

Wind Integration Update

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June 3, 2008



NW Wind Integration Action Plan: Summary of Major Messages

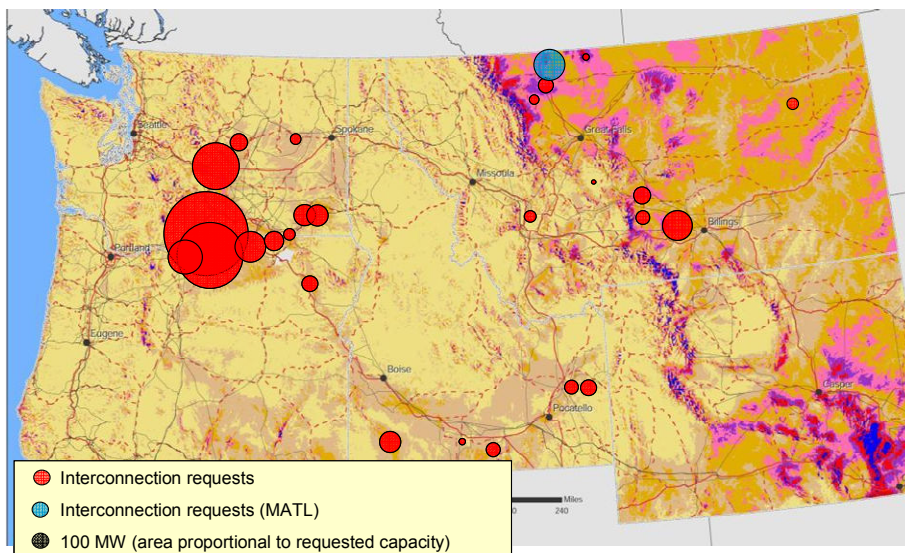
- Wind is an *energy*, rather than a *capacity* resource.
- Wind variability and uncertainty increases the variability and uncertainty of Balancing Area operations.
- Increased demand for system flexibility is the major driver of wind integration costs.
- Geographical diversity, Balancing Area cooperation, and expanded markets for Balancing Area Services can reduce the demand for system flexibility and mitigate the costs of wind integration.
- Technological innovation, especially in the area of storage, will help mitigate the increased demand for natural gas turbines to provide incremental integration services.
- Cost allocation and recovery will continue to be an important issue as more and more wind is integrated into the BPA System.

Slide 2

Balancing Area Operations

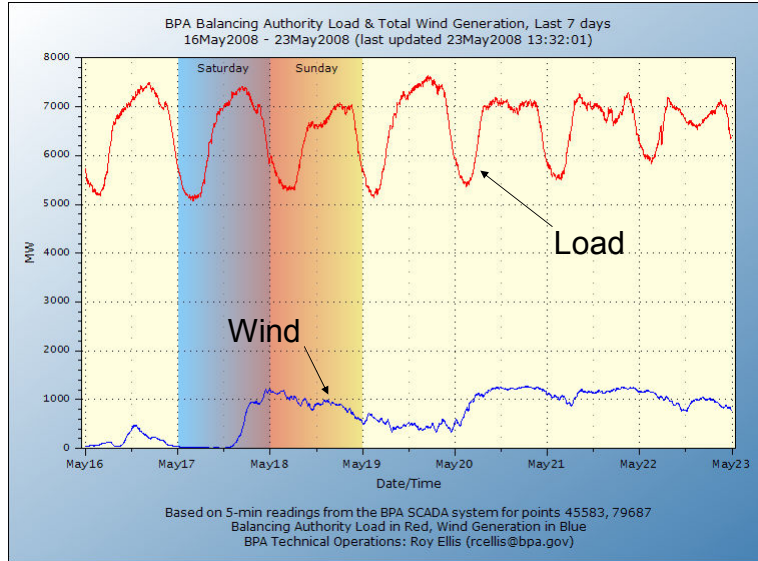
- The Northwest Power Pool has 17 Balancing Areas.
- Each Balancing Area operator is responsible for maintaining reliability by continuously balancing loads and generation.
- The following slides are snapshots of load and wind generation in the BPA Balancing Area.
- The first slide depicts wind and load during the week of May 16-23, 2008.
- The second two slides depict wind and load during the heat storm of July 24, 2006 and during the winter peak load day of December 27, 2007.

Slide 3

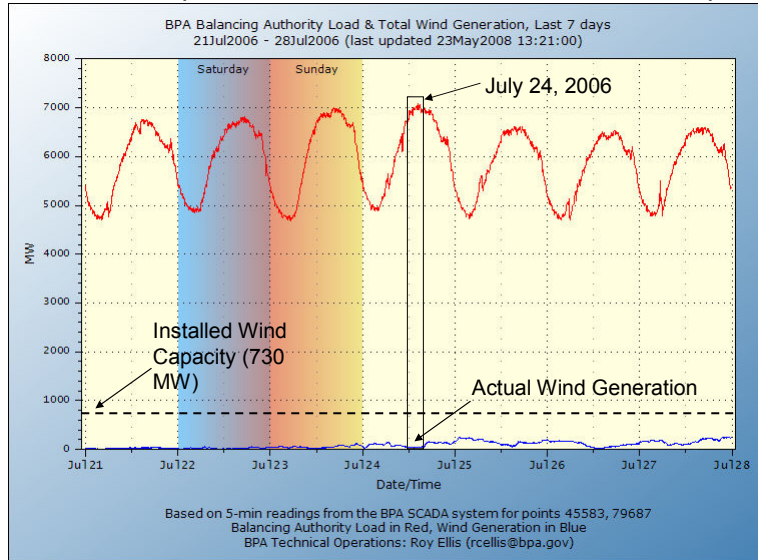


Slide 4

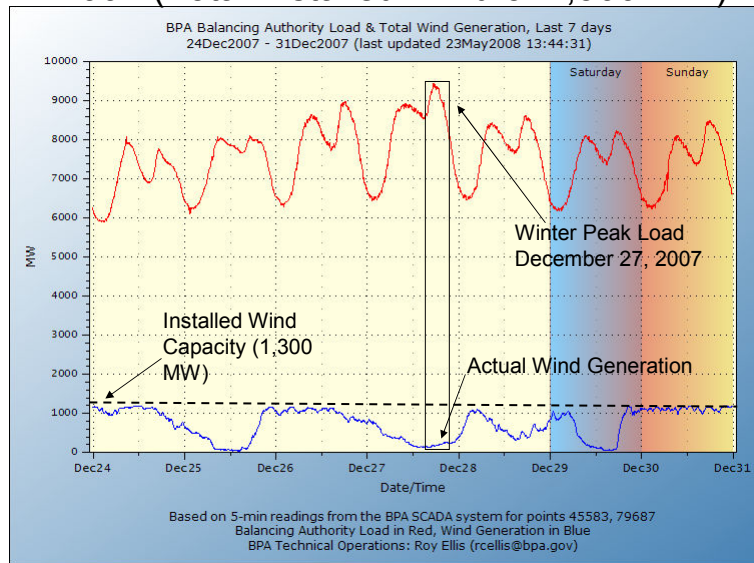
Load and Wind on BPA System May 16 – 23, 2008 (Total Installed Wind of 1,425 MW)



Load and Wind on BPA System July 21 – 28, 2006 (Total Installed Wind of 730 MW)



Load and Wind on BPA System December 24-31, 2007 (Total Installed Wind of 1,300 MW)



Strategies for Achieving Geographical Diversity

- Transmission Expansion -- BPA Open Season
- PAC and Idaho Plans of Service
- Conditional Firm Transmission Service
- Dynamic Scheduling Exchanges
- Columbia Grid, NTTG, NTAC, WREZ....

Increased Balancing Area Coordination and Broader Flexibility Markets

- ACE Diversity Pilot
- Northern Intertie Dynamic Scheduling Expansion Study
- Third Party Supply of Balancing Services in BPA Control Area
- Emergence of new Firming and Shaping Services

Slide 9

The Drive for Technological Innovation

- More flexible natural gas turbines -- GE LMS100 peaker/ramper.
- Compressed Air/Pumped Hydro Storage
- Flywheels, demand management, plug-in hybrids

Slide 10

Cost Recovery and Allocation

- BPA Wind Integration Rate Case
- BPA Balancing Area approaching saturation point
- Price signals, coordinated planning, transmission expansion and technological innovation are all key to spreading the wind out across the Northwest and sharing the integration burden.

Slide 11