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MISSOURI PUBLIC SERVICE COMMISSION

REGULATORY REVIEW DIVISION

REBUTTAL TESTIMONY

OF

SEOUNG JOUN WON, Ph.D.

NORANDA ALUMINUM, INC., et al, COMPLAINANT,

v.

**UNION ELECTRIC COMPANY, d/b/a
AMEREN MISSOURI RESPONDENT**

CASE NO. EC-2014-0223

*Jefferson City, Missouri
June 2014*

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1 duties at the Commission include managing weather data, calculating normal weather,
2 analyzing revenues, and developing rate designs.

3 **EXECUTIVE SUMMARY**

4 Q. What is the purpose of your rebuttal testimony?

5 A. The purpose of this testimony is to explain the weather variables Staff used to
6 weather normalize sales of Union Electric Company d/b/a Ameren Missouri (“Ameren
7 Missouri” or “Company”) and to present the weather normalization and 365-days adjustments
8 of Company’s revenue.

9 **WEATHER VARIABLES**

10 Q. What is the purpose of calculating weather variables?

11 A. The purpose of calculating weather variables is to restate a twelve-month
12 period of weather-sensitive, actual-customer usage and revenues in order to reflect “normal
13 weather” for that period. Because each year's weather is unique and varies from normal,
14 usage and revenue of weather-sensitive customer rate classes need to be adjusted to "normal"
15 weather conditions. In this proceeding, the Staff has weather normalized Ameren Missouri’s
16 weather-sensitive customer usage and revenues for the twelve-month period ending December
17 31, 2013 (“Year 2013”).

18 Q. What are Year 2013 weather and normal weather for this case?

19 A. Year 2013 weather is an observed daily maximum and minimum temperature
20 data series reported by Midwestern Regional Climate Center ("MRCC") for a year period of
21 January 1, 2013 through December 31, 2013, from the Lambert - St. Louis International
22 Airport ("STL"), St. Louis, Missouri.

1 According to the U.S. National Oceanic and Atmospheric Administration ("NOAA"),
2 a climate normal is defined, by convention, as the arithmetic mean of a climatological element
3 computed over three consecutive decades.¹ As a measure of normal weather, Staff used
4 "climate normal period" published in July 2011 by the National Climatic Data Center
5 ("NCDC") of NOAA as the authoritative definition of normal weather. To conform to the
6 NOAA's three consecutive decade convention for determining normal temperatures, Staff
7 used an observed maximum and minimum daily temperature data series for the 30-year period
8 of January 1, 1981, through December 31, 2010, on which NOAA bases its calculation of
9 normal.

10 Inconsistencies and biases in the 30-year time series of daily temperature observations
11 occur if weather instruments are relocated, replaced or recalibrated. Changes in observation
12 procedures or the instrument's environment may also occur during the 30-year period. NOAA
13 specifically identified three major instrument and location changes for STL in 1988, 1996 and
14 2002 during the 30-year period of 1981–2010.² To remove the anomalies in the 30-year
15 temperature data series, Staff utilizes the adjustments used in the Company's most recent rate
16 case (Case No. ER-2012-0166). The detail of adjustments is presented in Staff's workpapers.

17 Q. What is the weather variable used for weather normalization?

18 A. The weather variable required to weather-normalize sales is the two-day
19 weighted mean daily temperatures ("TWMDT") of the test-year actual and the 30-year
20 normal. Weather fluctuates greatly from day-to-day in STL. The day's mean daily
21 temperature ("MDT") is defined as the simple average of the day's maximum daily
22 temperature and minimum daily temperature. The day's TWMDT is calculated using the

¹ Retrieved on April 25, 2014 from NOAA website, <http://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data>.

² Retrieved on April 25, 2014 from NOAA website, <http://www.ncdc.noaa.gov/homr/>

1 previous day's MDT with a one-third weight and the current day's MDT with a two-thirds
2 weight.³ This was done because yesterday's weather effects how electricity is used today.

3 For example, if yesterday was hot and the air conditioner was on, it is more likely that
4 the air conditioner will be left on today. If yesterday was a mild day and today is slightly
5 hotter, air conditioning may not be used or would be turned on later in the day.

6 Q. What is the normal daily TWMDT?

7 A. The normal daily TWMDT is a temperature data series used to normalize
8 weather sensitive class usage. Staff used a ranking method to calculate normal weather
9 estimates of daily normal temperature values, ranging from the temperature that is “normally”
10 the hottest, to the temperature that is “normally” the coldest, thus estimating “normal
11 extremes.” Staff ranked the daily TWMDT for each year of the 30-year history from hottest
12 to coldest and then calculated the normal daily temperature values by averaging the ranked
13 TWMDT for each rank, irrespective of the calendar date. This results in the normal extreme
14 being the average of the most extreme temperatures in each year of the 30-year normal period.
15 The second most extreme temperature is based on the average of the second most extreme day
16 of each year, and so forth. Because actual temperatures do not smoothly move up and down
17 from day to day during the year, Staff assigned these normal temperatures to the days of Year
18 2013 based on the rankings of the actual temperatures of Year 2013.

19 Q. How are these weather variables used?

20 A. This information was provided to Staff witness Shawn E. Lange for weather
21 normalization of Year 2013 kWh usage. Please refer to the rebuttal testimony of Mr. Lange

³ To calculate the dth day's two-day weighted mean daily temperature (TWMDT_d), the current day's (d) mean daily temperature (DMT_d) is averaged with the prior day's (d-1) mean daily temperature (MDT_{d-1}), applying a 2/3 weight on the current day and 1/3 weight on the prior day: $TWMDT_d = (2/3) MDT_d + (1/3) MDT_{d-1}$.

1 for a complete discussion of Staff weather normalization of Ameren Missouri's customer
2 usages during Year 2013.

3 **WEATHER NORMALIZATION OF REVENUE**

4 Q. What is Staff's weather normalization of revenue?

5 A. Staff weather normalized Year 2013 usage for the weather-sensitive rate classes
6 such as Residential Service, Small General Service, Large General Service, and Small Primary
7 Service by applying weather-normalization factors provided by Staff witness Shawn E. Lange for
8 each class for each month. Staff adjusted the billing units by these factors and applied current
9 rates to determine weather-normalized revenues. The difference between these weather-
10 normalized revenues and Year 2013 revenues determined the amount of the weather-
11 normalization adjustment. The Staff's weather-normalization adjustment would reduce Ameren
12 Missouri's Year 2013 revenues by approximately \$17.4 million.

13 **365-DAYS ADJUSTMENT OF REVENUE**

14 Q. What is Staff's 365-days adjustment of revenue?

15 A. Since billing months are an aggregation of bill cycles, they will differ from
16 calendar months in the time period they cover. To adjust revenue for this difference, Staff
17 allocated the kWh days adjustment calculated by Staff witness Mr. Lange proportionately to the
18 appropriate monthly kWh usage for each class and applied current rates to arrive at the 365-days
19 adjustment to revenue of the Large Primary Service and weather-sensitive classes. The Staff's
20 365-days adjustment would reduce Ameren Missouri's Year 2013 revenues by approximately
21 \$7.5 million.

22 Q. Does this conclude your direct testimony?

23 A. Yes, it does.

Credentials and Background of

Seoung Joun Won

I am currently employed as a Regulatory Economist III in the Energy Economic Analysis Section of the Utility Operation Department, Regulatory Review Division of the Missouri Public Service Commission. I have been employed at the Missouri Public Service Commission since May 2010.

I received my Bachelor of Arts, Master of Arts, and Doctor of Philosophy in Mathematics from Yonsei University in Seoul, South Korea, and earned my Doctor of Philosophy in Economics from the University of Missouri - Columbia. Also, I passed several certificate examinations for Finance Specialist in South Korea, such as Enterprise Resource Planning Consultant, Financial Risk Management, Derivatives Consultant, and Financial Planner.

Prior to joining the Commission, I taught both undergraduate and graduate level mathematics at the Korean Air Force Academy and Yonsei University for 13 years. I served as the director of the Education and Technology Research Center in NeoEdu for 5 years.

My duties at the Commission include managing weather data, calculating normal weather, and analyzing revenues and developing rate designs.

List of Previous Testimony Filed

Seoung Joun Won

Case/File Number	Company	Issue
ER-2010-0355	Kansas City Power & Light Co.	Normal Weather Revenue
ER-2010-0356	KCP&L Greater Missouri Operations Co.	Normal Weather
GR-2010-0363	Union Electric Co. d/b/a Ameren Missouri	Normal Weather
ER-2011-0028	Union Electric Co. d/b/a Ameren Missouri	Normal Weather Revenue
ER-2011-0004	Empire District Electric Co.	Normal Weather Revenue
HR-2011-0028	Veolia Energy Kansas City, Inc	Normal Weather
ER-2012-0166	Union Electric Co. d/b/a Ameren Missouri	Normal Weather Revenue
ER-2012-0174	Kansas City Power & Light Co	Normal Weather Revenue
ER-2012-0175	KCP&L Greater Missouri Operations Co.	Normal Weather
ER-2012-0345	Empire District Electric Co.	Normal Weather Revenue

GR-2013-0171	Laclede Gas Co.	Normal Weather
HR-2014-0066	Veolia Energy Kansas City, Inc.	Normal Weather Weather Normalization
GR-2014-0086	Summit Natural Gas of Missouri, Inc.	Normal Weather