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ACTION REQUEST RESPONSE

To: Public Service Commission

From: Chris Parker, Director
Artie Powell, Energy Section Manager
Charles Peterson, Technical Consultant
Sam Liu, Utility Analyst

Date: October 15, 2012

Re: Docket No. 12-035-93 – Major Event 29 – July 13, 2012

RECOMMENDATION

The Division recommends that the Commission approve the Company's application for Major Event exclusion for the event that took place on July 13, 2012 (Event 29). The System Average Interruption Duration Index (SAIDI) value for the event exceeded the threshold that defines a Major Event under the Institute of Electrical and Electronic Engineers' (IEEE) 2.5 Beta methodology adopted by the Commission in 2005 in Docket No. 98-2035-04.

ISSUE

On August 30, Rocky Mountain Power (Company) filed Major Event Report for the weather-related events July 13, 2012; the Commission issued an Action Request with a due date of September 28, 2012 on this matter. On September 18, 2012 the Commission issued an Amended Action Request directing the Division to review the Customer Analysis and SSM

(SAIDI, SAIFI, MAIFI) Analysis for this Major Event where information on CAIDI was substituted for MAIFI data. The Division issued a formal data request to Rocky Mountain Power (Company) on September 6, 2012, and an informal data request following the Commission’s Amended Action Request. The Division received responses to its data requests in the afternoon on September 25, 2012. The Division requested that the Commission extend the deadline for comments to Tuesday, October 16, 2012. The Commission granted this request on October 3, 2012. This memorandum represents the Division’s response to the Commission’s Action Request and Amended Action Request.

EVENT DESCRIPTION

On July 13, 2012, a severe thunderstorm blowing through Utah caused extensive damage to Rocky Mountain Power facilities primarily in Park City, Salt Lake City Metro, and Jordan Valley operating areas. Most significantly, a microburst in Summit County hit a 138 kV line at about 6:20 pm and a sub-transmission line went out at 9:22 pm, taking out power to more than 90% of the Company’s Park City customers. The damaging high wind forces slapped lines together, toppled trees and blew branches into distribution lines in several counties. The storm damage resulted in sustained interruption that affected 84 substations and 122 circuits. The longest interruption event occurred on Ogden’s Little Mountain #18 (LMT18) circuit, affecting 7 customers for 1,219 minutes (20.3 hours) due to a pole fire. The event resulted in 41,156 customers experiencing sustained outage and 6,292,810 customer minutes being lost. In response to a Division data request the Company refined its cost estimate to a total of \$237,199 as set forth in the table below.

Category	Capital	Expense	Total
External Contactors	11,996.01	26,457.84	38,453.85
Internal Labor	49,425.24	127,739.75	177,164.99
Materials (Stores)	12,508.76	9,071.48	21,580.24
Total	73,930.01	163,269.07	237,199.08

DISCUSSION

To determine whether the event of July 13, 2012 was a Major Event the Division followed the IEEE 1366-2003 definition of a Major Event. The Commission adopted this methodology, commonly referred as the 2.5 Beta Method, in Docket No. 98-2035-04. The IEEE 1366-2003 defines a Major Event as “*an event that exceeds reasonable design and or operational limits of the electric power system. A Major Event includes at least one Major Event Day*”. IEEE 1366-2003 defines a Major Event Day as “*a day in which the system SAIDI exceeded a threshold value, T_{MED} .*” A Major Event Day is simply a day in which the reliability of the distribution system is much worse than normal. The 2.5 Beta Method allows the segmentation of reliability data into normal and abnormal categories, based on the identification of outlier events that cause Major Event Days. Assuming that the daily SAIDI measures follow a log-normal distribution, the probability of a day being defined as a Major Event day under the 2.5 Beta Method is less than 1 percent. The expected number of major event days is 2.3 per year.

According to the definition of a Major Event, any daily SAIDI value that exceeds 5.91 minutes is considered a Major Event. The Company’s Utah SAIDI value for July 13, 2012 was 7.51 minutes. Therefore, the event of July 13, 2012 was a Major Event and should be excluded from the network performance reporting.

Pole Fires

The Company mentions that “The longest interruption of the event occurred on Ogden’s Little Mountain #18 (LMT18) circuit, affecting 7 customers for 1,219 minutes (20.3 hours) due to a pole fire.” Little Mountain is geographically distant from the primary outage areas, and the pole fire event appears to be coincidental to the storm that caused major outages. The Company reports that the cause of the pole fire is unknown.¹ The pole fire incident appears to be part of a systemic problem, the solution of which the Company continues to study.

¹ DPU Data Request 1.1

Given the IEEE definition of a major event adopted by the Commission, the possibly coincidental pole fire incident is included as part of the SAIDI and SAIFI measures for the major event (excluding it would have no material effect on these calculations). However, the Division believes that some further consideration may need to be given in major event calculations when an incident is geographically distant from the primary major event area and/or is due to systemic issues rather than random and uncontrollable factors such as unusual weather events. Therefore, the Division believes that the Little Mountain pole fire incident should be excluded from the major event calculations and SAIDI and SAIFI measures associated with the pole fire should be included with the “normal” operating statistics of the Company.

CAIDI OR MAIFI

The Company always reported MAIFI measurements and not CAIDI measurements in Customer Analysis and SSM² Analysis for its Major Event report through 2011. MAIFI (Momentary Average Interruption Frequency Index), a reliability indicator, is the total number of customer interruptions less than 5 minutes in duration divided by total the number of customers served. In response to Division data requests 2.1 and 2.2 the Company explained that it recently revamped its base reports, which were used to generate Major Event supporting materials. The Company actually uses its Supervisory Control and Data Acquisition (SCADA) for communicating between distribution breakers and the control room as the method for calculating an industry-compliant MAIFI and MAIFI_e calculation. Furthermore, the Company indicates that its MAIFI data are estimates which may not be very accurate because only about 60 percent of the distribution breakers in Utah are presently connected through SCADA.

MAIFI_e (Momentary Average Interruption Event Frequency Index) is very similar to SAIFI, but it tracks the average frequency of momentary interruption events, i.e. the, series of operations necessary to clear event and how many 5-minute intervals in which a MAIFI interruption occurred. These are momentary outage measures and they potentially signal system stresses. MAIFI and MAIFI_e are generally better evaluated over a longer term for “underlying”

² “SSM” is the abbreviation used to label the Company’s exhibit. It stands for “SAIDI, SAIFI, MAIFI.”

or non-Major Event metrics, as opposed to the sustained metrics, i.e. SAIDI, SAIFI and CAIDI. In any event, MAIFI or MAIFI_e are not used to determine a Major Event.³

The Customer Average Interruption Duration Index (CAIDI) is more useful than MAIFI as a measure for a major event. It reflects how stressed and constrained resources may be as they restore power. CAIDI is sum of all customer interruption durations divide by total number of customer interruptions and is same as SAIDI/SAIFI. CAIDI can also be viewed as the average restoration time. According to IEEE Standard 1366-1998 the median value for North American utilities is approximately 1.36 hours duration per customer.⁴ The Company's responses to the Division's data requests concerning MAIFI/CAIDI are included as an attachment.

Restoration Efforts

The graphical hourly analysis of Event 29 below shows that the impact of the storm had been building up for a number of hours with the Company restoring customers as soon as practicable. This is evidenced by the fact that the cumulative customer lost was relatively flat for the first few hours of the storm. That means that as some customers were restored, some other customers were losing power. The peak number of customers without service took place when a microburst in Summit County hit a 138 kV line at about 6:30 p.m. and a sub-transmission line subsequently went out around 9:30 p.m. causing a second spike in the outages on July 13, 2012, taking out power to more than 90% of the Company's Park City customers.

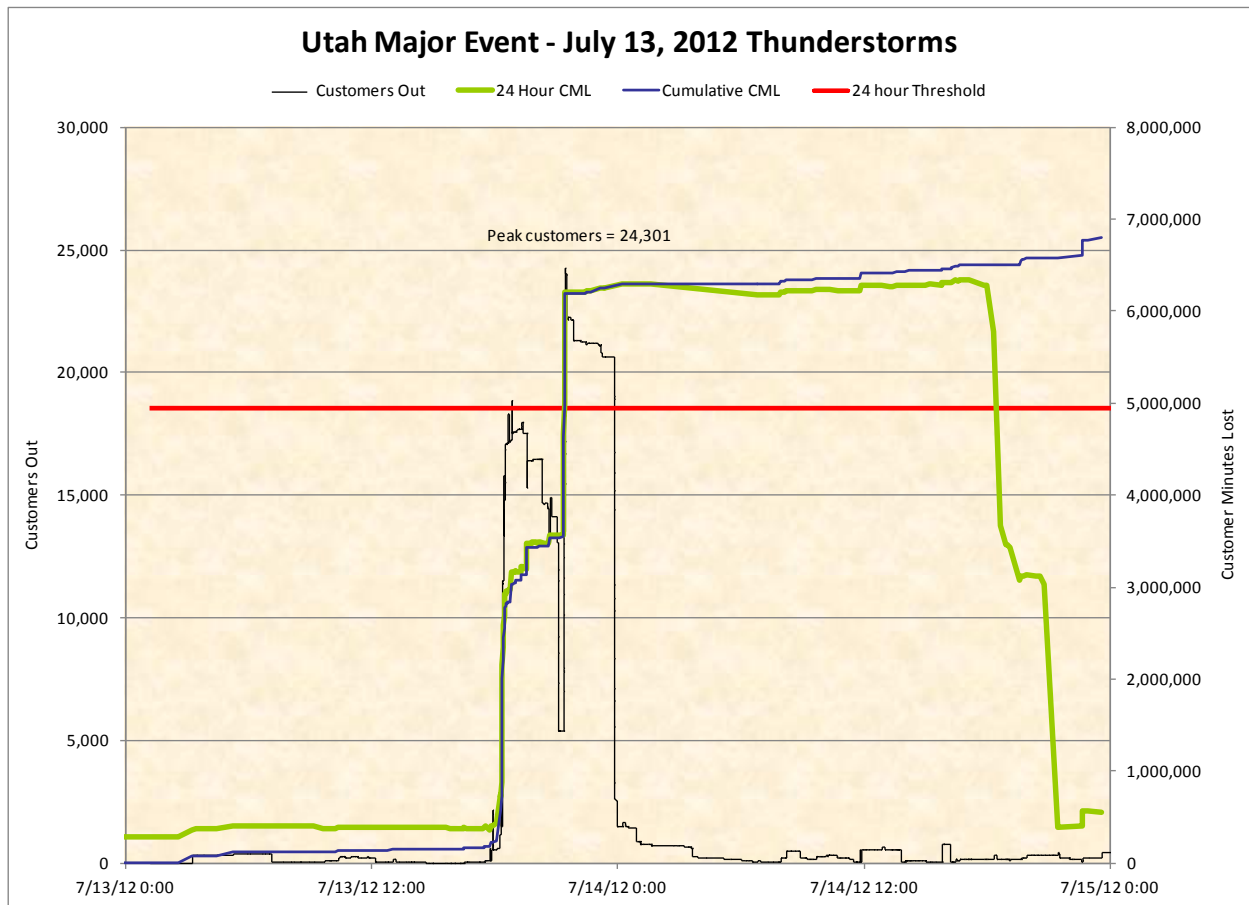
Despite the setback caused by the 9:30 p.m. sub-transmission line failure, using its own crews from Utah, crews borrowed from Idaho, and contract crews, the Company managed to restore 90% of its customers within 3 hours and 100% of the customers that experienced sustained outages within 24 hours.

³ MAIFI is easily calculated from the Company-provided data by simply dividing (total number of customer interruptions less than 5 minutes) by (total number of customers served).

⁴ Wikipedia, <http://en.wikipedia.org/wiki/CAIDI>

Customer Guarantee 1 (Restoring Supply After an Outage) requires that in the event of an outage, the Company will restore a customer's electric supply within 24 hours of being notified except where, among other things, there is an inability to access the Company's or the Customer's facility for reasons beyond the Company's control and where there is a major event. Therefore, the Division concludes that the Company's restoration efforts were reasonable.

Figure 1. Hourly Analysis of Event 29



Restoration Resources:

Troubleman/assessors	17
Internal local crewmembers	90
Internal borrowed crewmembers	12
External (contract) crewmembers	8
Vegetation crewmembers	9
Total	136

CONCLUSION

As reported by the Company, the July 13, 2012 (Event 29) has a SAIDI value of 7.51 minutes. Excluding the pole fire on Ogden's Little Mountain #18 circuit has a SAIDI value of 7.48. In either case, therefore, this was a major event by the criteria adopted by the Commission. Even though the exclusion of the Little Mountain minutes lost does not affect the classification of Event 29, the Division recommends that the minutes lost for the Little Mountain pole fire not be included as part of this major event; but rather they should be included in the calculation of SAIDI values for other service quality reviews and reports.

APPENDIX – DISCUSSION OF THE 2.5 BETA METHOD

For the 2.5 Beta Method to be valid, the daily SAIDI data must follow a log-normal distribution. That is, the log of the daily SAIDI data must follow a normal distribution. Using the daily SAIDI provided by the Company (from January 1, 2007 to December 31, 2011), the Division performed a normality test to determine if, under normal operating conditions, the natural log of PacifiCorp's daily SAIDI values approximate a normal distribution (testing if the daily SAIDI values follow a log-normal distribution will lead to the same conclusion).

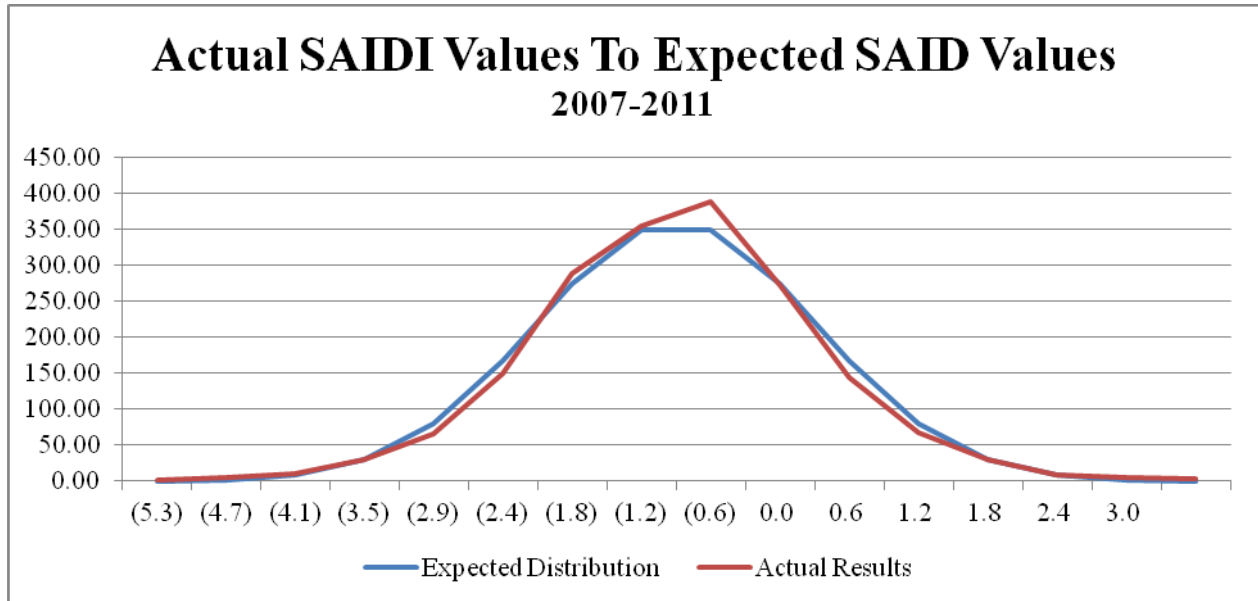
To implement the test, the Division used a Box-and-Whisker plot to identify any outliers in the data set. SAIDI values determined to be outliers were removed from the data set. Removing the outliers was essential to ensure that the remaining data represented "normal" operating conditions. To test for normality, the Division used the Kolmogorov-Smirnov normality test. The null hypothesis tested was that the natural log of PacifiCorp's daily SAIDI values is normally distributed. The Kolmogorov-Smirnov failed to reject the null hypothesis (at $p < 0.01$). Hence, based on the result of the Kolmogorov-Smirnov normality test, the Division concludes that, under normal conditions, the natural log of PacifiCorp's daily SAIDI values are normally distributed and the use of the 2.5 Beta Method is justified.

The Division calculated the Major Event threshold (T_{MED}) as 5.91. The T_{MED} , is calculated using the following procedure:

1. Assemble the preceding five years of daily SAIDI values,
2. Remove from the data set any day in which the daily SAIDI value was zero,
3. Take the natural log of each of the daily SAIDI values,
4. Calculate the mean, α , and the standard deviation, β , of the natural logs of the daily SAIDI values, and
5. Calculate the threshold, $T_{MED} = e^{(\alpha + 2.5\beta)}$.

The Company provided a statistical analysis that indicated the 2007 – 2011 SAIDI are approximately distributed log-normal. The figure below graphically depicts the goodness-of-

fit of the log of the 2007-2011 SAIDI data to the normal curve, i.e. a visual demonstration of the log-normal nature of the SAIDI data.



Attachment

- CC Marialie Martinez, DPU
- Doug Bennion, RMP
- Dave Taylor, RMP
- Michele Beck, CCS

DPU Data Request 2.1

Please explain why the Company is now reporting CAIDI measurements in place of MAIFI? The Company always reported MAIFI and not CAIDI through 2011.

Response to DPU Data Request 2.1

The Company recently revamped base reports, which were used to generate Major Event supporting materials. At that time, critical review of the data being reported was performed. The Company recognized that the underlying system for capturing MAIFI was representing an incomplete view of MAIFI, since the Company actually uses its SCADA enabled distribution breakers as the method for calculating an industry-compliant MAIFI and MAIFI_e calculation. Thus, data captured in prior reports was likely mis-stating the MAIFI index. The Company has proposed in its comments to current reliability rules its reasons for advising that MAIFI_e calculations should be performed at a wider system view for a larger period of time, since calculation of either momentary index over a short period of time and a small area is not useful, nor is it straightforward to accomplish.

DPU Data Request 2.2

Please explain the advantages and disadvantages of CAIDI vs. MAIFI. Please include in this explanation what information CAIDI conveys that MAIFI does not; whether MAIFI has any use in major event report; and why, generally, CAIDI is a more reasonable measure to have available than MAIFI.

Response to DPU Data Request 2.2

CAIDI is a key measure for a major event, which reflects how stressed and constrained resources may be as they restore power. CAIDI measures the average restoration time for the period and is the calculation of SAIDI/SAIFI. During a Major Event, when outages are stacked up for response personnel, use of CAIDI can show the extent to which they were either overloaded with calls or were impacted by inclement weather. MAIFI or MAIFI_e, however is not a useful Major Event metric. These are momentary outage measures and they only potentially signal system stresses. MAIFI and MAIFI_e are generally better evaluated over a longer term and for “underlying” or non-Major Event metrics, as opposed to the sustained metrics, i.e. SAIDI, SAIFI and CAIDI. These capture, even on a relatively short time period, the full magnitude of actual system stresses and the operational response to these stresses.