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TESTIMONY OF

ELLIOT E. MAINZER, LAWRENCE E. KITCHEN, KIERAN P. CONNOLLY, RAYMOND D. BLIVEN, AND SARAH K. BERMEJO

Witnesses for Bonneville Power Administration

**SUBJECT: OVERVIEW OF WIND INTEGRATION – WITHIN-HOUR BALANCING SERVICE RATE PROPOSAL**

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**Section 1: Introduction and Purpose of Testimony**

*Q. Please state your names and qualifications.*

A. My name is Elliot E. Mainzer, and my qualifications are contained in WP-10-Q-BPA-40.

A. My name is Lawrence E. Kitchen, and my qualifications are contained in WP-10-Q-BPA-33.

A. My name is Kieran P. Connolly, and my qualifications are contained in WP-10-Q-BPA-12.

A. My name is Raymond D. Bliven, and my qualifications are contained in WP-10-Q-BPA-06.

A. My name is Sarah K. Bermejo, and my qualifications are contained in WP-10-Q-BPA-65.

*Q. What is the purpose of your testimony?*

A. The purpose of our testimony is to provide an overview of BPA's generation inputs cost allocation and discuss particular policy issues associated with the proposed cost allocation for Wind Integration – Within-Hour Balancing Service (Wind Balancing).

*Q. How is your testimony organized?*

A. Our testimony contains four sections including this introduction. In section 2 we provide background information and discuss our general policy regarding generation inputs. Section 3 details the effects that wind generation is having on the Federal Columbia River

Power System (FCRPS). Section 4 discusses some alternatives to the rate treatment of reserves for wind balancing compared to the Initial Proposal.

**Section 2: Background And General Policy Regarding Generation Inputs**

*Q. Please describe generation inputs and explain why costs allocated to generation inputs are assigned to transmission rates.*

A. Generation inputs are the necessary use of generation resources to provide the Ancillary Services, control area services, and other generation uses that support reliable operation of the electrical system. These necessary uses of the generating resources of the FCRPS are allocated their proportionate share of the annual costs of the power resources. The costs are allocated in a manner that reflects their proportionate use of the FCRPS available capacity. They are also allocated additional variable costs that are incurred to operate the FCRPS so as to provide Ancillary and control area services.

*Q. Please summarize the basic technical principles underlying generation inputs for Ancillary and control area services.*

A. First, one must be familiar with the term Balancing Authority Area (BAA) (formerly known as control area). The electrical grid in North America is divided into various BAAs. Each Balancing Authority is responsible for ensuring that, in its area, electrical generation (power production) equals electrical load (power consumption). This is known as balancing generation with load, or maintaining load and resource balance. Usually a transmission provider is the Balancing Authority.

It is difficult to predict exactly how much power the load (the ultimate consumers of power) will need at any given moment in time. Nevertheless, if at any time load is greater than generation, or generation is greater than load, then the reliability of the transmission and power system will quickly be compromised. Accordingly, the

Balancing Authority must keep generation and load in balance to maintain reliable electrical service. All Balancing Authorities must maintain reliability within their BAA.

*Q. Please explain how this applies to BPA.*

A. BPA is divided into two organizations, known as Transmission Services (TS) and Power Services (PS). BPA is a Balancing Authority, and TS is responsible for ensuring that all BAA responsibilities are met. As such, TS has the crucial responsibility to maintain reliability for BPA's BAA by keeping electrical generation in balance with electrical load. To do so, TS requires generation services supplied by PS.

*Q. What happens if BPA does not maintain this balance?*

A. When generation and load are out of balance the frequency of the electrical grid will change, it will increase if there is too much generation and decrease if there is too little generation. Other BAAs will be forced to make up some of this difference by frequency response so there is an associated increase on loading of transmission lines between BAAs. In extreme cases, the electric grid may become unstable which could cause a number of problems, including variations in electrical frequency that can damage electronic equipment or cause generators to trip offline (that is, stop producing power for the electrical grid). Also, depending on severity, an imbalance of generation and load can force the Balancing Authority to suspend electrical service to certain loads or lead to cascading blackouts, in which major portions of the electrical grid are automatically disconnected.

*Q. How does BPA maintain balance between generation and load?*

A. To maintain balance, TS must have access to reserve generation; that is, generators that are standing by ready to increase or decrease their output when called on. When load increases or decreases relative to a pre-arranged schedule, TS must be able to call on

generators to produce either more or less power, depending on whether the load has increased or decreased.

*Q. Please explain what the pre-arranged schedule is.*

A. To plan for the varying needs of many users of the electrical grid, Balancing Authorities require transmission customers to submit on a daily basis hourly schedules of their planned use of the transmission system. These schedules show how much energy the entity expects its generators to place on the transmission system each hour to meet the loads the entity expects for that hour. Entities submit the schedules on the morning before the day of expected use (known as the day-ahead scheduling window) and update them shortly before the start of each hour. BPA requires schedules to be balanced for each hour, that is, the power put on to the system must equal the power taken off the system.

*Q. Please describe the distinction between energy and capacity in the context of generation inputs.*

A. Energy is the actual use of electricity to do work and is commonly measured in megawatt hours (MWh) (the amount of power delivered multiplied by the amount of time that the amount of power is delivered). In the context of generation inputs, energy is the amount of electricity in MWh used by a load or provided by an entity's generation in excess of its load.

Capacity is the maximum amount of output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, adjusted for ambient conditions. In the context of generation inputs, capacity is the maximum amount of output that generation may be required to increase or decrease during any given period.

For example, the difference between energy and capacity is seen in the provision of energy imbalance. The energy component is recovered through the difference in

schedule, and the actual provision of energy through the Energy Imbalance Ancillary Service charge, but this energy charge does not account for the cost of the capacity associated with the within-hour balancing reserve that must be maintained each hour in order for the FCRPS to supply this energy, whether this energy is actually supplied or not.

*Q. What is reserve capacity, and how is it used as a generation input?*

A. The Balancing Authority determines the generation capacity that it may need to balance generation and load throughout time. That generation capacity is set aside, or reserved, so that it is available if needed. The balance between generation and load may be changed due to more or less load than expected, more or less generation than expected, or the loss of the expected ability to move planned generation to load. The Balancing Authority has strict parameters that it is expected to operate within based on the composition of the generation and load in the BAA and the reliability of its transmission system. Based on these parameters, the Balancing Authority is required to have generation capacity that it can call upon to either increase or decrease within specific time windows. These time windows range from seconds up to 10 minutes. The time windows define the types of generation inputs the Balancing Authority requires.

*Q. Please describe the various generation inputs used to balance generation and load.*

A. The generation inputs for Ancillary and control area services used to balance between generation and load include Regulating Reserve, Within-Hour Wind Balancing Reserve (Wind Balancing Reserve), and Operating Reserve. These generation inputs are provided through within-hour balancing reserves. The within-hour balancing reserves are either incremental (*inc*) or decremental (*dec*) reserves. *Inc* reserves are provided from generators that can increase generation when loads increase or other generation decreases. *Dec* reserves are provided from generators that can reduce generation when

loads decrease or other generators increase. *Inc* reserves are either spinning or supplemental reserves. Spinning reserves are unloaded generating capacity that is synchronized to the power system and can be increased on very short notice. Supplemental reserves are generating capacity that is not spinning, but that can be brought online, synchronized, and capable of serving load on a sustained basis within 10 minutes. *Dec* reserves are spinning reserves, because generation can be reduced only at units that are already producing energy.

*Q. Does PS provide other within-hour balancing reserves to TS for use by the BPA Balancing Authority?*

A. Yes. PS provides within-hour balancing reserves to TS to follow changes in Federal loads during the hour. These reserves are called Load Following. The costs associated with Load Following Reserve are recovered in BPA's power rates rather than in transmission rates. Load following is sometimes referred to in a broader sense to describe all following reserves, including the following reserves needed to support generation. For purposes of understanding the various generation inputs described in this Initial Proposal, "Load Following Reserve" is the following reserve needed to follow changes in Federal loads, and "following reserve" is used to refer to the component of within-hour balancing reserves that is used to follow changes in both loads and generators.

*Q. Please describe the various components of within-hour balancing reserves.*

A. Within-hour balancing reserves are comprised of regulating reserve (which compensate for moment-to-moment variances in generation and load), following reserve (which compensate for larger variances that occur over longer time periods during the hour), and imbalance reserve (which compensate for differences between the load's or generator's schedule and the actual load or generation during an hour). As a convention for purposes

of understanding whether we are referring to one of these components or the generation input derived from the component(s), we have capitalized all the specific generation inputs and related services provided by TS, and not capitalized the component reserves.

*Q. Please explain how you propose to allocate costs to generation inputs for the use of within-hour balancing reserves.*

A. BPA uses three types of within-hour balancing reserves. Within-hour balancing reserves are provided by regulating reserves, following reserves, and imbalance reserves. For purposes of allocating costs to Regulating Reserve, Load Following Reserve, and Wind Balancing Reserve, we use the forecast amount of *inc*s for each of these reserves that will be required on average during the rate period. *See* McManus et al., WP-10-BPA-E-23. We also use the forecast average amount of Operating Reserve that will be required in the rate period. *See* Bolden et al., WP-10-E-BPA-26, section 2. We compare these to the forecast average amount of sustained peaking capability certain FCRPS resources can provide consistent with the forecast level of reserve use. *See* Klippstein et al., WP-10-E-BPA-24, section 3. The annual revenue requirement for the set of FCRPS resources that are able to provide these reserves, *see* Lennox et al., WP-10-E-BPA-12, section 3, is then allocated to the various uses. We propose to allocate the revenue requirement on a proportionate basis to the total use of the specific FCRPS resources. We label this proportionate allocation of the revenue requirement as "embedded costs." The embedded costs assigned to Regulating Reserve, Load Following Reserve, and Wind Balancing Reserve differ from the embedded costs assigned to Operating Reserve based on the FCRPS resources capable of providing these different reserve services.

In addition, we have identified variable costs incurred by using the FCRPS to provide within-hour balancing reserves for Regulating Reserve, Load Following, Wind Balancing Reserve, and Operating Reserve. These variable costs are costs that the

FCRPS incurs to change from an operation optimized for power production to a combined operation for power production and the supply of reserves to the Balancing Authority. As explained in more detail in the testimony of Bermejo and Beale, WP-10-E-BPA-25, section 2, these variable costs are the result of: 1) the reduced efficiency (and the resulting decrease in the amount of electric power produced) in the conversion of water into electricity when configuring the operation of the FCRPS to provide reserves; 2) the cost of shifting electric power generation from heavy load hours (HLH) to light load hours (LLH) (and the resulting loss of value of the electric power) when configuring the operation of the FCRPS to provide reserves; and 3) the reduced efficiency in the conversion of water to electricity when within-hour balancing reserves are actually deployed.

*Q. What are the other generation inputs not provided by within-hour balancing reserves?*

A. Other generation inputs are Generation Dropping, Synchronous Condensing, Station Service, and Redispatch Service. Generation Dropping is the obligation to drop (disconnect from the system) large increments of generation virtually instantaneously from a certain region of the transmission system. Synchronous Condensing is the operation of FCRPS generating units in a mode that dynamically absorbs or supplies reactive power, while not producing real power. Station Service is the electric power used by Federal substations and other Federal transmission facilities. Redispatch Service is the intentional increasing or decreasing of Federal generation at the request of TS to relieve congestion in the transmission system. In addition to these generation inputs, a segmentation study identifies the annual cost of U.S. Army Corps of Engineers (COE) and U.S. Bureau of Reclamation (Reclamation) transmission and delivery facilities that would otherwise be included in power revenue requirements.

*Q. Please explain the proposed cost allocation for these other generation inputs.*

A. As explained in more detail in the testimony of Wellschlager et al., WP-10-E-BPA-27, section 2, we are proposing to allocate to generation inputs the estimated cost of the amount of real power consumed when operating FCRPS generators in Synchronous Condense mode and the annual cost of the investment in plant modifications necessary to allow certain FCRPS generators to operate in synchronous condense mode. In addition, we propose to allocate to generation inputs the estimated cost of increased wear and tear on the generating equipment caused by Generation Dropping and the lost electric power production during the additional outages required to replace and overhaul these generators. Also, we asked staff to analyze the energy component associated with providing Energy and Generation Imbalance; staff forecasts zero revenues to be associated with the energy component of providing these services.

As explained in more detail in the testimony of Winner et al., WP-10-E-BPA-28, section 2, we asked staff to forecast the amount of revenue that it expects PS to recover from TS for providing Redispatch Services. In addition, we asked staff to forecast the use of electric power taken directly from the FCRPS for use by TS at transmission substations and other transmission facilities. Also, we asked staff to identify the portion of the revenue requirement for COE and Reclamation included in the FCRPS revenue requirement that is associated with transmission facilities owned by the COE and Reclamation. We propose to assign a portion of these costs to TS reflecting the cost of facilities used for transmission purposes.

*Q. Please explain how TS uses the various generation inputs to supply Ancillary Services, control area services, and other services.*

A. TS offers customers six Ancillary Services: 1) Scheduling, System Control, and Dispatch; 2) Reactive Supply and Voltage Control from Generation Sources Service;

3) Regulation and Frequency Response Service; 4) Energy Imbalance; 5) Operating Reserve–Spinning Reserve Service; and 6) Supplemental Reserve Service. In addition, TS provides five control area services: 1) Regulation and Frequency Response Service, 2) Generation Imbalance Service, 3), Spinning Operating Reserve for interconnected generators, 4) Non-Spinning Operating Reserve for interconnected generators; and 5) Wind Integration–Within-hour Balancing Service (Wind Balancing Service).

TS provides Scheduling, System Control, and Dispatch from its own facilities. Generation inputs are not used to provide this service.

TS provides Reactive Supply and Voltage Control from generators in the BPA BAA, but does not charge transmission customers for this service, so no generation input costs are allocated to TS for providing this service. Synchronous Condensing is used to provide voltage support, but it is a distinct service that only PS supplies to TS. TS does not assign Synchronous Condensing costs to its Ancillary Services rates; rather, it recovers these costs through its transmission rates.

Transmission Services provides Regulation and Frequency Response Service for loads in the BAA from generation inputs supplied by PS. This service is provided entirely from within-hour balancing reserves that are spinning.

TS provides Energy Imbalance Service. PS provides Energy Imbalance generation inputs by providing energy to meet loads that exceed schedules or providing reductions in FCRPS generation when loads are less than schedules. We are not forecasting any revenues or cost allocation, because from an energy perspective providing Energy Imbalance Service has historically been revenue neutral. Wellschlager et al., WP-10-E-BPA-27, section 4. As discussed above, the energy component associated with Energy and Generation Imbalance is distinct from the capacity component needed to allow the system to respond to these deviations from schedule.

TS provides Operating Reserve–Spinning Reserve Services. This service is provided directly by some transmission users from non-Federal generators. The remaining amount is provided by PS from the FCRPS using within-hour balancing reserves that are spinning. PS also provides energy to meet schedules that exceed the actual generation for an hour following a contingency event that requires employing Operating Reserves.

TS provides Operating Reserve–Supplemental Reserve Services. This service is provided directly by some transmission users from non-Federal generators. The remaining amount is provided by PS from the FCRPS using within-hour balancing reserves that are supplemental (capable of being synchronized within 10 minutes). As with Operating Reserve–Spinning Reserve Services, PS also provides energy to meet schedules that exceed the actual generation for an hour following a contingency event that requires employing Operating Reserves.

TS provides Generation Imbalance Service from generation inputs by providing energy to meet schedules that exceed the actual generation for an hour or providing reductions in FCRPS generation when schedules are less than the actual generation for an hour. Similar to Energy Imbalance, TS has limited Generation Imbalance Service to the energy component of deviations between actual generation and generation estimates during an hour. We are forecasting no revenues or cost allocation for this service.

TS also provides Wind Balancing Service from generation inputs supplied by PS. This service is comprised of the three different types of within-hour balancing reserves: regulating reserve, following reserve, and imbalance reserve. The regulating reserve is provided entirely from within-hour balancing reserves that are spinning. The following reserve is provided 50 percent from within-hour balancing reserves that are spinning and

50 percent from within-hour balancing reserves that are not spinning. The imbalance reserve is provided entirely from within-hour balancing reserves that are not spinning.

*Q. Why does the proposed cost allocation for Wind Balancing Reserve, Regulating Reserve, and Operating Reserve include both an embedded cost component and a variable cost component?*

A. Provision of within-hour balancing reserves is a required use of the system. We propose to allocate a share of the revenue requirement of the FCRPS to the use of the system that provides *inc* capability for within-hour balancing reserves proportionate to the other required and firm uses of the system. Failure to allocate a share of the revenue requirement of the FCRPS to the use of the system to provide *inc* capability for within-hour balancing reserves would result in other users of the system paying the costs for this use. Allocating embedded costs to these uses is consistent with the ratemaking principle of cost causation.

We also propose to allocate to generation inputs certain variable energy costs that the system incurs solely due to the operation of the FCRPS to provide within-hour balancing reserves. Providing this within-hour reserve capability requires PS to change the operation of the FCRPS from an optimal power operation to an operation that 1) is less efficient in converting water to electricity and 2) produces electricity at times at which it is less valuable than during optimal power operation.

A significant amount of these variable costs results from utilizing the capability of the FCRPS to provide *dec*s during light load hours. We propose not to allocate any embedded costs to the service of providing *dec*s. A portion of these variable costs is the result of utilizing the capability of the FCRPS to provide additional *inc*s during HLH. All of the allocated variable costs are estimates of actual operational costs that are not included in the revenue requirement.

*Q. If BPA was not required to provide this within-hour reserve capability, how would these variable costs be recovered?*

A. If BPA were not required to provide the within-hour balancing reserves, BPA would not incur the variable costs of these generation inputs. Rather, power production would be optimized, and BPA's revenues would be increased by selling the additional amounts of power into the market. In addition, BPA would sell the portion of its power that is shifted from HLH to LLH as a result of the provision of within-hour balancing reserves during the higher-value HLH period.

**Section 3: The Variability Of Wind Generation**

*Q. Please briefly describe the trend of wind development in recent years in the BPA BAA.*

A. BPA has experienced extensive growth in wind generation in its BAA. In 2007, BPA and the Northwest Power and Conservation Council outlined steps to integrate up to 6,000 MW of wind in the Northwest region by the early 2020s. *See* Northwest Wind Integration Action Plan (2007), available at http://www.nwcouncil.org/energy/wind/library/2007-1.pdf. The authors of the plan expected about 3,000 MW of that wind generation to be located in the BPA BAA. However, the amount of wind generation in the BPA BAA has grown more rapidly than expected. Between 2004 and 2008, the amount of wind generation in the BPA BAA roughly doubled every year. As of the end of calendar year 2008, there is approximately 1,800 MW of wind generation operating in the BPA BAA. By the end of calendar year 2009, it is expected that BPA will have integrated 3,155 MW of wind generation. Study, WP-10-E-BPA-08, Table 2.1. Substantially more than 50 percent of the wind generation in the PNW is being located in the BPA BAA, and developers are building the new wind generators much faster than the plan forecast.

By the end of FY 2011, we forecast approximately 4,500 MW of wind generation to be integrated into the BPA BAA. McManus et al., WP-10-E-BPA-23, section 4.7. As a result of such growth, we expect the BPA BAA will, by the end of 2011, have one of the highest ratios of installed wind (4500 MW to peak load 10,500 MW) in North America. Although the majority of new wind generation is locating within the BPA BAA, most of that wind generation is exported out of the BAA to other utilities for their load service.

*Q. What impacts does the significant increase in wind generation interconnected to the BPA system have on the operations of the FCRPS?*

A. The magnitude of wind generation has led to increasing commitments of the operational flexibility of the FCRPS to address uncertainty associated with wind generation variability and scheduling accuracy. Because the output of wind generation is subject to the variable and uncertain nature of wind speed, wind generators have difficulty predicting how much power they will generate at any given time. Wind speed can change greatly within minutes. Because most of the wind generation in the BPA BAA is located within a geographically confined area, BPA can experience swings in generation of hundreds of megawatts within a single hour. To manage these tremendous swings in wind generation (and accompanying increased variability and uncertainty) and to maintain load and resource balance, BPA must carry an increasing amount of reserve generation.

In addition, the need to retain flexibility to respond to over- and under-generation shifts hydro system fuel supply and generation from HLH into LLH to allow the system to carry the additional *inc* and *dec* reserves. *See* Bermejo and Beale, WP-10-E-BPA-25, section 2. When these reserves are deployed, hydro duty schedulers must account for the resulting adjustment in water flows in the system to maintain hydraulic control, meet

loads over time, meet fish-related and other system operational constraints, and maintain the flexibility to deploy reserves in future hours.

*Q. How does wind generation affect BPA's obligation to maintain load and resource balance?*

A. It is the variable nature of wind generation that affects BPA's ability to maintain load and resource balance. Whenever a generator deviates from its scheduled generation or loads deviate from the average hourly expectation, the BAA must call on FCRPS generation resources to offset differences between schedules and actuals to maintain within-hour load-resource balance in the BAA. BPA's automatic generation control (AGC) system dynamically adjusts the Federal generators based on the differences between scheduled and actual load and generation. The additional variability and uncertainty introduced into the operation by increased amounts of wind increase the demands on the reserve capability and availability of the FCRPS for other uses.

*Q. How has BPA historically addressed the cost of reserves to accommodate wind generation?*

A. Prior to FY 2009, BPA allocated only the costs for the capacity associated with Regulating Reserves and Operating Reserves and did not allocate any costs for the capacity needed to support within-hour balancing of wind generation. In 2008, in the WI-09 rate proceeding, BPA staff proposed a rate for Wind Integration−Within-Hour Balancing Service (Wind Balancing Service), to be effective for FY 2009. BPA proposed to charge the rate to wind generators in the BPA BAA based on nameplate capacity. As increasing amounts of wind generation were integrated into BPA's BAA, the increasing variability and uncertainty of wind generation led to increased costs and lost revenue through the need for additional reserve capacity, the shift of energy generation from HLH to LLH, and reduced system efficiency. The proposed Wind

Balancing Service rate was designed to ensure that these costs were borne by the entities that caused the costs. However, the proposed WI-09 rate did not include an evaluation of the capacity needs associated with providing generation imbalance to wind generators.

BPA and the parties to the WI-09 rate proceeding entered into a settlement of the case. BPA agreed to, among other things, conduct a series of public rate case workshops as part of the WP-10 rate case to develop a methodology for estimating within-hour regulation and following reserve needs to accommodate expected higher levels of wind integration and changing system operations within the BPA BAA. BPA agreed to propose the methodology resulting from such workshops as the basis for estimating the quantity of within-hour reserve needs in the Initial Proposal.

*Q. Please explain any significant changes in the reserves forecasting method from the WI-09 rate case.*

A. The key difference is that in the Initial Proposal, we propose to examine and price the impact of carrying capacity to provide generation imbalance service for within-hour balancing. Historically, generator imbalance service was only an hourly average energy settlement service: BPA would charge or credit a generator for the generator's monthly deviation between scheduled energy and delivered energy. A penalty was charged for deviations outside of a minimal band. Because the amount of wind on the system was much smaller than today and deviations were relatively small, the service placed little strain on FCRPS reserve capacity. With the recent influx of wind generation on the BPA system, however, generation imbalances have significantly increased. For the WI-09 rate case, 268 MW of reserve generation capacity was forecast for the end of FY 2009 for the within-hour variations in wind output. However, this forecast evaluated only the regulating reserve and following reserve components of providing within-hour balancing reserves and not the imbalance reserve component of providing within-hour balancing

reserves. We currently estimate the potential for up to 1,312 MW of *inc* reserve capacity and 1785 MW of *dec* reserve capacity by the end of FY 2011, a more than six-fold increase. McManus et al., WP-10-E-BPA-23, section 4.7. The increase in reserve need is caused not only by the increase in wind capacity but also by a change in the generation reserve forecast methodology to reflect the impacts of generation imbalance (inaccurate estimates or schedules) and to more accurately allocate the reserves needed between load and wind.

*Q. When BPA is planning its daily operation of the hydro system, what assumption must BPA make regarding the behavior of wind generators?*

A. When BPA is planning the operation of the hydro system, BPA plans both to meet an expected operation and to hold sufficient flexibility to respond to a number of uncertainties, including the output and scheduling behavior of wind generators. BPA assumes that wind generators will attempt to schedule each hour of generation accurately. BPA also assumes that the uncertainties associated with wind generation output and wind generation forecasting will result in generation that does not conform to the schedule. BPA plans system operations to allow for *inc* and *dec* capability to absorb the differences between scheduled and actual generation. BPA does not assume any net energy storage into the FCRPS or withdrawal from the FCRPS based on the wind generators' behavior.

## Section 4: Alternatives To The Wind Balancing Rate Proposal

*Q. What role does scheduling accuracy play in the cost allocation proposal for the Wind Balancing Reserves?*

A. The scheduling accuracy of wind generators in BPA's BAA is a critical assumption in the Generation Reserves Forecast. McManus et al., WP-10-E-BPA-23, section 4.4. If scheduling accuracy for wind generation is low, BPA must increase the reserve

requirement to provide Wind Balancing Services, which results in greater cost. Conversely, the higher the scheduling accuracy, the lower the resulting reserves requirement, which results in lower costs. The Generation Reserve Forecast shows that the historical scheduling behavior of the existing wind generators in BPA's BAA is consistent with the use of a two-hour persistence forecasting model. *Id*.

*Q. What are persistence forecasting models, and how are they used in the Generation Reserve Forecast?*

A. Persistence models are relatively simple forecasting tools that base the forecast of a future event (e.g., wind generator output for the next hour) on the level of an observed value from a current or previous time period. Under a two-hour persistence forecast, generation schedules submitted by wind generators are consistent with the output of the generators two hours prior to the scheduling hour. *Id*.

*Q. What other persistence model forecasting assumptions did staff evaluate for the Initial Proposal?*

A. BPA staff developed reserve forecasts using 30-minute, 45-minute, and 60-minute persistence forecast accuracies for comparison to the two-hour persistence forecast accuracy. McManus et al., WP-10-E-BPA-23, section 5.

*Q. What is the estimated impact of these other persistence forecast accuracies on the cost allocation for Wind Balancing Service?*

A. Tighter persistence forecasting accuracies would result in lower overall reserve requirements. *Id*. As the required reserves decrease, the embedded and variable costs that are proposed to be allocated to generation inputs are also reduced. *See* Klippstein et al., WP-10-E-BPA-24, section 4, and Bermejo and Beale, WP-10-E-BPA-25, section 5.

*Q. How would a change in the assumed persistence scheduling accuracy impact BPA's other rates?*

A. The Initial Proposal is based on the assumption of a two-hour persistence forecast accuracy. Tighter persistence forecast accuracy would result in PS providing fewer reserves to balance wind. It would also result in lower forecast revenues from generation inputs and a reduced revenue credit in the revenue requirement. Finally, it would also increase the amount of secondary energy available, resulting in a corresponding increase in secondary revenue projections. Our proposal has included the lower secondary energy revenues as part of the variable cost of Wind Balancing Services in the generation inputs revenue credit. Therefore, tighter persistence forecast accuracy would reduce the generation inputs revenue credit, although part of the reduction would be offset by an increase in the secondary energy revenue credit.

*Q. Are there any ongoing efforts that might change BPA's assumptions regarding the persistence forecast accuracy that will be used in the Final Proposal?*

A. Yes. The selection of the appropriate persistence forecast accuracy will depend on the level of reserves that is likely to be necessary during the FY 2010-2011 rate period. We begin with the premise that the amount of needed reserves is based on expected scheduling accuracy. And as noted above, historical data suggest that the Administrator should assume a two-hour persistence accuracy. This will not be the case, however, if a mechanism is put in place to delink the reserve requirement from scheduling accuracy, such as the mechanism being developed by the Wind Integration Team (WIT), discussed below.

*Q. What is the WIT?*

A. As part of the WI-09 Settlement, BPA established WIT as a cross-agency team to explore technical solutions to address the challenge of balancing loads and resources to preserve

system reliability while accommodating the increasing magnitude of variability in wind generation. *See* McManus et al., WP-10-E-BPA-23, section 5.

*Q. What is the mechanism WIT is developing to delink the reserve requirement from scheduling accuracy?*

A. In recent months, WIT has engaged stakeholders regarding ways to incentivize more accurate wind forecasting and to limit the amount of generation capacity that is reserved to balance wind generation. BPA also has engaged stakeholders in discussions about how to ensure system reliability in the face of ever-increasing amounts of wind generation seeking interconnection to the BPA system. To preserve reliability of the BPA system, WIT has worked with stakeholders to develop a set of reliability and operational requirements that would apply to wind generators within BPA's BAA. Through these requirements, BPA aims to meet the multiple objectives of ensuring reliability, improving wind scheduling accuracy, and limiting the amount of FCRPS capacity reserved for wind balancing.

The WIT-established requirements would enable BPA to instruct wind generators to reduce output when BPA is close to exhausting the total amount of *dec* reserves for balancing. In addition, BPA would be able to revise wind transmission schedules within the hour when actual wind generation is far below schedule and BPA is close to exhausting total *inc* reserves. If BPA adopts these requirements, it would need a smaller amount of reserves for wind balancing and could lower proposed rates accordingly.

*Q. How would these requirements affect the amount of within-hour balancing reserves BPA needs to maintain for providing Wind Balancing Service?*

A. Under the WIT reliability and operational requirements discussed above, BPA will have the ability to limit the amount of balancing reserves needed to maintain load-resource balance. Correspondingly, the new requirements would allow BPA to carry a lower

amount of reserves than what might otherwise be needed to manage the variability of wind generation. For example, the WIT reliability and operational requirements could be used to change the assumed persistence forecast accuracy in the generation reserves forecasting methodology from two-hour persistence accuracy to 30-minute persistence accuracy. This would reduce the amount of required *inc* reserve from 1,042 MW to 541 MW. McManus et al., WP-10-E-BPA-23, section 5.

Without the WIT reliability and operational requirements, it has not been demonstrated that wind generators have the capability to schedule to this level of accuracy. As a result, if BPA carries the smaller quantity of reserves based on a lesser persistence forecast accuracy without the WIT requirements in place, BPA would either face unreliable operating conditions or need to increase the amount of reserved capacity above the amount assumed in ratesetting. The former condition would place BPA outside of WECC reliability operating criteria, and the latter would result in other users of the system paying the costs that the wind generators should be paying. However, with the reliability and operational requirements being established through WIT, BPA would be able to reliably depend on the lower amount of reserves established under a tighter persistence forecast accuracy and preserve reliable operations.

*Q. What is the current status of the new reliability and operational requirements that would allow the Administrator to assume a tighter persistence accuracy in the Generation Reserve Forecast?*

A. WIT has released a final version of its operating approach to maintain system reliability for wind generators within the BPA BAA. Based on the response from stakeholders and the expectation that BPA will be able to implement the WIT initiatives before the beginning of the FY 2010-2011 rate period, we expect that the Administrator will select the persistence forecast accuracy that will be used in establishing the Final Proposal.

*Q. Are there technical upgrades needed to implement these new requirements?*

A. Yes. By October 1, 2009, BPA will have to make a number of changes to its AGC system to implement the new requirements, including development of the internal infrastructure to coordinate transmission and generation operations. In addition, all wind generators will have to ensure that the necessary communication infrastructure to receive and respond to dispatch signals from BPA is in place by October 1, 2009.

*Q. Why does BPA require the technical upgrades by October 1, 2009?*

A. The proposed new wind integration rate becomes effective October 1, 2009. Accordingly, the amount of reserves to balance wind must be established and technical upgrades must be in place before the rate period begins.

*Q. If the WIT reliability and operating requirements are not implemented or BPA is unable to complete its technical upgrades by October 1, 2009, should the Administrator consider adopting an alternative to two-hour persistence scheduling accuracy?*

A. The successful implementation of BPA's reliability and operational requirements is a necessary pre-condition to BPA's adoption of an alternative persistence scheduling accuracy (e.g., a 30-minute, 45-minute, or 60-minute persistence forecasting assumption). In addition, if all wind generators are not operating under the same reliability and operational requirements, it will be unfeasible for BPA to adopt an alternative persistence scheduling accuracy.

If, at the time the Administrator is making decisions for the Final Proposal, it appears that BPA will be implementing the reliability and operational requirement, but the necessary technical upgrades will not be in place by October 1, 2009, we would propose that the Administrator consider alternatives based on the likelihood that the requisite technical upgrades described above may be in place soon after October 1, 2009.

*Q. If the persistence forecast accuracy assumption is changed for the Final Proposal, would this cause power rates to increase from Initial Proposal levels?*

A. Not necessarily. Although the Administrator has yet to decide which persistence forecast accuracy will be used in the Final Proposal, BPA staff has assumed that it is likely that he will choose a tighter persistence forecast accuracy. Therefore, we have included an *ad hoc* adjustment to the generation inputs revenue credit used to determine the Initial Proposal power rates. The *ad hoc* adjustment reduces the generation inputs to an amount that is the average of the 45-minute and 30-minute persistence forecast accuracies. As explained in the testimony of Bliven and Lefler, WP-10-E-BPA-10, this *ad hoc* adjustment is a temporary assumption that will be removed for the Final Proposal. The Final Proposal will use the persistence forecast accuracy selected by the Administrator.

*Q. Has BPA considered obtaining third-party supplies of generation inputs to provide reserved capacity to balance wind?*

A. Yes. BPA submitted a request for information in August 2008 seeking additional sources of generation inputs for load following and regulation to augment generation inputs provided by the FCRPS. This is one of several steps BPA is taking to facilitate the integration of large amounts of wind generation into BPA's BAA at the lowest possible cost. BPA is proposing to proceed with this effort as a pilot program aimed at developing, testing, and evaluating third-party supply generation inputs to support incremental wind integration in the BPA BAA.

*Q. How does BPA's effort to obtain third-party supplies of generation inputs affect the balancing reserves needed to meet increasing wind integration in the rate period?*

A. Because BPA is proposing to acquire only a small amount of third-party supply of generation inputs through a pilot program, we have assumed that the third-party supply under that program will not affect the amount of reserves the FCRPS must provide during

the rate period to balance wind. TS is proposing to increase its program spending levels by including in its general revenue requirement $5 million each year for a total of $10 million to fund the pilot program over the rate period. The decision to increase the program spending forecast will be discussed outside of this rate proceeding in the Integrated Program Review process scheduled to begin in March 2009. Homenick *et al*., TR-10-E-BPA-06. A significant portion of the budget for the pilot program will be used to set up systems for integrating third-party resources into BPA's AGC system. Thus, it is premature to forecast third-party-supplied generation inputs in a quantity that would materially affect the amount of FCRPS capacity reserved for generation inputs.

*Q. Are there any other aspects of the generation inputs proposal that are likely to change significantly between the Initial and Final Proposals? If so, what is the impact on the cost allocation for Wind Balancing Service, and what is the impact on the PF rate?*

A. Yes, other aspects are likely to change. The WECC has proposed to change Operating Reserve requirements from 5 percent of hydro generation plus 7 percent of thermal generation to 3 percent of all generation and 3 percent of load. This proposal has been approved by the NERC board of directors and will be before the Federal Energy Regulatory Commission (Commission) for its approval. Should the Commission approve the proposal, TS would change its Operating Reserve requirements to conform to the standard. This would reduce the amount of generation inputs that TS purchases from PS. We expect approval by the Commission before the Final Proposal. The effects of such change are described in the testimony of Bolden et al., WP-10-E-BPA-26, section 4.

*Q. Does this conclude your testimony?*

A. Yes.