Solving the Wind Integration Puzzle

Elliot Mainzer
Executive Vice President, Corporate Strategy

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Overview of BPA’s Short-Term Wind Strategy
Wind Generation Capacity Connected to BPA’s Transmission System is Growing

![Bar chart showing the growth in wind generation capacity from FY1998 to FY2012. The x-axis represents fiscal years from FY1998 to FY2012, and the y-axis represents MW (megawatts). The chart shows a significant increase in wind generation capacity over the years, with a substantial jump from FY2008 to FY2012.]
Wind Generation is Variable and Requires Other Generation Resources to Maintain Reliability
Wind Energy has Very Limited Capacity Value

BPA Balancing Authority Area Load & Total Wind Generation
Jan. 5-25, 2009

BPA TOTAL WIND GENERATION
BPA BALANCING AUTHORITY AREA LOAD
BPA’s Wind Integration Strategy

BPA is committed to finding innovative solutions to meet the renewable resource objectives of the Pacific Northwest by reliably and cost-effectively extending the integration capability of the BPA Balancing Authority while honoring our statutory obligations to our preference customers and the operational limitations on the Federal hydroelectric system.
How, specifically are we planning to accomplish this?
I. Plan & Build Transmission  
II. Maintain Reliability  
III. Explore Adding New Capacity  
IV. Build Partnerships
I. PLAN & BUILD TRANSMISSION

Build the BPA Transmission System to Integrate Additional Wind Generation

- Conduct Network Open Seasons to obtain customer commitments for transmission service
- Evaluate participation in other regional transmission plans to increase access to WY, ID, and MT
- Promote a more geographically diversified wind fleet
Three New Proposed Transmission Lines To Integrate 1,800 MW of New Wind Power Resources
I. PLAN & BUILD TRANSMISSION

Recover & Allocate Costs

- To date, BPA has spent $126 million on infrastructure to integrate wind
  - 6 line taps, 5 new substations and 23 interconnection facilities

- The BPA Wind Integration Rate
  - charges wind generators for the balancing costs incurred
  - sends a price signal to encourage more efficient use

- BPA currently provides balancing service for all wind in its balancing authority area, but 80% of the wind generation is exported out of the area
II. MAINTAIN RELIABILITY

*Provide Incentives to Encourage Efficient Use of System Operations*

- Established new reliability protocols to require wind generators to:
  - adjust their schedules down to actual output if they substantially *under-generate* relative to schedule
  - reduce output if they substantially *over-generate* relative to their schedule
II. MAINTAIN RELIABILITY

Situational Awareness

- Installed 14 wind measurement sites
- Develop a wind forecasting system by Mar. 2010
- Add a BPA “Wind Desk” to support dispatchers in the efficient use of wind, hydro and other generation

Accurate Forecasts and Situational Awareness are Key
II. MAINTAIN RELIABILITY

*Speed Things Up!*

- Create **sub-hourly** transmission scheduling protocols to allow power schedule changes to better match within-hour variations in wind generation.

- Pilot now underway allows wind operators to sell power when wind output quickly increases.
II. MAINTAIN RELIABILITY

Enable Self-Sufficiency

- Permit customers to self-supply wind balancing service by Oct. 2010
  - Allow wind generators to purchase balancing capacity from suppliers other than BPA
- Requires new business policies, system upgrades and operational protocols
- Will create a third-party market for balancing services
II. MAINTAIN RELIABILITY

Become More Dynamic

- Study and Increase Dynamic Transfer Capability
  - Allows wind generators physically located on BPA’s system to be remotely balanced by other utilities using electronic signals

- Evaluate the impacts on transmission capacity and reliability, including voltage stability
II. MAINTAIN RELIABILITY

Virtual Balancing Authority Consolidation

- The 17 discrete balancing authorities in NW Power Pool are inefficient:
  - 17 individual requirements to maintain a constant balance between load and generation
  - 17 system operators
- This balkanization is a major challenge for the NW
III. EXPLORE ADDING NEW CAPACITY

Energy Storage

- Explore the costs and benefits of using storage technologies to add capacity to the system
  - Pumped Storage
  - Compressed Air Storage
  - Distributed Batteries
  - Flywheels

- Sec. of Energy Steven Chu is interested in adding pumped storage to the NW
III. EXPLORE ADDING NEW CAPACITY

Smart Grid

- PNW Smart Grid Demonstration Project
  - Validation of new smart grid technologies

- A smarter grid could allow for balancing services to be procured on a real-time, distributed basis
IV. BUILD PARTNERSHIPS