Exhibit No. 221

MoPSC Staff – Exhibit 221
Hari K. Poudel, PH.D.
Direct Testimony
File Nos. ER-2022-0129 & ER-2022-0130

Exhibit No.:	
Issue(s):	*Weather Variables*
Witness:	*Hari K. Poudel, PhD*
Sponsoring Party:	*MoPSC Staff*
Type of Exhibit:	*Direct Testimony*
Case Nos.:	*ER-2022-0129 and ER-2022-0130*
Date Testimony Prepared:	*June 8, 2022*

MISSOURI PUBLIC SERVICE COMMISSION

INDUSTRY ANALYSIS DIVISION

TARIFF/ RATE DESIGN DEPARTMENT

DIRECT TESTIMONY

OF

HARI K. POUDEL, PH.D.

Evergy Metro, Inc., d/b/a Evergy Missouri Metro
Case No. ER-2022-0129

Evergy Missouri West, Inc., d/b/a Evergy Missouri West
Case No. ER-2022-0130

Jefferson City, Missouri
June 2022

DIRECT TESTIMONY

OF

HARI K. POUDEL, PH.D.

Evergy Metro, Inc., d/b/a Evergy Missouri Metro
Case No. ER-2022-0129

Evergy Missouri West, Inc., d/b/a Evergy Missouri West
Case No. ER-2022-0130

Q. Please state your name and business address.

A. My name is Hari K. Poudel, and my business address is P.O. Box 360, Jefferson City, Missouri, 65102.

Q. By whom are you employed and in what capacity?

A. I am employed by the Missouri Public Service Commission ("Commission") as a Regulatory Economist in the Tariff/Rate Design Department in the Industrial Analysis Division.

Q. Please describe your educational and work background.

A. I received a Ph.D. in Public Policy and a master's degree in Public Health from University of Missouri, Columbia and another master's degree in Agricultural Economics from University of Hohenheim, Germany.

In January of 2020, I began working for the Missouri Department of Health and Senior Services as a research/data analyst. I was employed with the Division of Community & Public Health from January 2020 until October 2021. I started my career with the Commission as a Regulatory Economist in October 2021.

Q. Have you previously testified before the Commission or any other regulatory agency?

A. No. I have not.

EXECUTIVE SUMMARY

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to discuss the weather variables Staff used to weather normalize billing determinants for Evergy Missouri West, Inc., d/b/a Evergy Missouri West ("EMW") and Evergy Metro, Inc., d/b/a Evergy Missouri Metro ("EMM").

Q. Please summarize your testimony.

A. Each year's weather is unique; consequently, test year usage, hourly loads, revenue, and fuel and purchased power expense need to be adjusted to "normal" weather so that rates will be designed on the basis of normal weather rather than any anomalous weather in the test year. In the quantification of the relationship between test year weather and energy sales, Staff used weather data observations for the update period, January 1, 2021, through December 31, 2021.

NORMAL WEATHER

Q. What source did you use for weather data?

A. Staff used weather data produced by the Midwestern Regional Climate Center ("MRCC").[1] MRCC is a cooperative program between the National Centers for Environmental Information ("NCEI") and Purdue University, Indiana. The NCEI is a part of the Department of Commerce, National Oceanic and Atmospheric Administration ("NOAA").[2] Staff used the weather station data from the Kansas City International Airport ("MCI") in Kansas City, Missouri for the service territories of EMM and EMW, for actual and normal weather variables. This weather station was selected based on the availability and reliability of the weather data as

[1] https://mrcc.purdue.edu/.
[2] https://www.ncei.noaa.gov/data.

well as their approximate location to the customer base of EMW and EMM. The weather data sets consist of actual daily maximum temperature ("T_{max}") and daily minimum temperature ("T_{min}") observations. As is customary, "mean temperature" (T_{avg}) is defined as the average of T_{max} and T_{min} for the day.

Q. What is a climate normal?

A. A climate "normal" is defined by the NOAA, as the arithmetic mean of a climatological element computed over three consecutive decades.[3] In developing climate normal temperatures, the NOAA focuses on the monthly maximum and minimum temperature time series to produce the serially-complete monthly temperature ("SCMT") data series.[4] Staff utilized the SCMT published in July 2011 by the National Climatic Data Center ("NCDC") of NOAA.

Q. Why does Staff use NOAA's SCMT?

A. The serially-complete monthly temperature is an intermediate product that includes adjustments for inconsistencies and biases that may occur in the 30-year time series of daily temperature, (e.g. such as the relocation, replacement, or recalibration of the weather instruments). Changes in observation procedures or in an instrument's environment may also occur during the 30-year period. NOAA accounted for documented and undocumented anomalies in calculating its SCMT.[5] The meteorological and statistical procedures used in the NOAA's

[3] Retrieved on October 17, 2013, https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals.
[4] Retrieved on October 17, 2013, https://www1.ncdc.noaa.gov/pub/data/normals/1981-2010/source-datasets/. The SCMT, computed by the NOAA, includes adjustments to make the time series of daily temperatures homogeneous.
[5] Arguez, A., I. Durre, S. Applequist, R. S. Vose, M. F. Squires, X. Yin, R. R. Heim, Jr., and T. W. Owen, 2012: NOAA's 1981-2010 U.S. Climate Normals: An Overview. Bulletin of the American Meteorological Society, 93, 1687-1697.

homogenization for removing documented and undocumented anomalies from the T_{max} and T_{min} monthly temperature series is explained in a peer-reviewed publication.[6]

To Staff's knowledge, NOAA is the only entity that provides reasonably reliable weather data for 30-year historical period and test year period for the Kansas City region. For the purposes of normalizing the test year energy usage and revenues, Staff used the adjusted T_{max} and T_{min} daily temperature series for the 30-year period of January 1, 1989, through December 31, 2010 at MCI and the raw data series from MCI for the period of January 1, 2011 and December 31, 2018. Staff used the raw data for the most recent period since the SCMT has not been made available to Staff from NOAA at this time.

Q. How did Staff calculate daily normal weather?

A. Staff used a ranking method to calculate normal weather estimates of daily normal temperature values, ranging from the temperature that is "normally" the hottest to the temperature that is "normally" the coldest, thus estimating "normal extremes." Normal weather is used to build the base forecast of future energy use. Staff ranked Mean Daily Temperatures (MDTs) for each month of the 30-year history from hottest to coldest and then calculated the normal daily temperature values by averaging the ranked MDTs for each rank, irrespective of the calendar date. The ranking process results in the normal extreme being the average of the most extreme temperatures in each month of the 30-year normals period. The second most extreme temperature is based on the average of the second most extreme day of each month, and so forth.

Q. Is Staff's calculation of daily normal temperatures the same as NOAA's calculation of daily normal temperatures?

[6] Menne, M.J., and C.N. Williams, Jr., (2009) Homogenization of temperature series via pairwise comparisons. J. Climate, 22, 1700-1717.

A. No. The Staff's calculation of daily normal temperatures is not the same as NOAA's calculation of smoothed daily normal temperatures. NOAA's published climatic normals are not directly useable by Staff since the daily normal is based on a calendar date average rather than the ranked daily average that Staff uses. NOAA's normal values are derived by statistically "fitting" smooth curves through the monthly temperatures. As a result, the NOAA daily normal values reflect smooth transitions between seasons and do not directly relate to the 30-year time series of MDT as used by Staff.[7] Staff calculated its normal daily temperatures based on the rankings of the actual temperatures of the test year, and the test year temperatures do not follow smooth patterns from day to day. Therefore, ranked daily average method has the ability of generating mean daily temperatures of each rank, irrespective of the calendar date. More details of Staff's ranked average method for normal weather are explained in a peer-reviewed publication.[8] The article highlights the importance of the ranked method in which both hot and cold extreme temperatures variations are incorporated in the normals calculations whereas these extreme values are dampened in the standard climate normal estimation. The standard climate estimation methodology can inadvertently introduce biases in the weather normalization adjustment.

CONCLUSION

Q. What is your recommendation in this case?

A. I recommend reliance on the weather normal I derived from the MCI weather station data as the basis for weather normalization adjustments in this case. Staff witness,

[7] Won, S. J., Wang, X. H., & Warren, H. E. (2016). Climate normals and weather normalization for utility regulation. *Energy Economics, 54*, 405-416.
[8] *Id.*

Michael L. Stahlman, used this information for weather normalization of the test year kWh usage and update period hourly loads.

Q. Does this conclude your testimony?

A. Yes. It does.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Evergy Metro, Inc. d/b/a Evergy Missouri Metro's Request for Authority to Implement a General Rate Increase for Electric Service	))))	Case No. ER-2022-0129
In the Matter of Evergy Missouri West, Inc. d/b/a Evergy Missouri West's Request for Authority to Implement a General Rate Increase for Electric Service	))))	Case No. ER-2022-0130

AFFIDAVIT OF HARI POUDEL, PhD

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

COMES NOW HARI POUDEL, PhD and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Direct Testimony of Hari Poudel, PhD*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

HARI POUDEL, PhD

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 1st day of June, 2022.

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: July 18, 2023
Commission Number: 15207377

Diana L. Vaught
Notary Public

Hari K. Poudel

Present Position

I am currently employed as a Regulatory Economist with the Tariff/Rate Department within the Industry Analysis Division of the Missouri Public Service Commission ("Commission"). The Tariff/Rate Design Department participates and makes recommendations on tariff filings and various case filings at the Commission, such as rate, complaint, applications, territorial agreements, sales and merger cases. The department also performs and provides technical support on the issues of rate design, weather variables, and weather normalization. I am responsible for the application of quantitative economic methods and statistical analysis to energy issues that have an impact on utility ratemaking. Additionally, I am responsible for developing and making recommendations to the Commission based on the quantitative economic analysis of the energy-related issues.

Educational Credentials and Work Experience

I received a Doctor of Philosophy in Public Policy from the University of Missouri, Columbia, Missouri in May 2020. I graduated with a Master's in Public Health from the University of Missouri, Columbia in May 2019. Inn 2008, I received a Master's in Agricultural Economics degree from Hohenheim University in Germany.

Since October 25, 2021, I've been working at the Missouri Public Service Commission as a Regulatory Economist in the Tariff/Rate Department of the Industry Analysis Division. I worked as a Research/Data Analyst for the Missouri Department of Health and Senior Services

before to joining the Commission. As an analyst, I analyzed public health data that has a direct impact on Missourians for operational, service quality, and management purposes.

Memorandum

SN	Case Number	Company Name	Issue
1.	ER-2022-0146	Ameren Missouri	Rider Energy Efficient Investment Charge (EEIC)
2.	GR-2022-0235	Spire Missouri, Inc.	Weather Normalization Adjustment Rider (WNAR)
3.	GT-2022-0233	Liberty Utilities	Weather Normalization Adjustment Rider (WNAR)