BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Application of Rocky Mountain Power for Authority to Increase its Retail Electric Service Rates in Utah and for Approval of Its Proposed Electric Service Schedules and Electric Utility Service Schedules and Electric Service Regulations	))))))))))	**DOCKET NO. 09-035-23** **Exhibit No. DPU 15.0R** **Rebuttal Testimony and Exhibits**

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

Testimony of

Abdinasir Abdulle, PhD

November 12, 2009

Q. Please state your name and occupation?

A. My name is Abdinasir Abdulle. I am employed by the Utah Division of Public Utilities ("Division") as a Technical Consultant.

Q. What is your business address?

A. Heber M. Wells Office Building, 160 East 300 South, Salt Lake City, Utah, 84114.

Q. On whose behalf are you testifying?

A. The Division.

Q. What is the purpose of your rebuttal testimony?

A. In my rebuttal testimony I will address the issue of which coincident peak (CP) method should be used to allocate capacity costs. Specifically, I will address the 12 CP versus 3 CP allocation issue raised by UIEC witness Mr. Brubaker in his direct testimony.

Q**. Can you briefly describe the issue of the 12 CP versus 3 CP?**

A. Yes. The question here is for which months should capacity costs be assigned? If the peak load of a particular month(s) has some potential responsibility for new investment in generation, then the generation cost should be assigned to that month(s). Currently, the CP for all 12 months (12CP) is used to allocate capacity costs. This decision was made during the merger between Utah Power and Light and PacifiCorp (Merger). The use of the 12CP allocation indicates that the peak loads of all 12 months of the year contribute to the need for potential investments in new generation and transmission. Mr. Brubaker argues that since the Merger, the Company's load shapes have changed, therefore the current 12 CP allocation is no longer appropriate. He argues that 3CP is more appropriate under the current situation and should be adopted.

Q. What led Mr. Brubaker to this conclusion and recommendation?

A. Mr. Brubaker performed some analysis on the Utah jurisdiction's monthly loads at the time of the system peak. He used data from four time periods; 1990, 2007, 2008, and the forecast test year in this proceeding. He drew bar graphs of these data. These bar graphs show that the loads of the summer months, June, July, and August are larger than the other months for all years except 1990 (when Utah was winter peaking). Based on this, Mr. Brubaker concluded that a 3CP allocation is more appropriate than the current 12CP allocation method. Mr. Brubaker is recommending that all production and transmission costs classified as demand-related be allocated on the 3CP because the Rocky Mountain Power system is a summer peaking system.

Q. Do you agree with the analysis Mr. Brubaker performed?

A. No. Though the graphs show that the summer months have larger peak loads than the rest of the months in absolute terms, Mr. Brubaker did not show that the difference was statistically significant. That is, whether the peak load difference between the months is just due to chance or it represents a real difference. Additionally, Mr. Brubaker does not address how the Company uses its resources to meet its load requirements. He focuses exclusively on consumer demand and ignores important planning and operational characteristics of supply that influence cost allocation. Different generation resources serve different purposes with respect to system energy and capacity requirements. These differences affect cost classification and allocation of the production function. Without answering these questions, it is not possible to determine if any month's coincident peak load is more responsible for the potential investments in new generation and transmission than any other month's coincident peak load. Therefore, the kind of analysis performed by Mr. Brubaker cannot be used to draw reliable conclusions as to whether 12CP or 3CP is more appropriate.

Q. Did you perform any analysis yourself?

A. Yes, I performed an analysis to address the first question, namely, whether the three summer months' coincident peaks are significantly greater than the other months of the year. Using the Utah jurisdiction's monthly coincident peak data from 1993 to 2008, which were provided by Rocky Mountain Power (RMP) in its DPU Data Response No. 58, I performed a statistical analysis of the differences between the monthly coincident peaks. Division witness Mr. Joseph Mancinelli addresses the second question in his rebuttal testimony.

Q. Would you briefly describe your analysis?

A. Yes. The essence of the issue is to determine whether there is a significant difference between the mean monthly coincident peaks. Since the data contain the coincident peaks for the 12 months over 16 years, I used an analysis of variance or ANOVA to compare the 12 mean monthly coincident peaks. The null hypothesis to be tested is that mean monthly coincident peaks are the same for all 12 months against the alternative that at least one mean monthly coincident peak is significantly different. In a typical ANOVA design, subjects, which in this case are the years, are assigned at random to different treatments, the months in the present problem. This analysis is based on an analysis of the source of variations.

In the typical design, there are two sources of variation, namely, the within treatment variation and the between treatment variation. The within treatment variation is the variation due to differences in coincident peaks within individual months. It is calculated as the average sum of squares within treatment divided by the degrees of freedom associated with the within treatment variation. That is, the sum of squared deviations of individual observed monthly coincident peak from the average monthly coincident peak divided by the difference between the overall sample size and the number of treatments.

Second, the between variation is the variation due to differences between the average monthly coincident peaks of the different months. That is, the sum of squared deviations of individual average monthly coincident peaks from the grand mean is divided by the number of treatments less one (degrees of freedom associated with the between treatment variations).

In the typical ANOVA design, the ratio of the between treatment variation and the within treatment variation is the F-statistic. If the monthly coincident peaks of all months are drawn from the same population, then, the F-statistic would be less than the F-critical. That is, we would fail to reject the null hypothesis that all months' coincident peaks are the same. However, if the monthly coincident peaks of all months are drawn from different populations, then, the F-statistic would be greater than the F-critical and we would reject the null hypothesis.

In the present case, however, there is a third source of variation that must be taken into account. Since the data contain repeated observations of one treatment (month) over the 16 years of the data, the monthly coincident peaks may vary from year to year. In a typical ANOVA design as previously discussed, this variance would be embedded in the within treatment variation (MSE). Hence, the MSE would be overestimated and consequently the F-static underestimated. To avoid this problem we need to separate the year variance from the other sources of variation. The methodology known as the repeated-measures ANOVA does just that. Consequently, the analysis I used for this analysis is the repeated-measures ANOVA[1].

Q. What was the result of your analysis?

A. Table 1 shows the mean monthly coincident peaks calculated using the Company provided data. Note that the largest average monthly coincident peak occurs in July. The question is whether or not there is a significant difference between any of these mean monthly coincident peaks, in particular, whether any of these means is any different than the July average coincident peak.

Table 1. Mean Monthly Coincident Peaks

Month	Mean Monthly Coincident Peak	Month	Mean Monthly Coincident Peak
January	2,675	July	3,439
February	2,597	August	3,418
March	2,459	September	3,140
April	2,377	October	2,455
May	2,850	November	2,835
June	3,219	December	2,975

1 http://books.google.com/books?id=8rkqWafdpuoC&pg=PA113&lpg=PA113&dq=repeated+observation+ANOVA&source=bl&ots=FwxZB-X3wI&sig=L1gXxlEzlTIE1b9IipPfH3d2DAw&hl=en&ei=Zb7pSs23NIncsgOKi43WCA&sa=X&oi=book_result&ct=result&resnum=3&ved=0CA8Q6AEwAg#v=onepage&q=repeated%20observation%20ANOVA&f=false

Table 2. ANOVA Table

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F
Month	24,443,445	11	2,222,131	63.245
Year	37,339,554	15	2,489,303	
Error (Year x Month)	5,797,284	165	35,135	
Total	67,580,283	191		

Table 2 shows the results of the repeated measures ANOVA. The decision rule is to reject the null hypothesis if the F-statistic as calculated is greater than the F-critical at the 5% significance level. Since the F-calculated (63.245) is greater than the F-critical (1.84), we reject the null hypothesis of equality between the mean monthly coincident peaks and conclude that at least one of the months is statistically significantly different from the others.

Q. How can we tell which mean monthly coincident peak is significantly different from which?

A. After having concluded that the mean monthly coincident peaks are not all the same, the next logical question is which one(s) is significantly different from the others, and in particular, significantly different from the largest average monthly coincident peak. To determine this, one needs to perform a multiple comparison test. The multiple comparison test I used was Fisher's Least Significant Difference (LSD) with an adjusted critical value. This method calculates the least significant difference between any two means. If the difference between any two mean monthly coincident peaks is greater than the LSD, we conclude that the mean monthly coincident peaks for those two months are significantly different. If the difference is less than the LSD, we would fail to reject the null hypothesis or conclude that there is no evidence to support the conclusion that these two means are significantly different.

Q. What was the result of your multiple comparison test?

A. As is shown in DPU Exhibit 15.1, the LSD between any two mean monthly coincident peaks is 221.25. For any two mean monthly coincident peaks to be significantly different from one another, their difference must exceed 221.25.

Table 3 shows the differences between the mean monthly coincident peaks between any two months. For example, the difference between the mean monthly coincident peaks of January and February is 78 (2675 – 2597) and that between February and March is 138 (2597 – 2459). Comparing the numbers in Table 3 with the LSD will indicate which month's mean coincident peak is significantly different from which. Based on this comparison, we can see that the mean monthly coincident peaks of the months of June, July and August are not significantly different from one another but are significantly different from the rest of the months. The means of these months are significantly higher than the rest of the months except September which is statistically the same as June.

Table 3. Fisher's Least Significance Difference With Adjusted Critical Values

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Jan.												
Feb.	78											
Mar.	216	138										
Apr.	298	221	83									
May	175	253	391	473								
Jun.	544	622	760	843	369							
Jul.	764	841	979	1062	588	219						
Aug.	743	820	959	1041	568	199	21					
Sept.	465	542	680	763	289	80	299	278				
Oct.	221	143	5	78	396	765	984	963	685			
Nov.	160	237	375	458	16	385	604	583	305	380		
Dec.	300	377	515	598	124	245	464	443	165	520	140	

We can conclude that the average coincident peaks for June, July, and August are statistically significantly greater than the average coincident peaks for the other months of the year. However, since the mean monthly coincident peak of September is not significantly different than that of June, it is not clear whether or not to include it in the group of months that have significantly greater coincident peaks than the other months of the year.

Q. Does the kind of statistical analysis you made suffice to recommend what CP allocation is most appropriate?

A. No. This kind of analysis treats all generation resources uniformly and does not recognize the fact that different generation resources provide different planning and operational benefits to the system and its customers. A better CP allocation method would possibly be one that matches the operational use of the various generation assets with meeting base, intermediate, and peak loads. This approach is conceptually explained in Mr. Mancinelli's rebuttal testimony. However, it requires further study.

Q. What is your recommendation?

A. I would recommend that the Commission direct the parties in this proceeding to continue exploring this issue further and report their findings back to the Commission.

Q. Does this conclude your rebuttal testimony?

A. Yes.