E3T Energy Efficiency Emerging Technologies

Washington State University Energy Program

Demand Response Needs You!

BPA's learnings using distributed energy resources

Emerging Technologies Showcase

March 9, 2016

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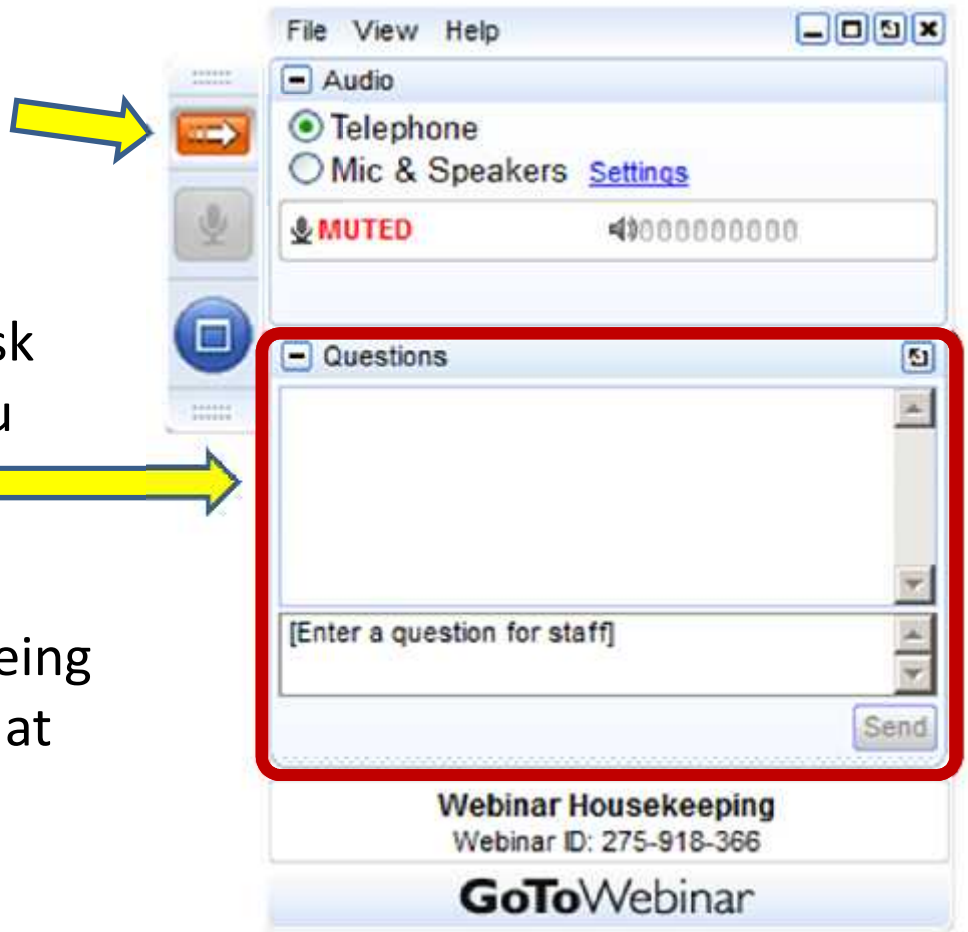

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E3T Showcase

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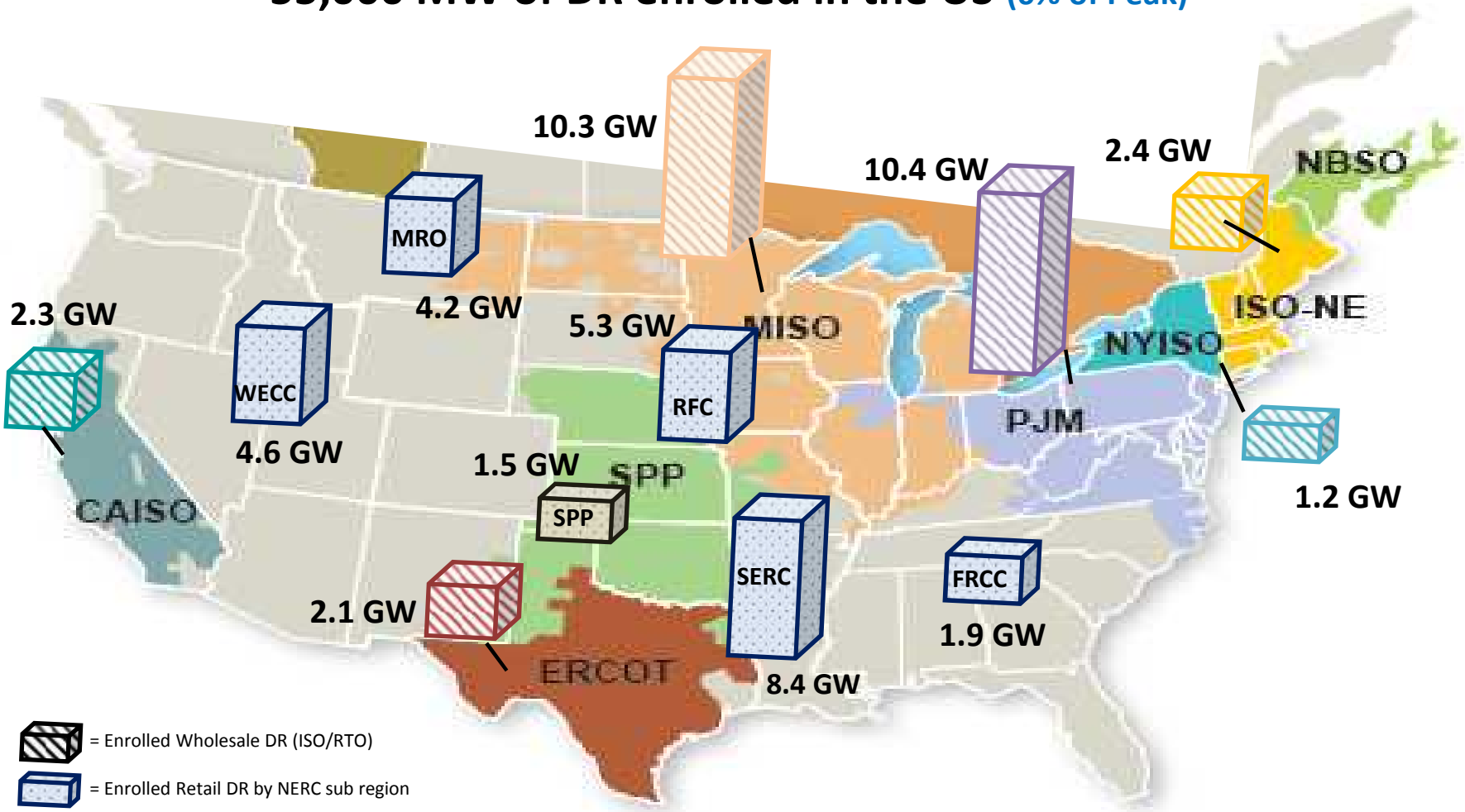
DR is Routinely Used, in Large Quantities, and for Many Purposes

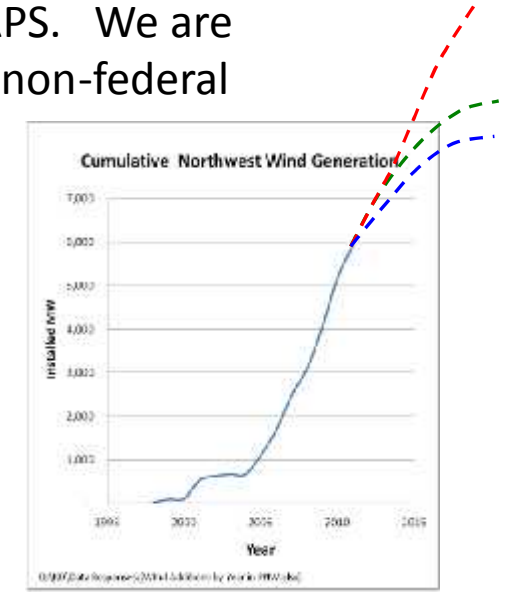
55,000 MW of DR enrolled in the US (6% of Peak)



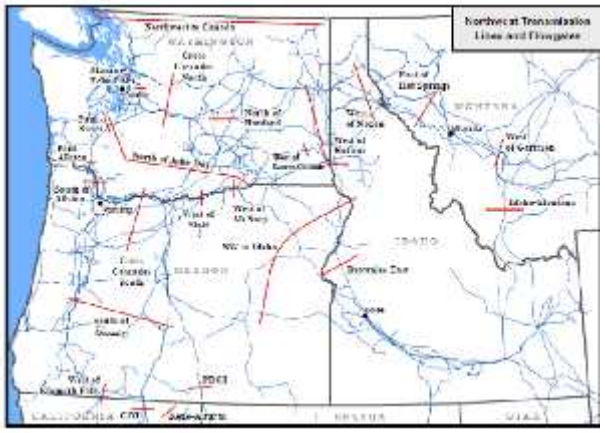
Source: *FERC Assessment of Demand Response and Advanced Metering*, Staff Report. December 2015. Excludes distributed generation and storage. Enrollment amounts over 1 GW shown on map only.

What Drives Demand Response at BPA?

BPA has had tremendous capacity and flexibility with the FCRPS. We are seeing emerging drivers that are pushing the need to look at non-federal measures as well:



- **Supply Constraints (generation capacity and reserves)**
- **Transmission Opportunities & Cost of Wires Projects**
- **Integrating Renewables, like Wind and potentially PV**
  - Installed wind capacity is approaching 50 percent of our load
  - Not much geographic diversity; most in BPA's balancing authority



- **Utility Interest in reducing their demand charge (load following) and evaluating DR as a tool to help manage their distribution system.**
- **7th Power Plan: Action plan calls for region/BPA to continue to build DR capability.**

Perspective on Demand Response

BPA's Administrator Elliot Mainzer giving a key note speech on demand response at a national conference in October 2013*:*

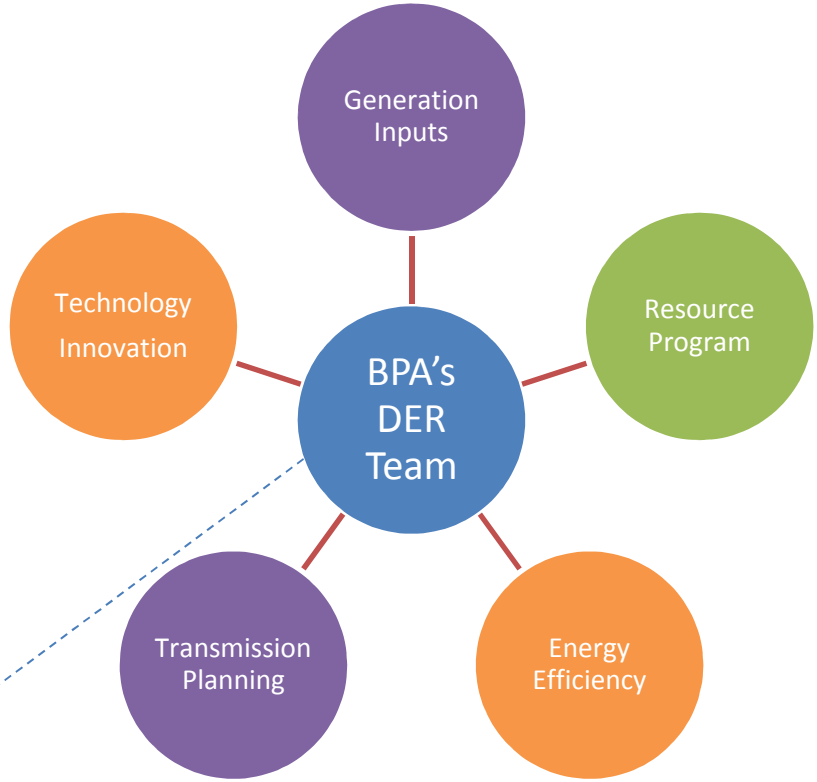
The hydro system has been stretched to its physical margin," Mainzer said. "Our task is to bring new and cost-effective, flexible capacity from outside of the hydro system."

Part of Mainzer's message was that demand response and energy storage can help utilities address their requirements to shave peak and defer infrastructure investments, as well as help the region reduce the need to build transmission and integrate the large amount of renewable energy in the Pacific Northwest.

Mainzer offered suggestions for moving forward by outlining the importance of determining supply curves; defining how reliable and dispatchable the DR tools are; and figuring out the physical and contractual capabilities, as well as how BPA will interface with utilities.

He also committed BPA to doing its part. "Demand response is a real opportunity, and BPA is mobilized to test and demonstrate it."

Distributed Energy Resources Program at BPA



Demand Response (DR) vs. Distributed Energy Resources (DER)

What Has BPA Done with Distributed Energy Resources?

Piloting and Testing Extensively in the Region (2009-2016)

- Thermal and process storage to support wind integration (load up/down)
- Tested oversupply strategy – e.g. aquifer recharge (pumping water into aquifer)
- Joint use of end-loads by BPA and utilities
- Recognized by Peak Load Management Alliance (PLMA) with *Innovative Application of Demand Response Award*

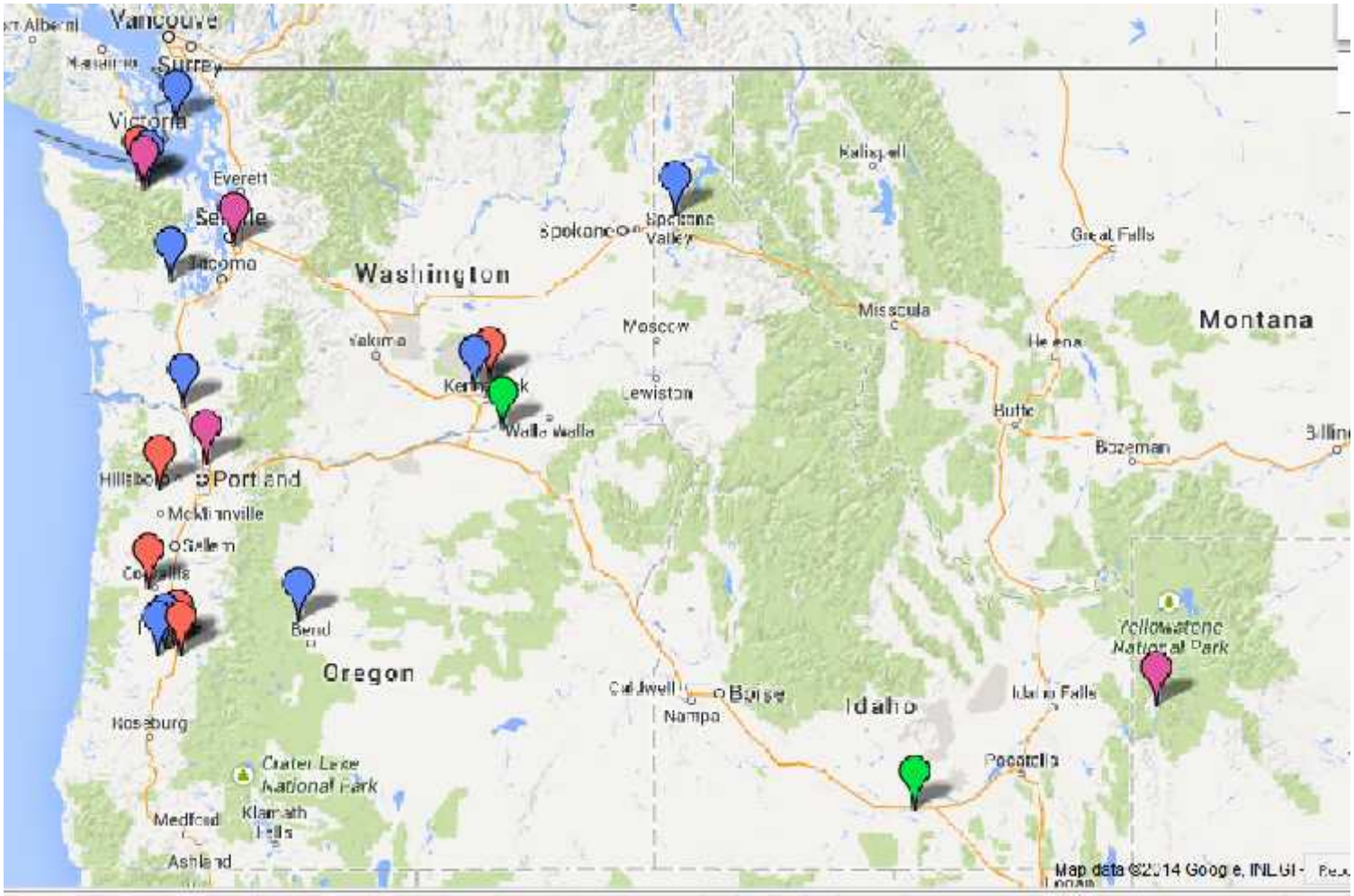
In 2014, BPA launched advanced "commercial" demonstrations

- Tested an industrial load in Port Angeles, WA (funded by BPA Technology Innovation Program)
- Aggregation demonstrations:
  - Energy Northwest
  - EnerNOC

Built a Demand Response Management System

Demand Response co- funded by power and transmission (FY14 – FY17)

BPA Has Completed Technical and Programmatic DR Pilots with Fifteen Utilities Across the Region



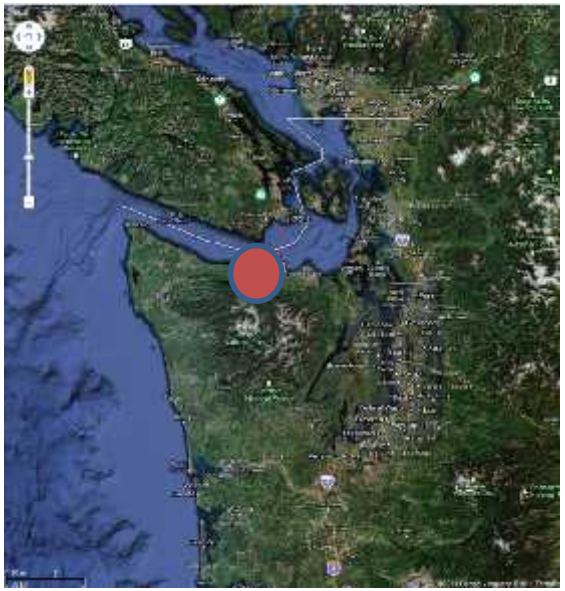
Residential Commercial Agricultural Industrial

In 2013 BPA Moved to Larger and More Complex Advanced Demonstrations of Demand Response

Entity	Status	MW	Timing	Product Demonstrated
City of Port Angeles	Complete	30	2013 - 2014	✓ Imbalance Capacity
Energy Northwest	Complete	35	2014 – Jan 2016	✓ Imbalance Capacity
EnerNOC	Testing in progress. Load Recruitment continues.	5 - 25	2015 - 2017	✓ Winter Peak Shave ✓ Summer Congestion Relief
Total		80*		

* Does not include Alcoa

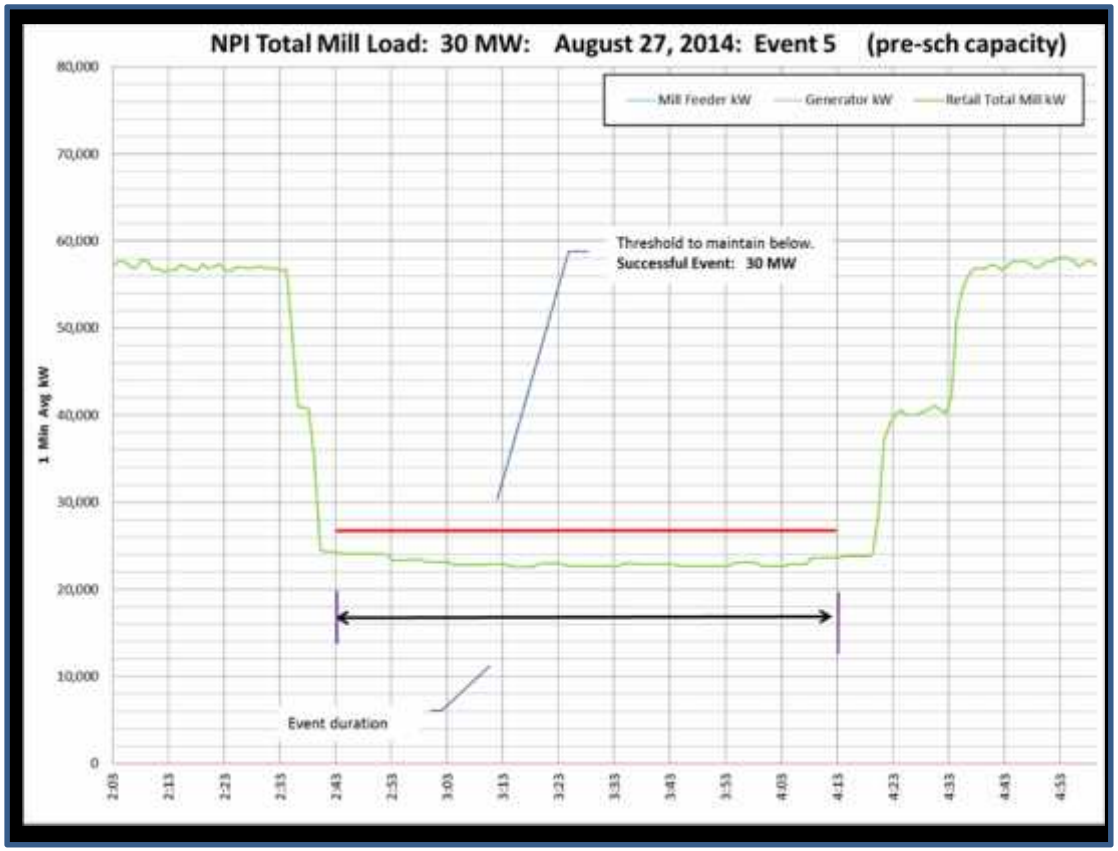
City of Port Angeles and Nippon Paper



City of Port Angeles / Nippon Paper Demonstration: Summary of Results

- **Learnings:**
  - Industrial facilities will have unpredictable downtimes; timely communications on outages is key.
  - High reliance on two refiner lines; no back-up was problematic.
  - The Nippon Paper plant performed well when existing load allowed them to do so.
- **Performance:**
  - Real-time events from Feb – July: 60% success rate.
  - Preschedule events Aug – Sept: 92% success rate.
- **Benefits:**
  - Contract structure, a settlement approach, deployment experience and BPA operations input & buy in.
  - Potential supplier for spring pre-schedule capacity.

Preschedule Imbalance Event: 2:43 – 4:13 am (10 minute notice)



Energy Northwest and BPA Launch Demonstration: Public Aggregation for Public Power

Background

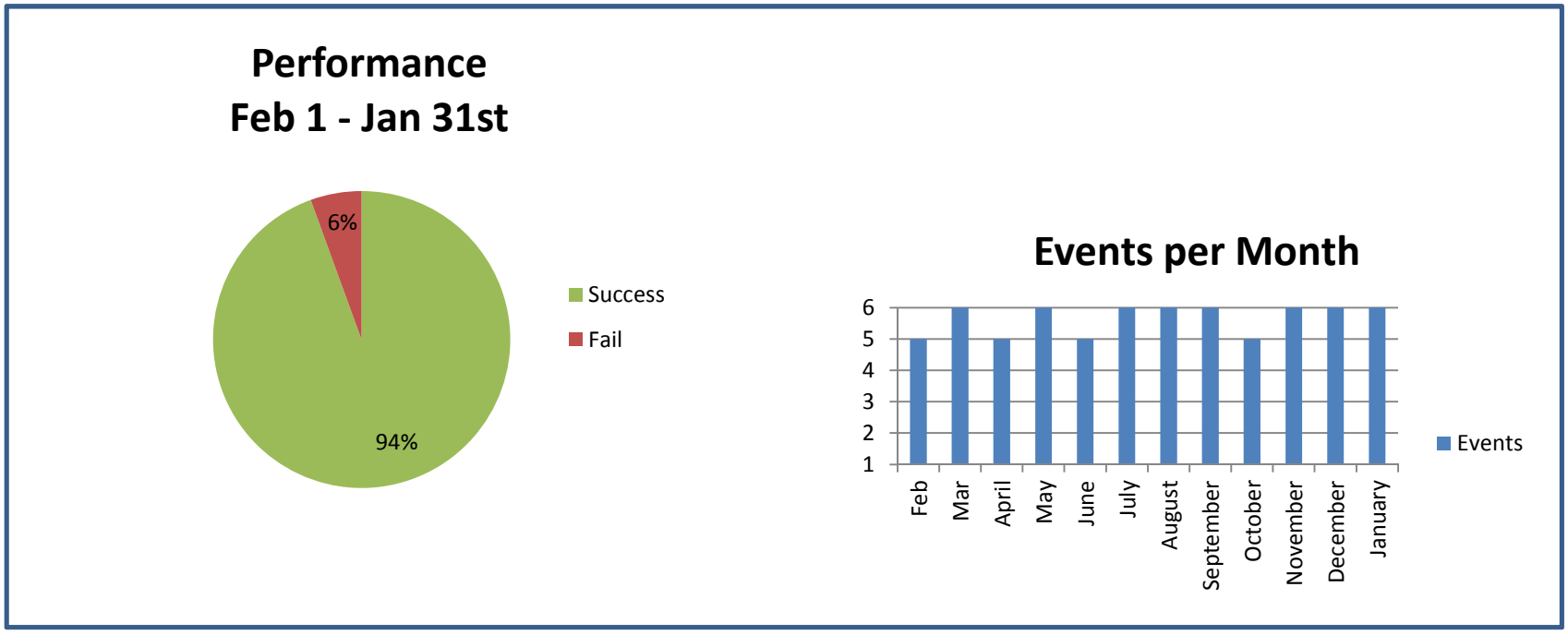
- "Public Power aggregating public utility load" model.
- Went live February 2015, ended January 2016.
- Original nomination was 25MW.
- ENW enrolled 35MW, the contractual cap.
- Phased testing: Pre-scheduled to Event triggered tests (Fall 2015).

Asset Roster

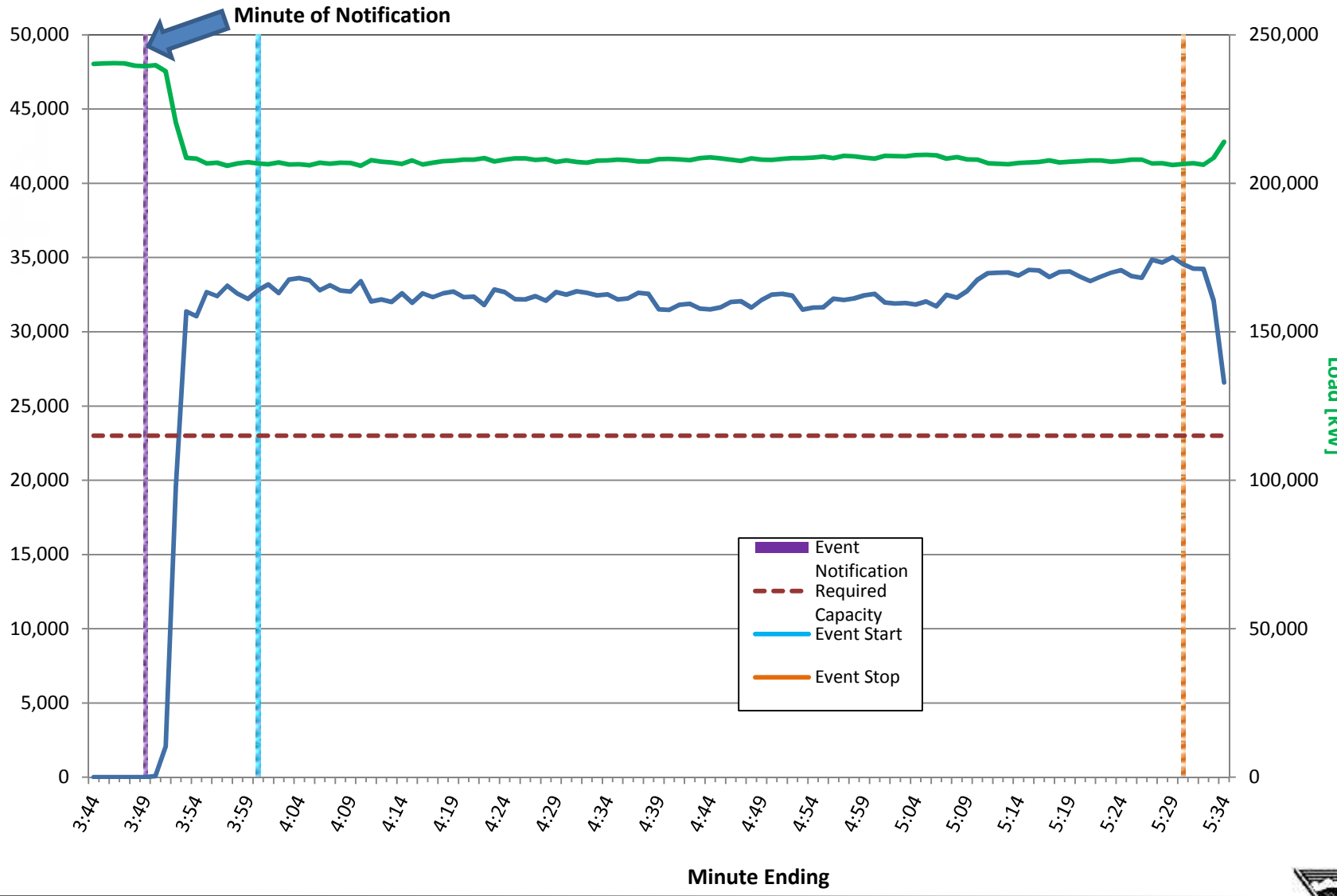
- **Cowlitz PUD:** NORPAC (up to 28 MW).
- **Pend Oreille PUD:** Ponderay Newsprint (up to 19 MW).
- **City of Richland:** 800 kW Demand Voltage Reduction.
- **Powin Battery:** 20kW.

The Model Proves Successful – Assets Perform Well

- **Performance - 94% with 64 successful events and 4 failures.**
- **Assets included NORPAC, City of Richland DVR, and a battery all responding on 10 minute notice for up to 90 minutes. A minimum 24 hour recharge period existed between events.**
- **Performance impressive given operating parameters of "Fast DR"**



Example Event: July 31, 2015



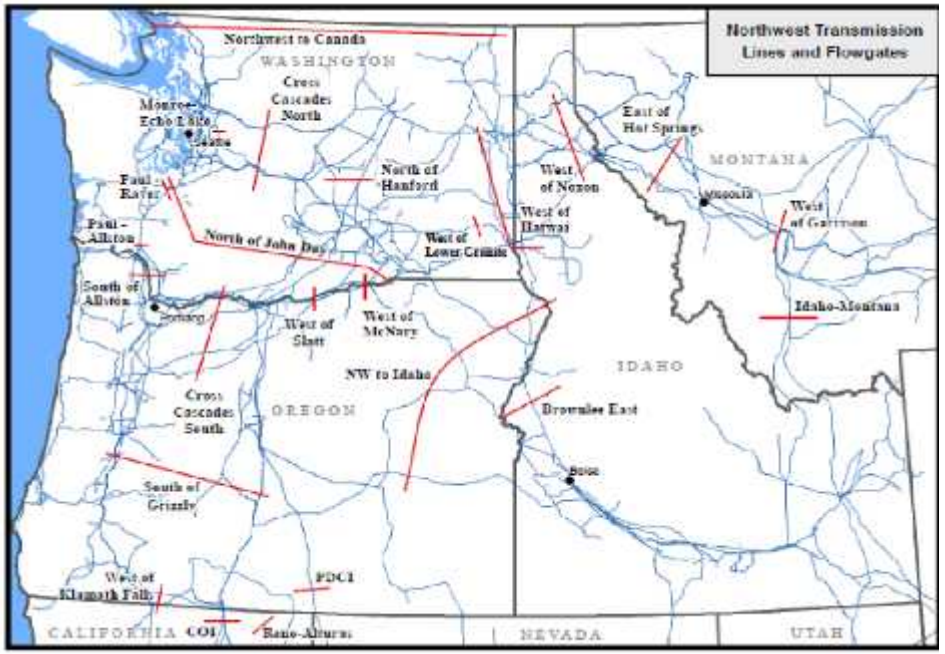
2014 Private Company Aggregation Demonstration Launched: EnerNOC Selected; Currently Running Test Events

Overview

- Test most common DR implementation model, and how this model will work with BPA and its customer utilities.
- Review the aggregator's ability to bring specialized expertise – financing, recruitment, metering and communications capability not available to many utilities.

Approach

- Test set of new products for BPA
  - Transmission Constraint (Summer)
  - Peak Shave (Winter)
- EnerNOC working closely with BPA customer utilities to introduce program and identify loads. Went live in December for the Winter peak shaving.



EnerNOC Demonstration: Testing Peak Shaving for Power and Congestion Management for Transmission

Power Product - Go Live December 1st

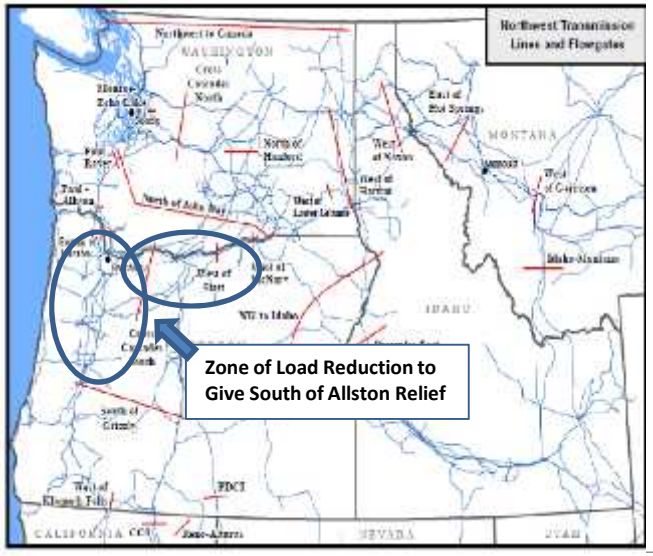
Winter peak shaving. Load in BPA BA.

Parameters
- -07:00 – 10:00, 17:00 – 20:00 M/F
- -60 minute response
- -1 to 3 hours in duration,
- -3 consecutive days
- -60 hours of seasonal testing

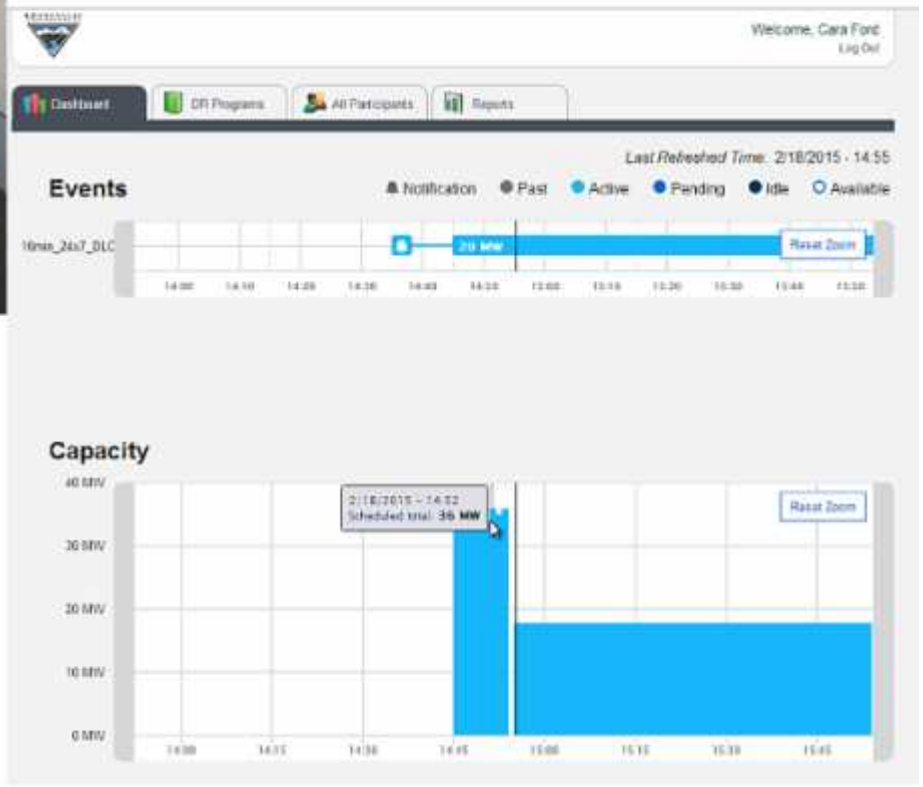
Transmission Product – Summer 2016

Summer non-wires contingency for the I-5 corridor. Load in BPA BA, in 18 public utility service areas.

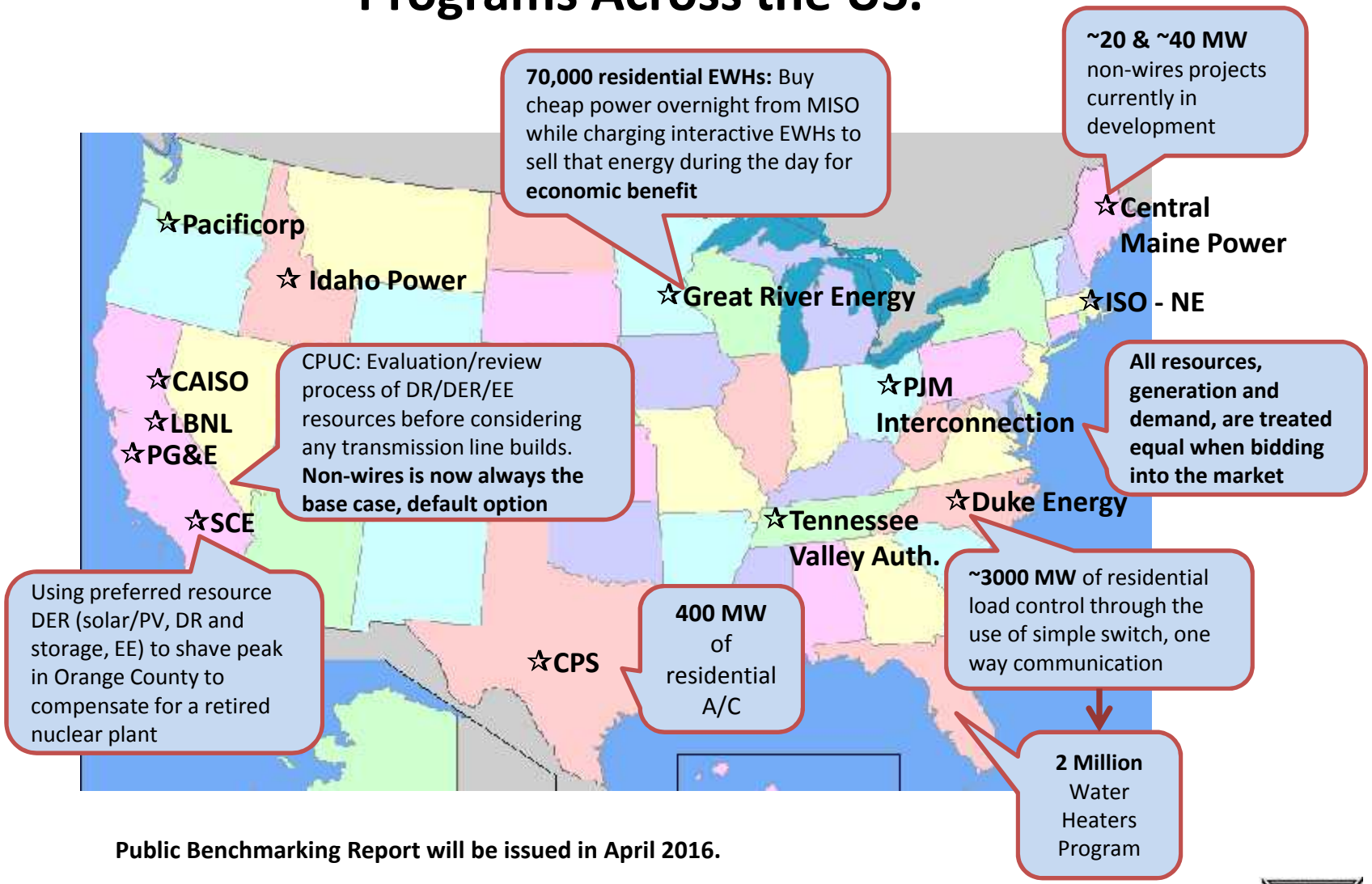
Parameters
- -12:00 – 20:00 M/F
- -60 minute response
- -1 to 4 hours in duration,
- -5 consecutive days
- -40 hours of seasonal testing



BPA Implements Technology to Enable Operations to Dispatch Load Reductions and See Load Movement in Near Real Time



BPA Is Conducting its Own Benchmarking of DR/DER Programs Across the US.



Public Benchmarking Report will be issued in April 2016.

Initial DR/DER Benchmarking Lessons Learned

- **Multi-year contracts** needed (3-5 years at least initially; TVA did a 10 year contract).
- **A market needs to be "seeded".** PJM wrote rules looser to build its market and attract entrants, and just now is tightening standards.
- **Residential should not be underestimated** as a viable source. 70% of BPA's Load is Residential.
- **Simple devices** are often more cost effective than complicated technologies.
- Trend is to integrate demand-side as a **standard part of resource planning** (e.g. Pacificorp and PG&E).
- Demand Response is used widely for **economic benefit**, not just reliability.

What's Next for BPA DER

- DR is mature nationally and it works. Still early in the Pacific Northwest.
- If used for a BPA service, vital that BPA coordinate closely with the serving utility who drives opting in/opting out and recruitment strategy.
- Loads outside the BA are more challenging to use.
- For Commercial and Industrial DR a high number of loads need to be vetted to see if DR can fit with end-load operations (and if it financially worth) in order to come up with enrollees.
- If BPA operations are going to use DR, it needs to be easy-to-use, available, and reliable.

WHAT'S NEXT

- Commercialize: Move cost-effective and reliable DR into operations based on need.
- Positioning BPA to consider non-wires equally alongside wire solutions.
- Next round of business planning for DER for BPA – incorporating the 7th plan guidance - and how BPA will work with our customers who are evaluating DR for their purposes. Scope will include not only DR, but storage and distributed generation.

For more information, contact:

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