STATEMENT OF
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UNITED STATES DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES

UNITED STATES SENATE

HEARING ON

THE ROLE OF GRID-SCALE ENERGY STORAGE IN MEETING OUR ENERGY AND CLIMATE GOALS

DECEMBER 10, 2009

Thank you, Mr. Chairman. My name is Elliot Mainzer and I am the Executive Vice President for Corporate Strategy for the Bonneville Power Administration (BPA). I am pleased to be here today to describe the significance of BPA's efforts to facilitate wind energy into the Western transmission system and the role storage technologies could play as one tool in the suite of initiatives we are developing to improve our ability to integrate variable renewable generation into our grid.

BACKGROUND

BPA, established in 1937 by an Act of Congress, is a power marketing agency within the Department of Energy. Our headquarters are in the Pacific Northwest, where we operate about three-quarters of the high voltage transmission system and market the power from 31 federal dams in the Columbia River Basin as well as the output of one nuclear plant. We supply about 40 percent of the Northwest's electricity, selling at wholesale and at cost.

Our service area covers Washington, Oregon, Idaho, western Montana, and small parts of eastern Montana, California, Nevada, Utah, and Wyoming. BPA is a self-financed agency that recovers its full costs and repayment obligations from power and transmission rates. Our power customers include Northwest cooperatives, municipalities, public utility districts, federal agencies, investor-owned utilities, direct-service industries, port districts, irrigation districts, and tribal utilities.

We sell transmission and related services to more than 200 utilities, power generators (including wind generators), and power marketers. Pursuant to our open access tariff, BPA provides transmission services to all customer utilities, power generators and marketers under the same rates, terms, and conditions that it applies to its own Power Services business line for use of transmission services.

RENEWABLES DEVELOPMENT IN THE PACIFIC NORTHWEST

BPA is maintaining a remarkable pace of connecting new renewable wind generation to its transmission system. All but one of the states in our service territory have enacted renewable electric generation standards for their retail utilities. These requirements, coupled with those of other Western states, have brought developers to our area looking for opportunities to develop and sell new renewable generation. They come to us for transmission services because of the capacity of our existing transmission system and the proximity of reasonably good sites for wind generation. To date we have almost 2,300 megawatts of wind generation connected to our system.

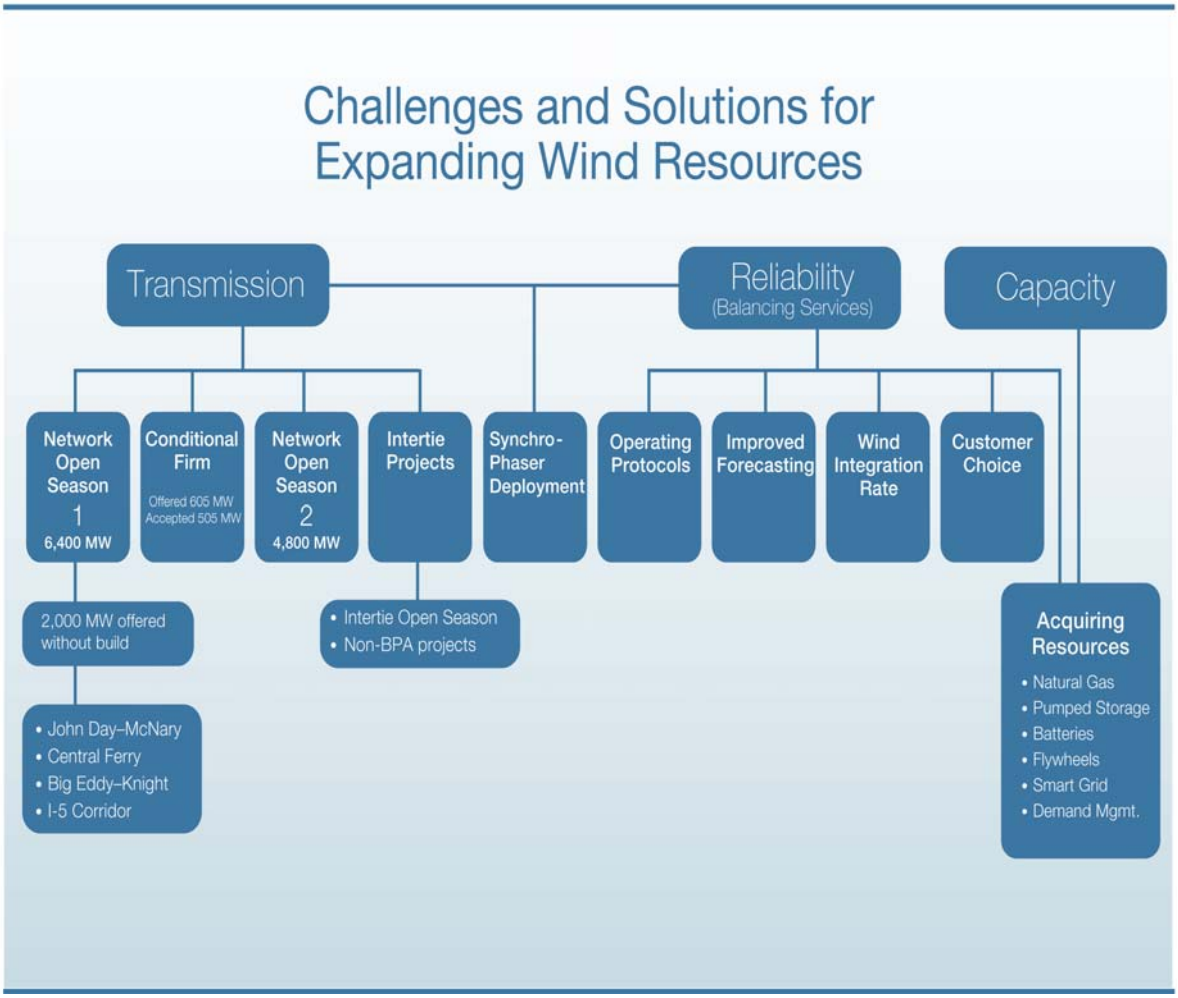


Figure 1: Three Strategies to Support Increased Wind Interconnections

Figure 1 shows the three categories of actions we are working on to expand wind power interconnection to the BPA system: 1) constructing additional transmission capacity; 2) developing the means to provide additional balancing services for reliability from existing system assets, and; 3) exploring the development of new resources that provide capacity and flexibility.

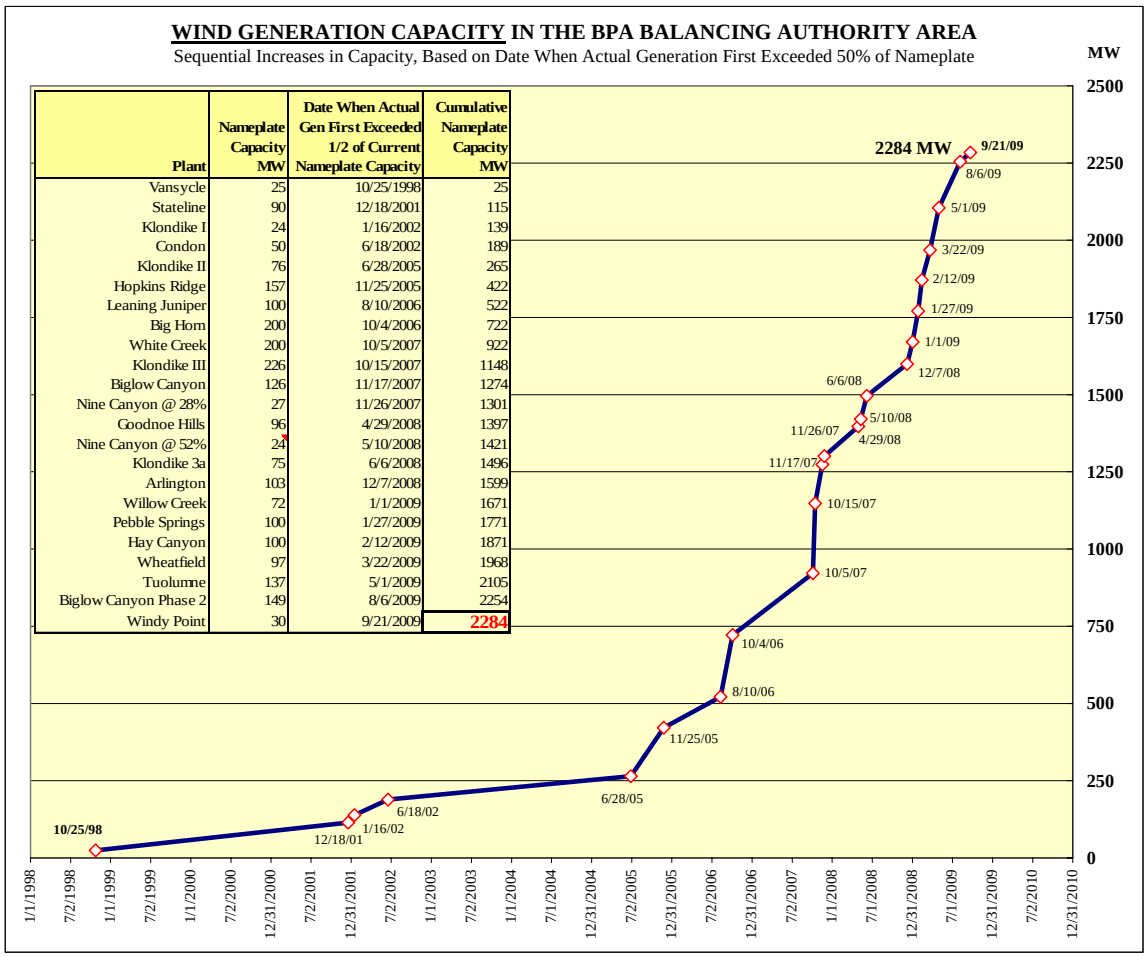
TRANSMISSION

The large amount of new wind generation in our region, combined with increases in electricity demand due to a growing population and changing patterns of seasonal energy use, has led BPA to propose three new transmission projects that will collectively facilitate about 1,800 megawatts of new wind generation. We have begun the environmental review process for those projects. With additional borrowing authority provided by the American Recovery and Reinvestment Act of 2009 (ARRA), we are ahead of schedule on the construction of a fourth line – the McNary to John Day 500-kilovolt transmission line that will support 575 megawatts of additional wind generation.

Our proposals for these projects, and the decision to begin construction on the McNary to John Day project, resulted from the completion of our first-in-the-nation 2008 Network Open Season. The Network Open Season is a new commercial approach to manage transmission requests and set priorities for financing and building transmission projects. BPA's first Network Open Season resulted in 6,410 megawatts of transmission service

requests with financial commitments by the customers who asked for the service. Three-quarters of the requested service capacity were for wind generation. Because we were able to clarify commitments to take transmission service, we were able to accommodate more than 20 percent of the requests with existing capacity. We were also able to offer a new Conditional Firm service to provide still more transmission service from the existing capacity of the system. These approaches are significant because they resolved planning and financing barriers that impeded transmission planning for renewable energy development across the Nation. They also allowed us to confirm the most efficient use of our existing system to serve new renewable generation before proposing new construction. We are completing our second Network Open Season and will continue to conduct the process annually.

RELIABILITY



Plant	Nameplate Capacity MW	Date When Actual Gen First Exceeded 1/2 of Current Nameplate Capacity	Cumulative Nameplate Capacity MW
Vansycle	25	10/25/1998	25
Stateline	90	12/18/2001	115
Klondike I	24	1/16/2002	139
Condon	50	6/18/2002	189
Klondike II	76	6/28/2005	265
Hopkins Ridge	157	11/25/2005	422
Leaning Juniper	100	8/10/2006	522
Big Horn	200	10/4/2006	722
White Creek	200	10/5/2007	922
Klondike III	226	10/15/2007	1148
Biglow Canyon	126	11/17/2007	1274
Nine Canyon @ 28%	27	11/26/2007	1301
Goodnoe Hills	96	4/29/2008	1397
Nine Canyon @ 52%	24	5/10/2008	1421
Klondike 3a	75	6/6/2008	1496
Arlington	103	12/7/2008	1599
Willow Creek	72	1/1/2009	1671
Pebble Springs	100	1/27/2009	1771
Hay Canyon	100	2/12/2009	1871
Wheatfield	97	3/22/2009	1968
Tuolumne	137	5/1/2009	2105
Biglow Canyon Phase 2	149	8/6/2009	2254
Windy Point	30	9/21/2009	2284

Figure 2: Growth of Wind Generation Capacity Connected to BPA's Transmission System

The pace of wind development and its concentration in our balancing authority, as shown in Figure 2, was initially surprising to us. Only five years ago, the Northwest Power and Conservation Council (Council), the four-state entity responsible for long-range energy

resource planning in our region, projected that the region could support 6,000 megawatts of wind development by 2025. In response, BPA and the Council convened the Northwest Wind Integration Forum, a regional steering committee and technical work group, to evaluate wind integration issues and develop a Wind Integration Action Plan. The Plan emphasized that wind energy is a renewable resource that can lower the fuel consumption and environmental emissions of other resources, but that wind energy cannot provide reliable electric service on its own. The Plan said that wind generation, with its natural variability and uncertainty, increases the need for flexible resources or dispatchable loads to maintain utility system reliability.

Almost five years after the Council's projection, we now expect we could be asked to connect 6,000 megawatts to our system alone and as soon as within the next four years. Much of that development remains concentrated in areas of Washington and Oregon east of the Columbia River Gorge. We have among the highest penetration in the country of wind generation relative to peak load on our system.

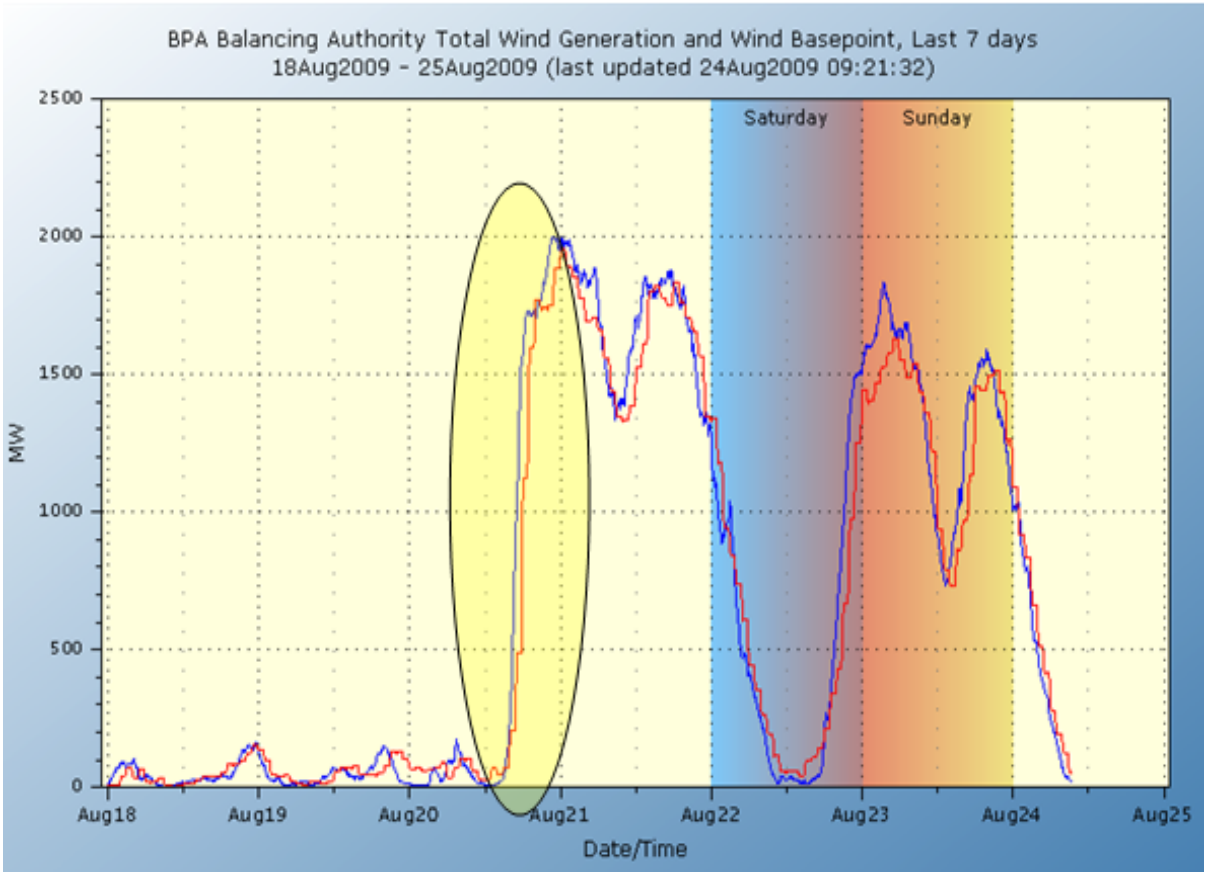


Figure 3: Wind's Variability Requires Resources to Maintain Reliability

The substantial amount of wind on our system has given us significant insight into the challenges of maintaining reliability with a large amount of variable generating resource. The nature of wind generation is, of course, that it increases and decreases depending on the weather. On our system that can mean swings of more than 1,000 megawatts in less

than an hour. We have also found that there is limited correlation between wind generation and system demand, often leading to surpluses of wind generation during off-peak periods. When the wind generation is concentrated as geographically as it is in the Pacific Northwest, it intensifies the magnitudes of its peaks, valleys and ramps, as Figure 3 illustrates. Electric power systems must perfectly balance generation and load in real time. We must dispatch or curtail other generation in very short time frames when actual wind generation varies from scheduled generation. This type of balancing is necessary to maintain electric system reliability.

Balancing variable generation using the flexibility of the existing hydro system has been a major focus for us. To date, we have been able to use our existing hydro assets to manage the variable output of the wind on our system. In essence, we are able to operate the hydroelectric system as a giant storage battery for the variable output of the wind while simultaneously meeting regional power demands consistent with our obligations to protect, mitigate, and enhance fish and wildlife. However, the system has its limits if reliability is to be maintained.

The greater the amount of hydro capacity we must maintain to support the growing wind resource, the more significant are the cost implications for our public power customers, and the greater are the reliability implications for the transmission system. The cost issues stem from the changes in system operations we must make in order to ensure we have sufficient reserve capacity to meet demand if the wind generation forecasted by the wind operators does not closely match actual generation. Until last year, the costs of carrying such reserves were paid by our public power customers. Because the amount of reserve capacity needed to support the burgeoning wind resource also grew, the cost to our public power customers also increased. This concern was exacerbated by the fact that approximately 80 percent of the wind interconnected to our system is sold for delivery to utilities outside of our balancing authority. Consequently, the cost of balancing wind generation is a concern for our public power customers who do not use the resource, yet were covering the cost of integrating it. In 2008, BPA began to charge the wind generators a portion of the cost of holding the reserves needed to manage the variability of the wind generation. When a revised wind integration rate was first proposed for 2009, it represented a significant increase in the cost of integrating wind for the wind developers. This was primarily due to the fact that we now had more wind on the system and it was creating additional costs. In response, BPA and the wind developers held many discussions that resulted in several new initiatives designed to maintain the reliability of the transmission system, yet at a lower cost to the wind generators and their customers.

Establishing a rate for wind integration also sent a price signal for the cost of wind integration services that is encouraging wind operators to more efficiently use those services. This stretches the capability of the existing system, allowing more wind to interconnect to our system.

The decisions in this last rate case have already bought us time relative to the need to secure new generating resources for balancing services. In addition, we are exploring

additional strategies to increase the amount of wind we can reliably integrate into the system. We have agreed with the wind community on a set of initiatives we expect will allow still more wind to connect to our system without building new balancing resources. The initiatives we agreed to pursue hold promise to secure additional breathing room by allowing us to wring more efficiencies from operational improvements, and from collaboration with the wind generators and our neighboring transmission systems.

These initiatives encompass developing new operating protocols for our system, working with our partners in the Western Interconnection to pool resources and increase the availability of balancing services, and working with our customers to improve the accuracy of wind forecasting to allow a larger amount of wind generation to be supported from the existing reserve capacity of the hydrosystem. We think these initiatives can make a significant dent in the amount of balancing reserves needed to support a tripling of the wind generation supported by our system, allowing more wind to be connected to our system, and limiting the costs to the wind generators and their utility customers.

OPERATING PROTOCOLS AND IMPROVED FORECASTING INITIATIVES

BPA has established an internal Wind Integration Team (WIT) to implement new operational and forecasting tools. Earlier this year, BPA met with its stakeholders, including wind developers, to determine which of the WIT initiatives are of the highest priority to the region. BPA reached agreement on pursuing several high-value initiatives with an estimated cost for completion of up to $15 million over two years. The accelerated initiatives include:

***Wind Forecasting**:* In October 2009, BPA completed installing 14 new wind measurement sites. We will share the new wind measurement data in real-time with all interested parties. We expect to develop a complete wind forecasting system by March 2010. By September 2010, we will give BPA dispatchers displays of real-time wind generation and next-hour wind forecasts so dispatchers can better anticipate changes in wind output and adjust generation to make more efficient use of combined wind, hydro, and other available resources.

Dynamic Transfer Limits Study and Pilot Project: We are working with our neighboring transmission systems to develop new methods to determine the transmission available to allow one of our utilities to remotely control and manage a power plant in another utility's transmission system. This is known as dynamic transfer, and such capability would allow us to serve more variable generation than the hydro system could otherwise support. We expect this study to be completed by mid-February 2010. Shortly thereafter, we will launch a test of such capability on a set of Pacific Northwest transmission interconnections to gain experience in the operational technology.

***Wind Generators' Self-Supply of Reserves**:* BPA is also planning to use the results of the Dynamic Transfer Limits Study to allow wind projects to purchase balancing reserves from suppliers other than BPA. This enables wind projects to manage their own costs in acquiring balancing services. BPA, the receiving utility and the appropriate wind project

all must install significant control and communications equipment to make this work. By October 2010, BPA will launch the first pilot project for self-supply of generation imbalance reserves.

***Intra-Hour Scheduling**:* Our current transmission scheduling is based on 60 minute delivery schedules. We are developing tools to allow power schedules to change at the half-hour as well as the hour to let customers sell power from fast changes in wind output. This would help reduce reserve requirements and maintain the transmission system's reliability. Last week, we initiated a pilot project to test such practices.

OPERATING PROTOCOLS

In the power and transmission rate cases for Fiscal Years 2010 and 2011, we worked with wind developers on an operating protocol that allows us to maintain lower levels of reserves while at the same time protecting system reliability. This protocol defines procedures that go into place when we are close to depleting our reserves because of the gap between actual wind generation and what was scheduled. We began implementing the protocol this fall and, in return, the customers' rate for balancing services is lower by nearly a half than we originally proposed. Essentially, the wind customers accepted more risk in return for a lower rate. They have also responded by investing in improving the accuracy of their scheduling. We appreciate the effort they made to help us reach these outcomes.

SMART GRID

We are also a partner in two significant regional smart grid efforts that have recently won funding from the Department of Energy. The first is the $53 million Western Electricity Coordinating Council (WECC) project that will test a large-scale synchrophasor measurement system with smart grid functions. The benefits would include increased transfer capability, better congestion management, and improved efficiency and lower costs for supporting variable renewable generation. The second is the Pacific Northwest Smart Grid Demonstration Project led by the Battelle Memorial Institute. That project received $89 million in ARRA funds from the Department of Energy. It spans five states and includes 12 utilities. The objectives of this demonstration project include validation of new smart grid technologies and businesses, quantifying smart grid costs and benefits, improving transmission system resiliency, and advancing interoperability standards and cyber security requirements for smart grid devices and systems. Both initiatives have the potential to significantly improve the regional transmission system's ability to facilitate variable renewable energy generation.

ADDING NEW CAPACITY

Ultimately, though we will wring all the efficiencies that can be wrung from the existing system, it is quite likely that the region will need to add additional resources to provide balancing services for variable renewable resources. To prepare for that day, we have

begun to explore storage options. From a broad perspective, we are working with the Pacific Northwest National Laboratory on their study of various storage options including pumped storage, compressed air storage, batteries, and flywheels.

At the same time, we are placing a particular emphasis on evaluating pumped storage. Given the hydroelectric profile of our generating resources, pumped storage appears to be particularly attractive to our region. Secretary of Energy Steven Chu emphasized this in his response to a letter written earlier this year by the four Pacific Northwest Governors, saying, "Pumped storage has unique potential in the Pacific Northwest where a higher percentage of wind generation has already been integrated into the region's transmission system than anywhere else in the Nation."

Pumped storage facilities have been in commercial operation for decades. The technology was originally conceived as a means of using low value surplus energy generated during nighttime hours to store water that could then be used to generate more valuable energy during heavy load hours. Systems that rely on large centralized coal and nuclear generation anticipated the need for pumped storage much earlier than hydro-oriented systems. This was because thermal generation was difficult to reduce during periods of low demand and to ramp up quickly to meet the next peak demand. In the WECC area – encompassing 14 Western states plus Alberta and British Columbia, Canada – the thermal dominated systems are located primarily in California and the inland Southwest. That's why the large, existing pumped storage plants in WECC are located in those regions.

The only existing pumped storage facility in the Pacific Northwest is in the state of Washington at Banks Lake, which is part of the Federal Columbia River Power System's (FCRPS) Grand Coulee complex. Its operation is largely dedicated to pumping water from Lake Roosevelt into Banks Lake to meet Bureau of Reclamation irrigation obligations. With the large recent penetration of variable renewable resources such as wind in the WECC area, pumped storage has the potential to be an additional resource that could be used to manage the variable output of wind projects and other renewable resources. BPA is currently exploring the potential for pumped storage in the Pacific Northwest, and expects to have its initial evaluation completed in mid-2010.

CONCLUSION

Mr. Chairman, I appreciate the opportunity to be here with you today and relate our experience in leveraging the reserve capabilities of the Columbia River power system in support of new renewable electric generation. We, our customers, wind developers, and our partner systems in the Western Interconnection have been on a steep learning curve. We will stay focused on the suite of measures I have described and continue our role in meeting the region's demand for new carbon-free resources. I am happy to respond to any questions from the Committee.