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MEMORANDUM

To: Public Service Commission

From: Division of Public Utilities
                    Philip Powlick, Director
              Energy Section
                    Artie Powell, Energy Section Manager
                    Charles Peterson, Technical Consultant
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Date: August 4, 2010

Ref: Docket No. 10-035-68 – Major Event 20 – April 27-28, 2010

RECOMMENDATIONS

The Division recommends that the Commission approve the Company's application for Major Event exclusion for the event that took place on April 27-28, 2010 (Event 20). 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 under Docket No. 98-2035-04.

EVENT DESCRIPTION

On April 27, 2010, a major spring storm with strong winds moved into Utah causing extensive damage to the system. The storm damage resulted in sustained interruption that affected 113 substations and 152 circuits. The event resulted in 48,064 customers experiencing sustained outage and 5,800,602 customer minutes being lost. The cost to repair the damage was estimated to be $500,000, composed of $300,000 for labor and $200,000 for equipment.

PROCEDURE

To determine whether the event of April 27-28, 2010 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. Given that the daily SAIDI measures follow a log-normal distribution, the probability of a day being defined as a Major Event day is less than 1 percent. The expected number of major events days is 2.3 per year.

FINDINGS

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, 2005 to December 31, 2009), 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 Kolmogrov-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 6.73. The T_{MED}, is calculated using the following procedure:

1. Assemble the preceding three to 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, $T_{MED} = e^{(\alpha+2.5\beta)}$.

According to the definition of a Major Event, any daily SAIDI value that exceeds 6.73 is considered a Major Event. The Company's Utah SAIDI value for April 27-28, 2010 was 7.08. Therefore, the event of April 27-28, 2010 was a Major Event and should be excluded from the network performance reporting.

Restoration Efforts

The graphical hourly analysis of Event 20 shown 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 minutes 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 around 3:00 p.m. on April 27, 2010. The Millcreek substation jumpers were damaged by storm driven vegetation and had to be repaired before the substation and circuits could be reenergized. This resulted in prolonged outage duration.

Despite this damage to the Millcreek substation jumpers, the Company, using its own crews (both local and from other Company service areas) and contract crews, managed to restore 77%

and 100% of the customers that experienced a sustained outage within between 5 minutes and 3 hours and within 24 hours, respectively.

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. Hence, since the Company restored the electric supply to all customers within 24 hours, the Division concludes that the Company's restoration efforts were adequate.

Figure 1. Hourly analysis of event 20

Utah Major Event - April 27, 2010
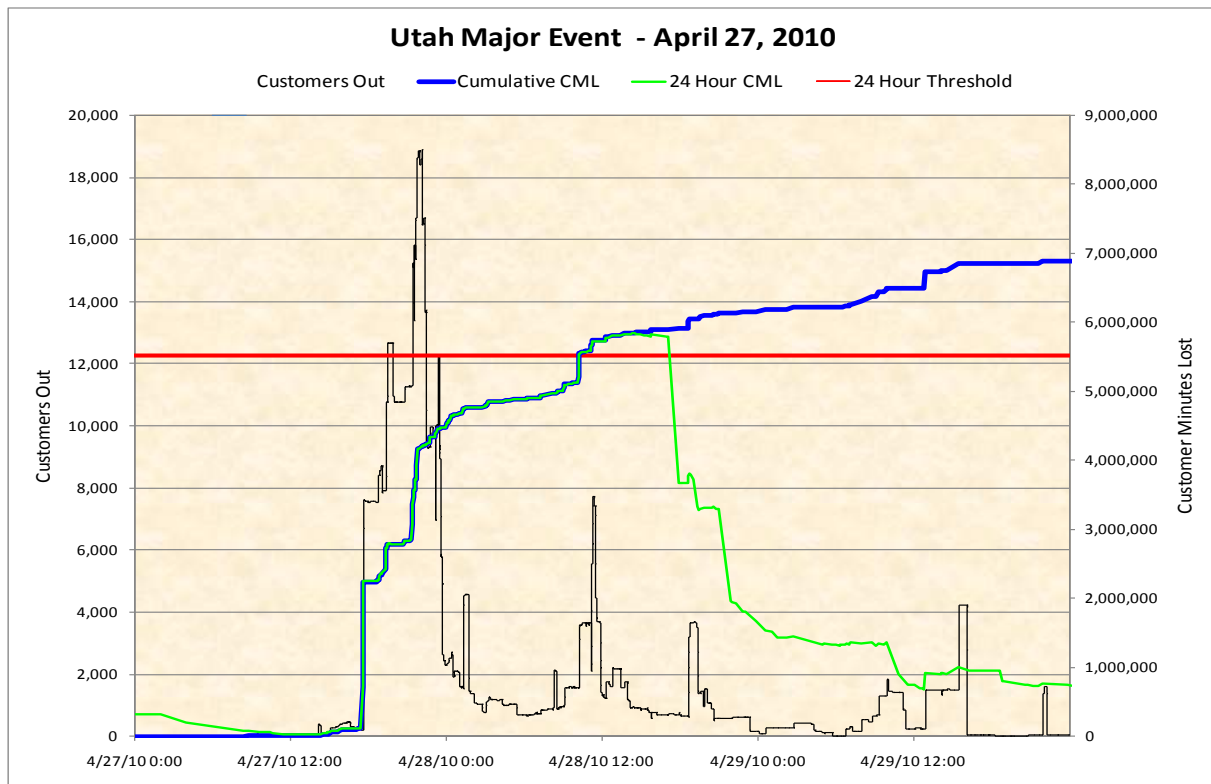
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