INDEX

TESTIMONY OF

ELLIOT E. MAINZER, LAWRENCE E. KITCHEN, and KIERAN P. CONNOLLY

Witnesses for Bonneville Power Administration

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

Page

This page intentionally left blank.

TESTIMONY OF

ELLIOT E. MAINZER, LAWRENCE E. KITCHEN, and KIERAN P. CONNOLLY

Witnesses for Bonneville Power Administration

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

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 WI-09-Q-BPA-09.

A. My name is Lawrence E. Kitchen and my qualifications are contained in WI-09-Q-BPA-08.

A. My name is Kieran P. Connolly and my qualifications are contained in WI-09-Q-BPA-03.

Q. What is the purpose of your testimony?

A. The purpose of our testimony is to provide an overview of BPA's Wind Integration - Within-Hour Balancing Service (Wind Integration) rate proposal.

Q. How is your testimony organized?

A. Our testimony is divided into five sections, including this introductory section. Section 2 discusses the background behind the proposed Wind Integration – Within-Hour Balancing Service rate and the reliability concerns that underlie the proposal. Section 3 explains how the variable nature of wind generation places costs on the power system. Section 4 describes the appropriate allocation of the costs. Section 5 discusses future wind integration rates.

Section 2: Background and Reliability

Q. Please provide a brief, general summary of BPA's proposal.

A. In this rate case, BPA proposes to adopt a rate for Wind Integration − Within-Hour Balancing Service to be effective for Fiscal Year (FY) 2009 (October 2008 – September 2009). This rate will be charged to wind generators in the BPA Balancing Authority Area based on their nameplate capacity. As increasing amounts of wind generation have integrated into BPA's transmission system, the variability and uncertainty of wind generation have led to increased costs through the need for additional reserve capacity, the shift of energy generation from heavy load hours to light load hours, and reduced system efficiency. The proposed Wind Integration − Within-Hour Balancing Service rate will ensure that these costs are borne by the parties that cause the costs.

Q. Please summarize the basic technical principles underlying the proposed rate.

First one must be familiar with the term Balancing Authority Area (formerly known as Control Area). The electrical grid in North America is divided into various Balancing Authority Areas. 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/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 time. Nevertheless, if in any minute load is greater than generation, or generation is greater than load, the reliability of the power system will be compromised. Accordingly, the Balancing Authority must keep generation and load in balance to maintain reliable electrical service.

Q. Please explain how this applies to BPA.

A. All Balancing Authorities must maintain reliability within their Balancing Authority Area. BPA is divided into two organizations, known as Transmission Services and Power Services. BPA is a Balancing Authority, and the Transmission Services organization is responsible for assuring that Balancing Authority responsibilities are met.

As such BPA Transmission Services has a crucial responsibility to maintain reliability for BPA's Balancing Authority Area by keeping electrical generation in balance with electrical load.

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

A. When generation and load are out of balance the electrical grid becomes unstable and a number of problems can occur, 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, BPA's Transmission Services organization 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, Transmission Services 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 the many users of the electrical grid, Balancing Authorities, including BPA's Transmission Services organization, require transmission customers to submit daily 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, and the loads the entity expects to serve each 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.

These schedules are fixed for the upcoming hour even though loads and generation will fluctuate throughout the hour. To maintain continuous balance between load and generation, the Balancing Authority must have access to reserve generating capacity to address the fluctuations that occur within the hour.

Q. Are there different types of reserve generating capacity that the Balancing Authority must carry?

A. Yes. Within-hour balancing requirements are comprised of two different reserve requirement services that provide balancing for two different time periods within the hour: regulation service (which compensates for moment-to-moment variances between generation and load) and following reserves (which compensates for larger variances that occur over longer time periods, between five and 60 minutes). *See* McManus and Enyeart, WI-09-E-BPA-02 (discussing regulation and following in more detail).

Q. Please explain what types of resources provide these two types of reserves.

A. BPA's system consists primarily of hydroelectric generators, so BPA uses these generators for its short time frame regulating reserves needs *and* for its longer time frame following reserves needs. BPA does not have the same type of generators that most utilities use (thermal generators such as combustion turbines) to manage the longer time frame. Because hydroelectric generators respond more quickly than thermal generators, a utility would normally use hydroelectric generators only as regulating reserves; that is, to manage short time frame variations. Because BPA's system consists primarily of hydroelectric generators, however, BPA must use them for both time frames. BPA has identified and assigned different costs for its regulating reserves for the different time frames for this proposed wind integration rate.

Q. Please recap how these reserves are used for maintaining a reliable Balancing Authority Area.

A. Across both the regulation and following time frames, when load increases or generation decreases in the Balancing Authority Area, Transmission Services must be able to call on extra generation within the Balancing Authority Area to match those changes. Conversely, when load decreases or generation increases in the Balancing Authority Area, Transmission Services must be able to direct generators in the Balancing Authority Area to reduce output. Ultimately, regulating reserves and following reserves are required to balance against unanticipated within-hour changes from scheduled amounts of energy and load. As will be discussed below in Section 3, both types of reserves are used to provide the proposed Wind Integration – Within-Hour Balancing Service that is necessary to compensate for the inherent variability of wind generators.

Q. How does BPA access reserve generation (both regulating and following reserves) to maintain Balancing Area reliability?

A. BPA Power Services provides the regulating and following reserves to BPA Transmission Services. BPA testimony in this case will sometimes refer to these reserves as the "generation inputs" supplied by the Power Services organization.

Q. Can you briefly describe the costs that BPA incurs to supply the reserve needs of the Transmission Services organization?

A. Yes, there are four categories of costs: embedded cost, energy shift costs, system efficiency losses, and response costs. Embedded costs represent the overall costs of the BPA system (known as the Federal Columbia River Power System) used to provide the reserves. They include amortization and depreciation, interest costs, fish and wildlife expenses, and base level plant operation and maintenance costs that are identified in the revenue requirement for the 2007 Wholesale Power Rate Case. Energy shift costs compensate BPA's Power Services organization for the lost value associated with changes in the timing of energy production. System efficiency losses are costs associated with setting up certain hydro generating units (those in the largest 10 dams in BPA's

system, the "Big 10") in a less-than-optimal way to ensure the units have enough flexibility (the ability to quickly increase or decrease generation) to provide regulating reserves. Response costs are additional incremental costs the Big 10 experience when they are called on to actually supply regulating reserves for the transmission system. For further detail, *see* Bermejo, et al., WI-09-E-BPA-03.

Section 3: The Variability of Wind Generation

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

A. Wind generation increases the uncertainty of the supply of generation in BPA's Balancing Authority Area. The variable and uncertain nature of wind generation was discussed in The Northwest Wind Integration Action Plan (Action Plan), which was released in March 2007 by BPA and other significant entities in the Pacific Northwest electric utility industry. The Action Plan was a collaborative effort to understand and resolve uncertainties surrounding wind power development. The Action Plan concluded that, over varying time spans ranging from minute-to-minute, to hour-to-hour, to day-to-day, wind output is much more variable and uncertain than conventional generating resources, which maintain very steady outputs of generation. The Action Plan also concluded that, because of this variability and uncertainty, wind generation increases the demand for reserves to maintain load/resource balance.

Q. Aren't other types of generating resources variable and uncertain?

A. In comparison to wind generation, the variability of other generating resources is negligible. *See* McManus and Enyeart, WI-09-E-BPA-02, Attachment B. Therefore, to date, BPA has had no need to obtain regulating and following reserves to account for the negligible amount of unscheduled changes that occur with other generators.

Q. Can you be more specific about why wind generation increases demand for reserves?

A. Yes. Wind generation depends on the variable and uncertain nature of wind speed. Therefore, the output of wind generation is quite variable and wind generators have

difficulty maintaining a generation level for the hourly scheduling period. Until recently, with a small amount of wind energy spread across BPA's relatively large Balancing Authority Area, this incremental variability and uncertainty of wind has had a small impact on BPA's reserve requirements.

However, there has been (and continues to be) a vast increase in the amount of wind generation coming on-line in BPA's Balancing Authority Area. Whereas 733 megawatts (MW) of wind generation had been integrated into the BPA Balancing Authority Area at the end of FY 2007, 1,380 MW has been integrated as of December 2007, and BPA expects a total of 2,877 MW to be integrated by the end of FY 2009 (which is the end of the one-year rate period for this proposed Wind Integration rate). Indeed, the Northwest Power and Conservation Council's Fifth Northwest Electric Power and Conservation Plan (under the Northwest Power Act, the Power Council periodically releases reports regarding the region's resources and loads) foresees up to a total of 6,000 MW of wind generation being integrated in the region by 2025.

Q. What is the effect of increasing amounts of wind generation on BPA's need for reserves?

A. The variability caused by wind generation within BPA's Balancing Authority Area has begun to exceed the variability associated with loads. Accordingly, to manage these tremendous increases in wind generation (and accompanying increased variability and uncertainty) BPA must carry an increasing amount of reserve generation to maintain load/resource balance. BPA forecasts that the amount of wind generation in the Balancing Authority Area in FY 2009 requires an average of 203 MW of reserve generation. *See* McManus and Enyeart, WI-09-E-BPA-02.

Q. How has BPA managed the increasing need for reserves to accommodate wind generation?

A. Through fiscal year 2007, BPA Transmission Services procured approximately 150 MW of regulating reserves from Power Services to maintain Balancing Authority reliability.

In the 2008 Transmission Rate Case, BPA recognized that, because of the continued growth of wind in the BPA Balancing Authority Area, Transmission Services would have to procure additional reserves to maintain reliability during the FY 2008-2009 rate period. As a temporary measure, Transmission Services procured an additional 25 MW of regulating reserves from Power Services for FY 2008 and FY 2009 to support wind integration in the BPA Balancing Authority. BPA included this additional expense in the transmission revenue requirement.

In addition, in recognition of the increasing need for reserves, as part of the 2008 Transmission Rate Case Settlement agreement BPA reserved a right to conduct a rate case during the FY 2008-2009 rate period "for the purpose of adopting a rate for generation regulation service and/or generation following service." TR-08-A-01, Appendix A, at 3.

Section 4: Cost Allocation

Q. How has BPA historically allocated the costs of regulating and following reserves?

A. BPA has traditionally billed the cost of *regulating* reserves to all loads in its Balancing Authority Area through Transmission Services' Regulation and Frequency Response rate. BPA has allocated the costs of *following* reserves to BPA preference customer loads through charges embedded in the Priority Firm (PF) power rate. As a result, loads in the BPA Balancing Authority Area have paid for the costs of regulating and following reserves. This has been appropriate because loads, not generation, have historically been the only significant source of within-hour variability in BPA's Balancing Authority Area.

Q. Does the increase in wind generation indicate a need for a new cost allocation approach?

A. Yes, for two reasons. First, BPA is expecting that the majority of wind generation integrated into the BPA Balancing Authority Area in the next two years will be serving load outside of BPA's Balancing Authority Area. Of the 1,380 MW of wind generation

integrated as of December 2007, Power Service estimates that 480 MW is being used within the BPA Balancing Authority Area (355 MW from contracts that Power Services has with wind generators to serve its load, and up to 125 MW used by other entities to serve their loads in the BPA Balancing Authority Area). In addition, BPA does not expect to purchase large amounts of the additional 1,497 MW of wind generation that is expected to come on-line by the end of the FY 2009 rate period. Nor does BPA expect its customers will purchase large amounts of this generation to serve their loads in FY 2009. BPA's customers already have all their loads met through contracts with BPA (to supply Federal power) and other arrangements (to supply power from existing resources other than wind). Therefore BPA expects this wind generation to be serving load outside the BPA Balancing Authority Area. It is inappropriate to charge loads *within* the BPA Balancing Authority Area for the cost of obtaining reserves to address variability that is caused by wind generators serving loads *outside* the Balancing Authority Area.

Second, the mix of resources serving loads in the BPA Balancing Authority Area varies among BPA's customers; some purchase wind generation and others do not. BPA customers that do not purchase wind generation should not pay for the costs of reserves for wind generation that serves other customers.

Q. How does BPA's proposal address these issues?

A. BPA is proposing a Wind Integration – Within-Hour Balancing Service rate under which the costs of the additional reserves that are needed to support the increasing amounts of wind within BPA's Balancing Authority Area will be assessed to the wind generators. *See* Gilman and Jackson, WI-09-E-BPA-04.

The proposed Wind Integration – Within-Hour Balancing Service rate will ensure that BPA recovers the costs that wind generation places on the system. It will also better align cost causation with cost allocation, an important principle of rate design. Further, the proposed rate will inform market participants regarding the costs of integrating wind

into the BPA Balancing Authority Area so that other utilities and resource providers can better understand these costs and respond accordingly.

Q. For the 2009 Fiscal Year, how does BPA propose to address the 25 MW of regulating reserves that were identified in the 2008 Transmission Rate Case?

A. Transmission Services proposes to discount the rate for Regulation and Frequency Response Service to ensure the transmission rates recover the appropriate cost of within-hour balancing for wind. *See* Gilman and Jackson, WI-09-E-BPA-04.

Q. Do BPA's existing rate mechanisms provide a means to appropriately recover the costs of obtaining reserves to address the variability of wind generation?

A. No. As described above, the Regulation and Frequency Response rate is charged to loads in the Balancing Authority Area. That rate recovers the cost of regulating reserves needed to manage the variability in those loads. However, as described above, BPA loads are not the appropriate parties to charge for costs incurred as a result of the variability of wind generation when the majority of the wind generation is not serving them. Further, the Regulation and Frequency Response rate is designed to recover only the costs of moment-to-moment variations in the balance between generation and load. A new rate is needed to recover the costs of reserves needed for integrating wind generation to cover both the short time frame of regulation and the longer time frame of following. *See also*, Gilman and Jackson, WI-09-E-BPA-04.

BPA also has a Generation Imbalance Rate, which is designed to settle only the *energy* component of deviations between actual generation and generation schedules. Energy costs represent only the physical power that is delivered in a given period. BPA's proposed Wind Integration – Within-Hour Balancing Service rate assumes that there is no energy imbalance (that is, that over the course of an hour the amount of energy scheduled will equal the amount of energy generated) and therefore does not cover any costs associated with Generation Imbalance. The proposed Wind Integration – Within-Hour

Balancing Service rate is needed to capture costs of regulating reserves and following reserves. *See also*, Gilman and Jackson, WI-09-E-BPA-04.

Section 5: Future Wind Integration Rates

Q. Does BPA contemplate changes to this Wind Integration rate in the future?

A. As stated above, BPA is proposing a rate for a one-year rate period, FY 2009. As BPA and the industry gain more information and experience about the effects of integrating wind and the use of within-hour balancing service, BPA expects that it will refine and revise the rate in future rate cases.

Q. Does this conclude your testimony?

A. Yes.