CalWEA California Wind Energy Association

December 10, 2013

To: **Donald J. Brooks - CPUC Energy Division**

From: **Nancy Rader, Executive Director - CalWEA**

Re: **Informal Comments on 11-25-13 Probabilistic Reliability Modeling Inputs and Assumptions**

cc: **Michael Goggin, American Wind Energy Association**
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Service list R.11-10-023

Pursuant to the instructions in your email of December 3, 2013, the California Wind Energy Association ("CalWEA") provides these informal comments on the Energy Division's "Probabilistic Reliability Modeling Inputs and Assumptions, Draft Staff Recommendations, Part One," within the Resource Adequacy Proceeding, R.11-10-023 ("Draft Staff Recommendations"). CalWEA's comments benefit from the review and recommendations made to us by Michael Goggin of the American Wind Energy Association.

As described in the Draft Staff Recommendations, Staff is developing a probabilistic reliability model in order to calculate the Effective Load Carrying Capability (ELCC) and Qualifying Capacity (QC) of wind and solar resources in compliance with Senate Bill (SB) X1 2 and in accordance with the RA proceeding Scoping Memo. This paper is the first of approximately three such papers that will document the modeling inputs and assumptions that staff intends to issue. Official party comments on the formal ELCC proposal and associated workshop will be solicited later.

A. General Comments on Approach

CalWEA urges caution with the approach being taken – developing a model to generate the load and generation datasets, rather than using historical, empirical data – for several reasons. First, the modeling approach is far more time- and resource-intensive compared with an empirical-historical approach. Second, a modeling approach risks committing substantial errors, such as those we highlight below. Third, the statistical advantage of a long-term modeled dataset will be of marginal value as compared with five years of historical load and generation data.[1]

[1] A NERC report shows that five years of data provides accuracy of +/ - 10%. See page 21 at http://www.nerc.com/files/ivgtf1-2.pdf.

Other major ELCC studies have taken the historical-empirical approach, such as the ELCC studies conducted for the California Energy Commission in 2003-4.[2]

However, if the Energy Division proceeds with developing a modeled dataset, CalWEA strongly recommends several corrections to the model inputs as described below.

B. Specific Comments on Model Inputs and Assumptions

CalWEA comments here on some of the most important inputs to the model, where we find the CPUC's data to be highly problematic: those relating to calculating wind output, and those relating to the reliability of conventional generators. While other inputs are also important, these inputs must be realistic in order to generate accurate ELCC results for wind energy relative to conventional generation.

1. Both proposed approaches for calculating wind output using NOAA weather data are problematic; the CPUC should use NREL's wind output dataset instead.

The CPUC proposes two methods for calculating wind power output. Both are problematic, as the only meteorological data inputs are NOAA weather data. NOAA weather data are good for representing wind speeds where the data is collected, at 8-meter elevation at airports, but have very limited skill for predicting wind speeds at turbine hub height at wind plants, typically 80-100 meter elevation and at locations that are usually very distant geographically from NOAA's airport data collection points. Winds at hub height are often very different from winds at 8 meters elevation, and winds are very different at wind plant sites than they are at airports, which tend to be located in low wind speed areas.

To avoid recreating the wheel using an inferior data source, the CPUC should use NREL's publicly available dataset[3] for wind energy output. This dataset has several advantages. First, it produces wind output estimates at wind plant sites at 100-meter elevation and has already calculated wind energy output based on meteorological data using a complex model for the wind plant power curve. It would be very difficult to adjust NOAA data to accurately account for those two factors, even with the CPUC's proposed neural network method. Second, the NREL dataset has been extensively validated against actual wind plant output, and has been demonstrated to be accurate.[4] Finally, the NREL dataset includes 32,000 potential wind plant sites representing 960 GW of potential wind energy development across the Western U.S., allowing the dataset to accurately represent future wind energy deployments and deployments outside of California. If desired, California data could be extracted from the dataset.

The NREL dataset currently includes only wind output data for the years 2004-2006, though NREL is in the process of adding the years 2007-2011 to the dataset.[5] While the CPUC's proposed modeling method includes 30 years of weather profiles, the eight years to be covered by the NREL dataset should

[2] *California RPS Integration Cost Analysis-Phase I: One Year Analysis of Existing Resources*, California Energy Commission, Report 500-03-108C (December 2003); and *California Renewables Portfolio Standard Renewable Generation Integration Cost Analysis, Phase III: Recommendations for Implementation,* California Energy Commission, Report P500-04-054 (July 2004).

[3] *See* http://www.nrel.gov/electricity/transmission/western_wind_methodology.html

[4] *See* http://wind.nrel.gov/public/WWIS/3TIERValidation/.

[5] *See* http://www.3tier.com/en/about/press-releases/3tier-selected-nrel-update-national-wind-integration-dataset/.

be more than sufficient for representing the range of potential weather events as it includes the full range of the El Nino Southern Oscillation cycles and other inter-annual weather variations. For reference, ERCOT used 15 years of wind output data for its ELCC calculation method.[6]

Should the CPUC wish to extend the wind output dataset to cover years prior to 2004, it may be possible to use the proposed neural network learning algorithm to create a reasonably accurate wind output dataset by training the model using both the NOAA and NREL data for the 2004-2011 period and then having the model predict wind output patterns for prior years based on the NOAA data alone. As a more accurate alternative, the CPUC could hire a wind resource assessment expert to develop a longer wind output dataset, as ERCOT did for its ELCC analysis.

2. **For several reasons, the CPUC's proposed method is likely to significantly overestimate the reliability contributions of conventional generators.**

First, weather-driven reductions in the efficiency and maximum output of conventional generating units do not appear to be included in the model. According to the documentation the CPUC has provided, weather data is used only to calculate hourly profiles for load and variable energy renewables, and weather data is not an input into calculations for conventional generator output. This is a major drawback as many thermal generators have a well-documented reduction in efficiency and maximum output during periods of high ambient air and water temperatures.[7] Importantly, time periods of high ambient temperatures tend to coincide with peak electricity demand, and thus these temperature-driven reductions in maximum output will have a major impact on the calculated ELCC of conventional power plants. It should be relatively easy to incorporate weather-driven impacts on generator efficiency and maximum output into the modeling process. This phenomenon was shown in the results of the CEC's ELCC studies.[8]

Second, the CPUC's proposed model incorrectly assumes that conventional generator forced outage occurrences are random and that the probability of any plant's outage is independent of other plants' outages. Generator forced outages are not random and tend to be correlated with certain factors, including temperature and other weather factors. Importantly, because most or all power plants would be simultaneously affected by these factors, the probability of a single plant's outage is not independent of other plants' outages. A notable example of such a weather-driven "common mode failure" was the occurrence of rolling blackouts in February 2011 in ERCOT during a period in which 210 generators failed due to extreme cold.[9] A common concern is that during periods of extreme cold when gas demand is simultaneously high for heating and electricity generation, limitations in natural gas supply and pipeline capacity will cause a common mode failure of many gas-fired generators.[10]

The CPUC's assumption that conventional generator outages are random and independent of each other likely greatly overstates the ELCC contribution of these generators. The CPUC should examine available forced outage data as well as other analysis, including modeling of the gas supply system, to identify the

[6] *See* http://www.ercot.com/content/news/presentations/2013/ERCOT%20Loss%20of%20Load%20Study-2013-PartII.pdf.
[7] *See*, for example, http://dukespace.lib.duke.edu/dspace/handle/10161/6895. http://www.ijcsi.org/papers/IJCSI-10-1-3-439-442.pdf.
[8] *See supra* note 2.
[9] *See* http://www.ferc.gov/legal/staff-reports/08-16-11-report.pdf.
[10] *See* http://www.nerc.com/files/gas_electric_interdependencies_phase_i.pdf.

extent to which various plants' forced outages are correlated and also the extent to which these outages are and will be driven by weather events, and incorporate those findings into the analysis.

Finally, the CPUC should confirm that planned unit outages for maintenance and nuclear refueling are accurately represented. Many of these outages occur simultaneously during fall and spring periods, increasing the risk of loss of load at times when wind energy output tends to be at its highest, so to accurately assess the reliability contribution of wind generators it is essential that such planned conventional generator outages be accurately represented. This phenomenon was also shown in the results of the CEC's ELCC studies.[11]

We appreciate this opportunity to comment, and look forward to further discussion on these topics.

[11] *See supra* note 2.