ACEEE
American Council for an Energy-Efficient Economy

ACEEE Intelligent Efficiency Conference

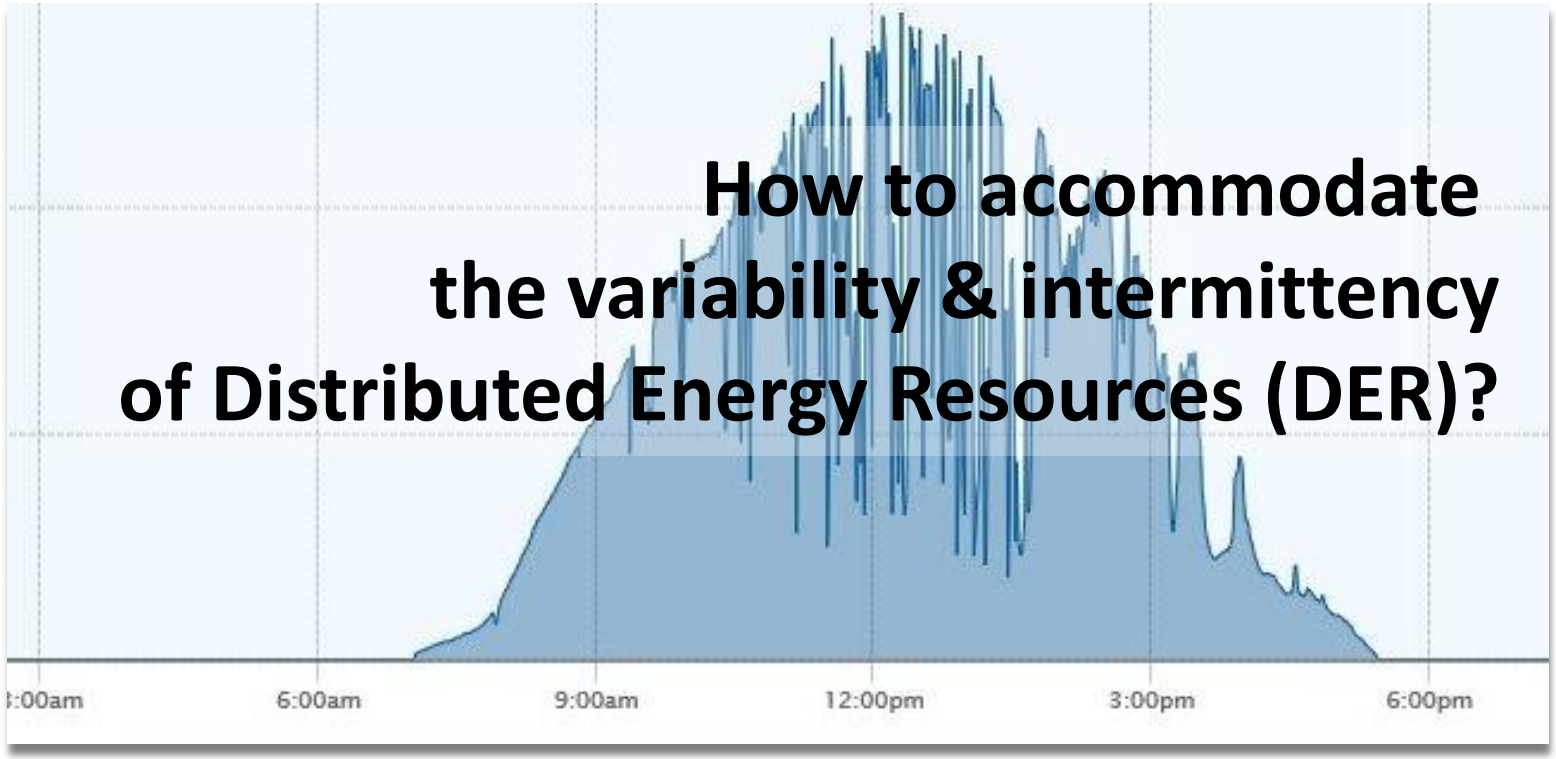
Utility Load Integration & Balancing

December 7, 2015

Raymond Kaiser, LEED AP
Director
Energy Management Systems

Local Focus. Global Reach.
Amzur Technologies

How to accommodate the variability & intermittency of Distributed Energy Resources (DER)?



The Duck Bill Challenge

Overvoltage

Unexpected capacity / backfeed

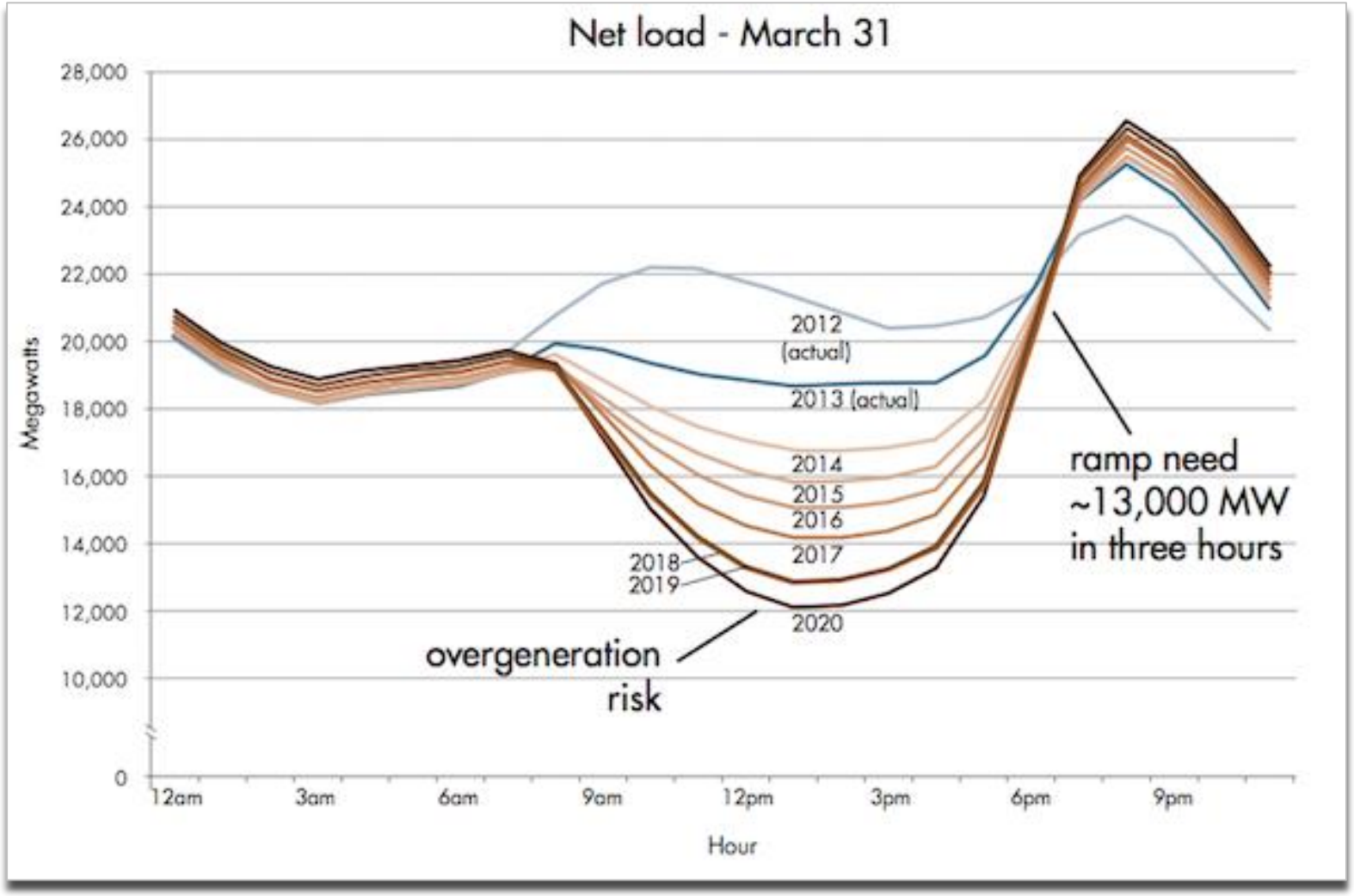
Dynamic supply changes

Time of day/weather

Supply Demand Mismatch

Supply peaks midday
Evening is new peak
Quick ramp time

How to maintain safe, reliable and affordable service?



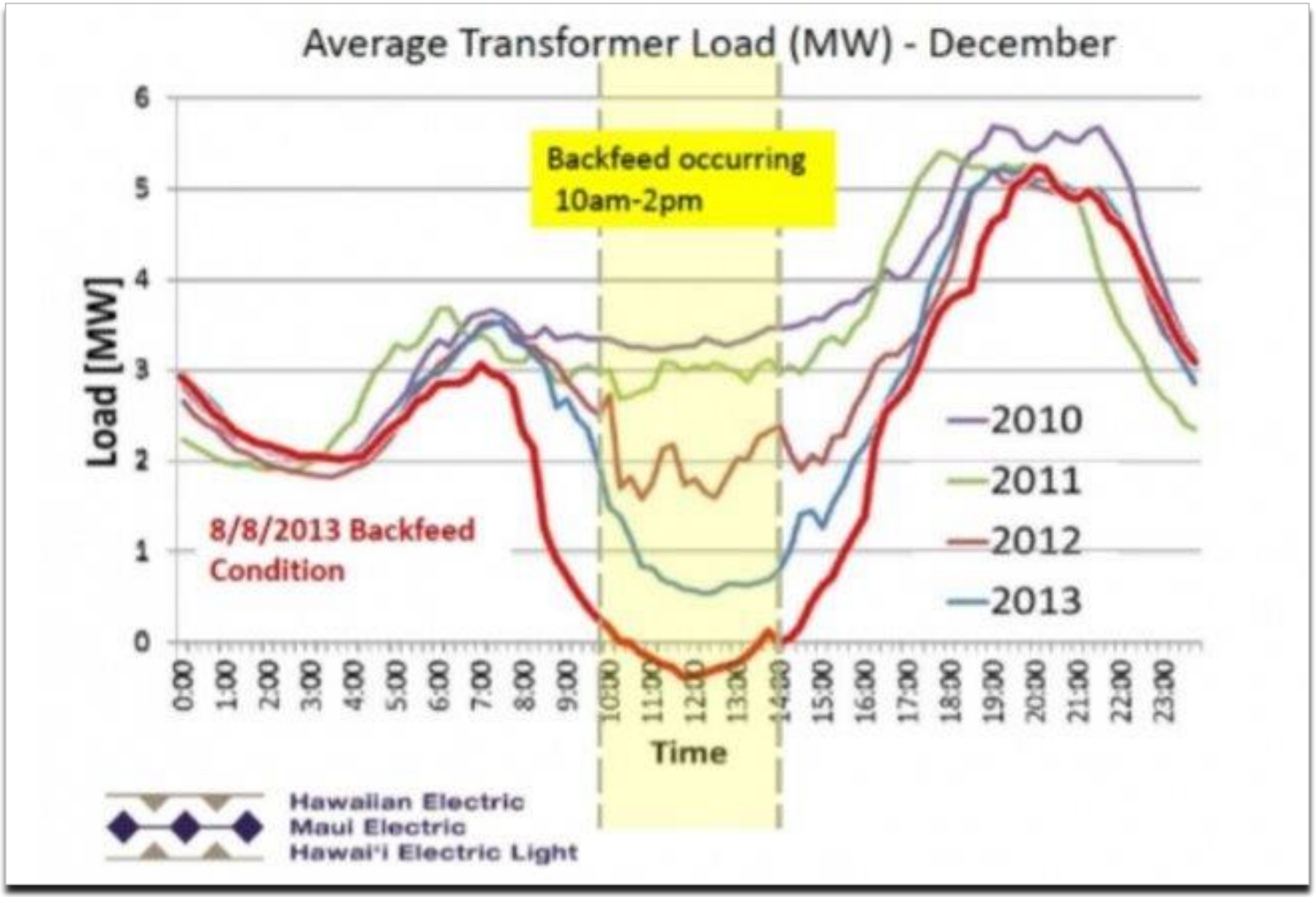
"In the near future, utilities may no longer just supply electricity to customers, but may have to plan for, coordinate, and manage the flow of energy to, from, and between customers."

California ISO
Your Link to Power

A good
hockey player
plays
where
the puck
is.

A *great*
hockey player
plays
where
the puck
is going
to be.

Wayne Gretzky



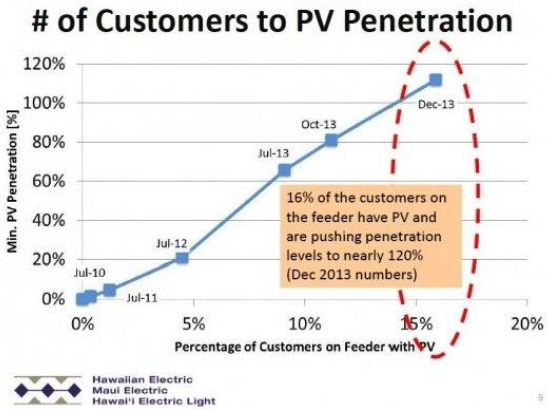
THE FUTURE IS NOW

HECO

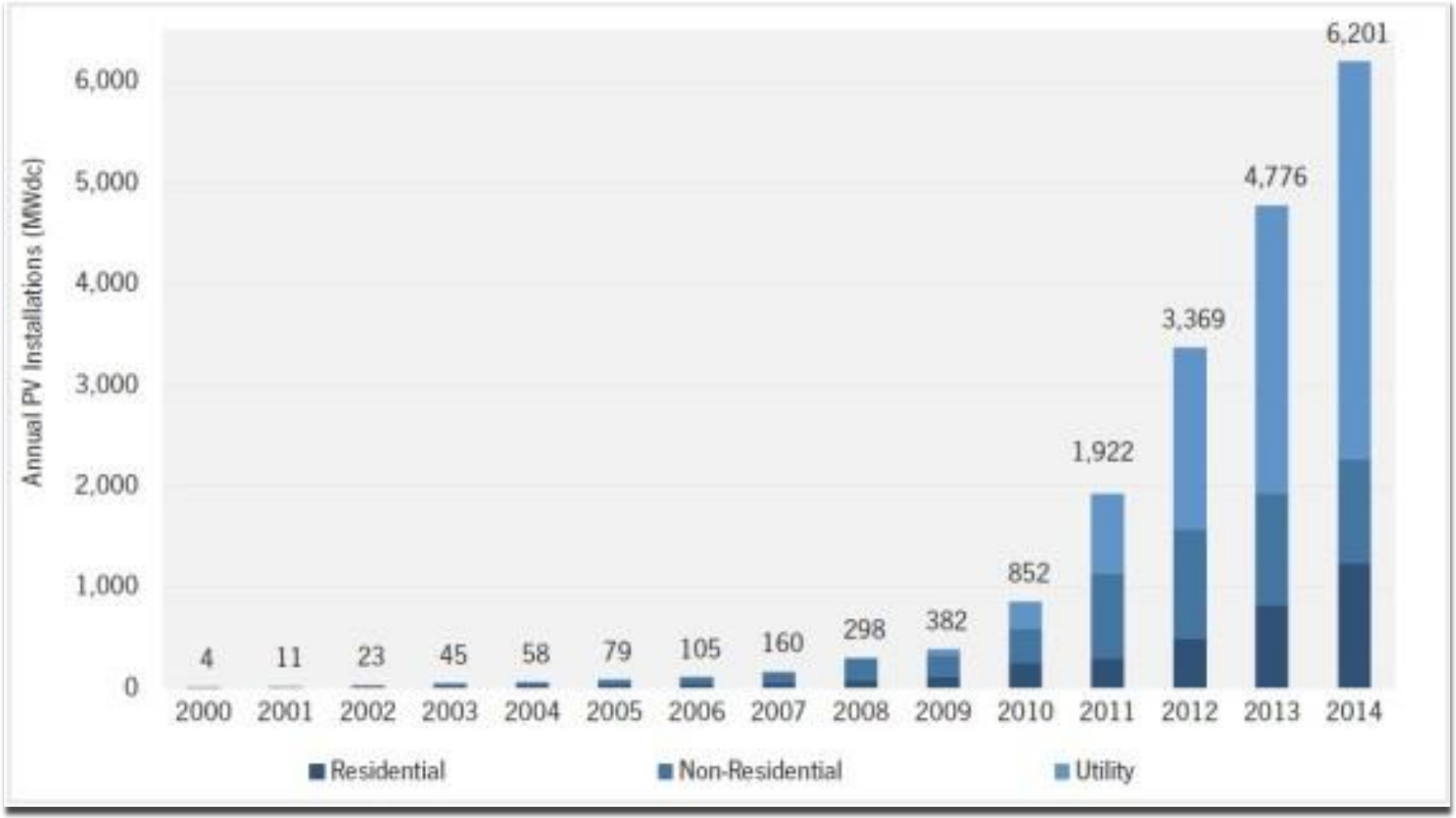
46 kV circuit

16% solar PV penetration

Daytime minimum load > 100%



US Solar PV growth



LBNL-1003750

ERNEST ORLANDO LAWRENCE
BERKELEY NATIONAL LABORATORY

Flexibility Inventory for Western Resource Planners

Andrew Mills and Joachim Seel

Energy Technologies Area

October 2015

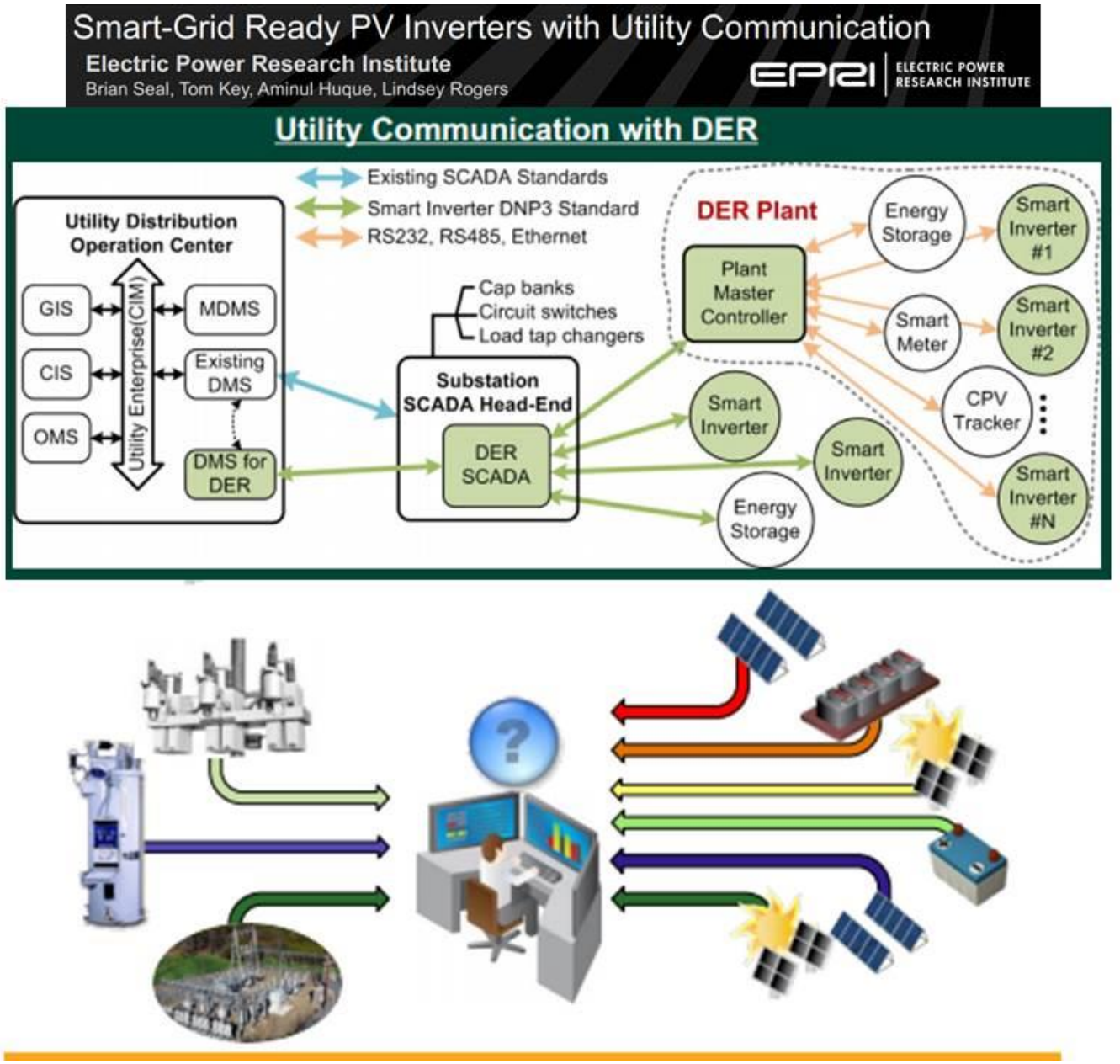
As grid-connected solar and wind resources become more prevalent, fifteen-minute resources become more important for grid stability.

An Oct 2015 LBNL study concluded that batteries, demand response, and quick-start generators provide this service much more effectively than large, fossil-fueled power plants.

The flexibility of these options enables them to react quickly, and at full capacity, to imminent, short-term needs.

INDUSTRY POINT OF VIEW

"This is *our* wheelhouse."



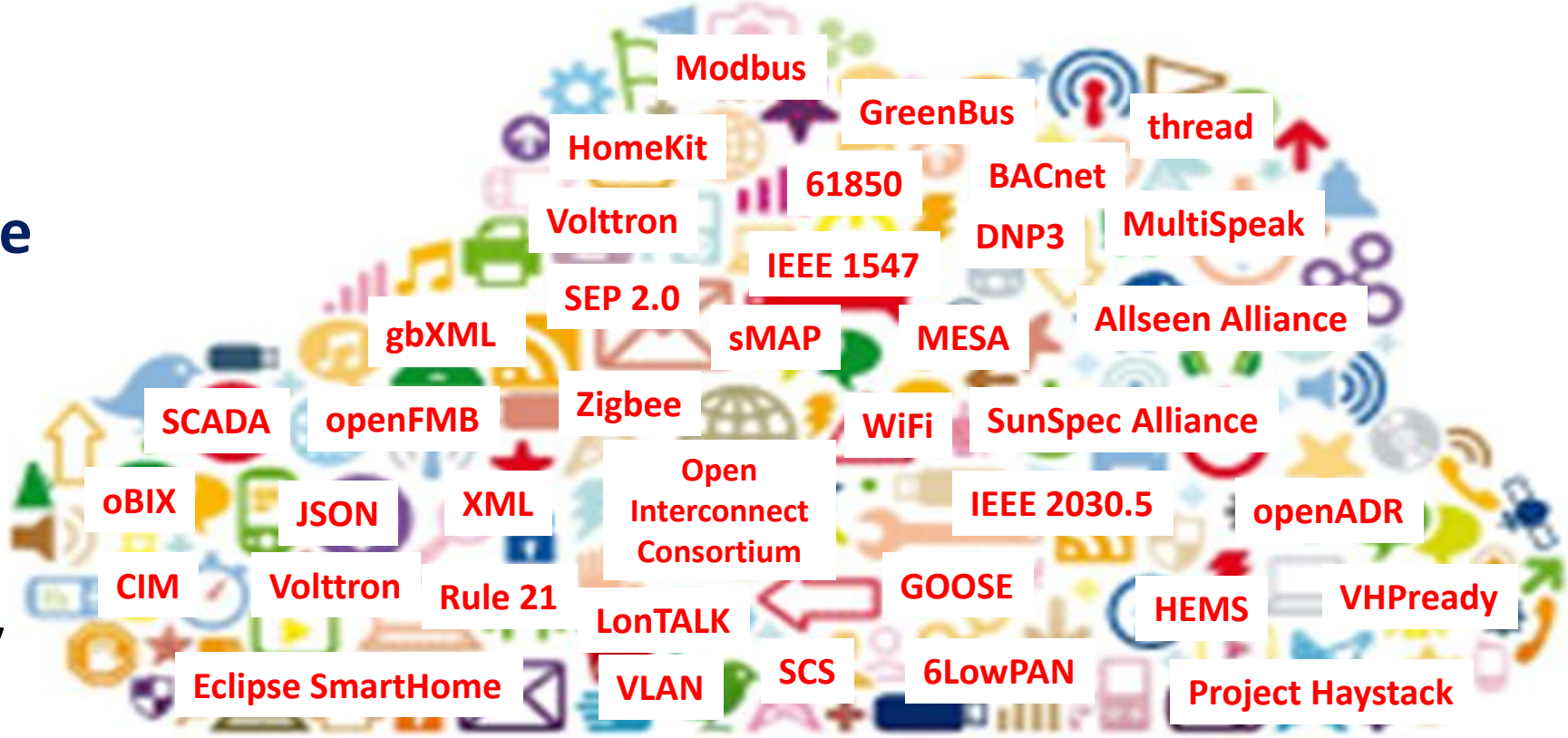
A utility will
boldly go
where everyone
has gone before.

Jim Rodgers
former CEO Duke Energy

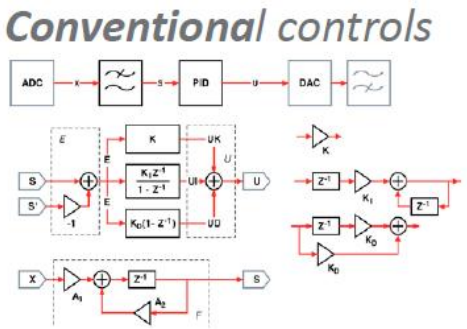
The Challenge

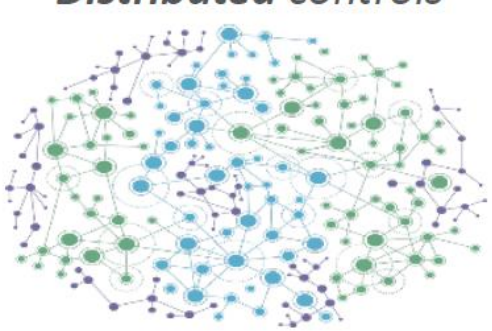
Complexity Catastrophe

precludes end-to-end plug and play solutions

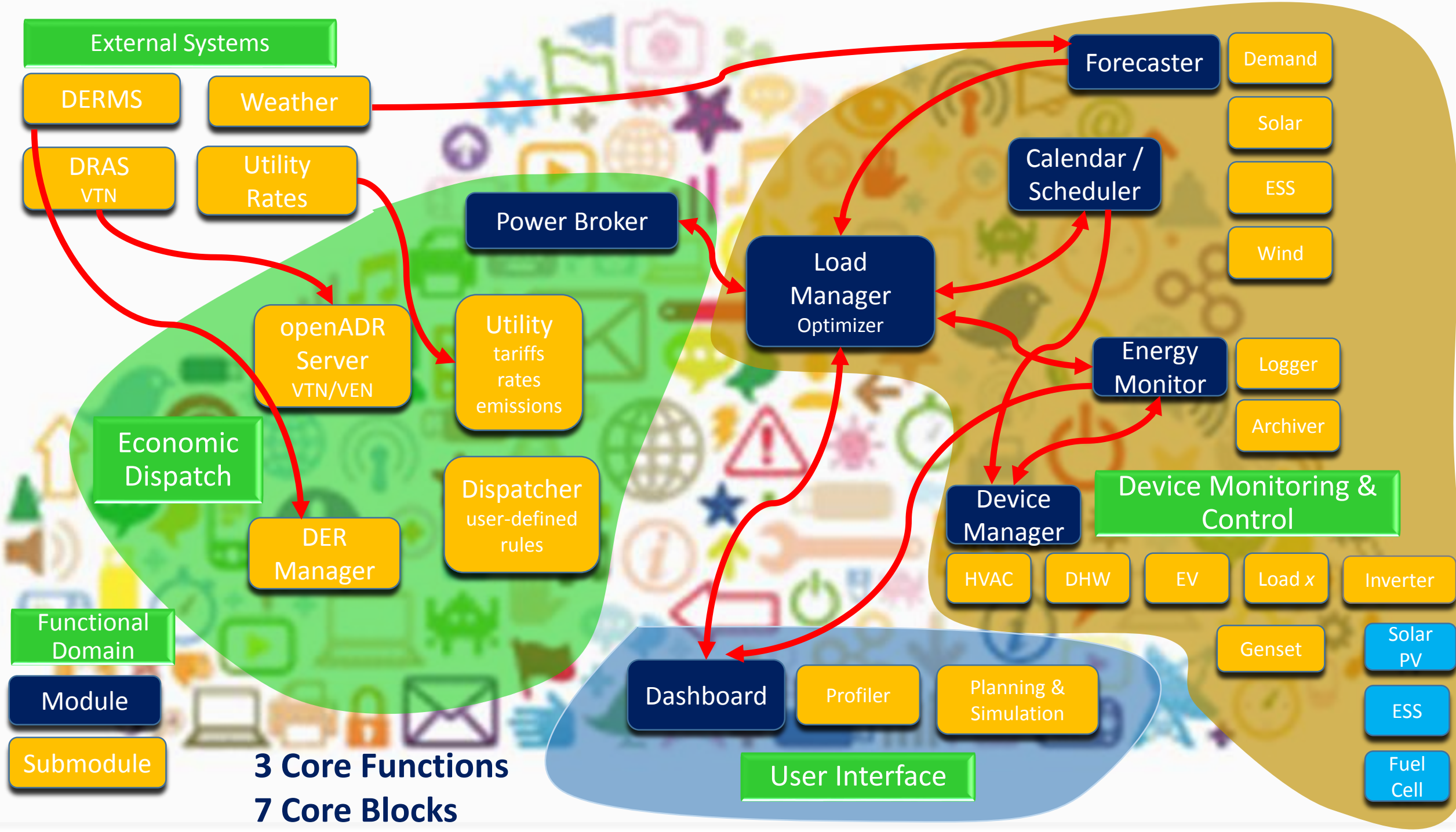


The Cloud of Unknowing where and how to plug in new applications, functions & devices



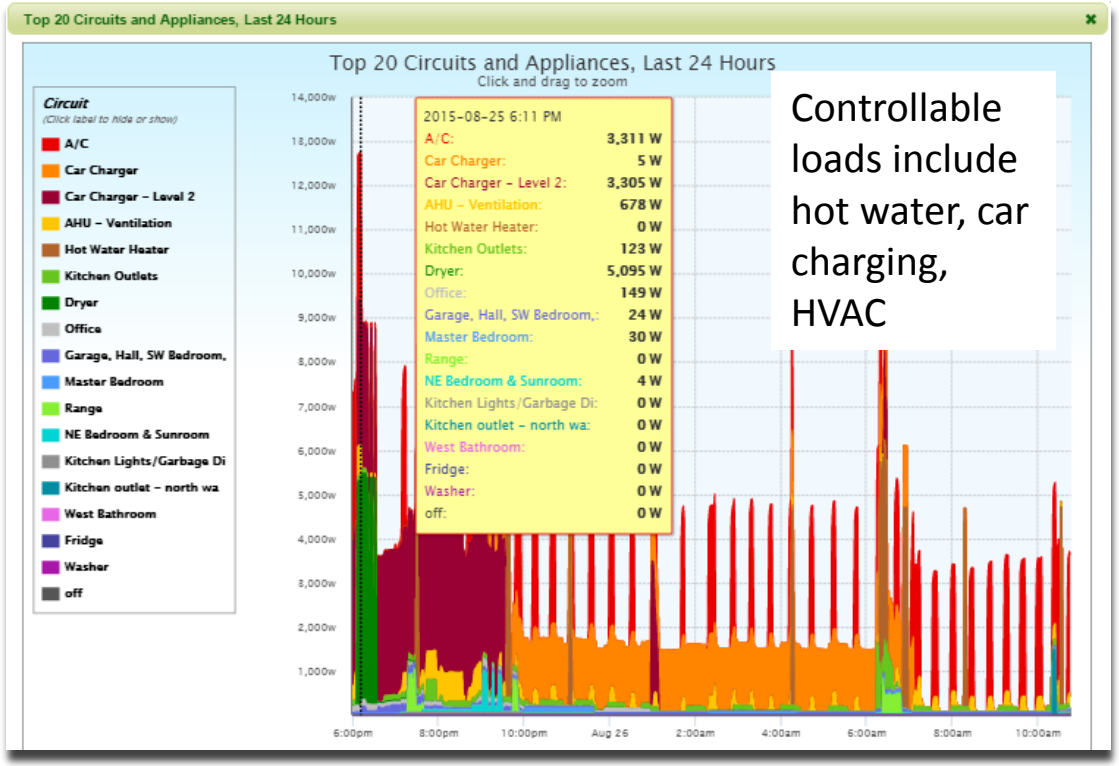


Traditional ICT model	Information Centric Networking (ICN)
Based on IP addressing.	Context aware communications.
Topology based.	Dynamic and flexible name resolution. Self-organizing.
IP addresses not persistent for mobile devices.	Secure binding between names and content instead of IP addresses to identify devices, data, users and services inherently more secure.
Vertical silo architecture. Vendor lock-in version 2.0	Unified, vendor-neutral, service oriented architecture.
Vendor specific APIs and ecosystems (Google Nest, Apple Homekit, Samsung SmartThings)	Standard APIs for system and device types, i.e. software defined buildings.
Broadcast, cloud centric	Content locality, local computing and caching, multicasting


External Systems
DERMS
Weather
DRAS
VTN
Utility
Rates
Power Broker
openADR
Server
VTN/VEN
Utility
tariffs
rates
emissions
Economic
Dispatch
DER
Manager
Dispatcher
user-defined
rules
Forecaster
Demand
Solar
Calendar /
Scheduler
ESS
Wind
Load
Manager
Optimizer
Energy
Monitor
Logger
Archiver
Device
Manager
Device Monitoring &
Control
HVAC
DHW
EV
Load x
Inverter
Genset
Solar
PV
ESS
Fuel
Cell
Dashboard
Profiler
Planning &
Simulation
User Interface
Functional
Domain
Module
Submodule
3 Core Functions
7 Core Blocks

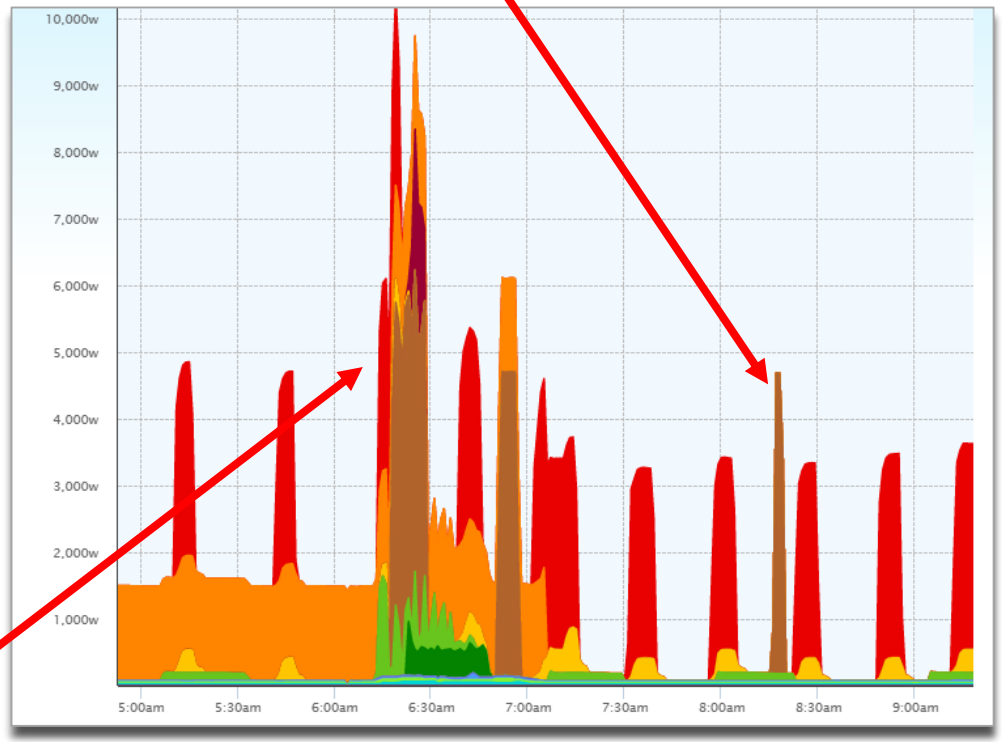
BRINGING IT ALL BACK HOME

Big Data & Demand Response



Controllable loads include hot water, car charging, HVAC

Move DHW from peak to valley



Coincident loads

eNOS