Exhibit No.:
Issue(s): *Weather Normalization*
Witness: *Michael L. Stahlman*
Sponsoring Party: *MoPSC Staff*
Type of Exhibit: *Direct Testimony*
Case No.: *ER-2024-0319*
Date Testimony Prepared: *December 3, 2024*

MISSOURI PUBLIC SERVICE COMMISSION

INDUSTRY ANALYSIS DIVISION

TARIFF/RATE DESIGN DEPARTMENT

DIRECT TESTIMONY

OF

MICHAEL L. STAHLMAN

UNION ELECTRIC COMPANY,
d/b/a Ameren Missouri

CASE NO. ER-2024-0319

Jefferson City, Missouri
December 2024

DIRECT TESTIMONY

OF

MICHAEL L. STAHLMAN

UNION ELECTRIC COMPANY,
d/b/a Ameren Missouri

CASE NO. ER-2024-0319

Q. Please state your name and business address.

A. My name is Michael L. Stahlman, and my business address is Missouri Public Service Commission, 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 for the Tariff/Rate Design Department, in the Industry Analysis Division.

Q. Please describe your educational and work background.

A. Please see Schedule MLS-d1.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the weather normalization adjustments, 365-day adjustments, and rate block adjustments I provided to Staff witness Kim Cox and the Load Requirement at Transmission I provided to Staff witness Shawn Lange.

Q. Please summarize your testimony.

A. I performed regression analysis using weather information provided by the Midwest Regional Climate Center and load information provided by Ameren Missouri to estimate the impact of weather on the test year and update period, including the changes to which rate block energy was billed. This information was provided to Staff witness Kim Cox.

Further, I estimated the impact of weather on Load Requirement at Transmission, which was provided to Staff witness Shawn Lange.

Q. What is weather normalization?

A. Weather normalization is the process of adjusting billing determinants to account for differences in weather from year to year. Electricity consumption is highly responsive to the weather, specifically temperature for many rate classes. As the temperature reaches higher levels, the demand for cooling, air conditioning and fans increases the customers' consumption of electricity. As the weather becomes colder, the demand for additional heating, via electric space heating, also forces an increase in electricity consumption. Electric air conditioning and space heating are prevalent in Ameren Missouri's service territory; therefore, it follows that Ameren Missouri's electric load is linked with and responsive to temperature. Staff uses the correlation of customer class usage with weather and other variables to estimate usage for a year as if the weather was "normal."

Q. What is "normal weather"?

A. Normal weather is an estimate of what the average temperatures would be for a typical year at a given location. Staff used a ranking method to calculate normal weather estimates of daily normal temperature values, because this method helps preserve the extremes in weather that are typical of Missouri. Staff ranked the Mean Daily Temperatures ("MDT") 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 year of a 30-year period. The second most extreme temperature is based on the average of the second most extreme day of each year, and so forth. Staff's

calculation of daily normal temperatures is not the same as the National Oceanic and Atmospheric Administration's ("NOAA") calculation of smoothed daily normal temperatures because NOAA's calculations are based on an average temperature on a given calendar date which tends to smooth out any extreme temperatures. Staff calculated its normal daily temperatures based on the rankings of the actual temperatures of the test year including the update period, and these temperatures do not follow smooth patterns from day to day. Using these normal daily temperatures, Staff calculated normal MDT for each day of the test year using the weather station at St Louis Lambert International Airport. Staff then used this information for weather normalization of the test year Kilowatt hour ("kWh") usage and update period hourly loads.

Q. What is a weather normalization adjustment factor?

A. The weather normalization adjustment factor is a percentage value that I provide to Staff witness Kim Cox that is the end result of the weather normalization process. It is a monthly value specific to a particular class of Ameren Missouri's customers that adjusts actual usage in a given revenue month to an estimate of what usage would have been under normal weather. This factor also considers the mismatch of when a customer uses the energy with when a customer was billed for that energy.

Q. Did Staff provide specific time of use ("TOU") adjustments for the Residential and Small General Service ("SGS") classes?

A. Yes. I developed a weather normalization adjustment factor for the on-peak and off-peak periods for the Residential Evening and Morning rate schedule and the SGS Time of Day rate schedule. This analysis used information from the weather normalization regression analysis for both the peak and energy regressions to develop an estimate on the impact of normal

weather on the different time periods. While other TOU rate schedules were considered, this analysis was only ultimately applied to the Residential Evening and Morning rate schedule and the SGS Time of Day rate schedule due to the smaller number of customers in other rate schedules.

Q. What is the 365-day adjustment?

A. The 365-day adjustment accounts for certain bill cycles having greater, or less than, 365 days of consumption. Ameren Missouri bills its customers in a given revenue month using 21 different bill cycles. A bill cycle is the period between the dates on which a customer's meter(s) is read. These cycles typically have usage in two different calendar months and, due to weekends and/or holidays, will often have more or less than 365 days of usage. Staff developed the 365-day adjustment by calculating how many days each bill cycle was over/under 365 days, then subtracting/adding an average use day for each over/under day for each cycle, and then calculating a percentage adjustment factor for each class based on the sum of the adjustments for each bill cycle. This 365-day adjustment factor was provided to Staff witness Kim Cox.

Q. What are the rate block adjustments?

A. Some of the residential rate schedules have two winter block rates; one rate for usage at or below 750 kWh and another rate for usage above 750 kWh. Similarly, some of the SGS rate schedules have different rates for base use and seasonal use.[1] The rate block adjustments estimate how the overall energy consumption in a given revenue month will be distributed into the different rate blocks.

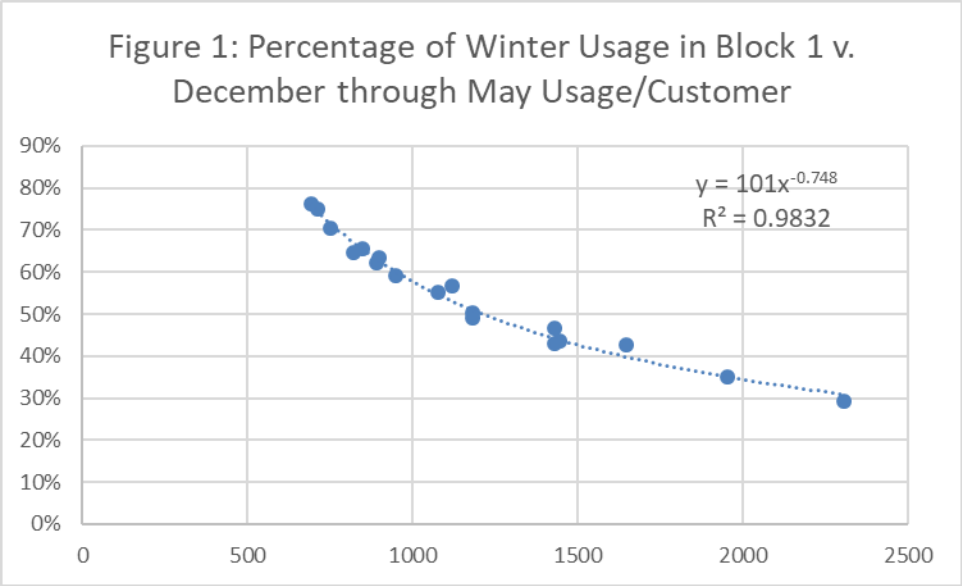
[1] Seasonal use defined in Ameren Missouri's tariff sheet No. 55.1 as, "The winter seasonal energy use shall be all kWh in excess of 1,000 kWh per month and in excess of the lesser of a) the kWh use during the preceding May billing period, or b) the kWh use during the preceding October billing period, or c) the maximum monthly kWh use during any preceding summer month."

Q. Why is it important to estimate the distribution of usage in the different rate blocks?

A. Ameren Missouri's customers do not have identical usage, so an increase of usage may be in block 1 for one customer and block 2 for another. Thus, applying the changes incorrectly will have an impact on the revenues.

Q. How did Staff estimate the Residential rate block adjustment?

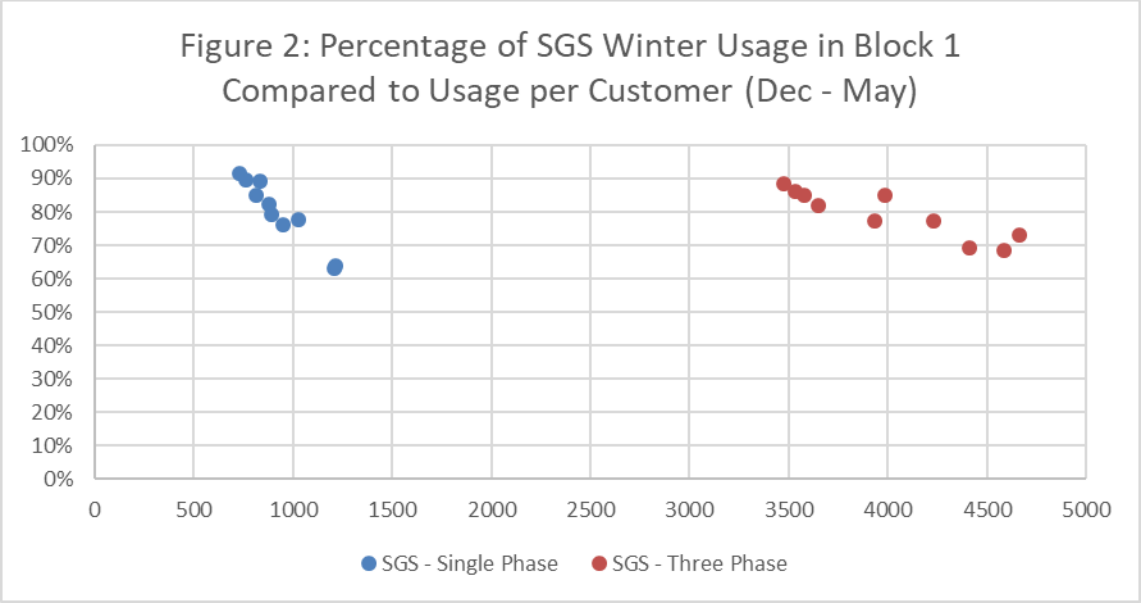
A. First, I graphed the Residential Block 1 usage as a percentage of total winter usage against total Residential rate schedule usage per customer. The resulting figure, shown as Figure 1 below, indicated that all residential rate schedules could be combined to form an estimate and that a power function was the best functional form for the regression.



Therefore, the block 1% estimate was determined by substituting in normalized usage per customer, provided by Staff witness Kim Cox, for the rate schedule's actual usage per customer for a given revenue month. These results were given to Staff witness Kim Cox.

Q. How did Staff estimate the SGS rate block adjustment?

A. Similar to the Residential method, I first graphed the SGS Block 1 usage as a percentage of total winter usage against total SGS rate schedule usage per customer. The resulting graph, shown in Figure 2 below, shows a much different story.



It shows that the SGS single phase customers and three phase customers needed to be determined separately for each rate schedule and that the appropriate functional form is less clear without being able to combine the data sets.

While a quadratic formulation with a dummy variable for shoulder month periods performed satisfactorily for the single-phase rate schedule,[2] a similar technique was insufficiently precise for the three phase rate schedule.[3] It is expected that a general increase in usage would increase the usage in both rate blocks, but the quadratic formulation for the three phase rate class resulted in in a lower usage in one block and a higher usage in the other. Based on the residential analysis, I applied a power function to the second rate schedule which

[2] The resulting Adjusted R^2 was approximately 99.3%.
[3] The resulting Adjusted R^2 was approximately 96.7%.

improved the regression results[4] and removed the irrational results. This indicates that the rate block adjustment analysis is highly sensitive and could benefit from additional data points.

Therefore, the block 1% estimate was determined by substituting in normalized usage per customer, provided by Staff witness Kim Cox, for each rate schedule's actual usage per customer for a given revenue month. These results were given to Staff witness Kim Cox.

Q. What is the Load Requirement at Transmission analysis?

A. This analysis provides an estimate of the normalized amount of electricity required to meet the energy demands of both the company's customers and its own needs at the transmission level. This analysis is used by Staff witness Shawn Lange. The hourly loads used in the analysis was obtained from Ameren Missouri's data provided in accordance with 20 CSR 4240-3.190 (1) (C).

Q. How was this analysis performed?

A. The analysis is performed nearly identically as the rate classes with TOU rate schedules discussed above. Regression analysis with actual loads and temperatures is performed for both peak and average energy consumption, then simulated with normal weather. The difference is that the results are also scaled to equal the final total Missouri Normalized load, calculated by Staff witness Kim Cox, with a loss factor for transmission losses, provided by Staff witness Alan Bax.

Q. Does this conclude your testimony?

A. Yes, it does.

[4] The resulting Adjusted R^2 was approximately 97.3%.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Adjust Its Revenues for Electric Service	)))	Case No. ER-2024-0319

AFFIDAVIT OF MICHAEL L. STAHLMAN

STATE OF MISSOURI	)	
	)	ss.
COUNTY OF COLE	)	

COMES NOW MICHAEL L. STAHLMAN and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Direct Testimony of Michael L. Stahlman*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

MICHAEL L. STAHLMAN

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 25th day of November 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

Michael Stahlman

Education

2009	M. S., Agricultural Economics, University of Missouri, Columbia.
2007	B.A., Economics, Summa Cum Laude, Westminster College, Fulton, MO.

Professional Experience

2010 -	Regulatory Economist, Missouri Public Service Commission
2007 – 2009	Graduate Research Assistant, University of Missouri
2008	Graduate Teaching Assistant, University of Missouri
2007	American Institute for Economic Research (AIER) Summer Fellowship Program
2006	Price Analysis Intern, Food and Agricultural Policy Research Institute (FAPRI), Columbia, MO
2006	Legislative Intern for State Representative Munzlinger
2005 – 2006	Certified Tutor in Macroeconomics, Westminster College, Fulton, MO
1998 – 2004	Engineering Watch Supervisor, United States Navy

Expert Witness Testimony

Union Electric Company d/b/a AmerenUE GR-2010-0363
In the Matter of Union Electric Company d/b/a AmerenUE for Authority to File Tariffs Increasing Rates for Natural Gas Service Provided to Customers in the Company's Missouri Service Area

Union Electric Company d/b/a Ameren Missouri GT-2011-0410
In the Matter of the Union Electric Company's (d/b/a Ameren Missouri) Gas Service Tariffs Removing Certain Provisions for Rebates from Its Missouri Energy Efficient Natural Gas Equipment and Building Shell Measure Rebate Program

KCP&L Great Missouri Operations Company EO-2012-0009
In the Matter of KCP&L Greater Missouri Operations Company's Notice of Intent to File an Application for Authority to Establish a Demand-Side Programs Investment Mechanism

Union Electric Company d/b/a Ameren Missouri EO-2012-0142
In the Matter of Union Electric Company d/b/a Ameren Missouri's Filing to Implement Regulatory Changes Furtherance of Energy Efficiency as Allowed by MEEIA

Kansas City Power & Light Company EO-2012-0323
In the Matter of the Resource Plan of Kansas City Power & Light Company

KCP&L Great Missouri Operations Company EO-2012-0324
In the Matter of the Resource Plan of KCP&L Greater Missouri Operations Company

Kansas City Power & Light Company EO-2012-0135
KCP&L Great Missouri Operations Company EO-2012-0136
In the Matter of the Application of Kansas City Power & Light Company [KCP&L Great Missouri Operations Company] for Authority to Extend the Transfer of Functional Control of Certain Transmission Assets to the Southwest Power Pool, Inc.

Kansas City Power & Light Company, KCP&L Great Missouri Operations Company, and Transource Missouri EA-2013-0098 EO-2012-0367
In the Matter of the Application of Transource Missouri, LLC for a Certificate of Convenience and Necessity Authorizing it to Construct, Finance, Own, Operate, and Maintain the Iatan-Nashua and Sibley-Nebraska City Electric Transmission Projects

Kansas City Power & Light Company EU-2014-0077
KCP&L Great Missouri Operations Company
In the Matter of the Application of Kansas City Power & Light Company and KCP&L Greater Missouri Operations Company for the Issuance of an Accounting Authority Order relating to their Electrical Operations and for a Contingent Waiver of the Notice Requirement of 4 CSR 240-4.020(2)

Kansas City Power & Light Company EO-2014-0095
In the Matter of Kansas City Power & Light Company's Notice of Intent to File an Application for Authority To Establish a Demand-Side Programs Investment Mechanism

Veolia Energy Kansas City, Inc HR-2014-0066
In the Matter of Veolia Energy Kansas City, Inc for Authority to File Tariffs to Increase Rates

Grain Belt Express Clean Line, LLC EA-2014-0207
In the Matter of the Application of Grain Belt Express Clean Line LLC for a Certificate of Convenience and Necessity Authorizing It to Construct, Own, Operate, Control, Manage, and Maintain a High Voltage, Direct Current Transmission Line and an Associated Converter Station Providing an Interconnection on the Maywood - Montgomery 345 kV Transmission Line

Union Electric Company d/b/a Ameren Missouri ER-2014-0258
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariff to Increase Its Revenues for Electric Service

Empire District Electric Company ER-2014-0351
In the Matter of The Empire District Electric Company for Authority to File Tariffs Increasing Rates for Electric Service Provided to Customers in the Company's Missouri Service Area

Kansas City Power & Light Company ER-2014-0370
In the Matter of Kansas City Power & Light Company's Request for Authority to Implement a General Rate Increase for Electric Service

Kansas City Power & Light Company EO-2014-0240
In the Matter of Kansas City Power & Light Company's Filing for Approval of Demand-Side Programs and for Authority to Establish a Demand-Side Programs Investment Mechanism

KCP&L Great Missouri Operations Company EO-2014-0241
In the Matter of KCP&L Greater Missouri Operations Company's Filing for Approval of Demand-Side Programs and for Authority to Establish a Demand-Side Programs Investment Mechanism

Ameren Transmission Company of Illinois EA-2015-0146
In the Matter of the Application of Ameren Transmission Company of Illinois for Other Relief or, in the Alternative, a Certificate of Public Convenience and Necessity Authorizing it to Construct, Install, Own, Operate, Maintain and Otherwise Control and Manage a 345,000-volt Electric Transmission Line from Palmyra, Missouri to the Iowa Border and an Associated Substation Near Kirksville, Missouri

Empire District Electric Company ER-2016-0023
In the Matter of The Empire District Electric Company's Request for Authority to Implement a General Rate Increase for Electric Service

KCP&L Great Missouri Operations Company ER-2016-0156
In the Matter of KCP&L Greater Missouri Operations Company's Request for Authority to Implement a General Rate Increase for Electric Service

Kansas City Power & Light Company ER-2016-0285
In the Matter of Kansas City Power & Light Company's Request for Authority to Implement A General Rate Increase for Electric Service

Union Electric Company d/b/a Ameren Missouri ER-2016-0179
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariff to Increase Its Revenues for Electric Service

Grain Belt Express Clean Line, LLC EA-2016-0358
In the Matter of the Application of Grain Belt Express Clean Line LLC for a Certificate of Convenience and Necessity Authorizing it to Construct, Own, Operate, Control, Manage and Maintain a High Voltage, Direct Current Transmission Line and an Associated Converter Station Providing an Interconnection on the Maywood-Montgomery 345kV transmission line.

Spire Missouri, Inc. GR-2017-0215 and GR-2017-0216
In the Matter of Spire Missouri, Inc.'s Request to Increase Its Revenues for Gas Service

Liberty Utilities GR-2018-0013
In the Matter of Liberty Utilities (Midstates Natural Gas) Corp. d/b/a Liberty Utilities' Tariff Revisions Designed to Implement a General Rate Increase for Natural Gas Service in the Missouri Service Areas of the Company

Spire Missouri, Inc. GO-2019-0058 and GO-2019-0059
In the Matter of Spire Missouri, Inc. d/b/a Spire's Request to Decrease [Increase] WNAR

Grain Belt Express Clean Line LLC EM-2019-0150
Invenergy Transmission LLC
Invenergy Investment Company LLC
In the Matter of the Joint Application of Invenergy Transmission LLC, Invenergy Investment Company LLC, Grain Belt Express Clean Line LLC and Grain Belt Express Holding LLC for an Order Approving the Acquisition by Invenergy Transmission LLC of Grain Belt Express Clean Line LLC

Union Electric Company d/b/a Ameren Missouri GR-2019-0077
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Increase its Revenues for Natural Gas Service

Union Electric Company d/b/a Ameren Missouri ER-2019-0335
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Decrease Its Revenues for Electric Service

Empire District Electric Company ER-2019-0374
In the Matter of The Empire District Electric Company's Request for Authority to File Tariffs Increasing Rates for Electric Service Provided to Customers in its Missouri Service Area

Union Electric Company d/b/a Ameren Missouri EA-2020-0371
In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Permission and Approval and a Certificate of Public Convenience and Necessity Under 20 CSR 4240-3.105

Spire Missouri, Inc. GR-2021-0108
In the Matter of Spire Missouri Inc.'s d/b/a Spire Request for Authority to Implement a General Rate Increase for Natural Gas Service Provided in the Company's Missouri Service Areas

Union Electric Company d/b/a Ameren Missouri ER-2021-0240
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Adjust Its Revenues for Electric Service

Union Electric Company d/b/a Ameren Missouri GR-2021-0241
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Adjust Its Revenues for Natural Gas Service

The Empire District Electric Company ER-2021-0312
In the Matter of the Request of The Empire District Electric Company d/b/a Liberty for Authority to File Tariffs Increasing Rates for Electric Service Provided to Customers in its Missouri Service Area

The Empire District Gas Company GR-2021-0320
In the Matter of The Empire District Gas Company's d/b/a Liberty Request to File Tariffs to Change its Rates for Natural Gas Service

Ameren Transmission Company of Illinois EA-2022-0099
In the Matter of the Application of Ameren Transmission Company of Illinois for a Certificate of Convenience and Necessity Under Section 393.170.1, RSMo. Relating to Transmission Investments in Southeast Missouri

Evergy Metro, Inc d/b/a Evergy Missouri Metro ER-2022-0129
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

Evergy Missouri West, Inc. d/b/a Evergy Missouri West ER-2022-0130
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

Spire Missouri, Inc. GR-2022-0179
In the Matter of Spire Missouri, Inc. d/b/a Spire's Request for Authority to Implement a General Rate Increase for Natural Gas Service Provided in the Company's Missouri Service Areas

Union Electric Company d/b/a Ameren Missouri EA-2022-0245
In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Approval of a Subscription-Based Renewable Energy Program

Union Electric Company d/b/a Ameren Missouri ER-2022-0337
In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Adjust Its Revenues for Electric Service

Grain Belt Express Clean Line LLC EA-2023-0017
In the Matter of the Application of Grain Belt Express LLC for an Amendment to its Certificate of Convenience and Necessity Authorizing it to Construct, Own, Operate, Control, Manage, and Maintain a High Voltage, Direct Current Transmission Line and Associated Converter Station

Union Electric Company d/b/a Ameren Missouri EA-2023-0286
In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Permission and Approval and Certificates of Public Convenience and Necessity Authorizing it to Construct Renewable Generation Facilities

Evergy Metro, Inc d/b/a Evergy Missouri Metro EO-2024-0002
Evergy Missouri West, Inc. d/b/a Evergy Missouri West
In the Matter of Requests for Customer Account Data Production from Evergy Metro, Inc. d/b/a Evergy Missouri Metro and Evergy Missouri West, Inc. d/b/a Evergy Missouri West

Liberty Utilities (Midstates Natural Gas) Corp. d/b/a Liberty GR-2024-0106
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

Evergy Missouri West, Inc. d/b/a Evergy Missouri West ER-2024-0189
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

Selected Manuscripts and Posters

Stahlman, Michael and Laura M.J. McCann. "Technology Characteristics, Choice Architecture and Farmer Knowledge: The Case of Phytase." Agriculture and Human Values (2012) 29: 371-379.

Stahlman, Michael. "The Amorality of Signals." Awarded in top 50 authors for SEVEN Fund essay competition, "The Morality of Profit."

Stahlman, Michael, Laura M.J. McCann, and Haluk Gedikoglou. "Adoption of Phytase by Livestock Farmers." Selected poster at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008. Also presented at the USDA/CSREES Annual Meeting in St. Louis, MO in February 2009.

McCann, Laura, Haluk Gedikoglu, Bob Broz, John Lory, Ray Massey, and Michael Stahlman. "Farm Size and Adoption of BMPs by AFOs." Selected poster at the 5th National Small Farm Conference in Springfield, IL in September 2009.