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Witness: *Hari K. Poudel, PhD*
Sponsoring Party: *MoPSC Staff*
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MISSOURI PUBLIC SERVICE COMMISSION

INDUSTRY ANALYSIS DIVISION

TARIFF/RATE DESIGN DEPARTMENT

DIRECT TESTIMONY

OF

HARI K. POUDEL, PhD

LIBERTY UTILITIES (Midstates Natural Gas) CORP.,

d/b/a Liberty

CASE NO. GR-2024-0106

Jefferson City, Missouri
July 2024

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HARI K. POUDEL, PhD

LIBERTY UTILITIES (Midstates Natural Gas) CORP.,
d/b/a Liberty

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DIRECT TESTIMONY

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LIBERTY UTILITIES (Midstates Natural Gas) CORP.,
d/b/a Liberty

CASE NO. GR-2024-0106

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, MO 65102.

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

A. I am employed by the Missouri Public Service Commission ("Commission") as an 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 the 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 and data analyst. I was employed with the Division of Community and Public Health from January 2020 until October 2021. I started my career with the Commission as an Economist in October 2021.

Q. Have you previously testified in proceedings before the Missouri Public Service Commission?

A. Yes. I have provided written testimony and been deposed in multiple cases before the Commission. Please see Schedule HKP-d1.

EXECUTIVE SUMMARY

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to provide Staff's weather normalization recommendation by rate classes[1] for three different service areas[2]. Within this testimony, I will:

1. Provide a detailed explanation on the weather normalization;
2. Discuss the source of the weather normalization data;
3. Discuss the 365-day adjustment; and,
4. Discuss the rate switchers.

Q. Do you provide any recommendations to the Commission in this case?

A. Yes. I recommend that the Commission utilize Staff's weather normalization adjustments, which are used to calculate the adjusted rate revenue.

WEATHER NORMALIZATION

Q. What is the weather normalization?

A. A weather adjustment, also known as weather normalization[3], is a process that is carried out with the goal of examining the influence of weather on the energy consumption during a test year. Rates will be designed on the basis of usage during normal weather rather than anomalous weather in the test year. In its simplest form, this means estimating the change in energy consumption or energy sales associated with a change in weather, where the change in weather is the difference between normal weather and actual weather.

[1] Northeast Division ("NEMO"), Southeast ("SEMO"), and Western ("WEMO") service areas. NEMO primarily serves northeast, SEMO the southeast, and WEMO the west near Kansas City.
[2] Residential, Small General Service ("SGS"), Medium General Service ("MGS"), and Large General Service ("LGS) classes.
[3] Weather normalization calculates how much energy customers would have used in normal weather.

Q. Please describe briefly the weather normalization process in general.

A. Since the primary use of natural gas in Missouri is for the purpose of space heating, natural gas sales are heavily dependent upon weather conditions. As natural gas rates are based on usage, it is important to remove abnormal weather influences from the test year in order to provide a more accurate representation of "normal" natural gas usage. This analysis focuses on Staff's weather normalization of natural gas consumption taking into account 365-day adjustments and rate switchers for Liberty Utilities (Midstates Natural Gas) Corp., d/b/a Liberty ("Liberty Midstates") customers.

Q. Please describe the data sources for Staff's weather normalization analyses.

A. Staff used two different data sources to perform weather normalization analyses. First, the weather normalization data used in this analysis comes from Staff witness Francisco Del Pozo. His data includes both the daily actual and daily normal HDDs[4] for the update period for the entire Liberty Midstates service territory. In his direct testimony, Mr. Pozo discusses the source of weather normalization and the HDD calculation. Second, bill counts, energy consumption, meter read schedules, and rate switchers used in this analysis are from the Data Requests.[5] Staff organized data exactly the way it fits into the workbook.

Q. How does Staff calculate the weather normalization adjustment for this filing?

A. Staff uses the same weather normalization methodology used in the previous rate cases[6] to adjust actual consumption to reflect normal weather conditions. Staff conducted an analysis of weather normalization adjustments for the Residential, SGS, MGS, and LGS

[4] Heating degree days ("HDD")
[5] Data Request Responses 0209, 0311.0 and 0311 supplement.
[6] GR-2018-0013

classes for the update year ending December 31, 2023.[7] Additionally, Staff performed weather normalization adjustments for the Small, Medium, and Large Transport customers. Staff performed regression modeling[8] to estimate a relationship between usage/customer/day and HDD/day. Staff processes the data provided by Liberty Midstates to figure out the usage/customer/day as well as the HDD/day.[9] Once the billing cycles were adjusted, Staff calculated the difference between normal and actual HDDs for each billing cycle.[10] The third step was to multiply these differences by the estimate rendered from the regression analysis. The fourth step was to sum the billing cycles' adjusted volumes by billing month. Then, Staff added the monthly adjustments in CCF[11] to the total monthly natural gas consumption to calculate normalized volumes.

Q. Discuss a statistical measure that shows the relationship between the natural gas consumption and the weather.

[7] Large General Service was not found to be weather sensitive and therefore is excluded from this portion of the analysis.

[8] The gas consumption model outlined provides a means of understanding and predicting how much gas (CCf) customers use based on the weather, specifically how cold it is. Mathematically, CCf/Customer/Day = Constant + Coefficient (HDD/Day). The key parts of the model are baseline usage (constant term) and the temperature-dependent usage (coefficient term). The baseline usage represents the amount of gas consumed daily by a customer when it's not col at all (if HDD/Day is zero). Knowing this term helps to see the basic gas needs that do not depend on the weather variations. The coefficient term refers to how much more gas is used when the weather gets colder. It is based on HDD, which measures how much heating is needed. A higher number of HDD means gas usage increases a lot when it gets colder, indicating higher HDDs.
The model uses historical data to adjust gas consumption figures to what they would be under normal weather conditions. This adjustment helps in (a) normalizing usage and (b) forecasting demand. The normalized usage adjusts gas consumption data to account for unusual weather, showing what usage would look like in normal conditions. The forecasting model predicts future gas needs based on weather forecasts, aiding in supply planning. To make the model work, the historical gas usage (CCf), customer bill account, and HDD data are needed. Historical gas usage and customer bill account information are provided by Liberty Midstates whereas HDD data is provided by Staff Witness Francisco Del Pozo.

[9] Data Request Responses 0209, 0311.0 and 0311 supplement.

[10] Liberty Midstates has established billing cycles for groups of natural gas accounts, where each billing cycle corresponds to different days of the month. Customers' accounts are usually grouped into one of nineteen (19) billing cycles. Staggering the billing of customers' accounts throughout the billing month allows the Company to distribute the work required in order to bill Liberty Midstates customers.

[11] A CCF (is one hundred cubic feet of gas. The first "c" comes from the Roman word for hundred, "centum" (Understanding Your Water Bill | WaterSense | US EPA).

A. R-squared ("R^2") is a statistical measure that shows the relationship between natural gas consumption and the weather. Statistically, R^2 is a number that tells us how well the independent variable(s) in weather normalization modeling explain the variation in the dependent variable. It ranges from 0 to 1, where 1 indicates a perfect fit of the model to the data. In this analysis, the regression analysis[12] effectively finds the relationship between natural gas consumption and weather by drawing a straight line that best fits the data. Since a higher R^2 implies the model (the straight line) fits the data better, and the data being fitted to the model relates usage/customer/day and HDD/day, a higher R^2 also implies a strong relationship between usage/customer/day and HDD/day (i.e., they're weather sensitive). The R^2 of the Residential Class for each district ranges roughly from 0.85 to 0.93. This indicates a strong goodness of fit[13] implying this service class is weather sensitive. Similarly, the R^2 of the SGS Class for each district ranges roughly from 0.88 to 0.94. This indicates a strong goodness of fit implying this service class is weather sensitive. Similarly, the R^2 of the MGS Class for each district ranges roughly from 0.80 to 0.85. This indicates a goodness of fit implying this service class is also weather dependent.

Conversely, the R^2 of the LGS Class for NEMO and SEMO districts are 0.21 and 0.23, respectively. This indicates that the LGS Classes are not weather sensitive, and this should not be weather normalized. The R^2 for the LGS Class for WEMO district is the outlier because of

[12] A regression analysis is a statistical method used to understand the relationship between one dependent variable and one or more independent variables. Alternatively, it measures the extent to which changes in a dependent variable (energy consumption) can be explained by changes in an independent variable (HDD).The regression analysis helps in predicting the value of the dependent variable based on the values of the independent variables. For example R^2 value of 96.0 percent shows that 96 percent of the variation in consumption can be explained by variations in HDD. In other words, there is a strong relationship between HDD and CCF used.

[13] Goodness of fit is a statistical term. This term refers to how well the observed data match with the values predicted by the model. It is typically measured using statistical tests and metrics such as R-squared (R^2), chi-squared tests, or residual analysis. When a model has a strong goodness of fit, it means that the model explains a large proportion of the variance in the observed data. Strong goodness of fit implies that the differences between the observed and predicted values are minimal.

the lack of having enough number of bill counts and CCF to show a relationship between the CCF and the HDD in regression analysis. The weather normalization adjustment calculation worksheets are provided on Schedule HKP-d2.

365-DAY ADJUSTMENT

Q. Does Staff perform the 365-day adjustment to usage for this case?

A. Yes. Staff applied the 365-day adjustment to usage in this case.

Q. What is the 365-day adjustment?

A. Calendar months and revenue months differ from one another because of the periods they cover and the differing beginning and ending times. Calendar months coincide with the calendar, beginning on the first day of the month and ending on the last day of the month. Liberty Midstates customers' usage is measured, and rate revenues are collected over a period known as a "revenue month," which is the interval over which Liberty Midstates reads customers' meters and issues bills. Revenue months usually take their names from the calendar month in which the customer's bill is rendered. For example, January 2023 billed consumption is primarily usage that occurred in November and December 2022. The length of a revenue month is dependent upon the interval between meter readings and does not necessarily have the same number of days that occur in a given calendar month of the same name; that is, a revenue month may have more than or less than the number of days for the same-named calendar month. When revenue month usage is totaled over the year, the resulting revenue year will include usage from the immediately prior calendar year and assign usage to the next calendar year, meaning a revenue year may contain more than or less than 365-day usage. Therefore, since the costs and expenses are accounted for over a calendar year, Staff calculates an annualization

adjustment to bring the revenue year CCF into a 365-day interval. This adjustment is stated in CCF and is referred to as the "365-day adjustment."

Q. How does Staff perform the 365-day adjustment in this filing?

A. Staff adjusted monthly natural gas volumes to normal by first adjusting the annual number of days for each billing cycle to 365. The data from the meter reading schedule sheet was transferred over to the weather normalization worksheet. Each cycle must equal 365 days. If the annual number of days in a billing cycle is below or above 365, Staff adds or subtracts the difference from the non-heating season.[14] This adjustment is performed so that each billing cycle is set to the same total number of days. Since natural gas utilities are winter peaking, any "HDDs" that are removed based on the 365-day adjustment are added back to October, since it is a shoulder month to the heating season. Using the shoulder month, which is the non-heating month immediately preceding the heating season, minimizes the impact on the heating season.

RATE SWITCHERS

Q. Does Staff adjust billing units for each class to account for customers who switched between rate classes during the test year?

A. Yes. Staff adjusted billing units for each class to account for customers who switched between rate classes during the test year and to account for known and measurable changes to rate classes during the test year. Based on the number of customers, usage, and HDD per billing cycle per month, Staff calculated the average use per customer per day and the

[14] Since it cannot be determined exactly which day is causing the annual number of days to be over or less than 365 days, adding or removing an average non-heating season day results in an adjustment with a lesser impact compared to an average heating season day.

number of HDD per day for each of the twelve months of the test period for the rate classes mentioned above for Liberty Midstates.

Q. How are the weather adjustment values for the different rate classes applied?

A. Staff witness Marina Stever used the weather adjustment values accounting for rate switchers and the 365-day adjustment in her analysis of the rate revenues. Staff performed 365-day adjustment as a part of the rate switcher and weather normalization process.

CONCLUSION

Q. What is your recommendation to the Commission in this case?

A. Staff recommends that the Commission utilize Staff's weather normalization adjustments as attached.[15]

Q. Does this conclude your direct testimony?

A. Yes it does.

[15] Schedule HKP -d2

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of the Request of Liberty Utilities (Midstates Natural Gas) Corp. d/b/a Liberty to Implement a General Rate Increase for Natural Gas Service in the Missouri Service Areas of the Company	)))))	Case No. GR-2024-0106

AFFIDAVIT OF HARI K. POUDEL, PHD

STATE OF MISSOURI	)	
	)	ss.
COUNTY OF COLE	)	

COMES NOW HARI K. 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 K. Poudel, PhD*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

HARI K. 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 16th day of July 2024.

D. SUZIE MANKIN
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: April 04, 2025
Commission Number: 12412070

Notary Public

Hari K. Poudel

Present Position

Currently, I work for the Missouri Public Service Commission ("Commission") as a Regulatory Economist in the Tariff/Rate Department of the Industry Analysis Division. The Department of Tariff and Rate Design takes part in and offers advice on matters filed with the Commission, such as rate, complaint, application, territorial agreements, sale, and merger. The department also handles rate design, weather variables, and weather normalization tasks and offers technical assistance. I am responsible for using quantitative economic techniques and statistical analysis to address energy-related challenges that have an effect on utility ratemaking. I am also responsible of recommendations for the Commission based on a rigorous economic analyses of the problems relating to energy.

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. In 2008, I received a Master's in Agricultural Economics degree from Hohenheim University in Germany.

I've been employed with the Missouri Public Service Commission since October 25, 2021, in the Tariff/Rate Department of the Industry Analysis Division as a Regulatory Economist. Prior to joining the Commission, I was a Research/Data Analyst for the Missouri Department of Health and Senior Services. I analyzed public health data that directly affects Missourians in my capacity as an analyst.

Testimonies/Memorandum

SN	Case Number	Company Name	Issue
1.	GR-2021-0320	Liberty Utilities	Tariff Compliance
2.	GR-2022-0235	Spire Missouri, Inc.	Weather Normalization Adjustment Rider (WNAR)
3.	ER-2022-0146	Ameren Missouri	Rider Energy Efficient Investment Charge (EEIC)
4.	GT-2022-0233	Liberty Utilities	Weather Normalization Adjustment Rider (WNAR)
5.	ER-2022-0129 & ER-2022-0130	Evergy Metro, Inc. & Evergy Missouri West, Inc.	General Rate Case
6.	ER-2022-0337	Ameren Missouri	365-Day Adjustment, Weather Variables, Weather Normalization, Hourly Load Requirement Energy Efficiency Adjustment
7.	GO-2023-0002	Spire	Weather Normalization Adjustment Rider (WNAR)
8.	GT-2023-0088	Liberty Utilities	Weather Normalization Adjustment Rider (WNAR)
9.	GT-2023-0274	Liberty Utilities	Weather Normalization Adjustment Rider (WNAR)
10.	EA-2023-0286	Ameren Missouri	Economic Feasibility
11.	GT-2024-0054	Liberty Utilities (Midstates Natural Gas)	Weather Normalization Adjustment Rider (WNAR)
12.	GT-2024-0055	The Empire District Gas Company	Weather Normalization Adjustment Rider (WNAR)
13.	GR-2024-0107	Ameren Missouri	Weather Normalization Adjustment Rider (WNAR)
14.	EO-2023-0136	Ameren Missouri	MEEIA
15.	EO-2023-0369 & EO-2023-0370	Evergy Metro, Inc. & Evergy Missouri West, Inc.	MEEIA (Throughput Disincentive, Rebound Effect, Rate Case Annualization)
16.	ER-2024-0189	Evergy Missouri West, Inc.	MEEIA, Net Margin Rate, Economic Development Riders, PISA Compliance

Residential Customers

Table 1. Regression Analysis of Billing Month Usage among WEMO **Residential Customers**.

	Regression Output:		
Constant			**0.611178764**
Std Err of Y Est			0.630294552
R Squared			0.851367336
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.112933**	
Std Err of Coef.		0.014921734	
"t" Statistic(s)		7.5683527	

Table 2. Regression Analysis of Billing Month Usage among NEMO **Residential Customers**.

	Regression Output:		
Constant			**0.519576575**
Std Err of Y Est			0.450305771
R Squared			0.930687895
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.135577**	
Std Err of Coef.		0.011700060	
"t" Statistic(s)		11.5877066	

Table 3. Regression Analysis of Billing Month Usage among SEMO **Residential Customers.**

	Regression Output:		
Constant			**0.421740418**
Std Err of Y Est			0.373135971
R Squared			0.920097492
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.119744**	
Std Err of Coef.		0.011158779	
"t" Statistic(s)		10.7309141	

Table 4. Regression Analysis of Billing Month Usage among WEMO **Small General Customers**.

	Regression Output:		
Constant			**1.245323292**
Std Err of Y Est			1.330209984
R Squared			0.885903638
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.277789**	
Std Err of Coef.		0.031525151	
"t" Statistic(s)		8.8116521	

Table 5. Regression Analysis of Billing Month Usage among NEMO **Small General Customers.**

	Regression Output:		
Constant			**1.137714422**
Std Err of Y Est			0.898879584
R Squared			0.948475618
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.316971**	
Std Err of Coef.		0.023362164	
"t" Statistic(s)		13.5677143	

Table 6. Regression Analysis of Billing Month Usage among SEMO **Small General Customers.**

	Regression Output:		
Constant			**0.902829792**
Std Err of Y Est			0.863403511
R Squared			0.928315612
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**0.293889**	
Std Err of Coef.		0.025825474	
"t" Statistic(s)		11.3798237	

Table 7. Regression Analysis of Billing Month Usage among WEMO **Medium General Customers**.

	Regression Output:		
Constant			**14.069926028**
Std Err of Y Est			12.635018707
R Squared			0.850765186
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**2.266681**	
Std Err of Coef.		0.300206838	
"t" Statistic(s)		7.5503969	

Table 8. Regression Analysis of Billing Month Usage among NEMO **Medium General Customers**.

	Regression Output:		
Constant			**16.190890118**
Std Err of Y Est			10.016442474
R Squared			0.809337676
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**1.698293**	
Std Err of Coef.		0.260663465	
"t" Statistic(s)		6.5152703	

Table 9. Regression Analysis of Billing Month Usage among SEMO **Medium General Customers**.

	Regression Output:		
Constant			**12.958980585**
Std Err of Y Est			8.552777730
R Squared			0.797526584
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**1.604908**	
Std Err of Coef.		0.255718103	
"t" Statistic(s)		6.2760816	

Table 10. Regression Analysis of Billing Month Usage among NEMO **Large General Customers**.

	Regression Output:		
Constant			**352.692020357**
Std Err of Y Est			341.028977387
R Squared			0.208407549
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**14.433874**	
Std Err of Coef.		8.895635880	
"t" Statistic(s)		1.6225792	

Table 11. Regression Analysis of Billing Month Usage among EMO **Large General Customers**.

	Regression Output:		
Constant			**262.973889628**
Std Err of Y Est			302.907032894
R Squared			0.227455252
No. of Observations			12
Degrees of Freedom			10
X Coefficient(s)		**15.507625**	
Std Err of Coef.		9.037725042	
"t" Statistic(s)		1.7158770	