

Exhibit No.:
Issues: Weather Normal Variable
Witness: Manisha Lakhanpal
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MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

REBUTTAL TESTIMONY

OF

MANISHA LAKHANPAL

THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. ER-2010-0130

Jefferson City, Missouri

April 2010

Rebuttal Testimony of
Manisha Lakhanpal

1 A. The Commission should adopt Staff's weather for the following reasons:

2 • First, TMAX and TMIN are the extreme temperature values, which occur
3 randomly but at specific moments during the day, whereas the 24-hourly
4 temperature data recordings used by EDE are taken at a specific and
5 predetermined moment in each hour and will only capture the TMAX and/or
6 TMIN if they occur at the moment of one of the scheduled hourly temperature
7 readings.

8 • NOAA publishes a complete series of TMAX and TMIN for the 30-year time
9 period used to calculate normal weather. There are hours in the 24-hourly
10 temperature series used by EDE that have missing temperature readings.

11 • NOAA collects and adjusts TMAX and TMIN for exposure changes over the 30-
12 year period of weather that Staff uses to compute monthly normal temperatures.
13 The 30-year period used by EDE is not adjusted for exposure changes.

14 • Staff adjusts daily weather temperature based off of NOAA's adjustments over the
15 normals period. This is done to weather normalize billing usage based on
16 temperature variation between days of the year.

17 Q. What is the source of Staff's data for TMAX and TMIN?

18 A. The TMAX and TMIN data were acquired from the Midwestern Regional
19 Climate Center (MRCC) database. The MRCC is a cooperative program of the Illinois State
20 Water Survey and the National Climatic Data Center (National Oceanic and Atmospheric
21 Administration, U.S, Department of Commerce (NOAA)).

22 Q. Are the TMAX and TMIN drawn from the hourly temperatures?

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1 A. No. Modern instruments measure and record the daily instantaneous extreme
2 temperatures electronically. Hourly temperatures are taken at a specific and predetermined
3 moment in each hour. TMAX and TMIN could occur at any moment of the day irrespective
4 of the time when the hourly temperature recording is taken. The recorded daily maximum
5 temperature will be equal or greater than the highest of the 24-hourly measurements.
6 Similarly the recorded daily minimum temperature will be equal or less than the lowest hourly
7 measurement. The recorded mean daily temperature is defined as the average of the daily
8 maximum and minimum temperatures, and will usually be different than the average of the
9 24-hourly temperatures.

10 Q. Does NOAA use TMAX and TMIN to calculate normals?

11 A. Yes, TMAX and TMIN are used by NOAA to calculate its normal weather.
12 To make its normal weather as accurate as possible, NOAA makes sure its daily weather data
13 is serially complete (i.e. no missing values) and also adjusts for exposure changes such as
14 changes in station locations, instrumentation, time of observation, surrounding environment,
15 observing practice and sensor drift.

16 Q. Were there exposure changes in the temperature data series for the Springfield³
17 (SGF) weather station?

18 A. Yes. Examination of the data shows that NOAA applied exposure change
19 adjustments dating backward in time from 1978, 1984, 1990 and 1995. The adjustments were
20 applied to monthly TMAX and TMIN from the years before 1996, and were intended to cause
21 the earlier temperature readings to correspond with those from the current weather instrument
22 installation at SGF, namely, the Automated Surface Observing System (ASOS).

³ Temperature data from Springfield Regional Airport weather station is being used by both the Company and Staff.

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1 | Consequently, temperatures for the years from 1996 forward are the baseline, and contain no
2 | adjustments.

3 | Q. Does the 24-hour daily data as used by the Company account for any of the
4 | above mentioned adjustments?

5 | A. No, it does not.

6 | Q. Does Staff make any additional adjustments to the daily weather variables that
7 | it uses to calculate normals?

8 | A. Yes. Staff adjusts daily weather temperature based off of NOAA's
9 | adjustments over the normals period. Staff makes adjustments to the daily weather variables
10 | such that the monthly average of the temperature variables matches the NOAA's published
11 | monthly sequentials while maintaining the same daily temperature distribution as the
12 | observed daily temperatures.

13 | Q. Doesn't NOAA publish a set of normal daily values?

14 | A. Yes. However, NOAA collects and adjusts monthly average temperatures over
15 | a defined 30-year period to compute monthly normal temperatures. Daily normal
16 | temperatures are derived by statistically fitting smooth curves through monthly values; daily
17 | data is *not* used to compute daily normals. As a result, the published values reflect smooth
18 | transitions between seasons. The resulting normals do not contain daily temperature variation
19 | for weather-normalizing billing usage. Although the methods used by Staff and the Company
20 | to calculate daily normal weather differ, both methodologies produce daily normals that
21 | reflect typical day-to-day variations in weather that is experienced in Missouri.

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1 Q. Does EDE make adjustments to the daily weather variables such that the
2 monthly average of the temperature variables matches the NOAA's published monthly
3 sequentials?

4 A. No, it does not.

5 Q. What is your recommendation to the Commission?

6 A. Staff recommends that the Springfield daily TMAX and TMIN data, including
7 Staff's adjustments to the daily weather temperature based off of NOAA's adjustments over
8 the normals period 1971-2000, be used to calculate normal weather.

9 Q. Does this conclude your testimony?

10 A. Yes, it does.