ALPERN MYERS STUART LLC
ATTORNEYS AT LAW
14 NORTH SIERRA MADRE STREET, SUITE A
COLORADO SPRINGS, COLORADO 80903-3311

Howard J. Alpern
Kenneth P. Myers
Dan D. Stuart
Lisa Tormoen Hickey
Matthew J. Werner
Virjinia V. Koultchitzka

TELEPHONE (719) 471-7955 Ext. 124
FACSIMILE (719) 630-1794
E-MAIL: lisahickey@coloradolawyers.net

Of Counsel
M. Allen Ziegler, Jr.
John L. Cyboron

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PacifiCorp
Integrated Resource Plan
IRP@PacifiCorp.com

We represent Interwest Energy Alliance to provide comments on the Wind Integration Study to be incorporated in the 2011 Integrated Resource Plan. Interwest Energy Alliance has reviewed and followed the proceedings including public comment and the interaction with Michael Milligan, Ph.D., which was required by *Stipulation and Agreement* dated March 18, 2010, adopted by the Wyoming Public Service Commission in its *Memorandum Opinion, Findings and Order Approving Stipulation* (issued July 29, 2010) entered in Docket No. 20000-352-ER-09 (Record No. 12319) and Docket No. 20000-363-ER-10 (Record No. 12433).

Interwest appreciates PacifiCorp's improvements from the last wind integration study and the public process associated with preparation of the new study. We acknowledge the contributions made by The Brattle Group's work and expertise. However, there remain substantive errors which skew the wind integration costs. Several of those errors have been identified for PacifiCorp during the public process and have not yet been corrected.

A. Regulation and load following reserves overlap, overstating the hour to hour load following costs.
B. The reserve costs are overstated.
C. Wind data is not validated sufficiently. There is substantial data manipulation which has likely slanted the results by over-correlating with existing projects, rather than recognizing the netting brought about by geographic diversity.
D. Transmission availability was not used to balance and reduce costs between the East and the West control areas.

1. Regulation and load following reserves overlap.

First, we note that regulation is based on the difference between each 10 minute wind output and the rolling average of the previous 60 minutes. Load following is based on the difference between current wind output and the value 40 minutes before the start of the hour. However, regulation up and regulation down requirements are each calculated separate from one another, so there is no netting of deviations. This error dramatically overstates the hour to hour load following costs.

Second, the equations on pages 13 and 19 are incorrect. Some data suggests these errors would overstate reserve requirements by a factor of two. The errors in these calculations have been brought to PacifiCorp's attention on several occasions now in various public comments. The calculations would be applicable if the variables in the formula represent standard deviation and if the data followed a normal distribution, but wind errors do not follow normal distribution. Therefore these formulas do not properly assess the regulation up and load following reserve requirements.

Third, a long-term study which assumes one-hour scheduling significantly overstates the reserve requirements. If the operators in the region are moving towards 30-minute scheduling, the reserve requirements should be determined in the same time frames. As scheduling intervals are reduced, reserve amounts are reduced to meet reliability requirements.

Fourth, PacifiCorp acknowledges that the required amount of reserves varies, but they failed to adjust regulation requirements on an hourly basis. The Company calculated reserve requirements monthly instead of annually because of this variation in reserve requirements:

> Analyzing the results on a monthly basis as opposed to grouping all the calculations together annually allowed for the fact that some months' power service actually required less regulation (for example, July and August) than others, . . . [1]

Pages 33 and 34 also show large differences in wind production from month to month and from plant to plant. PacifiCorp recognized that these differences in monthly production result in different reserve requirements.

However, hourly production varies more than monthly production. The Company failed to adjust regulation requirements hourly and therefore it carries excess amounts of regulation when wind is either high or low and requires much less regulation. Regulation requirements should be based on the capacity factor of each wind plant during each hour, with the total regulation requirement being a statistical combination.

Finally, it is not clear what quality of forecasting is currently used in this study. The wind forecast time series should be compared with state of the art forecasts from utilities and regions that are working with higher wind penetrations in order to build on their experiences and which types of forecasts are more effective.

2. *The interhour/system balancing reserve costs are overstated due to reservation of the most expensive types of reserves.*

First, regulation is the most expensive type of reserves, whereas infrequent events (tails events) can be responded to at much lower cost with non-spinning reserves. Curtailing wind or

[1] 2010 Wind Integration Study Draft, August 12, 2010, p. 14.

limiting up ramps can be a much lower cost solution than carrying regulations for infrequent events, but care must be taken not to curtail wind frequently.

Second, Section 3.3.6 "Modeling Gas Plan Utilization" indicates that Current Creek and Gadsby Units 4 through 6 were set as "must run" resources in the wind scenarios but not in the non-wind scenarios. In other words, the modeling uses peaking natural gas generators to regulate rather than having the production cost simulation verify that the correct amount of reserves are held and that the reserves are derived from the lowest cost sources. This process denies the benefit of consistent least-cost modeling. Natural gas plants also have an integration cost which is not assessed to them, and should not be included as part of the wind integration costs.

3. The wind data development was arbitrary and not adequately validated to give reasonable confidence in the results.

First, the wind data, compiled from several sources, appears to be over-correlated with existing projects and does not reflect the variability inherent in modeled wind. Therefore, results based on this data are likely to overstate reserve requirements because the data likely ignores some of the wind diversity and aggregation with load.

PacifiCorp describes the method used to synthesize wind data for new plants and plants with limited data but there are still many questions. It would be helpful if other experts in the field could review the actual data and the formulas so that the analysis can be duplicated.

We note that the Company chose to synthesize data for locations where historic data is partially or completely missing by time-lagging data from a site with a full 3 years of data.

$$Site_t^A = \alpha_0 Site_t^B + \alpha_1 Site_{t-1}^B + \alpha_2 Site_{t-2}^B + \alpha_3 Site_{t-3}^B + \alpha_4 Site_{t-4}^B + \alpha_5 Site_{t-5}^B + \alpha_6 Site_{t-6}^B + \varepsilon$$

For sites with a partial data set they use the partial data set to determine the coefficients for the time lag. For a new site PacifiCorp used two WWSIS sites that are geographically close to the reference site and the new site to develop coefficients and then apply those to the reference site data. WWSIS data is only used to develop coefficients, the time series data is not used. The synchronized relationships between the various wind facilities within the fleet that is based on the weather modeling is lost.

The formula is based on 10 minute data so the time lag is a maximum 1 hour (t-6). It is not clear if the physical locations selected are within 1 hour wind distance from each other. The method also generates results that are physically impossible (negative output and output above the name plate rating of the wind plant). To return the results to the possible they truncate ten minute values.

Using six time-lagged values tends to smooth results so the consultants added back in a sizeable random error term. Section 2.4.2 (Simulation Process) indicates that the Brattle Group iteratively adjusted the simulated data to accomplish a pre-determined result.

With this significant data manipulation built into the process it is not clear if the results represent either individual wind plants or if they represent the actual behavior of the aggregation. It is not clear if the outputs are properly correlated.

Second, it is not clear from the report what the size of each synthesized wind plant is. Ten minute output is calculated based on a time lagged version of another plant with added error, but it is not clear if each new wind plant is of similar size to the source data plant or of the output is also scaled. Linearly scaling up overstates variability.

4. Transmission was not used to combine the East and West balancing areas to provide ACE cost sharing.

PacifiCorp has the opportunity to combine its control areas to save costs. Where it chooses not to do so, PacifiCorp should still take some basic action to avail itself of the resources. This can benefit the system by increased diversity.[2] Until simple low cost steps are taken, the company cannot in good conscience claim the high costs that they simultaneously found in this flawed study are either just or reasonable.

SUMMARY AND PROPOSED RESOLUTION

The wind integration costs in the study have been grossly overstated due to several resolvable technical errors. A critical look at the results and comparison of the results with other studies indicate that further analysis is required. The 2010 analysis includes only 66% of the wind that was in the 2008 study (1,833MW vs. 2,734MW). Inter-hour costs came down ($0.86 vs. $2.45), which is consistent with what comments on the 2008 Study indicated would happen. However, the intra-hour cost rose to 118% of the 2008 Study results ($8.85/MWH wind vs. $7.51/MWH wind). Therefore, the results are not facially logical.

The proposed reserve cost for the 1,833 MW level divided by the reserve capacity yields a reserve capacity cost of $15.36/KW-month[3]. This is extremely high, and should be compared

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[2] For examples, see *Integrating Wind Generation Into the Grid – A Primer*, Black & Veatch, Sept. 2009; http://psc.state.wy.us/htdocs/Dwnload/WindIntegration/BlackVeatchWindIntegrationRptSept9-2009.pdf.

[3] Determined by taking the three-year average cost of reserves at 1,833 MW of wind penetration ($109,512,100/3= $36,504,033) in Table 11 and dividing by the incremental reserve requirement of 198 MW derived from the "Up" reserves in Table 2: $36,504,033 / 198,000 X 12 kW-months = $15.36/kW-month.

to the reserve capacity cost of $14.91 proposed by Puget Sound Energy to FERC which was rejected.[4]

We submit these comments in an effort to allow PacifiCorp to withdraw the draft report and correct the errors before relying on the report for any rate-making or resource planning purposes. These concerns can be addressed with prompt attention to this study without jeopardizing your need to incorporate wind integration analysis into other planning processes. We note that the second consultation with Michael Milligan Ph.D. has not yet occurred, so perhaps further consultation with him and/or other experts in the field could help inform remedies. This consultation can provide some of the technical expertise that an independent technical advisory committee would have provided to support your analysis. We urge you to modify these errors in a manner which is then acknowledged by independent experts in the field prior to finalizing this study.

This response was developed with assistance from Brendan Kirby, P.E., and other experts in the field of wind integration analysis who stand ready to assist you. Interwest reserves the opportunity to comment further related to the finalization or use of the wind integration study at future opportunities, but we anticipate that you will use the expertise which is available to you to correct the errors which have been highlighted through the various public comments.

We sincerely appreciate this opportunity.

Very truly yours,

ALPERN MYERS STUART LLC

By: Lisa Tormoen Hickey

On behalf of Interwest Energy Alliance

[4] See Order Rejecting Proposed Tariff Revisions, Issued August 13, 2010 Puget Sound Energy, Inc., Docket No. ER10-1436-000; 132 FERC § 61, 128.