Addressing grid challenges and exploring opportunities, including DR

Ancillary Services Workshop

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About BPA

Service area (sq. miles): 300,000
(Primarily Washington, Oregon, Idaho, Western Montana)

Transmission circuit miles: 15,215

BPA substations : 263

Grand Coulee Dam

2010 Balancing Authority (BA) Statistics	FCRPS/CGS	BA Total
Nameplate Rating (MW)	21,600	
Peak Generation (MW)	16,300	18,400
Average Generation (aMW)	6,900	8,000
Peak Load (MW)		9,800
Average Load (aMW)		5,900

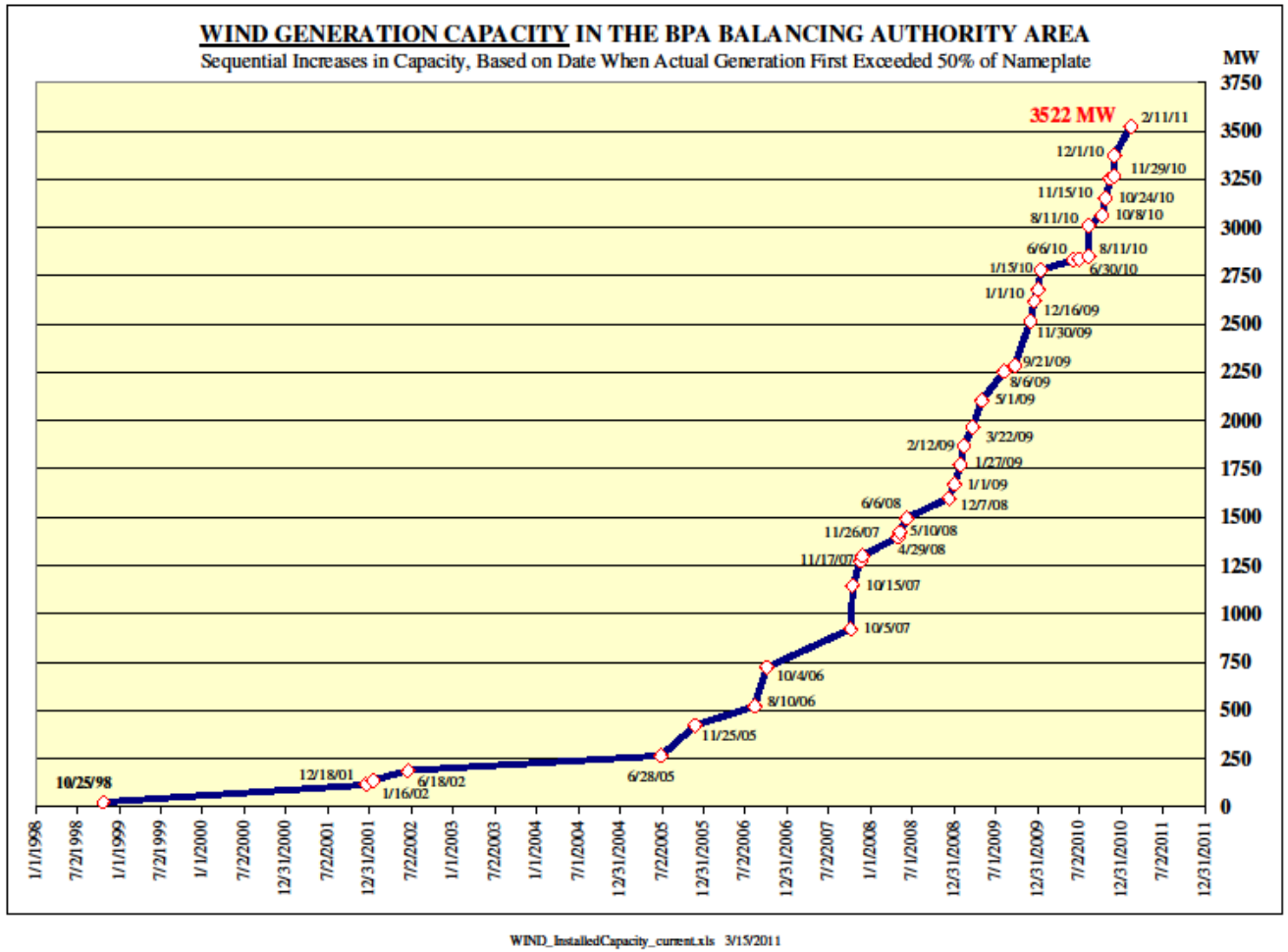
BPA is a Federal Power Marketing Administration in the U.S. Department of Energy

Presentation outline

1. Growth of wind
2. Tools to address the challenges
3. Exploring opportunities

Growth of wind

Growth of wind in BPA Balancing Authority

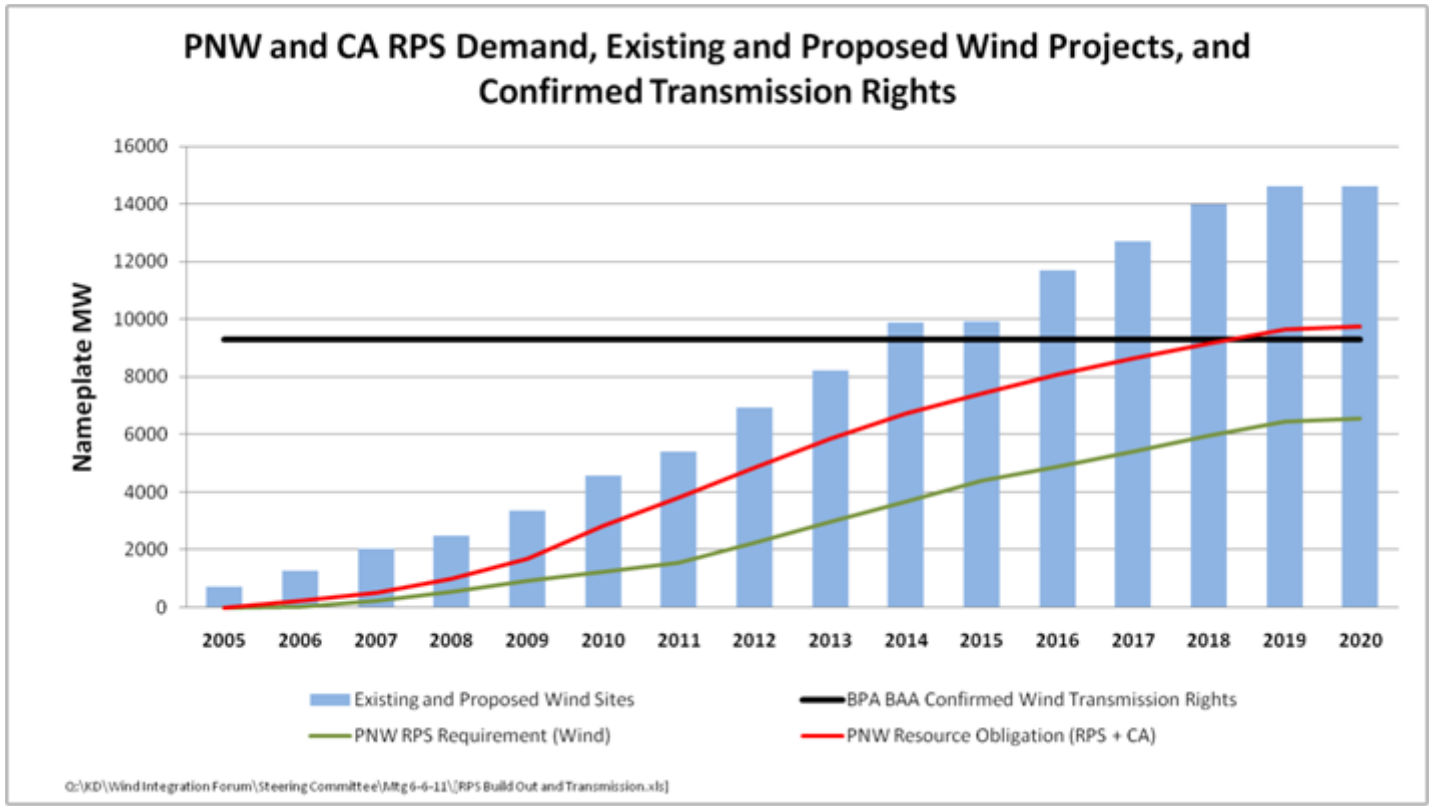


BPA's enablers of NW wind growth

- Relaxed imbalance penalties (2001)
- Storage and Shaping Services (2004)
- 2007 NW Wind Integration Action Plan – "Yes We Can"
- BPA Network Open Seasons (2008-2010)
- Relatively low-cost wind integration rates (2009-11)
  - Beginning October 2011, monthly fixed charge for wind integration lowered from $1.29 to $1.23 per KW
- BPA has developed a number of tools to adapt to the growth of variable generation in its Balancing Authority.

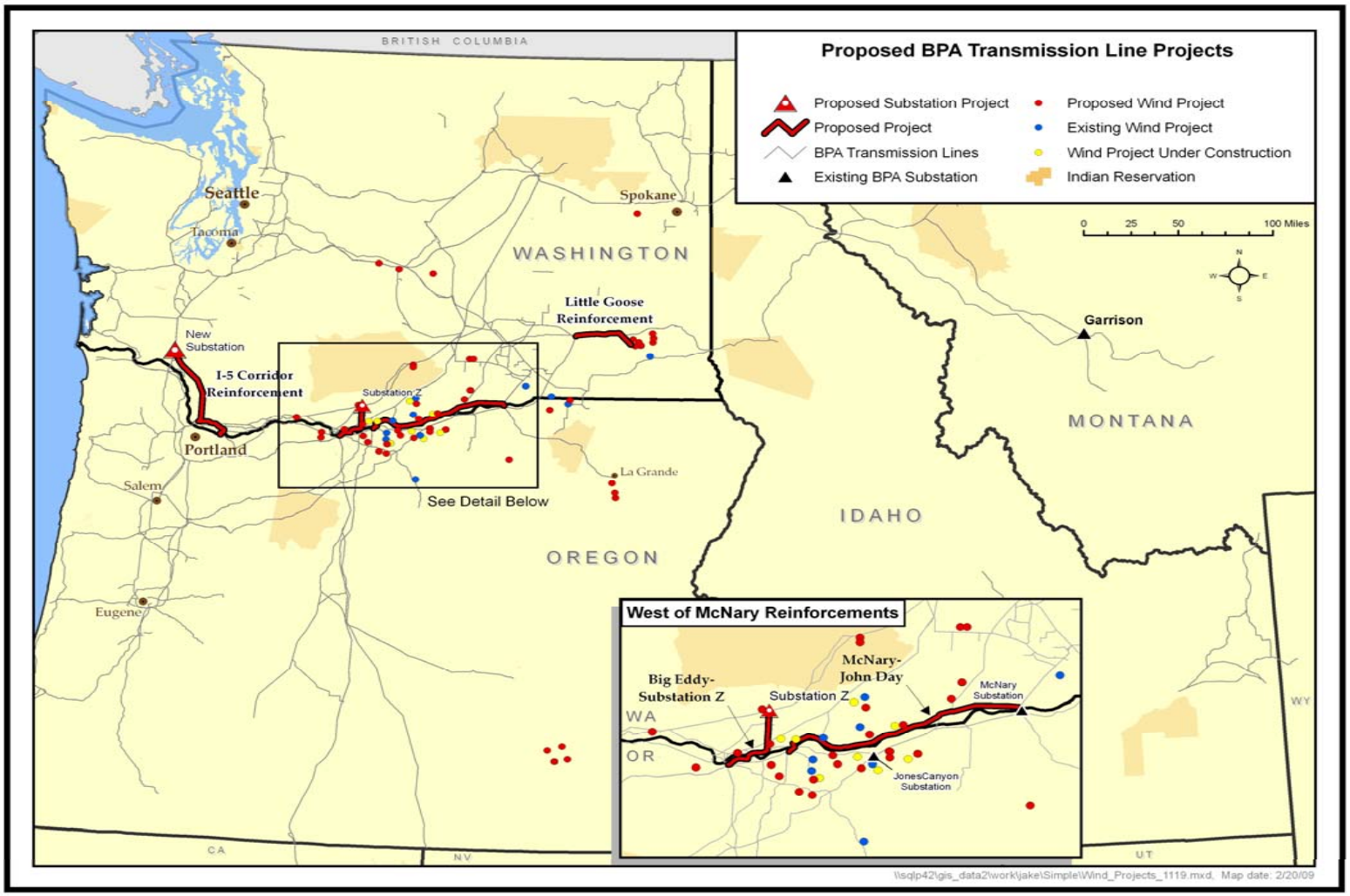
Wind resources to 2020

- **PNW and CA RPS targets would require ~10,000 MW of installed NW wind by 2020.**
  - ✓ **Nearly 6,000 MW currently operating or under construction.**
- **Existing wind projects and wind interconnection requests to at least 14,400 MW.**
  - ✓ **Significantly exceeds 2020 regulatory demand.**
  - ✓ **BPA has offered ~ 9,300 MW of transmission service to wind projects.**

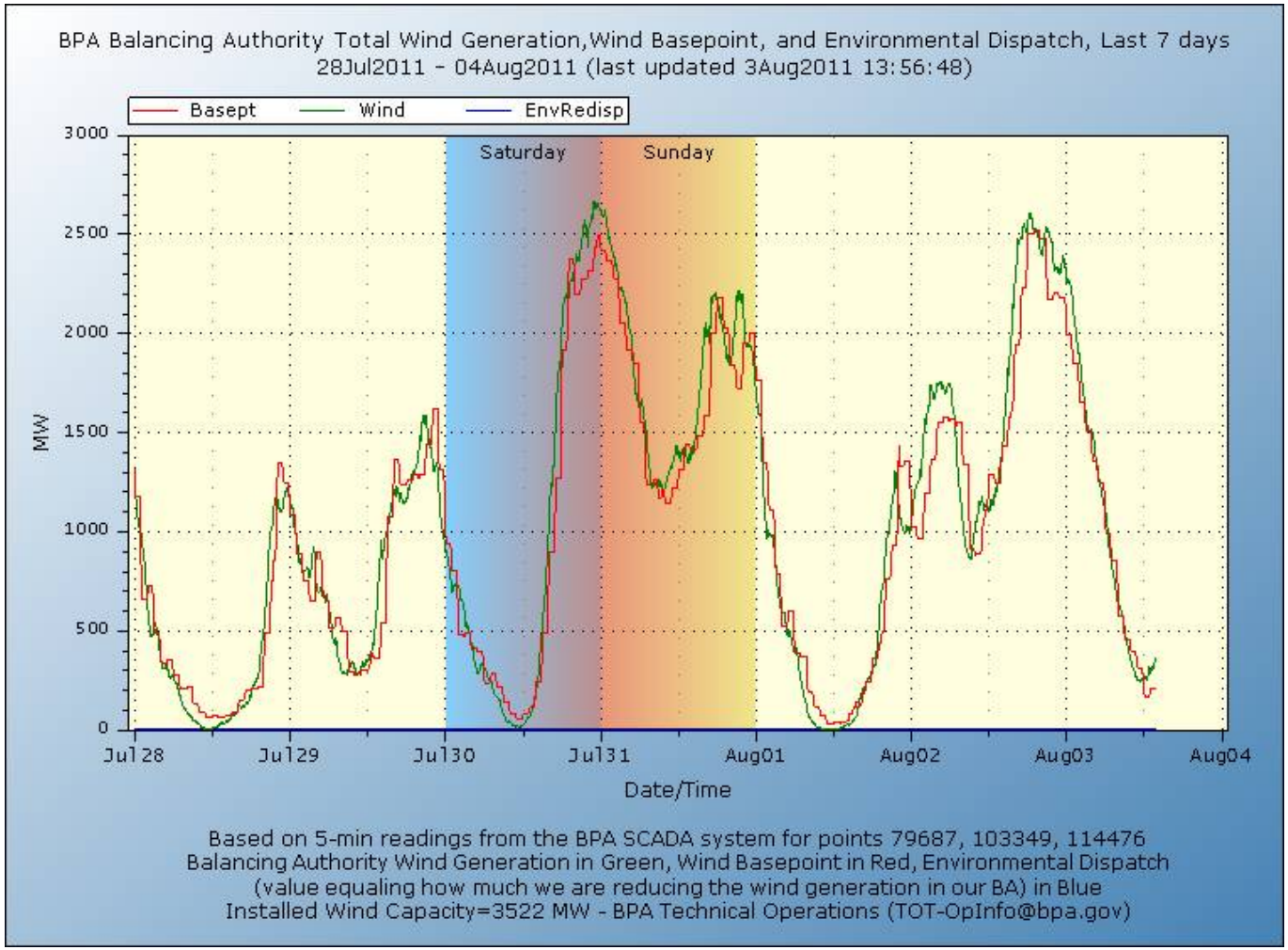


Based on BPA's wind interconnection queue and work done by E3

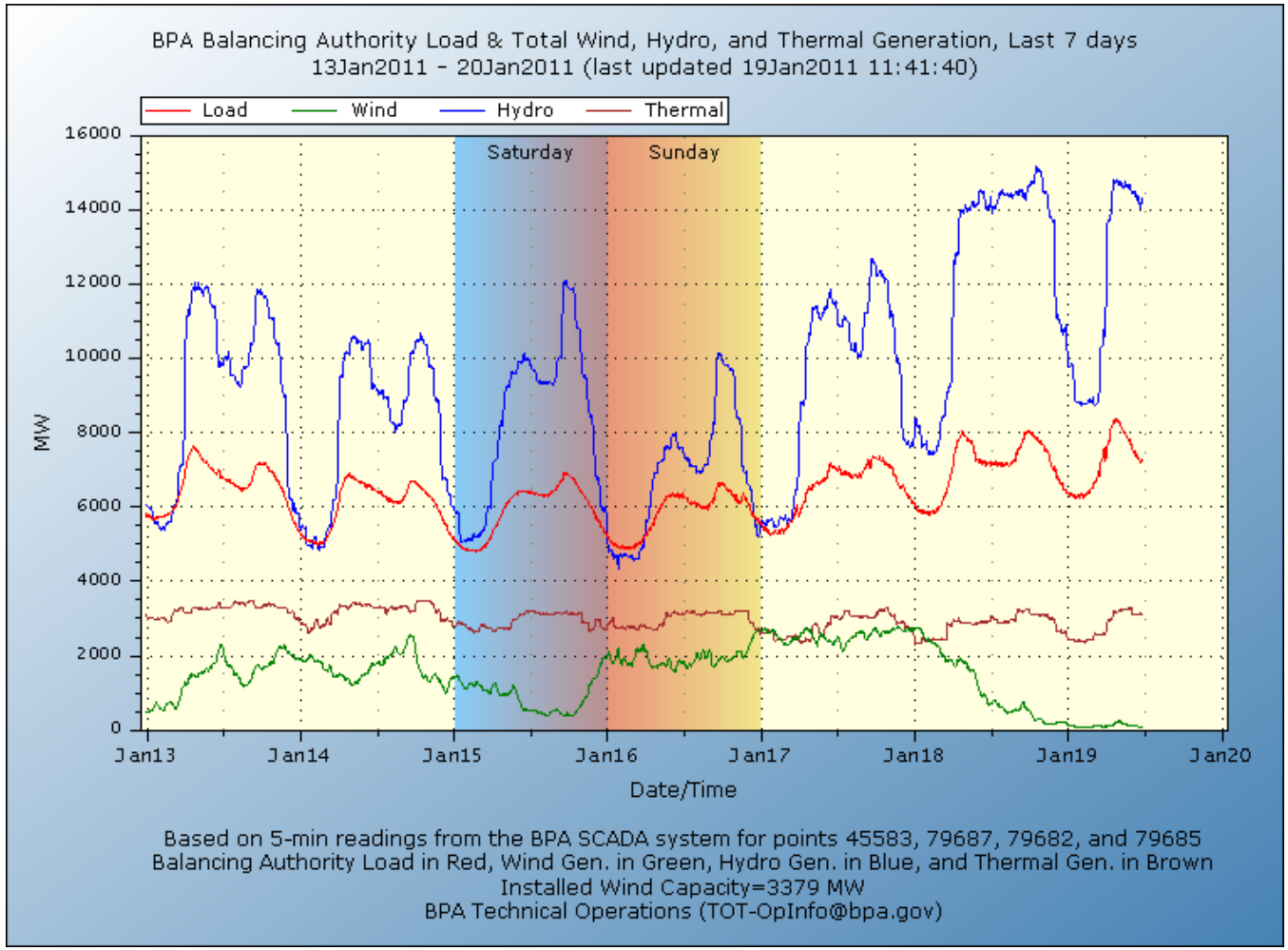
Wind farms are clustered along the Columbia River near existing BPA transmission and new transmission projects



Behavior traits: Volatile ramping behavior

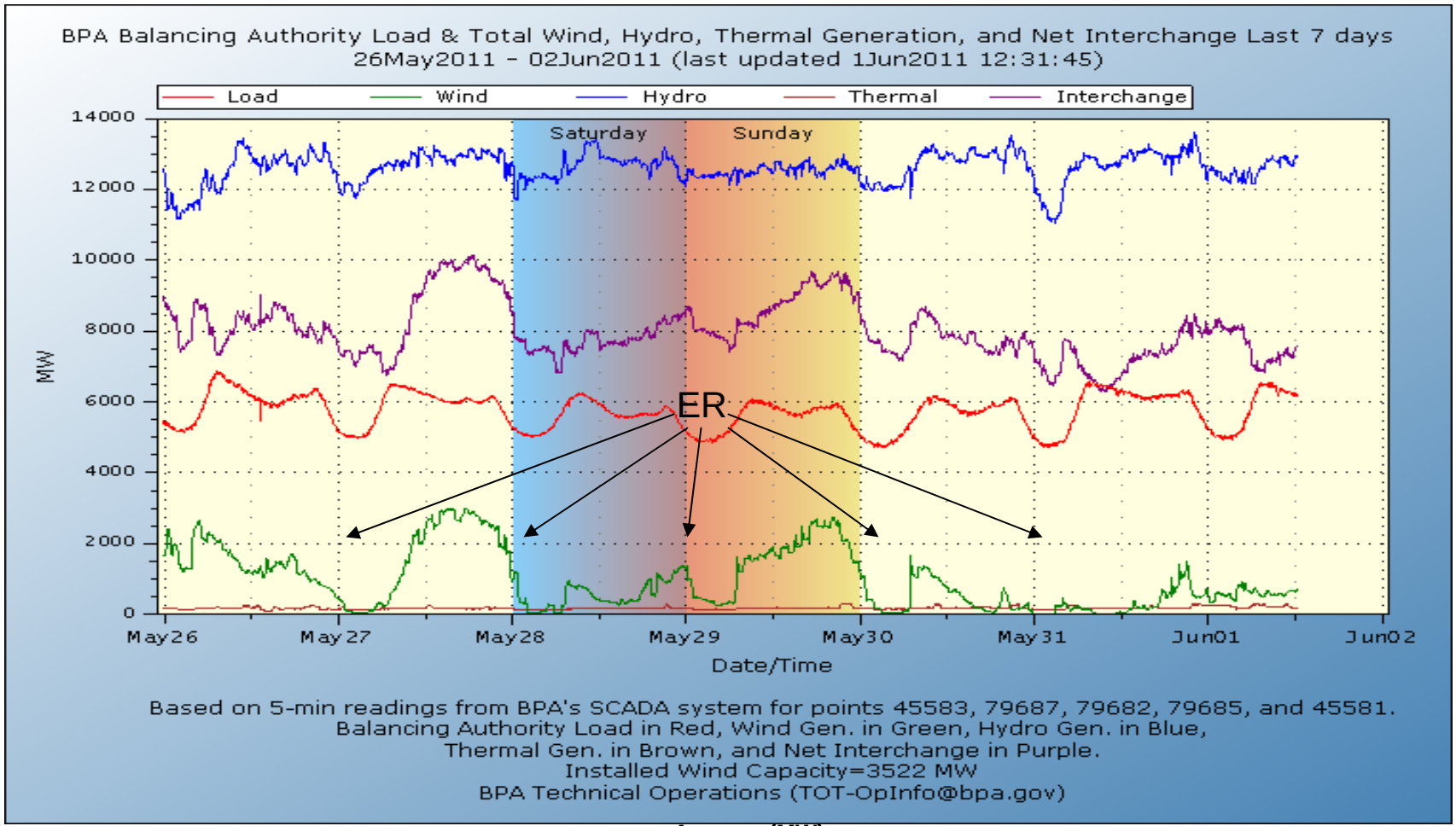


BPA Balancing Authority load and total generation (Winter 2011)



Tools to address the challenges

BPA Balancing Authority Load and Total Generation **Overgeneration** Conditions (Spring 2011)



Average (MW)

Load: 5,729 **Hydro: 12,599** **Wind: 943** **Thermal: 161** **Interchange: 7,985**

Tools to address the challenges

- Federal Columbia River Power System (FCRPS)
- Balancing Reserve Management -- DSO 216
- Improved Forecasting and Scheduling
- Intra-Hour Scheduling
- Increase the Pool of Balancing Reserves beyond the FCRPS
- Customer Supply of Imbalance
- Supplemental Service
- **Demand Response**
- Dynamic Transfer Capability (DTC)
- Environmental Redispatch

Exploring opportunities

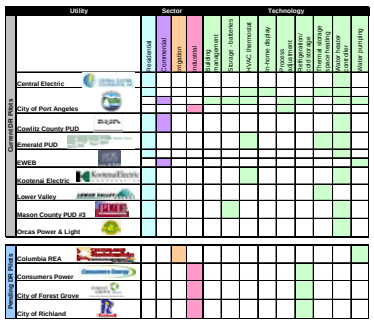
BPA's DR drivers

- Help integrate renewable resources such as wind
- Optimize resources including the hydro system and transmission (balancing reserves a strong focus)
- Facilitate research with broad applications to our customer utilities
- Enhance energy efficiency
- Ensure that a business case supports investments

BPA's three areas of focus in DR

- Pacific Northwest Smart Grid Demonstration Project
- Demand response pilot project
- Thermal storage and demand response

- Smart Grid



- DR pilots

- Thermal storage/DR

Pacific Northwest Demonstration Project

What:

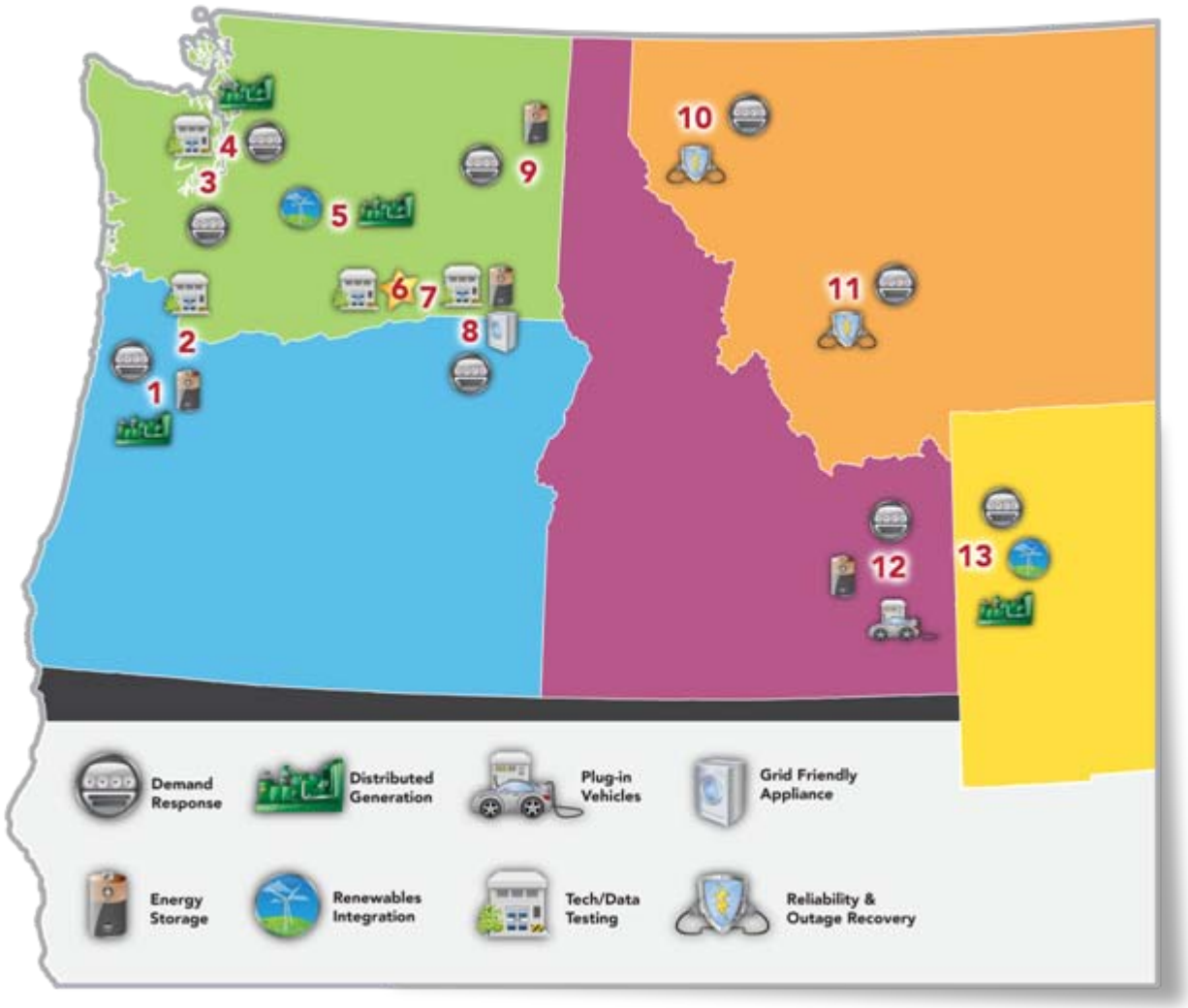
- $178M, ($89M private, $89M ARRA-funded), 5-year demonstration
- 60,000 metered customers in 5 states

Why:

- Quantify costs and benefits
- Develop communications protocol
- Develop standards
- Facilitate integration of wind and other renewables

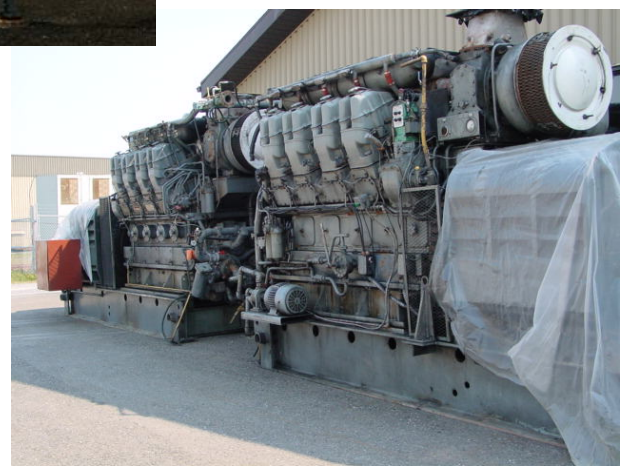
Who:

Led by Battelle and partners including BPA, 11 utilities, 2 universities, and 5 vendors



Evaluating many technologies to increase and decrease loads (and reserves)

- Electric Water Heaters (residential and commercial)
- Cold Storage
- HVAC (thermostats)
- Industrial processes (and electric boilers)
- Irrigation
- Municipal water pumps
- Battery storage
- Building energy management systems
- Space heating (thermal storage)
- In home displays



BPA has an evolving portfolio of DR pilots to assess BPA and regional needs

	Utility	Sector				Technology								
		Residential	Commercial	Irrigation	Industrial	Building management	Storage - batteries	HVAC thermostat	In-home display	Process adjustment	Refrigeration/ cold storage	Thermal storage space heating	Water heater controller	Water pumping
Current DR Pilots	Central Electric	■											■	
	City of Port Angeles	■						■	■			■	■	
			■			■	■	■		■	■		■	■
					■					■				
	Cowlitz County PUD	■	■										■	
	Emerald PUD	■						■				■	■	
	EWEB	■											■	
			■											■
	Kootenai Electric	■						■					■	
	Lower Valley	■										■		
	Mason County PUD #3	■					■						■	
	Orcas Power & Light	■											■	
Pending DR Pilots	Columbia REA			■										■
	Consumers Power				■						■			
	City of Forest Grove				■						■			
	City of Richland				■						■			

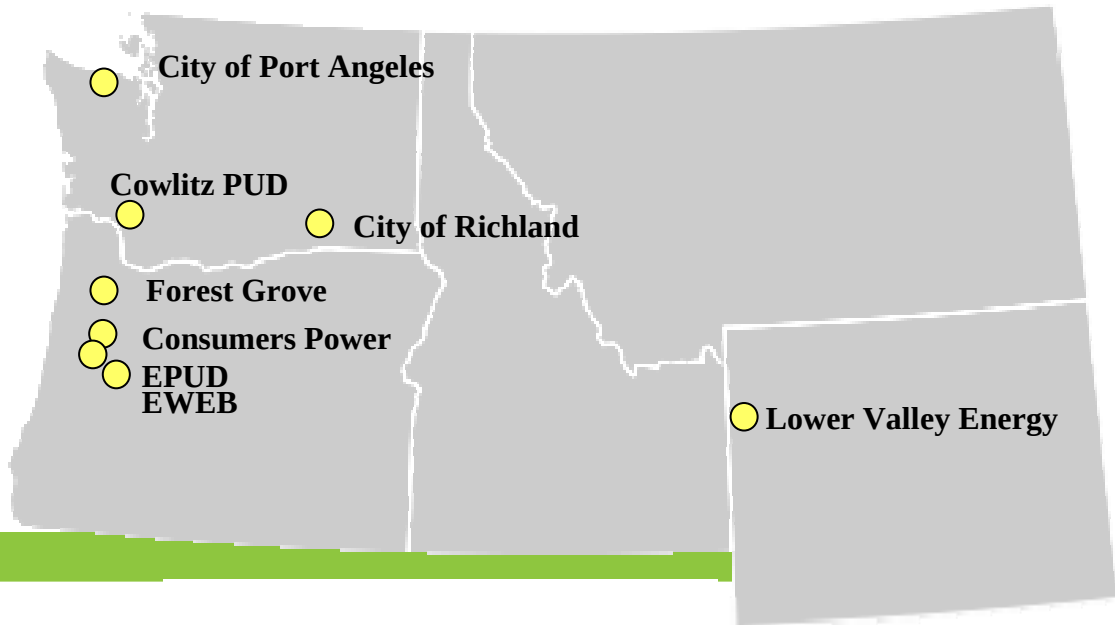
Energy storage pilot

Objectives:

- Use residential end-use controllable loads to help integrate variable renewables such as wind and solar
- Implement one to three commercial / industrial end-use storage projects.
- Develop a demand response business case and marketing materials to support utilities

Residential: ceramic heaters and water heaters

Commercial & industrial: cold storage



Participants:
BPA, Spirae, Steffes Corporation, EnerNOC, PNNL, Montana State, Renewable Northwest Project, Horizon Wind, Energy Northwest, Power and Conservation Council

Conclusions

- **Wind is a valuable addition to the PNW generation mix, and its contribution will continue to grow.**
- **Renewables presents new challenges and opportunities.**
- **BPA actively supports wind development with the 10 tools in place and with more long-term solutions to come… but we don't have all the answers!**
- As we seek answers and look toward longer-term solutions, we will:
  - Contribute to advances in wind generation forecasting
  - Work on new utility operational protocols and business practices
  - Explore imbalance markets
  - Foster support for more Demand Response
  - Research storage applications

Your feedback is encouraged!

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