Utility Load Integration & Balancing
December 7, 2015

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Director
Energy Management Systems

Amzur Technologies – Local Focus. Global Reach.
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.”
A good hockey player plays where the puck is.

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

Wayne Gretzky
HECO
46 kV circuit
16% solar PV penetration
Daytime minimum load > 100%
US Solar PV growth
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.

Flexibility Inventory for Western Resource Planners

Andrew Mills and Joachim Seel

Energy Technologies Area

October 2015
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
<table>
<thead>
<tr>
<th>Traditional ICT model</th>
<th>Information Centric Networking (ICN)</th>
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<tbody>
<tr>
<td>Based on IP addressing.</td>
<td>Context aware communications.</td>
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<tr>
<td>IP addresses not persistent for mobile devices.</td>
<td>Secure binding between names and content instead of IP addresses to identify devices, data, users and services inherently more secure.</td>
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<tr>
<td>Vertical silo architecture. Vendor lock-in version 2.0</td>
<td>Unified, vendor-neutral, service oriented architecture.</td>
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<tr>
<td>Vendor specific APIs and ecosystems (Google Nest, Apple Homekit, Samsung SmartThings)</td>
<td>Standard APIs for system and device types, i.e. software defined buildings.</td>
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<tr>
<td>Broadcast, cloud centric</td>
<td>Content locality, local computing and caching, multicasting</td>
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Big Data & Demand Response

Controllable loads include hot water, car charging, HVAC

Move DHW from peak to valley