ACTION REQUEST RESPONSE

To: Public Service Commission

From: Chris Parker, Director

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Date: February 9, 2012

Re: Docket No. 12-035-03 – Major Event 26 – December 1-2, 2011

RECOMMENDATION (Approve)

The Division recommends that the Commission approve the Company's application for Major Event exclusion for the event that took place on December 1-2, 2011 (Event 26). 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 1 - 2, 2011, a severe windstorm blowing through Utah caused extensive damage to the Company's facilities in Salt Lake City Metro, Jordan Valley, Ogden and Layton areas. Consistent wind speeds averaged 65 mph with gusts exceeding 100 mph. The damaging wind

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forces uprooted hundreds of trees, tore roofs off structures, destroyed traffic signals, toppled high-profile vehicles, and rapped utility poles and crossarms. The storm damage resulted in sustained interruption that affected 107 substations and 213 circuits. The event resulted in 137,799 customers experiencing sustained outage and 66,473,565 customer minutes being lost. In its initial filing the Company estimated the total cost to repair the damage to be $5,000,000. In response to a Division data request the Company has refined its cost estimate to a total of $4,719,000 as set forth in the table below.

Utah Storm	EXP	CAP
Internal Labor	$ 1,160,000	$ 1,537,000
External Labor	$ 1,113,000	$ 304,000
Materials, OH	$ 201,000	$ 404,000
Estimate Totals	$ 2,474,000	$ 2,245,000

DISCUSSION

To determine whether the event of December 1-2, 2011 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.[1]

According to the definition of a Major Event, any daily SAIDI value that exceeds 6.42 minutes is considered a Major Event. The Company's Utah SAIDI value for December 1-2, 2011 was 80.04 minutes. Therefore, the event of December 1-2, 2011 was a Major Event and should be excluded from the network performance reporting.

RESTORATION EFFORTS

The graphical hourly analysis of Event 26 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 (68,643) took place around 9:50 a.m. on December 1, 2011. Multiple road closures, blizzard conditions, deep canyons, mountain terrain, and damage to customer equipment 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 31% of the customers who had suffered a sustained outage power within 3 hours of the initial outage; and 96% of the customers that experienced a sustained outage were restored within 24 hours.

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

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[1] For 2.5 standard deviations (the meaning of the "2.5" in the 2.5 Beta Method), the right-tail probability is approximately 99.38 percent, or the probability of exceeding 2.5 standard deviations is about 0.62 percent. Multiplying 0.62 percent by 365 days is approximately 2.3 days.

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 96% of the customers within 24 hours. Therefore, the Division concludes that the Company's restoration efforts were reasonable.

Figure 1. Hourly Analysis of Event 26

Utah Major Event December 1-2, 2011 Windstorm
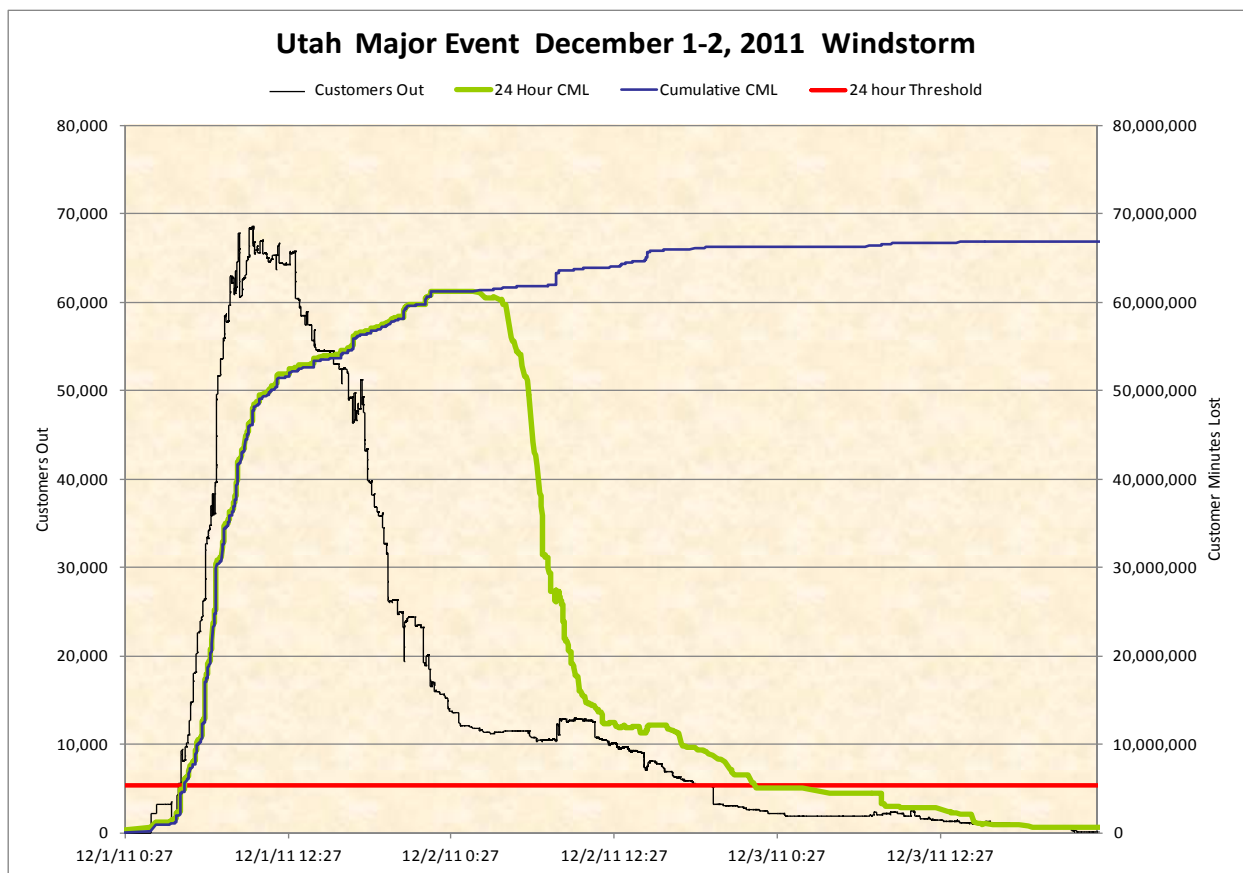
APPENDIX—DISCUSSION OF THE 2.5 BETA METHOD

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. For the current major event, the company provided the daily SAIDI provided over the January 1, 2006 to December 31, 2010 period.

The Division has previously 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). The Company SAIDI data have consistently passed the test for a log-normal distribution. 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 6.42. 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, $T_{MED} = e^{(\alpha + 2.5\beta)}$.

As summarized above, the Division calculated the T_{MED} threshold value to be 6.42 minutes. A T_{MED} value that exceeds 6.42 minutes is considered a major event by the criteria adopted by the Commission. The December 1-2, 2011 event has a T_{MED} value of 80.04 minutes, which greatly exceeds the threshold 6.42 minute value. Therefore, this was indeed a major event. The figure below graphically compares the expected normal curve of the log of the SAIDI data with the actual log of the 2006-2010 SAIDI data.
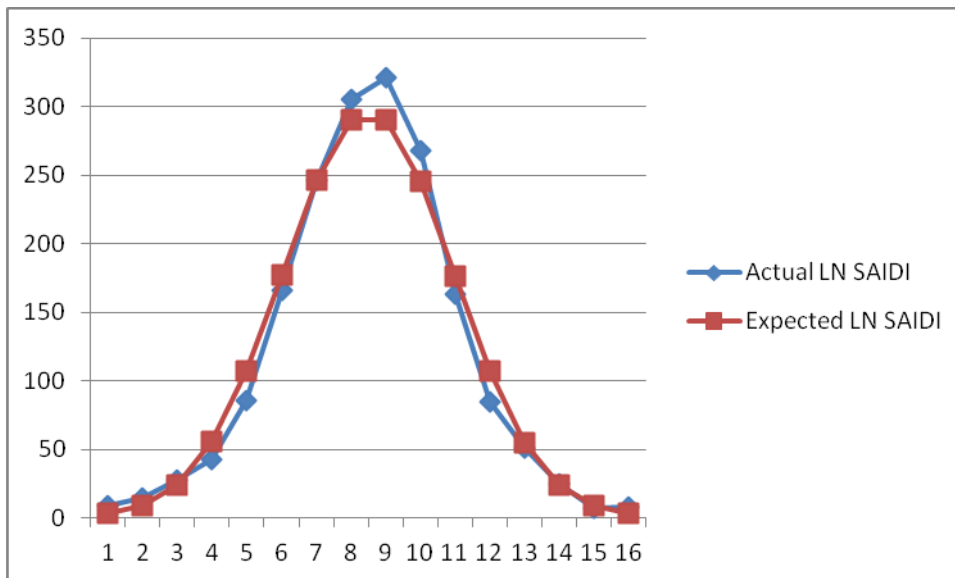
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