Exhibit No. 216

MoPSC Staff – Exhibit 216
Shawn E. Lange, PE
Direct Testimony
File Nos. ER-2022-0129 & ER-2022-0130

Exhibit No.:
Issue(s): *Variable Fuel*
Witness: *Shawn E. Lange, PE*
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

ENGINEERING ANALYSIS DEPARTMENT

DIRECT TESTIMONY

OF

SHAWN E. LANGE, PE

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

SHAWN E. LANGE, PE

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 Shawn E. Lange and my business address is Missouri Public Service Commission, P.O. Box 360, Jefferson City, MO 65102.

Q. What is your present position with the Missouri Public Service Commission ("Commission")?

A. I am a Senior Professional Engineer in the Engineering Analysis Department, Industry Analysis Division.

Q. Would you please review your educational background and work experience?

A. A list of the cases in which I have filed testimony and my credentials can be found in Schedule SEL-d1.

EXECUTIVE SUMMARY

Q. What is the purpose of your testimony?

A. The purpose of my testimony it to address Staff's calculation of variable fuel and purchased power expense.

Q. Is your testimony applicable to the general rate case filed by Evergy Missouri West ("EMW"), ER-2022-0130, or the general rate case filed by Evergy Missouri Metro ("EMM") in ER-2022-0129?

A. My direct testimony is only applicable to the EMM revenue requirement, ER-2022-0129. Staff witness Charles T. Poston, PE is concurrently providing direct testimony regarding the variable fuel and purchased power expense for developing the EMW revenue requirement in ER-2022-0130.

Q. In this testimony, do you provide any recommendations for expense levels to be reflected in the revenue requirement ordered in this case?

A. Yes. It is my recommendation that the revenue requirement determined by the Commission in this case should reflect Staff's calculation of variable fuel and purchased power expense, equal to $253,278,266.75.

Q. In this testimony, do you describe the development of a workproduct which you provided to another Staff witness for the development of an issue?

A. Yes. I provided the production cost model results to Staff witness Amanda C. Conner for use in determining the appropriate percentage of transmission expense for EMM to recover, and to develop the Staff's recommended Fuel Adjustment Clause Base Factor. I also provided the production cost model results to Staff witness Matthew R. Young to include in the calculation of Staff's revenue requirement.

VARIABLE FUEL AND PURCHASED POWER EXPENSE

Q. What is the purpose of your direct testimony regarding variable fuel and purchased power expense?

A. The purpose of this section of my direct testimony is to describe how Staff calculated its recommended variable fuel and purchased power expense for EMM through the use of a production cost model. Staff recommends that the revenue requirement chosen by the Commission include a variable fuel and purchased power expense of $253,278,266.75.

Q. What does Staff recommend concerning the variable fuel and purchased power expense for EMM?

A. Staff recommends that the revenue requirement chosen by the Commission include the variable fuel and purchased power expense calculated by Staff. Staff's variable fuel and purchased power expense is consistent with Staff's level of load and rate revenues.

Q. What is the purpose of a production cost model?

A. Staff uses a production cost model to perform a simulation of a utility's energy generation, energy sales, and energy purchases. The simulation results are used to calculate the indicated revenues and expenses.

The revenues and expenses calculated from the results of Staff's production cost modeling are:

- The purchase of the fuel necessary to support the generation of electricity at power plants;
- The costs and revenues from the purchases and sales of energy within integrated marketplace; and
- The purchases of energy through purchased power agreements.

Fixed expenses such as those related to the recovery of capital are not included in the results of Staff's production cost model.

Q. What production cost modeling software does Staff use?

A. Staff uses the PLEXOS® software for production cost modeling.

Q. What inputs are necessary for Staff's production cost model?

A. Staff's production cost model includes input data developed by multiple Staff witnesses. These include: market prices from Staff witness Saeid R. Dindarloo, PhD, PE, fuel

prices from Staff witness Matthew R. Young, and system load from Staff witness Hari K. Poudel, PhD. I developed the remaining inputs: generation from wind farms, planned and forced outages, and power plant characteristics.

Q. How did you adapt the output from wind farms for use in Staff's production cost model?

A. Historic hourly generation data for each of the wind farms that EMM purchases energy from was used to create representative average output profiles unique to each site. The prices paid for the energy from the wind farm purchased power agreements ("PPAs") were taken from the contracts that EMM entered into with the wind farm owners.

Q. How were planned and forced outages accounted for in Staff's production cost model?

A. Planned and forced outages are infrequent in occurrence and variable in duration. In order to capture that variability, the outages experienced at each power plant were normalized by averaging seven years of historic data.

Q. How were power plant characteristics for Staff's production cost model derived?

A. Staff relied on EMM for responses to data requests and data supplied to comply with 20 CSR 4240-3.190 for inputs relating to each generating unit such as:

- Unit capacity;
- Unit heat rate curve;
- Primary and startup fuels;
- Ramp rates;
- Startup costs; and,
- Variable operating and maintenance expense.

Definitions of the bulleted terms above are included in Schedule SEL-d2.

Q. Has there been a change in the structure of Staff's production cost model since EMM's last general rate case?

A. Yes. Staff has modified its production cost model to incorporate the use of multiple sets of market prices in order to better mimic the behavior of EMM[1] in the integrated marketplace. Staff implemented this production cost modeling philosophy in the two most recent rate cases filed by the Empire District Electric Company (ER-2019-0374 and ER-2021-0312).[2] In Staff's production cost model for EMM, all load requirements are met through market purchases of energy at its market defined load node. Staff witness Saeid R. Dindarloo, PhD, PE provided the sets of market prices relied upon for Staff's production cost model. The production cost model simulates the dispatch of each coal or natural gas-fired power plant based upon the market prices associated with that generator's node. In each hour of the simulation, the total generation from all sources is then summed and compared against the purchased energy required to satisfy load. If total generation exceeds purchased energy, then net purchases are recorded for that hour. Conversely, if total generation is less than purchased energy, net purchases are recorded. In that way, net sales and purchases within the market are determined for each hour of the simulation.

Q. What are the industry best practices related to the calculation of variable fuel and purchased power expenses?

A. Production cost modeling software is widely used throughout the electric power industry in the United States and throughout the world for the calculation of variable fuel and purchased power expenses. Similar software is used by electric utilities, regional transmission

[1] The production cost model created by Staff witness Charles T. Poston, PE for EMW in ER-2022-0130 is of the same style as the production cost model used here for EMM.
[2] The multi-nodal design of the production cost models used by Staff for EMW, EMM, and the Empire District Electric Company has not yet been implemented for Ameren Missouri.

operators, regulatory agencies, universities, and research laboratories for evaluating the costs related to the generation, transmission, and consumption of electricity. The use of modeling software allows for the calculation of the lowest cost method by which customer needs can be satisfied while considering a given utility's generating resources, load requirements, and other constraints.

Q. What was the Commission's decision regarding variable fuel and purchased power in EMM's previous general rate case, ER-2018-0146?

A. The Commission made no specific decision regarding variable fuel and purchased power in EMM's previous general rate case. The concurrent general rate cases for EMM and EMW, ER-2018-0145 and ER-2018-0146, were settled through a series of non-unanimous stipulations and agreements that were approved by the Commission. In those cases, Staff's billing determinants and revenues were used for the purpose of establishing rates.

Q. What is the recommended variable fuel and purchased power expense that resulted from Staff's production cost modeling?

A. Staff calculated that the variable fuel and purchased power expense for EMM for test year as updated, the 12 month period, ending December 31, 2021, to be $253,278,266.75. The revenue requirement determined by the Commission should reflect Staff's calculation of variable fuel and purchased power expense.

Q. Does this conclude your direct 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 SHAWN E. LANGE, PE

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

COMES NOW SHAWN E. LANGE, PE and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Direct Testimony of Shawn E. Lange, PE*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Shawn E. Lange P.E.
SHAWN E. LANGE, PE

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 7th day of June 2022.

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

D Suzie Mankin
Notary Public

CREDENTIALS AND CASE PARTICIPATION OF SHAWN E. LANGE, PE

PRESENT POSITION:

I am a Senior Professional Engineer in the Engineering Analysis Section, Industry Analysis Division, of the Missouri Public Service Commission.

EDUCATIONAL BACKGROUND AND WORK EXPERIENCE:

In December 2002, I received a Bachelor of Science Degree in Mechanical Engineering from the University of Missouri, at Rolla now known as the Missouri University of Science and Technology. I joined the Commission Staff in January 2005. I am a registered Professional Engineer in the State of Missouri and my license number is 2018000230.

TESTIMONY FILED:

Case Number	Utility	Testimony	Issue
ER-2005-0436	Aquila Inc.	Direct	Weather Normalization
		Rebuttal	Weather Normalization
		Surrebuttal	Weather Normalization
ER-2006-0314	Kansas City Power & Light Company	Direct	Weather Normalization
		Rebuttal	Weather Normalization
ER-2006-0315	Empire District Electric Company	Direct	Weather Normalization
		Surrebuttal	Weather Normalization
ER-2007-0002	Union Electric Company d/b/a AmerenUE	Direct	Weather Normalization
ER-2007-0004	Aquila Inc.	Direct	Weather Normalization
ER-2007-0291	Kansas City Power & Light Company	Staff Report	Weather Normalization
		Rebuttal	Weather Normalization
ER-2008-0093	Empire District Electric Company	Staff Report	Weather Normalization
ER-2008-0318	Union Electric Company d/b/a AmerenUE	Staff Report	Weather Normalization

Case Number	Utility	Testimony	Issue
ER-2009-0089	Kansas City Power & Light Company	Staff Report	Net System Input
ER-2009-0090	KCP&L Greater Missouri Operations Company	Staff Report	Net System Input
ER-2010-0036	Union Electric Company d/b/a AmerenUE	Staff Report	Net System Input
ER-2010-0130	Empire District Electric Company	Staff Report	Variable Fuel Costs
		Surrebuttal	Variable Fuel Costs
ER-2010-0355	Kansas City Power & Light Company	Staff Report	Variable Fuel Costs
ER-2010-0356	KCP&L Greater Missouri Operations Company	Staff Report	Engineering Review-Sibley 3 SCR
ER-2011-0004	Empire District Electric Company	Staff Report	Variable Fuel Costs
ER-2011-0028	Union Electric Company d/b/a Ameren Missouri	Staff Report	Net System Input
ER-2012-0166	Union Electric Company d/b/a Ameren Missouri	Staff Report	Weather Normalization
		Surrebuttal	Weather Normalization Maryland Heights In-Service
ER-2012-0174	Kansas City Power & Light Company	Staff Report	Weather Normalization Net System Input Variable Fuel Costs
		Surrebuttal	Weather Normalization
ER-2012-0175	KCP&L Greater Missouri Operations Company	Staff Report	Weather Normalization Net System Input
		Surrebuttal	Weather Normalization
ER-2012-0345	Empire District Electric Company	Rebuttal	Interim Rates
		Staff Report	Weather Normalization
EC-2014-0223	Noranda Aluminum v. Ameren Missouri	Rebuttal	Weather Normalization
EA-2014-0207	Grain Belt Express CCN	Rebuttal	Certificates of Convenience/Feasibility Analysis
		Surrebuttal	

Case Number	Utility	Testimony	Issue
ER-2014-0258	Union Electric Company d/b/a Ameren Missouri	Staff Report	Net System Input Variable Fuel Costs
ER-2014-0351	Empire District Electric Company	Staff Report	Net System Input Variable Fuel Costs
ER-2014-0370	Kansas City Power & Light Company	Staff Report	Net System Input Variable Fuel Costs
		True-up Direct	Variable Fuel Costs La Cygne In-service
EA-2015-0146	ATXI CCN	Rebuttal	Certificates of Convenience/Feasibility Analysis
		Surrebuttal	
ER-2016-0023	Empire District Electric Company	Staff Report	Net System Input Variable Fuel Costs
		Surrebuttal	Variable Fuel Costs
ER-2016-0179	Union Electric Company d/b/a Ameren Missouri	Staff Report	Variable Fuel Costs
EA-2016-0385	Grain Belt Express CCN	Rebuttal	Certificates of Convenience/Feasibility Analysis
		Surrebuttal	
ER-2018-0145	Kansas City Power & Light Company	Staff Report	Variable Fuel Costs Market Prices
		Rebuttal	Variable Fuel Costs Market Prices
		True-up Direct	Variable Fuel Costs Market Prices
EA-2018-0327	ATXI CCN	Rebuttal	Certificates of Convenience/Feasibility Analysis
EA-2019-0021	Ameren CCN	Staff Report	Certificates of Convenience/Feasibility Analysis
EA-2019-0010	Empire District Electric Company CCN	Staff Report	Certificates of Convenience/Feasibility Analysis
EC-2020-0408	MLA v. Grain Belt Complaint	Staff Recommendation	Formal Complaint
EA-2021-0167	ATXI CCN	Staff Recommendation	Certificates of Convenience/Feasibility Analysis

Case Number	Utility	Testimony	Issue
EA-2021-0087	ATXI CCN	Staff Report	Certificates of Convenience/Feasibility Analysis
ER-2021-0240	Union Electric Company d/b/a Ameren Missouri	Staff Report	Variable Fuel Costs Atchison wind farm Construction Audit and in-service review
		Rebuttal	Atchison in-service and Variable Fuel Costs
		True-up Direct	Variable Fuel Costs
ER-2021-0312	Empire District Electric Company	Staff Report	Transmission and Distribution Investment
EA-2022-0043	Evergy Metro and Evergy West Hawthorn Solar CCN	Staff Report	Certificates of Convenience/Feasibility Analysis
EA-2022-0099	ATXI CCN	Staff Direct Testimony	Certificates of Convenience/Feasibility Analysis

Definitions

Unit capacity:

The maximum capacity of a power plant is equal to its maximum level of energy output in megawatts (MW).

Unit heat rate curve:

The heat rate of a power plant, typically measured in BTU/kWh, is a measure of efficiency. It shows how much energy from the fuel consumed by the power plant is required to generate one kWh of electricity. The larger the magnitude of the heat rate, the less efficient a power plant is.

Primary and startup fuels:

A power plant's primary fuel is the main source of energy that it uses to generate electricity. For example, a coal-fired power plant will have coal as its primary fuel. This is distinct from startup fuel which may be used sparingly during limited periods of time while the power plant is being started. Fuel oil might be used as a startup fuel while a coal plant is being started. Once a certain power level is achieved, the startup fuel will stop being used, and the power plant will operate solely on it primary fuel.

Ramp rates:

Ramp rates describe how quickly a power plant can change its output power level and are typically given in units of megawatts per hour or megawatts per minute. Large coal or nuclear power plants have lower ramp rates than smaller natural gas-fired combustion turbines.

Startup costs:

Startup costs are the operations and maintenance costs associated with the startup of a power plant. The magnitude of startup costs can influence how a power plant is dispatched within a market. All other factors being equal, high startup costs would tend to make a power plant less likely to be dispatched in a given situation.

Variable operating and maintenance expense:

Variable operations and maintenance expenses ("VOM") are a part of the incremental cost of running a power plant. They represent the costs related to the equipment replacement and servicing that are necessarily incurred by the wear and tear that occurs when a power plant operates. These costs are measured in dollars per megawatt-hour ($/MWh) and will affect the price at which energy from a power plant is offered into the market. All other factors being equal, high VOM costs would tend to make a power plant less likely to be dispatched in a given situation.