BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power for Approval of Changes to Renewable Avoided Cost Methodology for Qualifying Facilities Projects Larger than Three Megawatts	))))))	Docket No. 12-035-100 DPU EXHIBIT 2.0R

Rebuttal Testimony of

Abdinasir M. Abdulle, Ph.D.

Division of Public Utilities

May 15, 2013

Q. Are you the same Abdinasir M. Abdulle that filed a direct testimony in this proceeding?

A. Yes. I filed direct testimony in this proceeding on behalf of the Division of Public Utilities ("Division").

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide responses to the direct testimony of the Office of Consumer Services (OCS) witness Mr. Randall J. Falkenberg, Utah Clean Energy witness Ms. Sarah Wright, Scatec Solar North America, Inc. witness Mr. Luigi Resta, UIEC witness Mr. Maurice Brubaker, and Energy of Utah witness Mr. Ros Vrba.

RANDALL FALKENBERG

Q. Did OCS witness Mr. Falkenberg's propose an alternative method for determining the capacity contribution of wind?

A. Yes. Mr. Falkenberg proposed a method, which he claims will equate the reliability of wind with that of thermal. He calculated the wind contribution associated with a given thermal reserve margin in such a way that the number of hours the Company may need to buy power from somewhere else remains the same. Recognizing that the Company's reserve margin is 12 percent to 16 percent, he used the minimum wind capacity contribution (13.8 percent) associated with this range of reserve margin.

Q. Can you briefly describe Mr. Falkenberg's proposed method to calculate the capacity contribution of wind?

A. Yes. Using Company data on the top 500 hours of peak load for the period from 2007 to 2011, Mr. Falkenberg determined the level of reliability obtained from specific levels of the thermal reserve margin. This was determined by sorting, in descending order, the thermal load-serving capacities of the top 500 peak load hours. The installed thermal capacity was then divided by these load-serving capacities to obtain the thermal reserve margins associated with each level of thermal load-serving capacities. This sorted data was then ranked from 1 to 500. The smallest thermal load-serving capacity is ranked 1 and the largest thermal load-serving capacity is ranked 500. The rank number associated with each load-serving capacity is interpreted as the number of hours the Company would need to obtain additional resources. Hence, the rank number represents the level of reliability.

As an example from Mr. Falkenberg's calculations,[1] assuming a thermal reserve margin of 16 percent, the corresponding thermal load serving capacity would be 7,333 MW, and the corresponding rank would be 19. Thus, at 7,333 MW of thermal load serving capacity, the Company would need additional resources 19 hours of the 500 hours.

Mr. Falkenberg creates a second variable by adding the thermal generation in a given hour of the sample of 500 hours with the wind generation during the same hour. He then sorts this "thermal-wind" variable from largest to smallest, ranking the data points from 500 to 1 as he did with thermal generation alone. Mr. Falkenberg then notes that the thermal-wind number that is ranked 19 is 7,505 MW.

[1] Direct Testimony of OCS witness Randall Falkenberg. Docket No. 12-035-100. Lines 347-351.

Subtracting the 7,333 MW from the 7,505 MW of thermal-wind load serving results in 172 MW, which is the amount of wind capacity the Company has to serve to obtain the same level of reliability (19 hours or less of capacity shortfall) as thermal alone. The 172 MW additional wind represents 14.1 percent of installed wind capacity. Therefore, the wind capacity contribution is 14.1 percent of wind nameplate and this is the level of wind capacity contribution Mr. Falkenberg recommends.

Q. Do you have any concern about Mr. Falkenberg's proposed method to determine the wind capacity contribution?

A. Yes. The results of this method depend on the difference between the thermal alone load-serving capacity and the thermal-wind load-serving capacity. These two values need to be matched in such a way that they both belong to the same hour of the same day and month in the same year. Failure to match these values in this manner would, inevitably, result in an over or under estimation of the amount of additional wind needed to serve the load. Additionally, the method yields varied results that cannot be relied upon, even if the matching errors are corrected, and the value of wind is not taken into account.

Mr. Falkenberg did not match the load-serving capacity values for thermal alone and thermal-wind in the manner described above. In fact, they belong to different time periods. Let us use the above example to illustrate the point. The 7,333 MW of thermal alone load serving capacity is for July 22, 2010 at 18:00 whereas the 7,505 MW of thermal-wind load serving capacity is for August 3, 2010 at 15:00. The difference between these values is unrelated to the amount of wind available on July 22, 2010 at

18:00. Hence, the capacity contribution recommended by Mr. Falkenberg is based on this erroneous matching and cannot be relied upon.

Q. Have you tried to match these values in the manner described above?

A. Yes. For the top 500 hour loads, I matched the available thermal and wind load serving capacities hour by hour and I obtained different results. Using the above example, the thermal-wind load-serving capacity for July 22, 2010 at 18:00 is 7,752 MW. When the thermal alone load-serving capacity for this same hour (7,333 MW) is subtracted, the result is 419 MW. This represents 34.5 percent of installed wind. Hence, the wind capacity contribution is 34.5 percent instead of the 14.1 percent proposed by Mr. Falkenberg.

Q. If Mr. Falkenberg's method were corrected for the matching problem, do you believe it would yield appropriate wind capacity contribution?

A. No. It would yield varied results that cannot be relied upon. For example, the added wind capacity required to meet the load associated with the thermal reserve margins from 12 percent to 16 percent would vary from 0.3 percent to 60.2 percent of the nameplate of wind with mean of 25.9 percent, standard deviation of 19.5 percent, and a coefficient of variation of 75.1 percent. This indicates that one cannot tell the amount of wind contribution that can be counted on.

Furthermore, the Division does not believe this method calculates the capacity contribution or value of wind. The difference between the load-serving capacities of the thermal-wind and thermal alone as a percent of wind nameplate is not and cannot be viewed as wind contribution. The difference Mr. Falkenberg calculates includes the difference in thermal output between different hours and not simply the capacity shortfall in terms of wind.

The Division believes that the method presented by UCE witness Ms. Wright is a superior method to that of either the Company or Mr. Falkenberg. Ms. Wright's methodology also appears to be an accepted industry standard for calculating the capacity contribution for renewable resources.

SARAH WRIGHT

Q. Would you explain the methodology UCE witness Ms. Wright recommends?

A. Yes. Ms. Wright references several methods described in a report published by the National Renewable Energy Laboratory or NREL.[2] The NREL report describes three similar reliability based methods for calculating the capacity value of photovoltaic systems. In brief, each of these methods compares the Loss of Load Expectation (LOLE) with and without the additional output from the renewable resource.

For example, in the Effective Load Carrying Capability (ELCC) method, the LOLE is calculated for the system without the renewable generation. The renewable generation is then added to the system and the LOLE is recalculated. Finally, since the LOLE will be lower with the additional generation, a constant decrement, D, is added to the load in an

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[2] Madaeni , Seyed Hossein, Sioshansi, Ramteen, and Denhilm, Paul. Comparison of Capacity Value Methods for Photovoltaics in the Western United States. Technical Report NREL/TP-6A20-54704. NREL. July 2012. This is the article that is attached to Sarah Wright's direct testimony in this proceeding.

iterative process until the LOLE with and without the added generation are equal. The final value of D is interpreted as the ELCC of the renewable resource.

Q. You indicated that the NREL report described methods for calculating photovoltaic capacity values. Are these methods applicable to other renewable resources?

A: Yes. The issue is not the renewable source itself but rather the intermittence of the resource. This is explained in both the NREL report and a report published by the IEEE, "Capacity Value of Wind Power."[3]

The IEEE report also describes the ELCC method. A copy of the IEEE report is attached to this testimony for convenience as DPU Exhibit 2.1R.

Q. Does the Division support Ms. Wright's recommendation to use a reliability method for calculating the capacity value of wind resources?

A. Yes, but with two caveats. First, the underlying assumption is that the PDDRR method is used to calculate the avoided costs. The Market Proxy method should already capture the capacity value of the renewable resource and, therefore, a separate calculation is not needed. This is consistent with Ms. Wright's recommendation and I only mention it for clarity. Second, as the NREL report indicates, the reliability methods are data and computationally intensive. Thus, an approximation method may be warranted.

Q. Would you explain the difficulties of calculating the reliability based capacity values?

[3] Kean, Andrew, Milligan, Michael, et.al., Capacity Value of Wind Power. Task Force on the Capacity Value of Wind Power, IEEE Power and Energy Society. IEEE Transaction on Power Systems, 26(2):564-572. May 2011.

A. Yes. As I previously described, the reliability methods involve three steps. In the first two steps, the LOLE is calculated with and without the renewable resource. To calculate the LOLE, the loss of load probability (LOLP) for each hour must be calculated. The LOLP calculation takes considerable data including the distribution of the loads and resource availability. In the third step, a constant decrement is added to each hour and the LOLP for each hour is recalculated until the LOLE with and without the renewable resource are equal.

Given the data requirements, both the NREL and IEEE reports discuss the use of approximation methods to calculate the capacity value of renewable resources.

Q. What conclusions do the reports draw with respect to approximation methods?

A. While the authors of IEEE report prefer the reliability method, specifically the ELCC method, they conclude, "The accuracy of these [approximation] methods is varied and while some may be useful given limited data, it is important to be clear about the approximations being made." (p. 9) Factors such as the correlation between the output of the renewable resource and load, the geographical area, and the target reliability level, which are shown to be key metrics, are estimated or ignored in the various approximation methods.

Q. What conclusions does the NREL report draw?

A. The authors of the NREL report conclude, "Overall, under the assumptions used in the analysis, we find that some approximation techniques can yield similar results to reliability-based methods such as [the] effective load carrying capability." (p. iv) Of the several approximation methods reviewed, the authors conclude that the capacity factor (CF) method performs the best.

In support of this conclusion, the authors report the average root mean squared error (RMSE) for each approximation method compared to the ELCC LOLE. The CF method has the lowest RMSE, approximately 4. The next best approximation method, Garver's Approximation, has a RMSE almost 3 times as large, approximately 12, as the CF method.

Q. Would you explain the meaning of the RMSE?

A. Most common probability distributions can be characterized by a finite set of parameters or values. For example, the normal distribution is characterized by two such parameters, namely, the mean and standard deviation. Since these parameters are generally unknown, they must be estimated. The RMSE measures the accuracy of the parameter estimate to the true value of the parameter.

Technically, the RMSE is the square root of the average squared deviations of the estimate relative to the real parameter value and has a similar interpretation as the common sample standard deviation. (See NREL Report at Equation 14) The sample standard deviation measures the dispersion of the sample values around the sample mean—the larger the standard deviation the larger the dispersion. The RMSE measures the dispersion of the parameter estimates around the true value of the parameter.

Again, of the seven approximation methods analyzed in the NREL Report, the CF method had the smallest RMSE. This suggests the CF method's superiority for estimating the more intensive ELCC method's results.

Q. Would you explain the CF approximation method used in the NREL Report?

A. Yes. The CF method weights the renewable resource output in each hour. The sum of these weighted outputs is the capacity value of the renewable resource. The weight in each hour is the relative value of the LOLP in that hour to the total LOLP for all hours in the study (LOLE). An explanation of the CF method is on page six of the NREL Report.

In addition to being the most accurate, the CF method has two other distinct advantages relative to the approximation methods analyzed in the NREL Report. First transparency—once the LOLP for each hour is calculated, the remaining calculations are relatively easy to follow and understand. Second, According to the NREL Report, the method yields reasonably accurate results using a limited amount of data. The NREL Report indicates that as few as the top 10% of hours is sufficient.

Q. Would you summarize the Division's position on the capacity value?

A. Yes. Where adequate data are available, the Division supports the use of a reliability method as advocated by Ms. Wright. While computationally intensive, the Company should have adequate data to calculate the capacity value for wind QFs. Where the data may not be available, such as for PV resources, or where the computations are overly burdensome, the Division recommends the use of the CF method described in the NREL Report.

Q. Did the Division calculate the wind capacity contribution using the ELCC or CF methods?

A. No. The Division requested that the Company perform the calculation and provide an ELCC number for the five-hundred hours in its study. The Company's response simply stated that it had not performed the calculations.

The Division had anticipated that in addition to the ELCC value, the Company's response would have provided the data necessary to calculate the CF method's value. Given the Company's response, the Commission will need to determine a capacity value for renewable resources at least on an interim basis.

Q. What would you recommend for the interim period?

A. Since the Division does not have the data it needs to provide specific capacity contribution recommendation, the Division proposes a wind capacity contribution in the range of 8.72 percent to 12.03 percent (DPU Exhibit 2.2R). The upper limit of this range is coincidentally similar to the capacity contribution proposed by Mr. Falkenberg. The midpoint of this range is approximately 10.4 percent.

Given the lack of data, the Division does not have its own recommendation on photovoltaic capacity values. As reported by Ms. Wright, the NREL report does have some specific estimates for the Salt Lake City area. The CF method's values range from approximately 68 percent to 84 percent depending on whether the PV system has a fixed axis or tracking capability. These values could be used on an interim basis for the types of PV systems.

To resolve the issue of capacity value for renewable resources, the Division recommends that the Commission hold two or three technical conferences in which parties can make presentations. Parties should then file comments on the information presented in the Technical Conference and the Commission could then make its decision based on these comments. In the mean time, the Division recommends that the Commission order interim capacity values for solar and wind based upon the information currently available.

Q. What other proposals did Ms. Wright make regarding avoided cost calculation?

A. Ms. Wright argues that in addition to the energy and capacity payments, there are other costs associated with the risks the Company would face if it did not use renewable resources in its resource mix. These risk associated costs include the risk of rising fuel costs, fuel price volatility, environmental compliance costs, potential carbon regulation costs, and the actual costs of changing climate.

Q. Do you agree that the avoided cost paid to a renewable QF should include these extra costs?

A. For several reasons, the Division does not support this part of Ms. Wright's proposal. First, Ms. Wright neither quantified nor proposed a method to quantify the risk-related costs. Therefore, the Commission has no basis to determine the level of costs to include in QF payments.

Second, no costs accrue simply because a risk exists. Costs associated with a risk accrue only if the event occurs or insurance is purchased against the likelihood that the event will occur. For example, there is a risk of flooding for homeowners. However, the risk of flooding does not necessarily impose a cost on the homeowner. The costs accrue only if the home is actually flooded or the homeowner purchases insurance in case flooding occurs. Similarly, unless fuel costs rise, environmental compliance costs are imposed, carbon regulation is imposed, or the changes in the climate impose costs, no costs accrue. Ms. Wright may have these accrual costs in mind when she recommends that the QF receive additional compensation.

However, and this our third point, the IRP preferred portfolio already compensates for the risk mitigation benefits of various resources. For example, suppose a purely least cost portfolio called for a base load thermal plant in 2016. However, the preferred portfolio, which accounts for the risks Ms. Wright identifies, defers that base load resource for several years and instead chooses a combination of energy efficiency and renewable resources in the early years. Under this scenario, the preferred portfolio already includes the benefits of risk mitigation and, thus compensates the QF accordingly.

Adding additional costs for the same risk costs captured by the IRP to the avoided cost would make the renewable resources more expensive. That is, the QF would receive an avoided cost payment higher than the cost the Company actually avoids. This would violate PURPA's ratepayer indifference standard.

Q. What types of risk does the IRP consider?

A. Through the IRP process, the Company selects the least cost/risk portfolio of resources. Among the things considered in the IRP are varying assumptions about gas prices, CO_2 prices, coal prices, regional haze investments, and other non-CO_2 environmental policy assumptions including costs to achieve compliance with mercury and air toxins, coal combustion residuals, and cooling water intake structures. However, the current IRP did not select wind as part of its preferred portfolio. Adding the risk-associated costs to the avoided cost price that the QF receives would not make it a least–cost, least-risk resource.

I should emphasize that the Division is not arguing here that the IRP has correctly captured the risk mitigation benefits. That is an issue for the IRP docket. The Division is arguing, however, that adding additional costs for these benefits that are, to some extent, already reflected in the preferred portfolio, would violate the PURPA ratepayer indifference standard.

As I pointed out in my direct testimony, the avoided costs do not distinguish between different types of QFs. Since different types of QFs provide similar benefits, it is appropriate that the QF receive compensation for those benefits regardless of its fuel source. For example, a long-term QF contract provides price volatility mitigation regardless of its fuel source. The Division contends that the PDDRR method captures for the QF these benefits.

There are, undoubtedly, other environmental benefits that renewable resources generate for which the renewable QFs might reasonably receive compensation. Much of these additional benefits are likely captured by the RECs, which, as I stated in my direct testimony, should be owned by the QF developers. Therefore, since the costs associated with the Company’s resource decisions are either captured in the IRP or by the RECs, including them in the avoided cost as an additional payment would be to double count these costs and is therefore not appropriate. To the extent any of the environmental benefits are not captured by RECs, IRP calculations, or other programs, the appropriate venue for recognition of those benefits is the federal or state legislative branch, not a calculation intended to achieve ratepayer indifference about generation sources.

Q. Ms. Wright recommended the use of a modified Market Proxy method when renewables are included in the preferred portfolio in the IRP. What modifications did she recommend?

A. In her direct testimony (lines 307-312), Ms. Wright suggested a number of alternative proposed modifications.

> An alternative approach might be to use cost assumptions that the Company uses in its IRP for the market proxy costs. Or a second alternative would be to explore the revenue streams that the Company receives for their owned wind projects, the average cost of PPAs for wind that the Company purchases through PPAs, or a weighted average by the capacity of wind PPAs from publically available contracts from other Western utilities.

In my direct testimony in this proceeding, I outlined the Division's recommendation to do away with the Market Proxy Method for calculating avoided costs. The Division believes that Ms. Wright's proposed modifications would not make this method reasonable.

Before I address each of Ms. Wright's proposed modifications, I should point out that avoided costs are forward looking in the sense that the costs that are avoided are the costs that the Company would incur but for the renewable resource. Ms. Wright's modifications would turn this concept on its head and have the avoided costs looking backward. With that, let me address her proposed modifications one at a time.

First, Ms. Wright's proposed use of the cost assumptions that the Company uses in its IRP for the Market Proxy costs is inconsistent with PURPA. The Market Proxy costs in the IRP are forecasted costs. To determine the avoided cost of a new QF to be introduced in the resource mix, the Company uses the most current cost information, not the forecasted costs. These forecasts may over or under-estimate the current costs. Hence, the proposed IRP cost assumptions for the Market Proxy is inappropriate. For example, the IRP may determine the timing of a new resource using these forecasted costs. However, the costs the Company recovers, if at all, will be the actual costs the Company incurs through say a competitive procurement process.

Second, the revenue stream that the Company receives for its owned wind projects is completely unrelated to its avoided cost. Revenues for the utility are equal to the cost the Company incurs to provide electricity plus some rate of return. Paying the QFs the revenue the Company makes from its own wind projects is not equivalent to its avoided costs and, thus, violates the ratepayer indifference principle.

Third, the average cost of PPAs for wind that the Company purchases through PPAs, would not be appropriate to be used as a proxy for avoided cost. The Dunlap contract is the most recent wind contract that Company entered and was entered in 2009. This is outdated. Taking the average cost of an outdated resource and other resources that are more outdated does not yield an improvement in avoided costs over the Dunlap-alone method. Again, this approach is backward looking, which violates the concept of avoided cost.

Finally, using the weighted average by the capacity of wind PPAs from publically available contracts from other Western utilities completely misses the point. The avoided cost that is at issue here is that of PacifiCorp not that of the western utilities. The costs that the Company would avoid are those that it would incur but for the renewable resource, not some weighted average of the wind PPAs in the western utilities.

Q. Regarding the implementation of the Proxy/PDDRR method, what did Ms. Wright propose?

A. Ms. Wright recommends that the Proxy/PDDRR method with modifications should be used when renewable energy is not included in the IRP.

Q. Do you agree with this recommendation?

A. No. As I indicated earlier in this testimony and in my direct testimony, the Division believes that the Proxy/PDDRR should be used regardless of whether a renewable resource is or is not included in the IRP preferred portfolio.

Q. Ms. Wright recommended that solar and other renewable resources should not incur any integration costs. Could you comment on that?

A. Yes. The Division disagrees with this recommendation. All intermittent resources, including solar, incur an integration cost and if we want to determine a fair avoided cost, they should be assessed such a cost.

LUIGI RESTA

Q. In his direct testimony, Scatec Solar North America, Inc.'s witness Mr. Resta indicated that for solar PV, the same kind of market proxy methodology should be used. Would you comment on this proposition?

A. Yes. One of the major questions that this proceeding is expected to answer is whether or not the Market Proxy methodology produces avoided costs that are in the public interest. The Division's position, for reasons outlined in my direct testimony, is that the Market Proxy method is flawed and cannot produce avoided costs that are in the public interest and should be discarded.

Q. In his direct testimony, Mr. Resta provided a list of the benefits that solar provides and concluded PacifiCorp's approach to solar is inappropriate. Do you have concerns with this conclusion?

A. Yes. On page 3, lines 21-22, Mr. Resta indicated that PacifiCorp should include an appropriate amount of solar power in its Integrated Resource Plan. In an attempt to justify this proposition, on Page 10, lines 5-18, Mr. Resta listed the possible benefits that flow from solar. These benefits included the hedging value of solar against future natural gas and coal prices and of compliance with environmental regulations. As previously discussed, these types of benefits are captured through an appropriate preferred portfolio. However, the Division does not believe that this proceeding is the right forum to decide what should or should not be included in the IRP. The Company recently filed its 2013 IRP and the Commission opened Docket No. 13-2035-01 for parties to comment.

Q. On page 11, line 15, Mr. Resta states that, solar provides Utah a great opportunity for in-state economic development. Would you like to comment on that?

A. Yes. The concept of economic development is irrelevant in the determination of avoided cost.

BRUBAKER

Q. UIEC witness Mr. Brubaker requested the Commission adopt, among other things, a procedure requiring the Division to provide verification of avoided cost calculations to the recipient. What is your position about this request?

A. On lines 130 to 131, Mr. Brubaker stated, "if the recipient is unable to verify RMP's avoided cost calculations, it should be able to seek verification of the results by the Division."

Pursuant to the Commission's 2005 Order, on a quarterly basis the Company files with the Commission all the updates to the avoided cost models and model inputs and issues an Action Request to the Division to investigate the filing. The Division files with the Commission the findings of its investigation. Thus, the Division already performs the work Mr. Brubaker recommends. Any party seeking the Division's review and verification of the Company's avoided cost calculations should refer to the memorandum that the Division files with the Commission in this regard. There is no need for the Division to duplicate its verification process and findings. Thus, the Division recommends that the Commission deny Mr. Brubaker's recommendation.

VRBA

Q. Energy of Utah witness Mr. Vrba indicated that though the wind capacity factor in Utah is between 32% - 40%, the Company's proposed method for calculating wind capacity contribution will result 4% capacity value for wind energy. Would you comment?

A. Mr. Vrba is referring to the capacity factor of wind resources. However, capacity value and capacity factor are not equivalent. The distinction between the two has been clearly described by Sarah Wright in her direct testimony. I also have addressed this previously in this testimony.

Q. Mr. Vrba argues that the Company's proposed methodology for calculating wind capacity factor discounts a number of critical issues. Do you agree with this?

A. No. On page 2, lines 26 to 28, Mr. Vrba listed a number items, including cost of fuel hedging, environmental regulation risks, generation diversity risk, and transmission costs that he claims the Company methodology did not consider. There also is a list of factors (lines 37 – 41) that he offered for Commission consideration. As I explained earlier in my testimony, considerations of these items belong to the IRP process. If one intends to discuss considerations of these items, one should comment on the 2013 IRP currently filed with the Commission.

Q. Does that conclude your direct testimony?

A. Yes.