

## 2010 Wind Integration Study

### **Consultation Session Conference Call with Michael Milligan, National Renewable Energy Laboratory**

**Conference Call date:** May 24, 2010

#### **Conference Call Attendees**

Michael Milligan (National Renewable Energy Laboratory)

*PacifiCorp:* Rick Link, Devon Williams, Pete Warnken, Greg Duvall, Stacey Kusters

*The Brattle Group:* Judy Chang, Frank Graves, Kamen Madjarov

#### **Session Agenda and Overview**

The focus of this consultation session was to answer clarification questions from Dr. Milligan on various aspects of PacifiCorp's wind integration study methodology as outlined in the [methodology white paper released on May 19, 2010](#). Dr. Milligan provided an overall assessment of the methodology as well as some study recommendations. The main discussion topics covered included (1) how PacifiCorp is developing hourly load forecasts and assessing forecast error, (2) specification of econometric models to characterize variable wind output and correlation among wind sites, and (3) metrics for determining the amount of generating capacity to allocate for regulation and load-following reserves.

#### **Discussion Details**

- Dr. Milligan indicated that the wind integration analysis methodology "looks good" and that it reflects large improvements over PacifiCorp's last wind integration study.
- The participants discussed how PacifiCorp is accounting for generation back-down as wind is added to the system. PacifiCorp staff summarized the use of its production cost model to balance the system with wind and associated reserves added.
- The participants next discussed how PacifiCorp is determining the reserve amounts to be fed into the production cost model. PacifiCorp mentioned that regulation amounts will be reviewed by operations staff for reasonableness. For the derivation of load-following reserves, PacifiCorp described its use of a similar-day load shape for creating hourly persistence-based load forecasts. The Company explained that this similar-day approach best approximates operational practice given available data. Subsequent questions focused on aspects of comparison with NREL's Eastern Wind Integration and Transmission Study, such as the use of rolling average-based persistence forecasts, Control Performance Standard 2 (CPS2) percentiles, and standard deviations as an indicator of variability. Dr. Milligan thought it worthwhile for him to contrast PacifiCorp's methods with those used in the NREL Eastern Wind Integration and Transmission Study's strategy, and to follow-up with PacifiCorp on his findings.
- Dr. Milligan recommended that PacifiCorp analyze the impacts of alternative Control Performance Standard 2 (CPS2) levels that are lower than the 97 percent historical performance level being used for computing load-following reserve amounts. PacifiCorp agreed that sensitivity analysis of CPS2 levels would be useful; for example, to assess the opportunity cost of

accounting for extreme events. However, given the limited time to conduct the current study, the Company considers such sensitivity analysis as something to tackle in another study.

- Dr. Milligan cited the Nebraska Statewide Wind Integration Study for its approach to assessing wind penetration levels and use of ideal shaped blocks of wind for estimating system balancing costs. PacifiCorp indicated that it will use flat blocks for heavy load hour and light load hour periods as a proxy for an ideal wind shape.
- Participants then discussed the approach and challenges of developing a full data set suitable for future wind penetration that is based on incomplete historical 10-minute wind data. PacifiCorp confirmed that it is using a distributed lag regression approach to characterize relationships among wind sites. The Brattle Group summarized its process of exploring the statistical behavior of wind data for a sample of wind sites.
- Dr. Milligan recommended that PacifiCorp might be able to improve characterization of correlations among wind sites by applying multiple regressions on three sites rather than just two, using wind output for a site located east of two others as the independent variable. The Brattle Group indicated that it is looking at spatial relationships between wind sites to improve data development, and will explore the recommended approach using the most promising wind sites.
- Dr. Milligan asked if PacifiCorp has a mechanism for addressing methodology-related parking lot items. PacifiCorp indicated that items will be documented in the final wind integration study report and attended to as part of on-going study work.
- Dr. Milligan asked how The Brattle Group is testing for biased regression parameters. Brattle Group staff responded that a robust estimator approach for standard errors will be used, and indicated that the lack of data stationarity (i.e., statistical properties that stay constant over time) is an issue for year-to-year characterization of the data.

### **Action Items**

- Dr. Milligan will review the NREL Eastern Wind Integration and Transmission Study and his project notes in order to critique methodology differences.
- The next consultation session with Dr. Milligan will be scheduled for no sooner than the first week in July 2010; PacifiCorp will coordinate with the parties to finalize the date and time.