Addressing grid challenges and exploring opportunities, including DR

Ancillary Services Workshop
October 25, 2011
Washington, D.C.

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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

2010 Balancing Authority (BA) Statistics

<table>
<thead>
<tr>
<th></th>
<th>FCRPS/CGS</th>
<th>BA Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nameplate Rating (MW)</td>
<td>21,600</td>
<td></td>
</tr>
<tr>
<td>Peak Generation (MW)</td>
<td>16,300</td>
<td>18,400</td>
</tr>
<tr>
<td>Average Generation (aMW)</td>
<td>6,900</td>
<td>8,000</td>
</tr>
<tr>
<td>Peak Load (MW)</td>
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<td>9,800</td>
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<tr>
<td>Average Load (aMW)</td>
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<td>5,900</td>
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BPA is a Federal Power Marketing Administration in the U.S. Department of Energy
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


Based on 5-min readings from the BPA SCADA system for points 79687, 103349, 114476
Balancing Authority Wind Generation in Green, Wind Basepoint in Red, Environmental Dispatch (value equaling how much we are reducing the wind generation in our BA) in Blue
Installed Wind Capacity=3522 MW - BPA Technical Operations (TOT-DpInfo@bpa.gov)
BPA Balancing Authority load and total generation (Winter 2011)

BPA Balancing Authority Load & Total Wind, Hydro, and Thermal Generation, Last 7 days

Based on 5-min readings from the BPA SCADA system for points 45503, 79667, 79662, and 79605
Balancing Authority Load in Red, Wind Gen. in Green, Hydro Gen. in Blue, and Thermal Gen. in Brown
Installed Wind Capacity=3379 MW
BPA Technical Operations (TOT-OpInfo@bpa.gov)
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

Based on 5-min readings from BPA's SCADA system for points 45583, 79687, 79682, 79685, and 45581. Balancing Authority Load in Red, Wind Gen. in Green, Hydro Gen. in Blue, Thermal Gen. in Brown, and Net Interchange in Purple. Installed Wind Capacity=3522 MW

BPA Technical Operations (TOT-OpInfo@bpa.gov)
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

<table>
<thead>
<tr>
<th>Utility</th>
<th>Sector</th>
<th>Technology</th>
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</thead>
<tbody>
<tr>
<td>Central Electric</td>
<td>Residential</td>
<td>Building management</td>
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<tr>
<td>City of Port Angeles</td>
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<td>In-home display</td>
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<td>Cowlitz County PUD</td>
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<tr>
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<td>Storage batteries</td>
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<tr>
<td>Mason County PUD #3</td>
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<td>HVAC thermostat</td>
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<td>Orcas Power &amp; Light</td>
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### 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
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

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

Residential: ceramic heaters and water heaters
Commercial & industrial: cold storage
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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