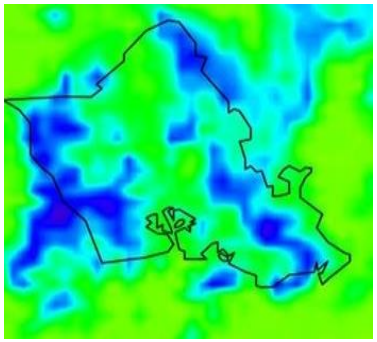


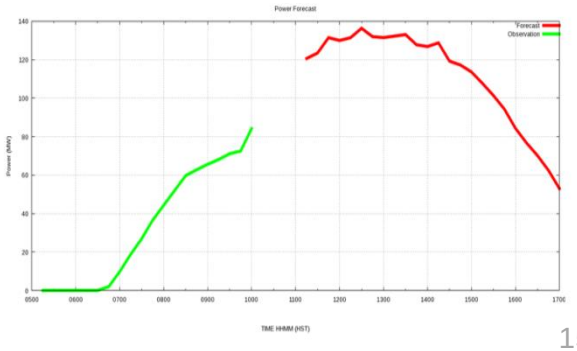
Solar Power Production (MW) Forecast for Oahu Region (RE11) in 15-minute Intervals With Observations





Solar Power Production (MW) Forecast for Oahu in 15-minute Intervals With Observations





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Hawai'i Electric Light

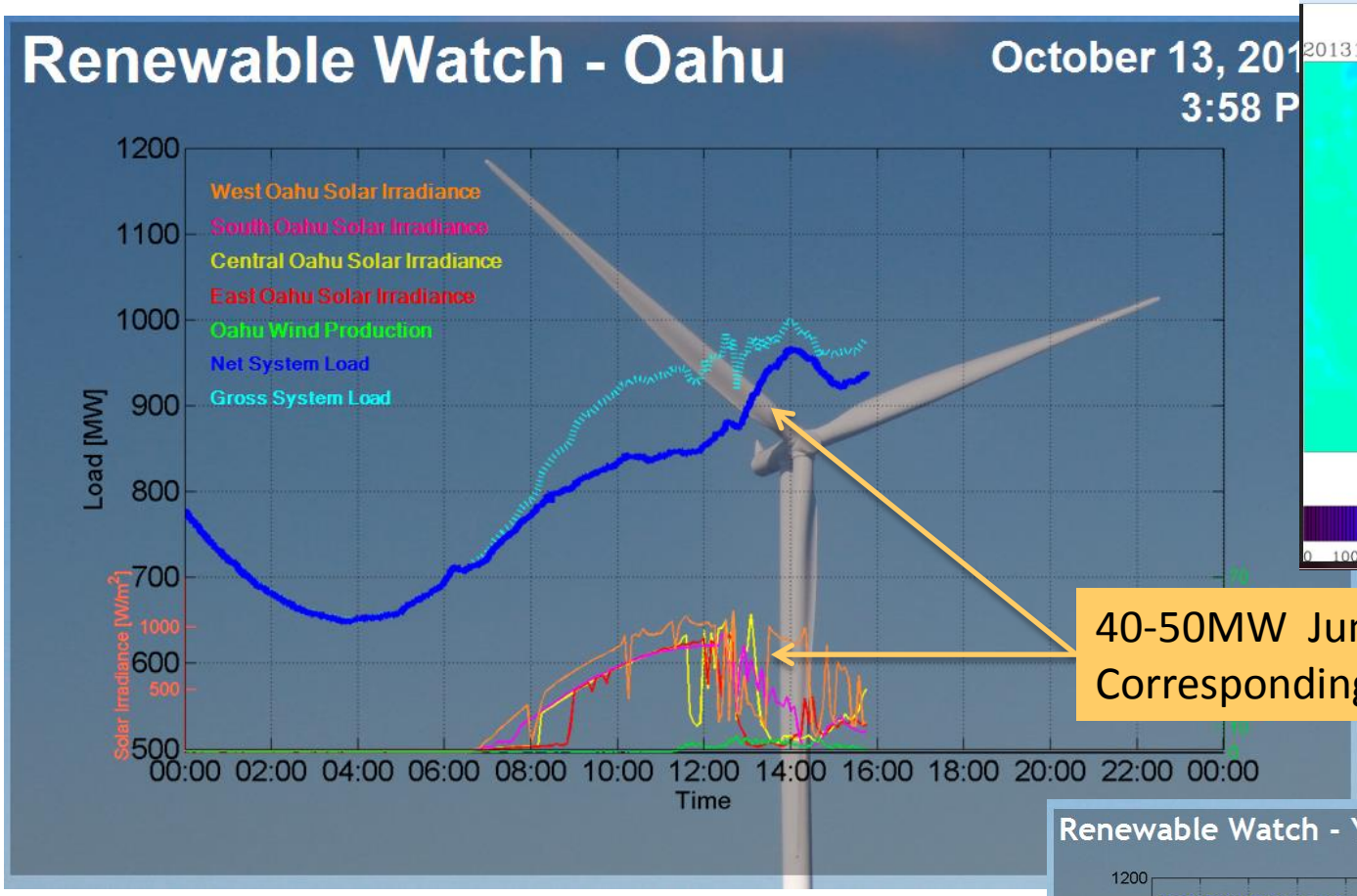
WindNET & SolarNET Field Instruments

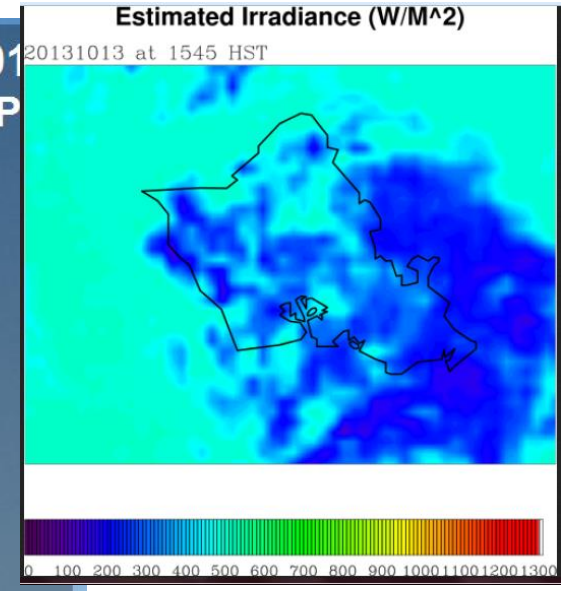
Site selection based upon Observational Targeting and Grid Integration Analysis (WindNET, SolarNET)

Utility WindNET & SolarNET Partnership: CalSO, SCE, SMUD, AWS TruePower, DNV-KEMA, Atmospheric Research Technologies, Leosphere

WindSENSE Utilities Industry DOE

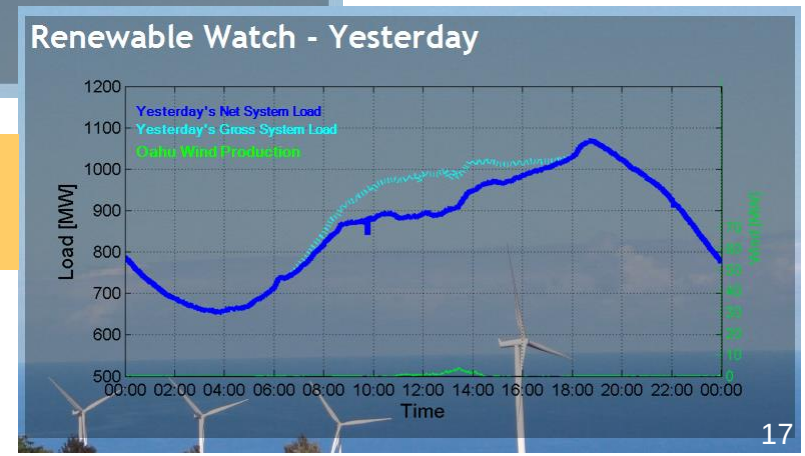
“Seeing” DG PV Ramp Condition





40-50MW Jump in Load
Corresponding drop in PV

Yesterday is not a good predictor of Today anymore



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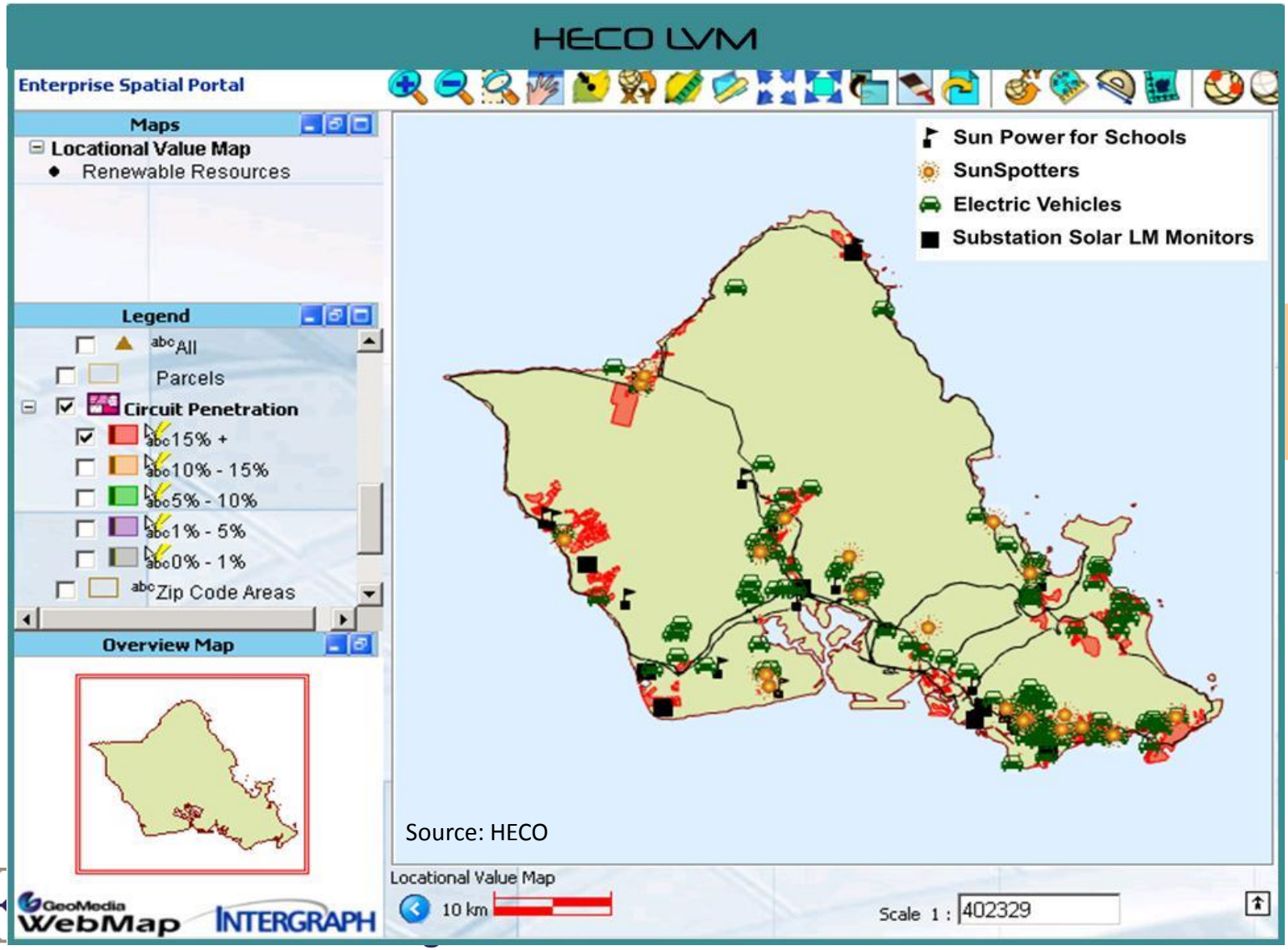
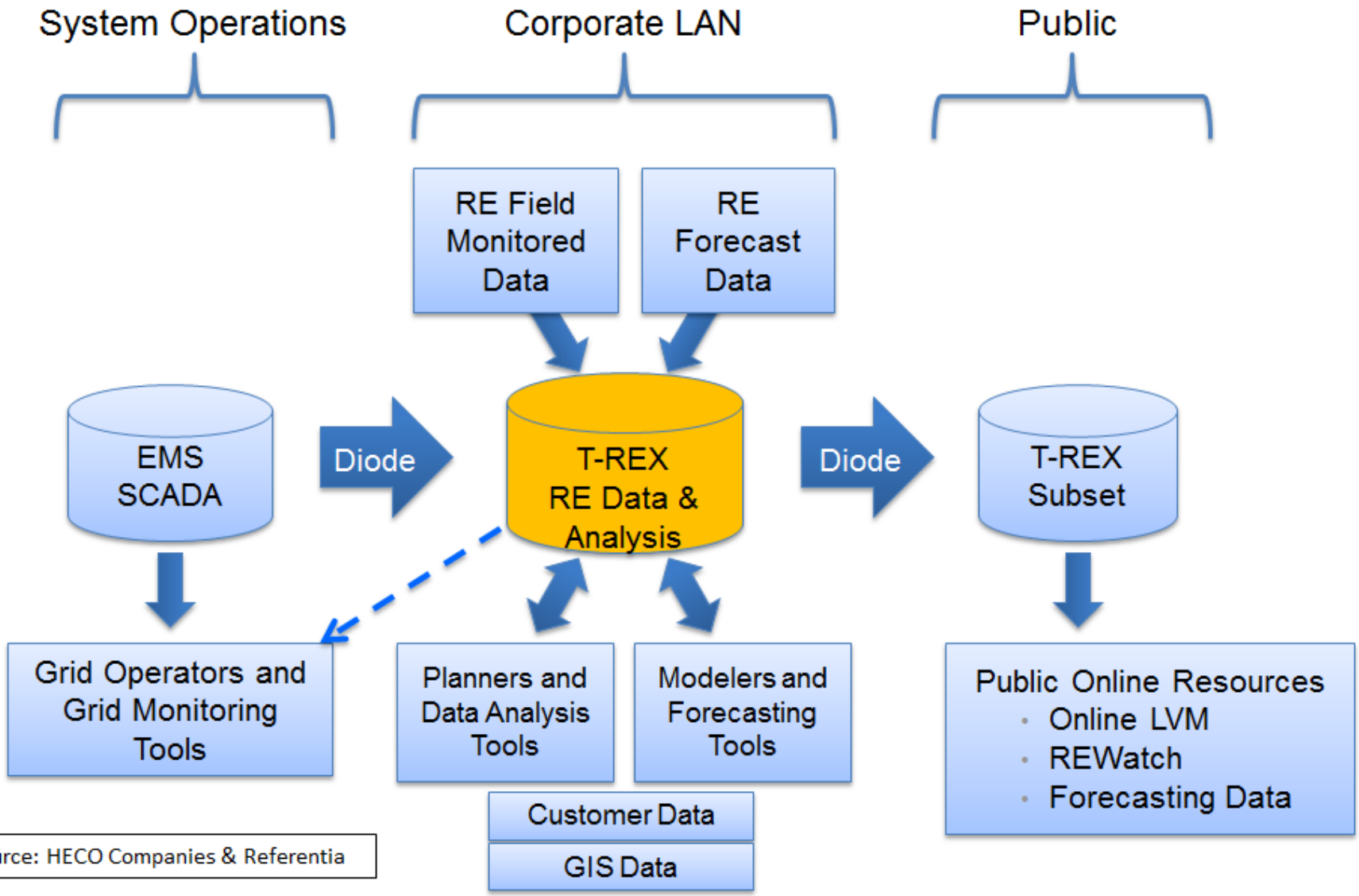
Maui Electric
Hawai‘i Electric Light

Grid Intelligence : More Change Coming (Demand Response, Electric Vehicle, Storage)



TREX Capability: Integrate Data, Support Analytics, Common Analytical Platform

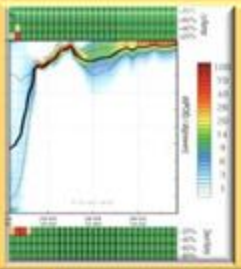


Source: HECO Companies & Referentia

Maui Electric
Hawai'i Electric Light

Bringing it All Together: Operational Awareness

Next Effort - DREAMS EMS Integration (US DOE SunShot)



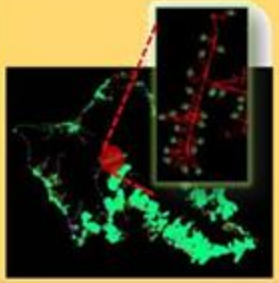
NEW Forecasting INPUTS:

- *Real-time renewables forecasts*
- *Ramp probabilities*
- *Historical and actual trends*
- *Satellite images, weather data*

Traditional input sources

- SCADA data
- Transmission data
- Generator data
- Protection data
- Others

System Ops EMS



NEW Renewable/DG INPUTS:

- *GiS-based distribution infrastructure (models)*
- *DG locations*
- *Field monitored data*
- *Modeled results*

ENHANCED Renewable Integration Capabilities:

- Operations & Planning with visibility to DG resource impacts
- Updated state-estimator and simulation capability to evaluate actions & impacts

WindSENSE Utilities Industry DOE

SolarSENSE Utilities Industry DOE

GO solar CALIFORNIA

EPRI ELECTRIC POWER RESEARCH INSTITUTE

SunShot U.S. Department of Energy

Source: HECO/SMUD HiP-PV Initiative

Ready for Launch?

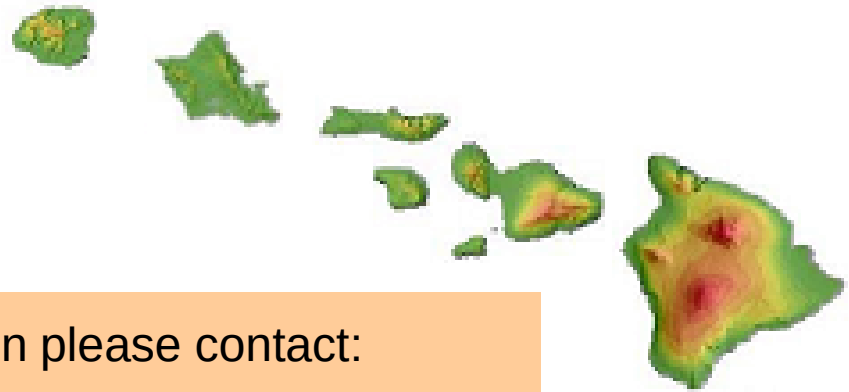
- Opportunities to leverage lessons learned
- Attract and collaborate on grants
  - US DOE Sunshots award
- Be part of the critical mass to drive needed change (standards, market, technology)

Hawaii is the Launch Pad

Hawaiian Electric
Maui Electric
Hawai'i Electric Light

Questions/Comments??

Mahalo



For more information please contact:

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Grid Technologies Department

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