Discussion Paper *March, 2011*

"Over-Generation" In the Pacific Northwest

- Bonneville Power Administration's Evolving Policy on Managing Over-Generation

- Resulting Impacts to the Renewable Energy Sector

- Opportunities for New Transmission Capacity to Mitigate the Problem

Overview

In June 2010, a combination of high spring run-off and a storm blowing through the Columbia River system generated significant hydro-electric and substantial wind energy at the same time. This produced a surplus of power generation and required immediate action to avoid significant impacts to the Pacific Northwest power grid and endangered fish species.

As more renewable energy—particularly wind energy in the Columbia River Gorge—is brought on line, the frequency and size of such challenges are expected to increase.

Proposals to manage this over-supply of generation will have very real impacts to development of renewable energy in the greater Pacific Northwest region.

The addition of new transmission capacity between the Pacific Northwest and British Columbia is one critically important step necessary to meet this challenge, and ensure the continued development of the renewable energy industry in this region

Background

The Federal Columbia River Power System is operated for multiple public purposes. These include flood control, irrigation, power production, navigation, recreation, and municipal water supplies. The system is also operated to protect the Columbia River's fish, including several species listed as threatened or endangered under the Endangered Species Act: salmon, steelhead, sturgeon, and bull trout.

The system is owned and operated by various federal agencies. The U.S. Army Corps of Engineers ("Corps") and Bureau of Reclamation ("Reclamation") own and operate the federal dams within constraints established to assure the requirements of all the multiple purposes are met. The Bonneville Power Administration ("BPA") markets power from the federal dams within these same overlapping constraints and requirements. Flood control, protection of fish listed under the Endangered Species Act, compliance with the Clean Water Act, and other requirements take precedence over power production.

In managing the hydropower assets and operating the primary high-voltage transmission system in the Columbia River Basin, BPA in turn must comply with various requirements. Consistent with Federal Energy Regulatory Commission policies for open-access, non-discriminatory high-

voltage transmission, BPA integrates new power sources that request such service into its transmission grid.[1]

In the past few years, there has been remarkable growth in wind power projects connecting to BPA's transmission grid, driven by renewable energy portfolio standards in Washington, Oregon, and California.[2] As a result, generating capacity is being developed in the Northwest far in advance of regional power demand, at least at certain times of year.

In the last ten years, wind generation in the BPA's control area has gone from a nominal amount to more than 3,000 megawatts ("MW") of capacity. BPA experienced a peak record of 3,006 MW on Tuesday, February 22, 2011.[3] The rapid growth in wind energy is projected to continue and, if anything, accelerate. BPA predicts that wind capacity in its control area will reach at least 7,500 MW by 2016, and may exceed 10,000 MW.[4]

Challenge of Integrating Renewable Resources—Especially Wind—into BPA's System

Due to the wide seasonal and annual variations in Columbia River stream flows and the high variability of wind power output, BPA has been aware for some time that a combination of high stream flows and significant wind events could pose new challenges for Columbia River system operations due to a variety of factors such as:

- constraints on federal hydro operations

- high springtime flows

- the magnitude and timing of wind resources in the Columbia River Gorge

- limitations in available transmission capacity.

High stream flows occurring simultaneously with high wind events challenge the system operators' ability to balance and accommodate various competing needs while maintaining system reliability.

Beyond a certain level, water cannot be spilled at the dams because excessive spill causes elevated levels of total dissolved gases, which can lead to violations of the Clean Water Act and, more seriously, threats to the health and survival of fish protected under the Endangered Species Act. One typical solution is to route flows through the generation turbines at the dams, which avoids the total dissolved gas issue. However, the electrical power generated in this manner must be accommodated in the system.

There are limits to how much power the system is able to absorb. Energy generation must be equal to energy uses (which include consumption, transmission losses and other efficiency

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[1] *See* www.bpa.gov/corporate/pubs/fact_sheets/09fs/factsheet_-_Investing_in_the_NW_transmission_system.pdf.
[2] For details, go to www.bpa.gov/go/wind.
[3] BPA Press Release, Wind Power on BPA System Sets New Record (Feb. 22, 2011), http://www.bpa.gov/corporate/BPANews/ArticleTemplate.cfm?ArticleId=article-20110223-02
[4] *See* Bonneville Wind Home Page at http://www.bpa.gov/corporate/WindPower.

factors, and energy storage - a very minor factor in the current system). Generation cannot exceed the sum of these energy uses, so if demand cannot be ramped up or exported from the area via transmission, then generation must be curtailed.

The theoretical concern about over-supply became real when high stream flows emerged for a short period in June 2010, an otherwise low water year, at the same time that a large storm blew through the system and generated substantial wind energy.[5]

Quick responses by system operators, including BPA, the Corps, Reclamation, Energy Northwest, and utilities and independent power producers in the Northwest, British Columbia, and California, were able to reduce excess spill and keep total dissolved gas at levels safe for fish.[6] In addition to managing flows within the hydro system itself, operators reduced nuclear plant output, stored water in Canadian reservoirs, temporarily reduced amounts of balancing reserves provided to wind power projects, and provided power at little or no cost to utilities to displace operation of their thermal power plants.[7]

During this period, power was traded in regional markets at negative prices and purchasers were being paid to take power.[8]

Limitations in transmission capacity exacerbated these problems. The transmission capacities across the Northern Intertie into British Columbia and the Southern Intertie to California were maxed out. According to BPA's analysis of the event, "reductions in transmission availability limited federal hydropower generation and contributed to the need to spill. Transmission stresses within the Northwest also affected generation options. Diminished thermal generation shifted the patterns of where generation was occurring, which changed the loading on specific transmission paths."[9]

The insufficiency of transmission capacity to transmit all of the power being produced during this period of "high wind and high water" resulted in significant losses of economic opportunities, including the opportunity to generate energy and credits from wind generation.

The spill due to "lack of market" during the event was approximately 223,000 MWh, and for the whole month of June 2010, was about 745,000 MWh.[10] Due to the inability to transmit or store this power, full economic benefit of this potential generation was lost, without even considering the losses due to the temporarily reduced, or even negative, prices paid for power.

In addition to the over-supply issues, the introduction of more wind energy to the region is also leading to a significant challenge of finding resources to balance the variability of wind in real time to meet peak load.[11] The Northwest Wind Integration Plan notes "New transmission will be needed to support growing loads and resource additions, and can help open up new areas for wind development, helping to diversify wind production."[12]

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[5] BPA Report, "Columbia River High Water Operations" (Sept. 2010), available at http://www.bpa.gov/corporate/pubs/final-report-columbia-river-high-water-operations.pdf.
[6] Columbia River High Water Operations.
[7] *Id.*
[8] *Id.* at 11 (citing "Clearing-Up," an industry publication).
[9] *Id.* at 10-11.
[10] *Id.*
[11] *See, for example,* Northwest Power and Conservation Council, Northwest Wind Integration Plan (March 2007), available at http://www.nwcouncil.org/energy/Wind/library/2007-1.htm.
[12] *Id.*

Likely Future Impacts of Over-Supply

The June 2010 high-water event presaged situations that BPA and the PNW region will face again and for longer periods during each annual cycle, particularly in years with high springtime flows.[13]

In 2011, for example, hydrologists at the U.S. Northwest River Forecast Center are projecting water run-off at the Dalles Dam on the Columbia River at 101 percent of the 30-year normal for Jan - July 2011, up from the previous forecast of 97 percent, and well above the actual runoff of 79 percent of normal for 2010.

Meanwhile, new wind generation capacity is steadily coming on line and will increasingly pose potential risks of more severe over-generation during spring freshet in the second quarter of each year, as well as the need for balancing throughout the balance of the year.

Changes to BPA Policy

BPA is presently grappling with how it manages such situations.[14] As part of this effort, BPA has announced a new policy of "environmental re-dispatch" under which it will unilaterally order operators of wind generation systems to curtail generation during peak hydropower generation periods,[15] a controversial policy with potentially significant negative economic impacts to the region.

There are two components to BPA's proposed policy:

(1) BPA will not pay entities to take Federal power when BPA must minimize spill to comply with Endangered Species Act (ESA) and Clean Water Act (CWA) requirements;

(2) When all other available operational measures to manage and mitigate the over-generation event have been exhausted, BPA will dispatch Federal hydro generation to displace other generation sources in its balancing area without compensation.[16]

Under this policy, BPA will order wind generators to stop generating power, without compensating them. Many investors in wind projects receive production tax credits and wind energy purchasers receive renewable energy credits only when the wind is blowing and wind power is being produced.

Both investors and purchasers of wind energy may be significantly impacted by a policy that denies them these benefits when wind energy is available.[17] While BPA intends for

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[13] Oregon Public Broadcasting, "New Dilemma: Renewable Power Gridlock" (Sept. 15, 2010), available at http://ecotrope.opb.org/2010/09/new-dilemma-renewable-power-gridlock/.
[14] See http://www.bpa.gov/corporate/AgencyTopics/ColumbiaRiverHighWaterMgmnt/.
[15] BPA "Statement on Environmental Dispatch" (Dec. 3, 2010), available at http://www.bpa.gov/corporate/AgencyTopics/ ColumbiaRiverHighWaterMgmnt /Environmental%20Redispatch%20statement.pdf.
[16] BPA "Customer and Stakeholder Update" (Feb. 2011), available at http://www.bpa.gov/corporate/AgencyTopics/ColumbiaRiverHighWaterMgmnt/Cover_letter_DEC_Meeting_Notes_Final_Feb_2011.doc.
[17] Clearing Up, "BPA Wind/Thermal Displacement Proposal Criticized/Questioned." No. 1471 (Dec. 13, 2010).

environmental re-dispatch to be a "last resort," and will curtail generation at thermal plants first, severe economic impacts are feared.[18]

Improvements to Transmission Are Key to Solving the Problem

Significant new additions to transmission can alleviate the need to curtail generation, and can assist in meeting the challenge of integrating wind energy into the system.

The need for more transmission is well recognized. For example, BPA noted in a December 2010 workshop entitled "Balancing an Over-Supply of Generation", that improving the use factor of transmission interties and the efficiency of the north-to-south intertie were both areas to explore further in dealing with the over-generation questions.[19]

Additional transmission capacity between the U.S. and Canada that can be built and brought online in the next two years would be of significant benefit.

By adding an additional 550 MW of capacity in the congested transmission corridor along Puget Sound, the Juan De Fuca Cable Project brings an approximately 25% increase over existing capacity between B.C. and the U.S.

Due to the interconnected nature of the transmission grid, transmission capacity would be enhanced in the east-to-west direction as well.[20]

The security of energy flow to key municipal areas in both the U.S. and Canada under extreme natural events or other situations would be enhanced, and the reliability of the energy supply to both areas would be improved as well.

Expanded capacity would facilitate marketing the additional power produced during high flow events, reducing the need for curtailments with their associated negative economic impacts.

Expanded transmission capacity between the U.S. and Canada would thus support ongoing development of renewable energy resources in the region, facilitate increased access to the balancing capabilities available in British Columbia, and allow renewable energy resources from the Pacific Northwest and western Canada to firm each other.

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[18] Customer and Stakeholder Update, n. 12 *supra*.
[19] BPA Workshop, "Balancing an Over-Supply of Generation" (Dec. 3, 2010); workshop materials available online at http://www.bpa.gov/corporate/AgencyTopics/ColumbiaRiverHighWaterMgmnt/.
[20] See ColumbiaGrid (February 2009), "Final Draft – 2009 Biennial Transmission Expansion Plan, Rev. 2," available online at http://www.columbiagrid.org/download.cfm?DVID=1181.