March 17, 2010

2010 Wind Integration Study
Public Comments on Draft Study Design

On February 26, 2010 a Draft Study Design was sent to public stakeholders for comments with responses due back on March 12, 2010. This document consists of the eight sets of comments received from the following stakeholders:

- Utah Division of Public Utilities
- Utah Association of Energy Users
- Utah Clean Energy
- Western Resource Advocates
- Industrial Customers of Northwest Utilities
- National Renewables Energy Laboratory
- Oregon Public Utility Commission
- Renewables Northwest Project

We appreciate our stakeholders who have provided comments on PacifiCorp's 2010 Wind Integration Study Draft Study Design.

Regards,
PacifiCorp
IRP@PacifiCorp.com

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Utah Division of Public Utilities

State of Utah
Department of Commerce
Division of Public Utilities

FRANCINE GIANI
Executive Director

THAD LEVAR
Deputy Director

PHILIP J. POWLICK
Director, Division of Public Utilities

JON HUNTSMAN Jr.
Governor

GARY HERBERT
Lieutenant Governor

MEMORANDUM

To: Utah Public Service Commission

From: Division of Public Utilities

Philip Powlick, Director
Artie Powell, Manager, Energy Section
Thomas Brill, Technical Consultant
Joni Zenger, Technical Consultant

Subject: In the Matter of the Acknowledgement of PacifiCorp's Integrated Resource Plan, Docket No. 09-2035-01.

Date: March 11, 2010

ISSUE

PacifiCorp (Company) presented a Draft Study Design for its 2010 Wind Integration Study on February 26, 2010. The Division of Public Utilities will submit the following Wind Integration Study comments to both the Company and the Utah Public Service Commission (Commission). These comments are based on a PacifiCorp PowerPoint slideshow: "2011 Integrated Resource Plan: 2010 Wind Integration Study, Draft Study Design, February 26, 2010."

BACKGROUND

Previous to the February 26, 2010 presentation of the Draft Study Design, the Company held a 2010 Wind Integration Study Public Input Meeting, which described the Company's Wind Integration Study process and outlined its schedule. At the Public Input Meeting held on February 16, 2010, which the Division attended by phone conference, the Company indicated that it would provide a "Draft Study Design" to the parties by February 26, 2010. Based on the technical nature of the issues and discussion that occurred at the phone conference, the Division

had anticipated that the Company would provide a document, complete with algebraic expressions, where necessary, detailing each step of the study. The PowerPoint slideshow sent by PacifiCorp falls far short of the Division's expectations. Furthermore, the schedule outlined on page 4 of the Presentation Deck leaves little time for comments on the draft or final study design. For example, the schedule provides only seven working days for the first round of comments. For these reasons, the Division is only able to provide cursory comments at this time. The Division's final comments on the overall design and results will be filed with the Commission when PacifiCorp files a Wind Integration Study in Utah.

COMMENTS ON THE DRAFT STUDY DESIGN

Given the limited nature of the Company's Draft Study Design, the Division makes the following specific comments.

Control Performance Standard II

On page nine, the Company indicates that it will "Apply a CPSII performance-based reliability metric" to establish the appropriate level of reserves. The Control Performance Standard II ("CPSII") uses a 90% (or 90th percentile) criterion to measure performance reliability. However, the Company's Draft Design does not explain or demonstrate that this is an appropriate level of confidence. Indeed, the Division's recollection of the February 26th discussion left this issue open for further research. The Final Study Design needs to provide empirical justification for the level of confidence used to determine reserve requirements. Additionally, the Final Study Design should explain in detail, including algebraic and numeric examples, of how the CPSII metric is applied to determine the reserve requirements. The last bulleted item on page 9 is a good example of where the Draft Study Design should include a mathematical formula, in addition to the narrative description, demonstrating the basis for their calculations.

Hour Ahead Forecast Rules

On page 11, the Company presents the "Hour Ahead Forecast 'Rules.'" On pages 11-12, the Company presents various parameters for the forecast "rules." In order to evaluate intra-hour variability, actual load and wind data are compared to some type of forecast. The Company does

this by looking at the percentage change in load between the forecast hour and two hours prior to the forecast hour in the prior like day and applying the actual observed load from two hours prior to the forecast hour on the forecast day in order to evaluate intra-hour variability It is unclear why two hours was selected in this forecast rule. For the "wind persistence forecast rule" the Company bases the forecast on a measurement 40 minutes prior to the forecast period; why is 40 minutes selected? The fact that Saturday is considered to be like a weekday is also unexplained. The Division's observation is that while Saturday load is typically greater than a Sunday or a holiday, it is noticeably less than a typical weekday. This contributes to the under-forecast in the example on page 12. In the graphical example on page 13 it appears that the 40-minute prior observation is used to fix the forecast for the entire forecast hour. If the 40-minute prior is such a good estimator, why not update the forecast every 10 minutes with the next newly observed 40-minute prior? In the example at least, this would have improved the forecast. It is unclear whether the Company has examined some other simple forecasting techniques, such as exponential smoothing, or moving averages, that could improve the forecast. The Company should provide this documentation.

For the Hourly Like-day Rule, the percentage change between two hours on the like-day is used to estimate or forecast the next hour load on the forecast day. For example, based on the graph on page 12, the percentage difference in load from hour 6 and hour 8 on the like-day is added to the actual load during hour 6 on the forecast day to forecast hour 8. Algebraically, this can be expressed as

$$\hat{L}_{i,fd} = \%\Delta L_{i,ld} + L_{i-2,fd} = \frac{L_{i,ld} - L_{i-2,ld}}{L_{i-2,ld}} + L_{i-2,fd}$$

Where "L" is the actual load, "$\hat{L}$" is the load forecast, and the subscripts represent the hour ("i"), the forecast day ("fd"), and the like-day ("ld"). The hourly load forecast variance is then,

$$S_L^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(L_{i,fd} - \hat{L}_{i,fd}\right)^2$$

1. The Draft Study Design does not explain how the hourly load ("L") is being measured: is it an average, peak or some other measure?
2. There is no justification of why this forecast method is better than other methods. For example, in the previous study filed in Utah's rate case, the hour ahead wind forecast used the average wind as the forecast of the next hour. What other rules might be possible? The Final Study Design needs to address this issue.
3. The like-day needs to be justified. For example, in the graph from page 12, the like-day used to forecast Monday is Saturday. Intuitively, Friday seems a more appropriate "like-day" or maybe even the previous Monday.

The Hourly Persistence Wind Forecast Rule is also defined on page 11: "The observed generation from 40-minutes prior to the forecast hour will be used to establish the hour-head forecast. Algebraically, this can be expressed as,

$$\hat{W}_i = W_{i-1,-40}$$

The hourly wind forecast variance is then,

$$S_W^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(W_i - \hat{W}_i\right)^2$$

1. The method for forecasting the persistence of wind is different here than that used in the previous wind integration study filed in Utah. In the previous case, the Company used the average of the previous hour as the forecast. The Company needs to justify empirically this change.
2. The Company also needs to justify empirically the 40-minute choice. Why not 10, or 20, or 30 etc.?

A final variance is identified on page 14 as "the hourly variance between load forecast net of wind and actual load net of wind":

$$S_Q^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(Q_i - \hat{Q}_i\right)^2$$

$$= \frac{1}{n-1}\sum_{i=1}^{n}\left[\left(L_i - W_i\right) - \left(\hat{L}_i - \hat{W}_i\right)\right]^2$$

$$= S_L^2 + S_W^2 - 2S_{LW}$$

where S_{LW} is the covariance of load and wind. The Final Study Design will need to define:

1. How the distributions are constructed. (The Draft Design on page 14 says "distributions of hourly variance." Is this the distribution of the hourly forecast error?)
2. The exact steps to "statistically estimate the amount of load following reserves."

In general, various calculations and statistical analyses are referred to throughout the PowerPoint slideshow of February 26, 2010. The Company should provide the mathematical formulae and numerical examples to go along with the narrative.

Estimation of Regulation Reserves

On page 15 of the Draft Study Design, the Company talks about the 10-minute variance from forecast. However, the description is not clear. In the previous study filed in Utah, the Company defined "regulate-up" and "regulate-down." Is this what is meant in the Draft Study Design? Additionally, the Final Study Design will need to define:

1. How the distributions are constructed.
2. The exact steps to "statistically estimate the amount of load following reserves."

Sampling and Statistical Methodology

In drafting the design for the study, the Division believes that the Company should consider using wind anemometer data that should be readily available, as well as alternative sampling design such as bootstrapping. The Company should also consider other forecasting techniques, i.e., exponential smoothing or moving averages, in order to improve the forecasts in the study. In addition, the Company needs to justify its selection of the confidence intervals that are used in the study design.

RECOMMENDATION

As previously stated, the Division believes that the proposed time line (to complete the study by August 2), leaves little time for stakeholder review and input, or for the Company to implement any input that is provided before moving to the next phase of the schedule. Going forward the Company must provide all mathematical formulae intact wherever calculations and statistical analyses are referred to, along with a narrative and some numerical examples. Information should be distributed at least three days prior to meetings; otherwise on-the-spot Power point presentations result in a process lacking in stakeholder input. Finally, the Division recognizes the Commission direction for the Company on wind integration cost found in the 2009 rate case Report and Order.[1] In particular, the Commission directed the Company to address all related issues in the next proceeding appropriate for addressing wind integration cost issues and we expect the Company to adhere to this directive as it designs and works to complete the study. The Division has outlined each issue below:

Office of Consumer Services

- The Company needs to revisit and justify the weighting factors its uses to calculate its west side and east side system wind integration costs.
- The Company's current method overstates the amount of wind energy on the west side.
- The Company's GRID output does not model reserves on coal and gas units that provide wind integration services, but the costs included in the test period accounts for those costs. The Company needs to correct the fact the GRID output reports do not match historical data.

UAE

- The Company needs to revisit the weighted average method its uses to calculate its west side and east side system wind integration costs.
- The Company must justify why the Company's self-supplied wind integration costs increased nearly six-fold.
- The Company's method for estimating the inter-hour integration costs needs to be reviewed and substantiated.

[1] Docket No. 09-035-23, Report on Revenue Requirement, Cost of Service, and Spread of Rates, February 18, 2010, p. 50.

- The Company needs to take into account the proper amount of wind resources integrated into BPA area and with BPA's current wind integration charges.
- The Company needs to justify and explain its assumptions regarding Company-owned reserves in its analysis of wind integration costs.
- The Company needs to justify and explain why all inter-hour wind integration occurs through market sales and purchases rather than from its own resources.
- The Company needs to justify the assumption that the Company loses financially on each and every transaction.
- The Company needs to take into account Company-owned reserves in its analysis of wind integration costs and justify why massive amounts of Company-owned generation must be held in reserves for intra-hour deviations in wind generation.
- The Company needs to justify why costs should be incurred for regulating down. Including such costs would mean over-recovery of wind integration costs.

Division

- The method for calculating intra-hour charges is flawed and needs to be revised due to several flaws in the analysis.
- The Company assumes that intra-hour variations, both regulate up and regulate down, follow a normal distribution, when in fact the distribution more closely approximates a Gumbel distribution.
- The Company has not justified its use of a 2 standard deviation in determining the proper level of reserves.
- The Company needs to substantiate the reliability of its estimation of wind integration costs.
- The Company does not evaluate the actual level of reserves that would be carried without the wind resources, but assumes that additional reserves must be added to accommodate wind resources.
- The Company incorrectly assumes that wind resources will always require additional reserves. The Company must substantiate this claim.
- The Company needs to include in its analysis whether reserves carried to cover other uncertainties are sufficient to cover the added uncertainty of wind.

- In its analysis of intra-hour energy deviation, the Company has not taken into account the net impact of all potential variations, such as hydro, customer demand, and fossil generation. The Company's analysis ignores all other sources of intra-hour variability.
- The Company needs to justify its claim that other generation resources must compensate for all changes in wind generation.
- The Company's analysis is based on 10-minute wind data from September 2008 through April 2009, not taking into account any summer data.
- The Company needs to take into account all wind facilities that are expected to begin commercial operations in making its analysis and in its basic assumptions used in the analysis.

The Division appreciates this opportunity to provide some initial comments at this time and hopes that the Company constructively applies our feedback to the study. The Division's final comments on the overall design and results of the study will be filed with the Commission when PacifiCorp files a Wind Integration Study in Utah.

cc: PacifiCorp IRP Mailbox
Dave Taylor, Rocky Mountain Power
Michele Beck, Office of Consumer Services

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Utah Association of Energy Users

PRELIMINARY COMMENTS AND QUESTIONS
OF THE UTAH ASSOCIATION OF ENERGY USERS (UAE)
ON PACIFICORP'S 2010 WIND INTEGRATION STUDY DRAFT DESIGN
(2011 IRP)

March 12, 2010

Introduction.

The Utah Association of Energy Users ("UAE") is submitting to PacifiCorp these preliminary comments, questions and requests for clarification on the 2010 Wind Integration Study Draft Study Design, as proposed by PacifiCorp on February 26, 2010, in the context of the Company's 2011 IRP.

UAE notes that the schedule proposed by the Company provides very limited time for analysis or comments on the draft study design. Thus, these comments and questions should be considered preliminary in nature. UAE reserves the right to submit further comments or questions to the Company and/or to the Commission on the study design, study results and any related issues, if and when UAE determines such comments or questions to be relevant or appropriate.

Intra-Hour Analysis.

It is not clear from the draft study design exactly what costs will be captured in the intra-hour load following analysis and how these costs may apply (or not apply) to potential cost recovery from ratepayers. This latter issue is relevant because PacifiCorp has used the results of its IRP wind integration cost studies in its general rate cases.

The intra-hour load following cost is depicted as being related to an incremental reserve requirement [p. 14]. Further, the Draft indicates that the incremental load following reserves will be "calculated," suggesting that an incremental "amount" of reserves attributable to wind integration will be identified.

- If so, please clarify how this amount of reserves will get valued for ratemaking purposes;

- Please clarify whether the "amount" of incremental reserves will be exported to the rate case and valued therein in the context of the opportunity cost incurred in carrying this amount of incremental reserves;

- If so, please clarify how reserves required for load following "down" incur an opportunity cost, as these reserves are not withheld from economic activity. Our

understanding from the stakeholder meeting held on February 16, 2010, is that the costs incurred with load following down involve certain sub-optimal operating configurations that may arise. This appears to reflect higher operating costs rather than an opportunity cost associated with incremental reserves. Please clarify.

- On pages 17 and 20, the Draft indicates that the "cost of incremental reserves" will be calculated as part of the study. This suggests that both an "amount" of incremental reserves and the "value" of this incremental amount of reserves with be calculated. If so, please clarify the nexus between this calculated value and the net power cost calculated using GRID for ratemaking purposes.

On page 18, the Load Only PaR Simulation is described. Our understanding from the description is that hourly varying wind profiles will be converted to daily flat energy blocks as part of the "Load Only" simulation [p.18] and then "hour to hour" variability in wind profiles will be used in the "Load Net Wind" simulation [p.19]. Please clarify the following:

- As this is an intra-hour analysis, we fail to understand why a <u>daily</u> flat energy block is used in the "Load Only" Simulation. Shouldn't this be an <u>hourly</u> flat energy block (i.e., flat <u>within</u> the hour)?

- Similarly, why does the "Load Net Wind" Simulation provide for "hour to hour" variability relative to the "Load Only" simulation? Wouldn't this measure the incremental reserves required for inter-hour load following rather than intra-hour load following? Wouldn't this approach overestimate the load following reserves required for intra-hour wind integration?

<u>Inter-Hour Analysis</u>.

In its investigation of a production cost simulation approach to estimating inter-hour wind integration approach, we request that the Company consider and address the following issues and concerns:

- The accommodation of increased wind output above forecasted levels can occur through a decrease in balancing purchases as well as an increase in balancing sales.

- The accommodation of decreased wind output below forecasted levels can occur through a decrease in balancing sales as well as an increase in balancing purchases.

- For ratemaking purposes, PacifiCorp already accounts for balancing sales and purchases each hour.

- In modeling the market transactions required to accommodate inter-hour wind integration, the incremental reserves being carried for intra-hour wind integration should be taken into account.

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Utah Clean Energy

UTAH CLEAN ENERGY
We Partner to Build the New Clean Energy Economy

March 16, 2010

Pete Warnken
PacifiCorp
825 NE Multnomah
Portland, OR 97232

Dear Mr. Pete Warnken,

We appreciate PacifiCorp's work on the 2010 Wind Integration Study. As Utah Clean Energy works to advance renewable energy and energy efficiency in Utah and the Western US we have a keen interest in seeing the 2010 Wind Integration Study reflect the best practices in wind integration study methodologies. Please consider the following suggestions on the February 26th Draft Study Design presentation as PacifiCorp continues to investigate wind integration. Our comments focus on the study design process, technical review process, and timeline, as we understand that RNP and National Renewable Energy Laboratory (NREL) have commented on many of the technical aspects of the study design.

Technical Review Committee

As wind integration issues are extremely complex and technical, we feel it is imperative that PacifiCorp utilize a Technical Review Committee with nationally recognized technical experts to assist PacifiCorp with this important study. A Technical Review Committee will ensure a study that utilizes best practices for wind integration analysis and it will enhance the credibility and acceptance of the study results throughout the affected stakeholder communities.

Free technical assistance is available from experts in the field through NREL. NREL has nationally renowned experts, and it is our understanding that NREL has a directive from the Department of Energy (DOE) to assist utility companies with wind integration studies across the United States. We encourage PacifiCorp to seek NREL's participation on a Technical Review Committee.

Additionally, we encourage PacifiCorp to make full use of its membership in UWIG. UWIG can supply professional information on engineering and operational practices that support the appropriate integration of wind power into the electric system while recognizing the needs and requirements of the electric utility. Furthermore, UWIG has developed a Technical Review Committee guide titled "*Technical Review Committee (TRC) Involvement in Studies of Wind Integration into Electric Power Systems*" that could serve as a template for committee participation, http://www.uwig.org/TRCguidelines.htm.

PacifiCorp, their ratepayers, and the public would be well served by incorporating a Technical Review Committee that includes the aforementioned experts in wind energy integration for this important study.

Scoping Documentation

We appreciate PacifiCorp's February 26, 2010 PowerPoint presentation, that outlined the draft study design. However, given the complex nature of the analysis a PowerPoint presentation lacks sufficient depth to fully analyze the proposed study protocol. We would expect that a fully scoped study plan will be available for technical review prior to finalizing the study design.

Study Schedule

While we understand that the timeline was influenced by external stakeholders, Utah Clean Energy is concerned with the limited amount of time devoted to this complex study. If we are to keep this schedule, we suggest that this first abbreviated study be followed by a more in-depth study.

Thank you very much for your efforts on this important analysis and your consideration of our recommendations. If you have any questions, do not hesitate to contact me.

Sincerely,

Sarah Wright

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Western Resource Advocates

WESTERN RESOURCE
ADVOCATES

WRA Comments **March 12, 2010**
PacifiCorp Wind Integration Study Design

WRA would like to thank PacifiCorp for this opportunity to provide input into its Draft Study Design for the Company's 2010 Wind Integration Study. In response to the last public input meeting, we appreciate the Company adding opportunities for public input and commentary, and we value the contribution that this analysis will make to the growing body of research aimed at better understanding the integration of wind energy into the electric grid. These comments contain a mix of recommendations and items we would like to better understand.

Technical Advisor(s)

As indicated on slide 5 of the February 26, 2010, Draft Study Design (Study Design), PacifiCorp is looking to finalize its selection of a technical advisor by the end of March. We agree that outside expertise in areas requiring technical specialty are important, but are concerned about "a" technical advisor. There are some very specific technical expertise that would bring cutting-edge experience, as well as credibility to the Study. In particular, someone with an expertise in wind regimes and modeling wind behavior, a field that has been progressing rapidly, would be extremely useful in this study, and the absence of that kind of input would likely weaken the ultimate result. Such an expert would also know if a statistician's input with regard to issues such as autocorrelation would be valuable.

In addition, an expert in utility cost modeling should be considered. PacifiCorp is extremely well-versed in its power cost models, and those might well be the best tools for the study, but there might also be other, more-common or open protocols that could be used to model PacifiCorp's system for purposes of this study. This expert, working closely with PacifiCorp's team, might be able to provide a model that would preserve the detail of PacifiCorp's model, but would make the results more comparable to other work being done in the field, and more accessible to others who then might want to build upon it.

Finally, for a project such as this, it might make sense to have a technical advisory panel with PacifiCorp's technical staff, researchers from the National Renewable Energy Laboratory (NREL), university faculty in the field, and other technical advisors who could provide oversight and guidance in a variety of areas. It is difficult to envision how a single technical advisor could provide the feedback needed in the myriad of technical issues that will be involved.

Methodology

It is not entirely clear from February's Study Design what methodology the Company will use to establish the technical needs and costs of wind integration on its system, though slide 4 suggests that this has not yet been decided upon. Specifically, many

COLORADO • 2260 Baseline Road, Suite 200 • Boulder, CO 80302 • 303-444-1188 • Fax: 303-786-8054 • E-mail: info@westernresources.org
NEVADA • 204 North Minnesota Street • Carson City, NV 89703 • 775-841-2400 • Fax: 866-223-8365 • E-mail: info@westernresources.org
UTAH • 425 East 100 South • Salt Lake City, UT 84111 • 801-487-9911 • Fax: 801-486-4233 • E-mail: utah@westernresources.org

www.westernresourceadvocates.org

studies rely on a comparison between a base case and comparator case. The material on reserves provided in late February was informative, but suggested that PacifiCorp is looking at reserves as the differentiating result to compare these two cases.

This seems different than approaches taken in some of the other wind integration studies that have been done, and raises a few questions. What is the rationale for choosing this methodology (if it has been chosen), and why does the Company expect this methodology to yield more accurate or useful results? How comparable will the results from this study be to the results of studies that did not use this methodology?

It would be helpful to understand which variables will be held constant (or to forecast) and which will vary in the base and comparator cases. It would also be helpful to know, if reserves are to be used as the determining factor to differentiate between the cases, which reserves the Company plans to look at and what standard it will use for those reserves.

Other Wind Integration Studies

As indicated on slide 5, PacifiCorp has been, and continues to, review other wind integration cost studies. We fully support such a review, and the integration of materials from those studies that would allow PacifiCorp to build upon that work as a foundation from which its study could expand. For those of us involved in the Study Design at a distance, it would be helpful to have a list of the studies reviewed, and what PacifiCorp found to be the salient pieces of information from each study with regard to how the Company would proceed with its own study. While this information may not lend itself to tabular format, for the studies reviewed, the following would be helpful in understanding the decisions that PacifiCorp makes:

- The reference case methodology and comparator case methodology used for each study;
- A break-down of the historical wind data used in each study, such as locations, frequency of sampling, vintage of data, *etc.*;
- The forecasting methodology for future wind generation and load;
- What outside experts were retained, what tasks they were retained for, and, if known, who they were; and
- Any other information that PacifiCorp found pertinent to its own Study Design.

Operation of East and West Balancing Areas

The U.S. Department of Energy and NREL have been working on a Western Wind Integration Study, of which drafts are available and a final report is expected later in the spring or early summer, which demonstrates some of the advantages of control area size for the integration of variable resources. For modeling actual costs and operational impacts for the Company, it might make more sense to model operation of the East and West balancing areas together, to take advantage of the benefit of the greater geographic diversity. This is particularly the case, given that PacifiCorp operates its two control areas as a single system. With regard to slide 20, it should still be possible to differentiate costs between the East and West balancing areas, and both would benefit from lower overall costs.

The Grid Benefit of Storage For Operational Integration of Intermittent Resources

Energy storage technologies, current and developing, can also facilitate grid integration of intermittent resources. PacifiCorp's examination of the costs of wind integration provides an opportunity to look at the operational benefits of energy storage technologies to the grid, and how those benefits can be modeled and planned for in order to facilitate their incorporation.

/s/ Lowrey Brown
Lowrey Brown
Senior Policy Analyst
Western Resource Advocates
2260 Baseline Road, Suite 200
Boulder, CO 80302

/s/ Nancy Kelly
Nancy Kelly
Senior Policy Advisor
Western Resource Advocates
9463 N. Swallow Rd
Pocatello, ID 83201

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Industrial Customers of Northwest Utilities

Davison Van Cleve PC
Attorneys at Law
TEL (503) 241-7242 ● FAX (503) 241-8160 ● mail@dvclaw.com
Suite 400
333 SW Taylor
Portland, OR 97204

March 12, 2010

Via Email

Pete Warnken
Manager, IRP
PacifiCorp
825 NE Multnomah Suite 600,
Portland, Oregon 97235

Re: PacifiCorp Wind Integration Comments
Docket No. LC 47

Dear Mr. Warnken:

The Industrial Customers of Northwest Utilities' ("ICNU") provides these initial comments on PacifiCorp's draft 2010 wind integration study design. PacifiCorp has provided a power point presentation regarding its proposed study design and process, but has not yet provided many of the underlying details or mathematical examples illustrating the algorithms of its yet to be developed new wind integration study. These comments address only the broad aspects of the study design and a few significant issues, but do not address the majority of the concerns ICNU has with PacifiCorp's previous or this new wind integration study. ICNU looks forward to working with PacifiCorp to develop a more accurate and reasonable wind integration study that can be used for both planning and ratemaking purposes.

ICNU recommends that all interested parties be provided copies of the comments submitted by all other stakeholders. The draft study design states that written comments be shared with other stakeholders, except those submitted with a preference to remain confidential. The wind integration study process should include an open exchange of information. If any stakeholder has concerns about commercially sensitive information, then the standard protective order in LC 47 (or a modification of it) should be sufficient.

The proposed study process may not provide interested parties an opportunity to provide meaningful comments and critiques of the Company's study results. The proposed schedule does not appear to provide parties with workpapers and supporting documentation once the draft study is complete, and the parties will have less than two weeks to analyze the study and provide comments. ICNU recommends that the study results be provided to the parties at an earlier date and that all workpapers and supporting documentation be provided simultaneous with the study results.

Little information has been provided regarding a number of critical assumptions and provisions regarding how PacifiCorp plans to integrate its wind resources. One critical aspects of the wind study are the hour ahead forecast rules. The Company should provide a detailed explanation regarding how it plans to quantify the wind variance and apply a performance based reliability metric to establish regulation and load following reserve requirements for load, and load net of wind.

ICNU has concerns regarding the Company's "forecast rules" in its current study and needs additional information to determine whether and how these rules will be revised. The forecast rule appears to be overly simplistic because it may rely upon assuming that observations more than an hour ahead wind generation will be the same as the most recent wind generation. Real time forecasts should be more accurate. A better rule could use the most recent 10 minute observation of wind generation. Any rule implemented should also take into account meteorological forecasts and other forecasting technologies that are being developed by wind generators. If the Company adopts a forecast rule that is overly simplistic, and overstates forecast error, then the wind integration costs will be overstated.

The draft study design proposes to produce distributions of hourly variance from forecast for load alone and again for load net of wind. ICNU proposes that a more logical approach would be to determine if the load and wind are correlated. If they are uncorrelated, then the Company should use the following equation: var (L-W) = var (L) + var (W). Most studies to date have shown little or no correlation between load and wind.

PacifiCorp has proposed to configure the planning and risk production cost simulation model with regulation and load following reserve requirements based only upon load variability. ICNU recommends that the Company first demonstrate that this type of model is adequate for this type of analysis.

The Company should determine, and explain the reason for its decision, whether to calculate wind integration charges on a dollar per kilowatt basis similar to the Bonneville Power Administration, or on a dollars per kilowatt hour basis. ICNU's initial analysis supports using the amount of wind capacity rather than the number of kilowatt hours produced. Using a dollar per MWH based analysis would tend to make more productive sites appears less attractive, which is counter-intuitive. Further, it is possible that sites with lower capacity factors will have more uncertain output and require higher integration costs.

Any modeling by the Company should be able to determine the wind integration costs for specific sites, taking into account the correlation between the proposed and existing sites. For example, two projects side by side will likely have higher wind integration costs than two similar sites that are geographically distant and which have different weather patterns.

PacifiCorp should ensure that its wind integration methodology can be easily utilized in its rate proceedings and integrated resource plans. For example, the methodology needs to be able to account for recent test year forward price curves. Because planning

assumptions are not necessarily appropriate for test year ratemaking, the final study needs to develop an approach that can be tailored to each application and the models used for those applications. ICNU recommends that one approach the Company should investigate is how to utilize the wind integration results in the GRID model. For example, rather than using the wind integration modeling as fixed cost adder, the wind reserve requirement (as is currently modeled for wind contingency reserves) could be an input into GRID. This would automatically vary wind integration requirements on an hourly basis in proportion to the amount of wind forecast.

An additional problem that does not appear to be addressed in the wind integration study design concerns scheduling and commitment related problems that may occur as wind penetration increases. At present, this is apparently not a significant problem, because wind penetration is not that high. PacifiCorp's planning models may need to be revised because these models are generally based on expected average wind profiles. For example, absent seasonal variations, a model may assume a wind farm has a 33% capacity factor, and show that on average 33 MW of a 100 MW farm is producing energy. In actual operation, however, the output of the project may vary dramatically from 0 MW to 100 MW. When wind penetration is low enough, these swings can be more easily accommodated. As the amount of wind capacity increases, however, PacifiCorp might not be able to accommodate the added wind capacity without cycling resources (such as coal plants) which are not typically used for cycling purposes. There also is day ahead uncertainty, which means that decisions to cycle units (or not) may be wrong. While the Company could conceivably sell the excess wind generation, PacifiCorp and other regional wind generators putting that much wind on the market could impact market prices.

Any wind methodology that is used for planning purposes should also address any potential problems associated with relying upon wind generation to meet the needs of the Company's expected average loads. For example, the Company needs to account for the variability of wind generation if PacifiCorp builds 300 MWs of wind generation to than has an average output of 100 MWs to meet 100 MWs of load. The decision to meet average load needs with wind will have different impacts, and different shaping, firming and backup capacity requirements than would occur if the same average loads were met with a thermal resource.

These dynamics should be addressed in the wind integration methodology by modeling how larger amount of wind capacity will impact costs for non-cycling generators (coal plants), the needs to meet average loads, and market prices. Specifically, the impacts on other PacifiCorp generation, customer loads, and the power markets should be considered in the long term planning of the Company.

ICNU appreciates the opportunity to submit these initial comments on the wind integration study design, and hopes that the Company will be open to constructive feed back from stakeholders during this short process. ICNU's ability to provide additional comments will, in part, depend on whether the Company provides detailed and well supported analysis and sufficient time and opportunity to review and analyze the wind integration study results.

Sincerely,

/s/ Irion A. Sanger
Irion A. Sanger

cc: Service List (LC 47 and UE 216)

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

National Renewables Energy Laboratory

Dear Mr. Warnken,

NREL Comments on PacifiCorp 2010 Wind Integration Study Methodology

We applaud PacifiCorp's effort to perform a 2010 wind integration study. This is a critical topic for power system reliability, economic, and emissions reasons and it is important to get the analysis methodology correct. The state of the art of wind integration analysis has advanced significantly in the last several years and we are encouraged that the PacifiCorp 2010 Wind Integration Study Draft Study Design reflects many of these advances. We offer the following suggestions on further improving the study process.

Technical Review Committee vs Technical Expert

We are gratified to see that PacifiCorp is conducting a relatively open wind integration study process with public reviews and solicitation of comments. The current state of the art for the best wind integration studies now utilize an independent Technical Review Committee (TRC) composed of external power system and wind integration experts. These experts periodically review the study progress and intermediate results. They interact with the utility planners that are conducting the study, and their consultants. The diversity of the TRC and utility experts has proven to greatly increase the quality of the studies and ultimately reduce the cost because concerns are resolved early in the study process.

We strongly encourage PacifiCorp to utilize a TRC for this study effort. We also suggest that PacifiCorp constitute the TRC based on the "Principles for Technical Review Committee (TRC) Involvement in Studies of Wind Integration into Electric Power Systems" developed by the Utility Wind Integration Group (UWIG). UWIG is a utility based organization (PacifiCorp is a member) concerned with the technical aspects of wind integration.

PacifiCorp's proposal to procure the services of a technical advisor to assist with the study is better than not seeking outside assistance but it is not nearly as effective as using a TRC.

PacifiCorp East and West Balancing Areas

Wind and load variability and uncertainty are reduced by aggregation. It is appropriate to model the PacifiCorp east and west balancing areas separately but it is also important to fully study and take advantage of the benefits of utilizing the transmission tie capabilities between the two balancing areas to reduce net variability and uncertainty. Simultaneously ramping generation up in one region while ramping down in the other or purchasing off-system power in one region while selling in the other would raise costs unnecessarily if transfer capacity was available.

Load Forecast

PacifiCorp is correct to recognize that both load and wind forecasts are important. Use of a persistence forecast for hour-ahead wind is appropriate. Load forecasting is more advanced than wind forecasting so persistence is not appropriate for load. It would be best to use either the recorded historic forecast or the same forecasting methodology as is used in practice. PacifiCorp's proposed method for developing a synthetic load forecast may be the best practical approach for this study. If this proves impractical, the best alternative may be to include a load forecast error term based on historic load forecasting performance.

We encourage PacifiCorp to immediately begin recording the day-ahead and hour-ahead load forecasts. These forecasts can be used to partially verify and possibly improve the synthetic load forecast method.

Intra-Hour Analysis

PacifiCorp is correct, intra-hour wind and load variability and uncertainty increase utility reserve requirements and costs. The basic study method outlined by PacifiCorp, which focuses on incremental requirements and maintaining reliability metrics, is sound. Netting load and wind variability and uncertainty is appropriate.

Wind and Load Data

PacifiCorp correctly recognizes that it is critical to use time synchronized ten minute wind and load data. The NREL WWSIS wind data set is the best time series wind data currently available for wind generators that do not yet exist. Verifying the WWSIS data set by comparing with data from existing wind projects is always a good idea. We strongly caution PacifiCorp not to scale existing wind data, even with time shifts, as an alternative time series wind data source. Past studies have found scaling methods to be seriously flawed.

Wind Forecast

A 40 minute persistence forecast is appropriate for short-term wind forecasting.

Inter-Hour Load Following Reserves

While regulating reserves should be modeled as reserves in the hourly production cost modeling load following requirements should be calculated directly with the production cost modeling. Load following should, to the maximum extent possible, be obtained from the economic movements of the energy supplying generators. Load following should not normally require dedicated reserves unless the production cost modeling shows that the ramping capability of the existing fleet is not adequate. At that point statistical analysis is appropriate to quantify the additional reserve requirements in terms of amount and frequency of response and the conditions

under which reserves are required. As noted below, it is very important to release any load following reserves for use by the model in the operating hour time frame.

Reserve Requirement and Operating Conditions

We encourage PacifiCorp to assure that hourly wind and load conditions are included in establishing all modeled reserve requirements. Further, the reserve requirements must be dynamic, changing hourly as appropriate. When wind generation is zero there is no need for up reserves. Similarly, when wind generation is high there is no need for down reserves. Reserves need to be modeled appropriately recognizing the physical need.

Inter-hour wind reserves also need to be treated differently than conventional contingency reserves. It is appropriate to include reserve requirements in the day-ahead unit commitment stage of the security constrained unit commitment and economic dispatch hourly production cost modeling. Unlike contingency reserves, however, it is necessary to release those reserves for deployment in the hour-ahead modeling. The difference with contingency reserve modeling is because planners do not typically model the actual contingencies and instead hold the reserves throughout the modeling time frame. Wind events, however, are included in the modeling so the reserves must be released to respond to the events. While most modeling tools do not accommodate releasing reserves in the operating time frame it is often possible to use carefully structured pseudo schedules to accomplish the same result.

Production Cost Modeling

PacifiCorp states “The Company is investigating use of a production cost simulation approach in estimating inter-hour wind integration costs.” We encourage the use of production cost modeling. A security constrained unit commitment and economic dispatch hourly production cost model is the appropriate method for best determining the impacts of integrating wind into the power system.

We think there is a misstatement in the way PacifiCorp outlined its proposed analysis of system balancing costs (slide 22). The proposed analysis method has two steps:

- The approach requires that a baseline simulation be completed that allows for unit commitment and dispatch with perfect foresight (no change in load or wind generation from day-ahead to real time)
- A second simulation is then completed in which unit commitment is established under an uncertain day-ahead forecast for load and wind, but dispatch choices are made against actual load and wind conditions

We suggest that the base case should include the variability and uncertainty of load should be included in the base case with the variability and uncertainty of wind added in the second comparative case.

Wind Integration Costs vs Total System Costs

With the current state of the art in wind integration studies total system costs with and without wind can be more easily calculated than wind integration costs themselves. This is because the value of the wind energy itself must be backed out of the total system cost analysis in order to calculate the wind integration cost. PacifiCorp's proposal to use a flat-daily-block energy proxy for the wind energy in the base case (slide 18) is significantly better than using a flat annual or seasonal block. The differential in energy value between the flat daily block and the actual wind delivery (as opposed to the integration cost resulting from uncertainty and variability) will get included in the wind integration cost. This could artificially raise or lower the wind integration cost based on the average wind pattern. The energy value difference should be backed out of the wind integration cost analysis either by shaping the energy proxy in the base case or through after-the-fact analysis.

Schedule

We are concerned with the fast pace of the analysis schedule. We believe it is most important to do a thorough and accurate study. Not a perfect study as that is not currently possible, but as accurate as current industry study methods allow. Sufficient time should be included in the schedule to give PacifiCorp planners an opportunity to explore unanticipated results and to become fully comfortable with the results. Clearly increasing the amount of wind generation on the PacifiCorp system is new territory for PacifiCorp operators and planners. Reliability cannot be compromised. Time will be required to find and verify methods that are both economic and reliable. It is easy to find solutions that are reliable but expensive. Time and effort are required to find optimal solutions.

Thanks you for your consideration

Brendan Kirby, P.E., NREL Consultant

Dr. Michael Milligan, NREL

Brendan Kirby, P.E.
Publications at www.consultkirby.com
865-250-0753 (cell)
2307 Laurel Lake Rd
Knoxville, TN 37932

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Oregon Public Utility Commission

Oregon
Theodore R. Kulongoski, Governor

Public Utility Commission
550 Capitol Street NE, Suite 215
Mailing Address: PO Box 2148
Salem, OR 97308-2148
Consumer Services
1-800-522-2404
Local: 503-378-6600
Administrative Services
503-373-7394

March 12, 2010

Pete Warnken
PacifiCorp
825 NE Multnomah
Portland, OR 97232

Comments on PacifiCorp's Draft Design 2010 Wind Integration Study

Staff of the Oregon Public Utility Commission appreciates the opportunity to comment on PacifiCorp's proposed 2010 Wind Integration Study. PacifiCorp's wind integration study is an important factor in many proceedings at the Commission, including integrated resource planning, annual power cost filings, and renewable portfolio standard filings. Staff has the following comments and questions on PacifiCorp's draft study design.

Load Forecast

Staff is concerned with PacifiCorp's attempt to determine forecast error using actual historical load and metered wind data without using historical weather information in its development of a backcasted load forecast. PacifiCorp indicates that it will use prior like-day load profiles to estimate a retrospective next hour load forecast. Is this the same methodology that PacifiCorp uses in real time load forecasting? Does PacifiCorp record its historical load forecasts? For comparison, PacifiCorp should provide the forecast error of its proposed methodology versus the load forecast error realized in real time operations.

Reliability metric

PacifiCorp has stated that it intends to use its CPS II reliability score, based on historical performance, to statistically estimate a required amount of regulation reserves. In response to further questions on the study, the Company identified that it would use a CPS II score of 97 percent. This seems high given current WECC standards, and has a significant implication on the level of reserves and the overall cost of wind integration. It would be helpful to see calculations of incremental reserves at different levels of CPS II reliability scores (e.g. 90, 92, 95, and 97) to understand the cost variance between these metrics.

East and West Balancing Areas

A better explanation of why PacifiCorp intends to hold its east and west balancing areas separate in its analysis would be helpful. Is the Company claiming that the variability from wind is not carried through economic transactions to other areas, including its own areas, in real time operations?

Incremental Reserve Requirement

Slide 14 of PacifiCorp's draft study design broadly describes how it will go about calculating incremental load following reserve needs associated with load net of wind variability from hour-

to-hour. Slide 15 of the draft study design shows the same methodology, but for calculating the intra-hour incremental reserves needed. Calculating the reserve requirements separately in this manner would seem to systemically overestimate the incremental reserve requirement by double counting. Is the Company simply adding these together and then configuring that number in PaR? The Company needs to provide more explanation about its intended statistical approach on these calculations.

Incremental Reserve Requirement Cost

Slide 18 is the beginning of the Company's discussion on calculating the incremental reserve cost. As described by the Company, it intends to run PaR for an unspecified period of time, at an unspecified level of wind, taking into consideration incremental reserves to account for only load variability (which it calculated earlier). The Company stated that it intends to remove the variability of wind in this analysis by converting wind profiles into daily flat energy. In Slide 19, the Company describes how it will reflect the incremental reserves associated with load net wind and change the PaR run to reflect the actual wind profiles. Comparing the PaR runs with different wind profiles and an additional reserve requirement, which took into consideration the hour-to-hour variance of wind, seems like a double count.

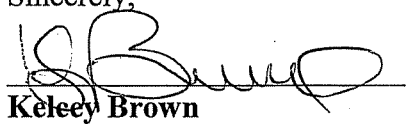
Additionally, the described analysis in slides 18 and 19 captures inter-hour cost as well as intra-hour cost. Yet, the Company indicates with its slide configuration that this calculation is only intended to capture intra-hour costs. Is the intent of slide 22 to introduce additional inter-hour integration costs, or is the Company speculating on an entirely different methodology that it is considering?

Practical Application

When determining the appropriate methodology for calculating either the incremental reserve requirement, or the incremental reserve requirement cost, it is important to keep in perspective the actual application of these study results. PacifiCorp uses the results of this study in various forums: annual power cost filings, integrated resource plans, renewable portfolio implementation plans, etc. In this study it is important for PacifiCorp to distinguish why its proposed methodology is appropriate, or not appropriate, for use in these varied applications using different levels of wind penetration and different time frames.

We appreciate this opportunity to comment on PacifiCorp's draft study design and look forward to working with the Company on developing a methodology that all stakeholders can support.

Sincerely,



Kelcey Brown
Senior Economist
Oregon Public Utility Commission

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

2010 Wind Integration Study
Public Comments on Draft Study Design

From

Renewables Northwest Project

Renewable Northwest Project

917 SW Oak, Suite 303
Portland, OR 97205

Phone: 503.223.4544
Fax: 503.223.4554
www.RNP.org

Renewable Northwest Project

March 10, 2010

Pete Warnken
PacifiCorp
825 NE Multnomah
Portland, OR 97232

Dear Mr. Warnken,

Thank you for this opportunity to comment on the February 26 Draft Study Design paper for the 2010 Wind Integration Study. We appreciate the vast improvement this study plan represents. As you may know, Renewable Northwest Project (RNP) advocated for a relatively short timeline for completion of this study and we recognize that some tradeoffs will be necessary to accomplish the task in the allotted time. We encourage the company to pursue outside expertise to help make or at least review some of the difficult decisions that lie ahead. Sources for such expertise can be found through the Utility Wind Integration Group of which PacifiCorp is a member, and the National Renewable Energy Laboratory (NREL).

Determination of Reserve Requirements

With respect to the development of wind and load reserve requirements, the plans for developing wind and load forecasts sound reasonable. In my personal experience, developing a "similar day" forecast method for loads is not particularly easy, nor does it result (without significant manipulation) in a particularly accurate forecast (e.g. the immediately preceding week might have very different weather conditions). Simpler methods that replicate the forecast error actually observed in system operations might be more easily implemented and more accurately reflect actual operations.

The proposal to determine east side and west side reserve requirements should be explained in more detail. We would not agree that there is no interaction between the east and west sides of PacifiCorp's system. If for example, the west side of the system is 50 MW long, and the east side is 50 MW short, we would not expect to see a 50 MW sale on the west with a simultaneous 50 MW purchase in the east. If that is what PacifiCorp proposes, it should clarify why this would be the case. If on the other hand, PacifiCorp is proposing to merely allocate the total reserve requirement between its eastern and western balancing areas, we would not object.

The nomenclature on slide 14 and ensuing slides is somewhat confusing. First, PacifiCorp appears to use the term "Load Following" to describe hour-to-hour variability and uncertainty of wind and load. Such a reserve requirement would actually reflect inter-hour variability. In BPA's rate case, this quantity was termed "imbalance reserves". On slide 15, the term "Regulation Reserve" appears to relate to the variability of ten-minute average load and wind variability/uncertainty—variability other utilities have deemed as "load

following reserve," or just "following reserve." The term "Regulating Reserve" usually represents the reserves needed to smooth fluctuations into the ten-minute averages. More standard terminology might reduce potential for misunderstanding.

Another nomenclature issue arises from the use of the word "variance" on slides 14 and 15. It appears that the word "difference" could be substituted without changing the intended meaning. The word variance also has the meaning in statistics as the square of the standard deviation. If the latter meaning is intended, it is unclear how that statistic is appropriate in this context. If the former definition is intended, we suggest using the word "difference" in place of "variance."

There appears to be a double counting of reserve requirements between slides 14 and 15. The reserves defined in slide 14 ought to be sufficient to supply a change in generator set points to account for the average difference between forecasts and observations. The Slide 14 reserves (called Regulating Reserves on that slide) should be calculated as the differences between observations and the average load and wind variability over the hour. Taking the difference between observations and schedules at this point appears to double-count the slide 14 reserves.

It is unclear from this presentation what target level of CPS 2 performance will be assumed. We suggest using the lower of 95% and some historical level of performance between 90% and 95%. In other words, if historically CPS 2 performance has been higher than 95%, use 95%. If it has been lower (presumably above the 90% minimum), that level should be used.

The use of the term "statistically estimate" on slide 15 is unclear. We would expect that if the target CPS 2 level were, say, 94% that the relevant reserve requirement estimate would be the 94th percentile of the distribution of differences. If something else is anticipated by "statistically estimate" this should be identified.

Operational Costs

The description on slide 17 outlining the intended means for determining the costs of holding intra-hour reserves is broadly correct. However, there are some important details that don't seem to be addressed. In the context of an hourly dispatch model, it makes sense to set aside reserves for the intra-hour variability, but not necessarily the inter-hour variability/uncertainty. If the "reserves" determined on slide 14 are added to the slide 15 reserves, most models will maintain those reserves throughout the hour regardless of whether they are needed. In the Idaho wind integration study, the model reported significant loss of load events due to the model's inability to release the inter-hour "reserves" to meet load as wind dropped—the very purpose for which the reserves had been identified. Entering the slide 14 result as a "reserve" in the model runs the risk of overstating the costs unless the model is capable of releasing those reserves as needed to balance the system.

Slide 18 describes a process which is normally used to capture the cost of inter-hour wind variability. It somewhat confusingly follows slide 16 titled "Intra-Hour Analysis." It is unclear whether this is a mistake or whether the company somehow views the slide 18 process as some kind of measure of intra-hour costs. If the wind modeled has a significant diurnal shape, the process of representing the wind as flat daily blocks introduces a potentially significant systematic error in the analysis. For example if wind generation is greater during light load hours, the flat block energy run will see a higher value simply due to the higher market value of energy during the day and result in an over-estimate of the wind integration cost. Conversely, if wind generation is greater during the heavy load hours, the wind integration cost will be underestimated. This can be addressed by dividing the wind

generation into separate heavy and light load hour blocks. At least one previous PacifiCorp study converted the varying wind generation into weekly heavy and light load hour blocks. It is also possible to fairly accurately estimate the systematic error introduced, and adjust for that outside the model runs. Either fix is acceptable, but some accommodation for the diurnal shape should be made if it is shown to exist in the wind generation data.

The cost of holding reserves is significant, and the ability to be dynamic is likely to have significant value. It is unclear whether this study will be able to adjust reserve requirements by hour of the day, season of the year, or output of the wind fleet. It would help to understand whether that will be part of this study.

PacifiCorp's earlier study assumed significant market transaction costs that escalated with volume. The presentation is unclear about what will be assumed in the present analysis. This should be a stated assumption—corroborating evidence would also be appreciated.

Day Ahead Balancing

As previously suggested, RNP is willing to accept a study that represents a reasonable approximation over a study that is prone to error by being overly complex, or takes too much time to complete. In that spirit, we are likely willing to accept a study that does not require multiple passes to establish unit commitment and purchase decisions, or perfectly capture day-ahead balancing purchases. However there seem to be some misconceptions on slide 22. The purpose of making day-ahead purchase decisions is to reduce costs by minimizing hour-ahead transactions in the less liquid real time markets. Much of the inter-hour costs will be captured by the process described on slide 18, while the proposed methods on slide 22 would seek to reduce the market transactions on an hourly basis represented by slide 18. Another, simpler way to capture the effect of day-ahead trading is to assume some fraction of the hourly transactions actually occur in the day-ahead market and reduce the value the model uses as an hourly transaction cost accordingly. This may in fact represent some of the originally reasoning behind using relatively low ($0.50/MWh) transaction cost in PaR.

Wind Data

Deriving a reasonable data set to represent wind is probably the biggest challenge to most wind integration studies. One possibility would be to use the US Department of Energy's Western Wind and Solar Integration Study data developed from mesoscale weather models. RNP has had questions about that reliability of that data for wind integration studies, but it may indeed represent the best available data.

Another possibility is to estimate wind generation data for future plants using on-site wind speed observations, or observations from nearby sites for which there may be significant correlation. There are important complexities in performing such analysis[1], and it may be advisable to employ a third party consulting firm to provide the data conversion service. RNP is aware of the Genivar company having provided such services to NorthWestern Energy, and they may be available to support this effort.

Overall Study Design

The slides were unclear as to exactly what penetration level is to be studies, or how the results of the studies of a single, or perhaps multiple years would be used to determine the

[1] We recommend some relevant papers on this process, including: "A Multi-Turbine Power Curve Approach," Nørgaard and Holtinen, Nordic Wind Power Conference, 2004 and "Considering Wind Speed Correlation of WECS in reliability evaluation using the Time Shifting Technique," Xie and Billinton, Electric Power Systems Research, 2009.

overall integration cost level. It was also unclear whether load growth would be considered in some way, or whether an historical period of loads would be repeated with various levels of wind penetration to determine the costs through time. RNP does not support using costs associated with an extreme level of wind penetration as representative of the costs through time. The study scope should also present the study horizon under consideration.

Scoping Document

RNP recognizes the relatively stringent time constraints under which PacifiCorp must develop the revised wind integration study. We appreciate the effort to get a scoping document to stakeholders in such a timely fashion. It is however, our expectation that a fuller scoping document will be developed including more complete descriptions than are possible in presentation-style bullets.

We appreciate the opportunity to provide these comments and look forward to a robust stakeholder process that will result in a study supported by stakeholders. The scoping document represents a good first step in that direction, and RNP is committed to being as helpful to the process as we can. Finally, we would again like to encourage the company to seek outside assistance, especially in the form of a technical review panel that can help make some of the difficult choices that lay ahead, and serve to add credibility to the final result.

Sincerely,

Ken Dragoon
Research Director
Renewable Northwest Project