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Department of Commerce  
Division of Public Utilities

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## **ACTION REQUEST RESPONSE**

To: Public Service Commission

From: Division of Public Utilities  
Chris Parker, Director  
Energy Section  
Artie Powell, Energy Section Manager  
Abdinasir Abdulle, Technical Consultant

Date: April 4, 2011

Ref: Docket No. 11-035-28 – Major Event 23 – December 20-22, 2010

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## **RECOMMENDATIONS**

The Division recommends that the Commission approve the Company's application for Major Event exclusion for the event that took place on December 20-22, 2010 (Event 23). 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 December 20 through 22, 2010, a heavy snowstorm preceded by three days of heavy rain caused extensive damage to the Company's facilities in Central Utah. The storm damage resulted in sustained interruption that affected 155 substations and 217 circuits. The event resulted in 33,974 customers experiencing sustained outage and 12,048,105 customer minutes being lost. The cost to repair the damage was estimated to be \$1,360,000, composed of \$725,000 for labor and \$635,000 for equipment.

## PROCEDURE

To determine whether the event of December 20-22, 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. 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 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 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 6.73. 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,  $\alpha$ , and the standard deviation,  $\beta$ , 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 December 20-22, 2010 was 14.7. Therefore, the event of December 20-22, 2010 was a Major Event and should be excluded from the network performance reporting.

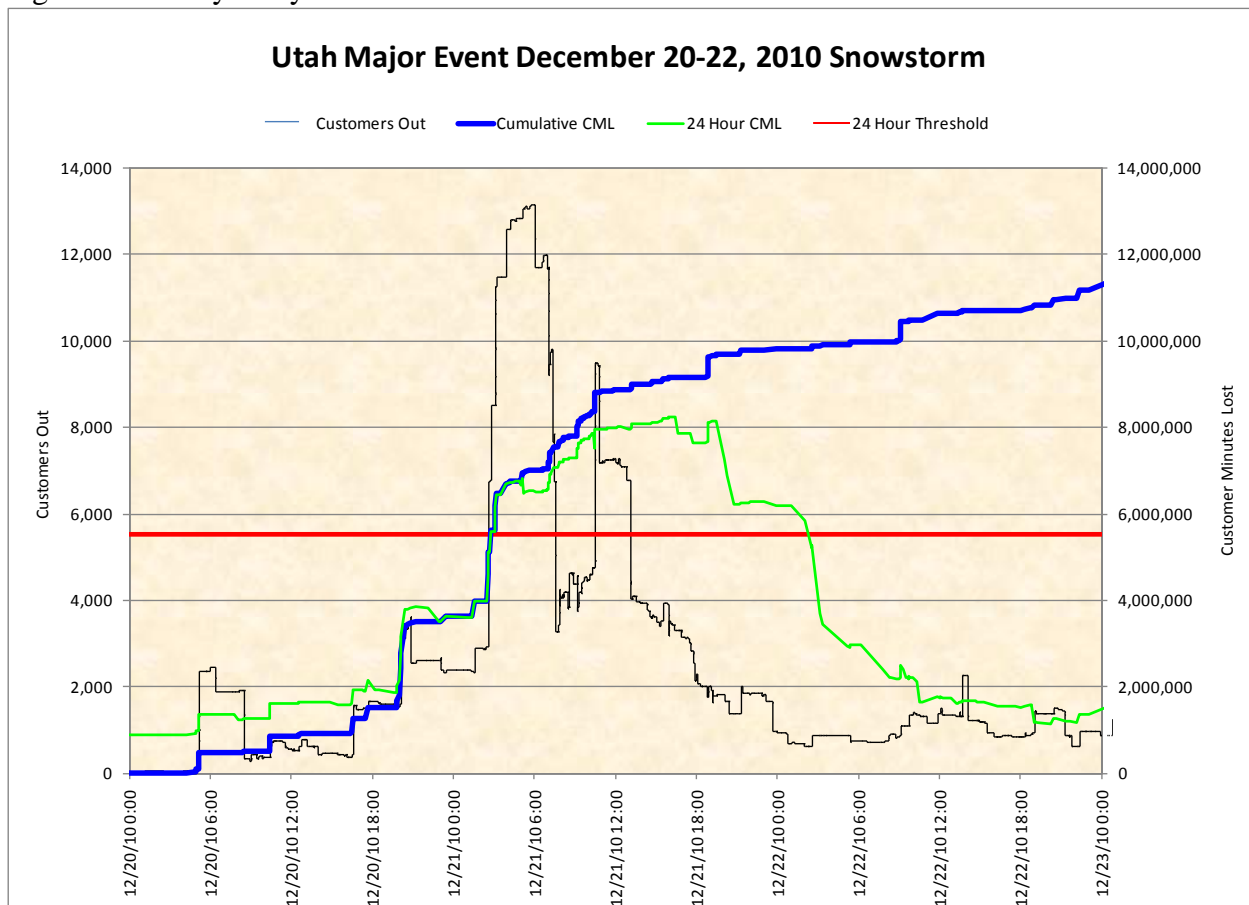
### **Restoration Efforts**

The graphical hourly analysis of Event 23 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 graph of the "customers out" 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 6:00 a.m. on December 21, 2010. Multiple road closures, blizzard conditions, deep canyons, mountain terrain, and damages to customer equipments, which needed to be repaired by private electricians before the Company could restore power, prolonged restoration time.

Despite these setbacks, the Company, using its own crews (both local and from other Company service areas) and contract crews, managed to restore 59% and 98% of the customers that experienced a sustained outage 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. Despite the access problems and the designation of a Major Event for this event, the Company restored the electric supply to 98% of the customers within 24 hours. Therefore, the Division concludes that the Company’s restoration efforts were reasonable.

Figure 1. Hourly analysis of event 23



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