BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Review of Electric Service Schedule No. 38, Qualifying Facilities Procedures, and Other Related Procedural Issues	)))))))))	**DOCKET NO. 14-035-140** **Exhibit No. DPU 1.0 DIR** **Direct Testimony of** **Charles E. Peterson**

FOR THE DIVISION OF PUBLIC UTILITIES
DEPARTMENT OF COMMERCE
STATE OF UTAH

Direct Testimony of

Charles E. Peterson

April 28, 2015

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I. INTRODUCTION

Q. Please state your name, business address and title.

A. My name is Charles E. Peterson; my business address is 160 East 300 South, Salt Lake City, Utah 84114; I am a Technical Consultant in the Utah Division of Public Utilities (Division, or DPU).

Q. On whose behalf are you testifying?

A. The Division.

Q. Would you summarize your background for the record?

A. I am currently a Technical Consultant for the Division. I have been employed by the Division for 10 years, during which time I have filed testimony and memoranda with the Commission involving a variety of economic, financial and policy topics.

Most significant for this docket is that I have been the primary Division staff person reviewing power purchase agreements (PPAs) under Schedule 38 for five or more years and I testified as one of the Division's witnesses in Docket No. 12-035-100, in which the

Commission considered changes to the method used for computing avoided costs for qualifying facilities (QFs) under Schedule 38.

I have an M.S. in Economics and Master of Statistics degree, both from the University of Utah. My resume is attached as DPU Exhibit 1.2 DIR.

Q. What is the purpose of your testimony in this matter?

A. I present the Division's analysis of the capacity contribution calculations for wind and solar facilities made by PacifiCorp (Company) in compliance with the Commission's Order in Docket No. 12-035-100.[1]

Q. Please briefly outline the procedural history in this matter.

A. Originally the issues that are covered in the Stipulation and the wind and solar capacity contributions were in separate dockets. In August the Company had made its second quarter avoided cost compliance filing in Docket No. 14-035-40. Various parties including the Division believed the time was ripe for a major review of the Schedule 38 tariff. On October 9, 2014, the Company filed its study in compliance with the Commission's Phase II order in Docket No. 12-035-100 regarding wind and solar capacity contribution values. In an October 14, 2014 memorandum, the Division represented that it and several other parties wanted the Commission to open a new docket that combined the issues the parties wanted to explore in

[1] Order on Phase II Issues, Docket No. 12-035-100, August 16, 2013, page 43, paragraph 6.

Docket No. 14-035-40 relative to Schedule 38 and the avoided cost calculations with the capacity contribution study filed by the Company. On October 27, 2014 pursuant to this request, the Commission created Docket No. 14-035-140 to consider all Schedule 38-related issues that had been raised by the parties along with the capacity contribution study.

Q. Please outline your testimony.

A. I will discuss the Company's capacity contribution study, the Division's analysis of that study, and its recommendation regarding that study.

II. PACIFICORP CAPACITY CONTRIBUTION STUDY

Q. Please briefly describe background of the capacity contribution study.

A. In Phase II of Docket No. 12-035-100, the Company had proposed capacity contribution values for wind and solar of 4.1 percent for wind resources, 11.5 percent for fixed solar resources, and 25.9 percent for single-axis tracking solar.[2] These calculations appeared to the Division to be based upon an *ad hoc* Company-developed method.[3] The Division and other parties in that docket believed that one of the methods discussed in a National Renewable Energy Laboratory study (NREL study)[4] would be more appropriate to arrive at capacity contribution values.[5]

[2] Direct Testimony of Gregory N. Duvall, Docket No. 12-035-100, page 17.
[3] The Commission found that "PacifiCorp's Exceedance Method [was] not an industry standard approach." Order on Phase II Issues, Docket No. 12-035-100, August 16, 2013, page 29.
[4] Madaeni, Seyed Hossein, et al. "Comparison of Capacity Value Methods for Photovoltaics in the Western United States," Technical Report, NREL/TP-6A20-54704, National Renewable Energy Laboratory, July 2012.
[5] "Capacity contribution" means, roughly, the amount of generation capacity of, typically, a combined cycle gas turbine generation facility, that a renewable resource can reliably replace to cover peak load. For example, if a

The Commission adopted as interim capacity values of 20.5 percent for wind projects, 68 percent for fixed solar QFs, and 84 percent for tracking solar QFs.[6] As mentioned earlier, The Company was "directed to perform and file a study calculating capacity contribution for wind and solar resources for the Proxy/PDDRR method using either the ELCC method or CF method considering LOLP."[7] On October 9, 2014, the Company made its compliance filing using the capacity factor approximation method (CF method) wherein it recommended capacity values of 14.5 percent for wind, 34.1 percent for fixed tilt solar, and 39.1 percent for single axis tracking solar.[8]

Q. The capacity contribution values are noticeably lower than the interim values set by the Commission, do you have any initial comments?

A. Yes. "Lower" is a relative term. In the Company's 2013 Integrated Resource Plan, Volume 2, Appendix O, it published the results of its "exceedance model" that it proposed in Docket No. 12-035-100 and apparently used that model to have capacity values implemented in other states. Table 1 sets forth data obtained in response to the Office of Consumer Service's (Office) data request 2.15 in this docket and Company testimony in Docket 12-035-100. As can be seen, from the perspective of stakeholders in states other than Utah, the Company is proposing to increase the capacity contribution values.

renewable resource has a nameplate generation capacity of 100 MW and a 25 percent capacity contribution value, then that 100 MW renewable plant can theoretically replace 25 MW of a combined cycle gas turbine facility.
[6] Order on Phase II Issues, Op. Cit., page 44, paragraphs 7 and 8.
[7] Ibid., page 43, paragraph 6.
[8] Direct Testimony of Rick T. Link, Docket No. 12-035-100, October 9, 2014, lines 34-36.

81 **TABLE 1**

Comparison of Capacity Contribution Values

	Wind	Fixed Tilt Solar	Single Axis Tracking Solar	
Company Proposal (Original in Docket 12-035-100)	4.10%	11.50%	25.90%	
Company Proposal (Compliance Filing, now in this Docket)	14.50%	34.10%	39.10%	
Utah	20.50%	68.00%	84.00%	1/
California	4.20%	13.60%	13.60%	2/
Idaho	4.10%	11.50%	25.90%	3/
Oregon	4.20%	13.60%	13.60%	2/
Washington	none.			
Wyoming	4.10%	11.50%	25.90%	

1/ Interim values
2/ California and Oregon are apparently the same.
3/ Idaho in 2012 apparently initially had values of 4.2%, 13.6%, and 26.8%.

Sources: Company Application, OCS DR 2.15, and
Direct Testimony of Gregory N. Duvall, Docket No. 12-035-100.

82 **Q. Is the Company proposing these capacity contribution values in other states?**

A. The Division has not researched this question. However, the Company included these values in its recently filed 2015 Integrated Resource Plan.[9] Given this fact, the Division expects that the Company will be proposing to implement these values in other states, if it has not already done so.

III. THE DIVISION'S REVIEW OF THE COMPANY'S CAPACITY CONTRIBUTION CALCULATIONS

Q. What has the Division done to review the CF model calculations?

A. The Division has reviewed the filings and supporting work papers and calculations supplied by the Company. It has reviewed and considered the answers to data requests. The Division had a conference call with Company representatives to clarify certain issues related to the Company's work papers; consultants for the Office also participated in that conference call. Finally, the Company contacted NREL and asked it to review the Company's calculations that NREL's Solar Technical Assistance Team (STAT) agency's Quick Response program available to state and local governments. The Division received responses to some follow-up questions to NREL's STAT.

Q. What feedback has the Division obtained from NREL regarding PacifiCorp's application of the CF method?

[9] PacifiCorp 2015 Integrated Resource Plan, March 31, 2015, Volume II, Appendix N.

A. NREL informed the Division regarding the PacifiCorp's capacity contribution study "that it has exactly followed the equations, methodology, and assumptions in the NREL report, 'Comparison of Capacity Value Methods for Photovoltaics in the Western United States.' The theoretical basis for capacity value calculations described in the NREL report is well established and nothing has changed since its publication. Our review, however, did not include verifying PacifiCorp data nor verifying the capacity contribution values." (Quoted from a letter to DPU staff dated February 17, 2015, which is included as DPU Exhibit 1.1).

Q. Did the Division verify the calculations performed by the Company in arriving at its proposed capacity contribution values?

A. Yes. I have studied the calculations and formulae set forth in the work papers provided by the Company and I have determined that they accurately convert the Company's data to capacity contribution estimates under the CF method.

Q. What were the data sources used by the Company in arriving at its proposed capacity contribution values?

A. For wind the Company used the average generation for each hour in a year that it has historically received from its wind generation plants in its eastern control area. This generation is dominated by wind farms in Wyoming. The Company has little representative data for Utah itself. While it is an open question as to how close future Utah wind development, if any, might be to Wyoming wind generation patterns, the Division believes

that use of the wind data that the Company has rather than speculative estimates for Utah is reasonable at this point.[10]

Q. What was the source of solar generation data used to develop the solar capacity contribution values?

A. The Company was supplied solar data by its consultant Black & Veatch, a well-known engineering company, in a study dated December 9, 2013 (B&V study). The B&V study investigated solar resources for several areas in Utah and Oregon for both fixed-tilt and single-axis tracking solar plants. One of the Utah sites was Milford, Utah which the Company used to base its capacity contribution values on.[11] The B&V study provided estimated generation data at Milford for 8760 hours of what it concluded was a "typical" year. While the Division has not audited the B&V study data, the Division believes that it is reasonable to rely on the information provided Black & Veatch.

Q. **Besides the hourly generation data, the other major component of the CF method is loss of load probability (LOLP). How did the Company determine the LOLP data used to complete the CF method estimates?**

A. The Company used its Planning and Risk model (PaR) to estimate hourly energy not served (ENS) events during the 2017 "test year" used by the Company. The PaR model is a stochastic dispatch model of the Company's system that has been used over several IRP

[10] It is likely that any future Utah wind resources, or Wyoming wind resources for that matter, will be inferior to the existing wind resources since developers are expected to have developed the better wind resource sites first.
[11] The other Utah locations evaluated by Black & Veatch were Veyo and Salt Lake City.

cycles by the Company. The Company ran 500 simulations of the Company's system for the 2017 "test year" allowing system load, hydro generation, and thermal outages to vary stochastically. The result of these simulation runs was a set of hours throughout the test year in which the Company's existing resources were unable to meet the load demand, i.e. the "energy not served." These hours during which there was ENS among the 500 simulation runs during the "test year" became the basis for the LOLP calculations that fed into the CF method calculations for both wind and solar.

Q. What is the Division's opinion regarding the LOLP results?

A. As noted above, the PaR model has been used for a number of years, particularly in the Company's IRP studies, and has been generally accepted, or at least not actively opposed, by parties in the IRP processes. However, it is largely a "black box." The loss of load probabilities produced by the model appear reasonable, but the Division is unable to audit the underlying calculations of the model.

Q. Given that the proposed capacity contribution values are much lower than the interim values adopted by the Commission based upon the NREL study cited above, are the proposed capacity contribution values reasonable? Please explain.

A. The Division believes that the values fall within the zone of reasonableness. First of all, as noted by the Commission when it set interim capacity contribution values, the NREL study itself warns against using its results for specific utilities.[12] Within the NREL study is a

[12] Order on Phase II Issues, Op. Cit., page 29.

citation to a study performed for Portland General Electric using a fixed-tilt solar plant estimating a capacity contribution value of 30 percent, which is similar to the 32.2 percent value the Company estimated for its Oregon location in its 2015 Integrated Resource Plan. Finally as part of a response to the Division's follow-up questions to NREL, the Division was provided with the following figure:

FIGURE 1

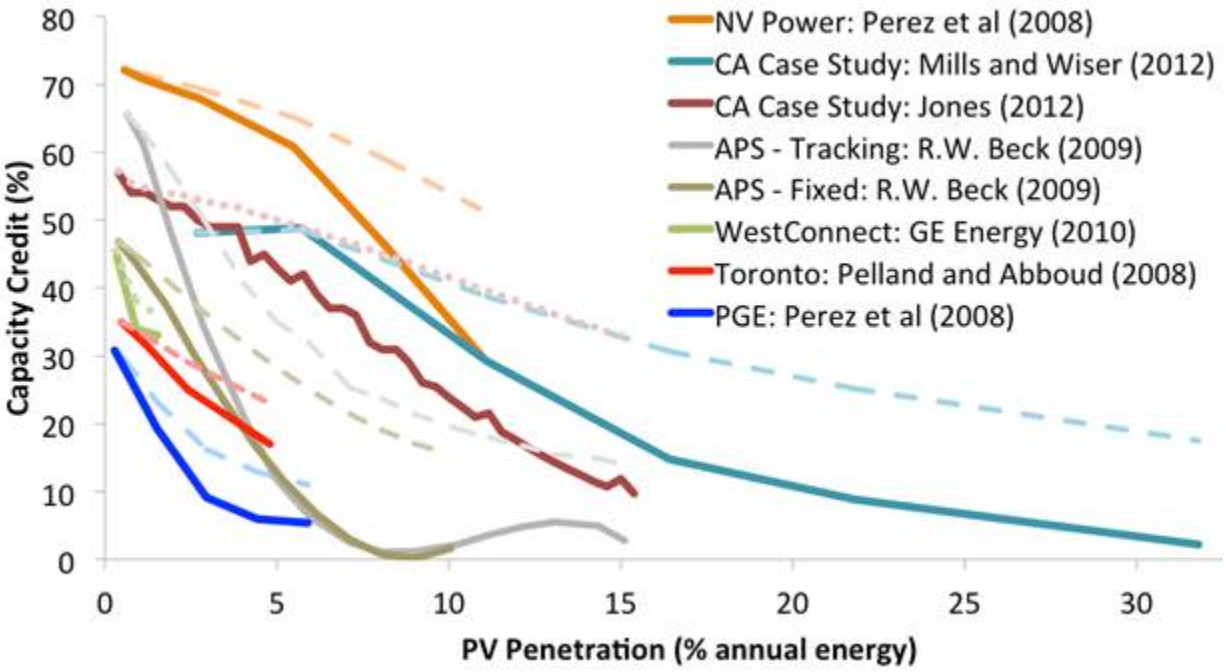

Chart from: Mills and Wiser 2012 - An Evaluation of Solar Valuation Methods Used in Utility Planning and Procurement Processes

Figure 1 shows the range of capacity contribution estimates from a number of studies. At near zero photovoltaic penetration, some of the studies give values similar to the interim figures adopted by the Commission. But some give values in the 30 to 40 percent range as

well. As the amount of solar generating capacity increases (i.e. "penetration" increases) the capacity values decline. Based upon its 2015 IRP, in the next two years or so, the Company may have 5 percent or more of its total generation capacity from solar. Based upon Figure 1, the average of the capacity contribution values for 5 percent penetration appears to drop to the low 30s. Based upon these data, the Division concludes that the Company's solar capacity contribution estimates that are in the mid- to upper 30 percent range fall within a reasonable range.

Q. Returning to the wind capacity contribution value, does 14.5 percent seem reasonable?

A. The change from the Commission adopted interim value of 20.5 percent to 14.5 percent for wind is not as severe as the change in solar values. In Docket No. 12-035-100, the Division attempted to provide an alternative estimate of capacity contribution for wind to the Company's 4.1 percent. The Division's estimates ranged from about 8.7 to 12.0 percent, with a middle range of 10 to 10.5 percent.[13] While the Division cannot claim a high degree of reliability for these previous estimates, there was some expectation that the wind capacity contribution value would be in the low- to mid-teens. Given the LOLP and wind generation data discussed above, the Division believes that the 14.5 percent value for wind is reasonable.

[13] Rebuttal Testimony of Abdinasir Abdulle, Docket No. 12-035-100, Exhibit 2.2R.

Q. The Company's witness, Mr. Rick T. Link testifies that the capacity contribution values should be updated over time.[14] Do you agree?

A. Absolutely. The Division understands that the Company may provide updates with its biennial Integrated Resource Plan. This would be appropriate. In any case, the study should be updated when additional data become available.

IV. CONCLUSIONS AND RECOMMENDATIONS.

Q. What are your conclusions?

A. With respect to the wind and solar capacity contribution values, the Division concludes that the Company has complied with the Commission order in Docket 12-035-100. The Division believes that the Company has provided estimates using the best information available to it and that it has used an appropriate and accepted method to calculate those estimates.

Q. What is the Division's recommendation?

A. The Division recommends that the Commission replace the interim capacity contribution values set in Docket No. 12-035-100 with the capacity contribution values found in the Company's compliance filing: 14.5 percent for wind, 34.1 percent for fixed-tilt solar, and 39.1 percent for single-axis tracking solar.

[14] Direct Testimony of Rick T. Link, lines 177-188.

Q. Does this conclude your testimony?

A. Yes.