BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of a Determination of Special Contemporary Resource Planning Issues to be Addressed by Union Electric Company d/b/a Ameren Missouri in its Next Triennial Compliance Filing or Next Annual Update Report	)))))	Case No. EO-2025-0077

PUBLIC COUNSEL'S SUGGESTED SPECIAL CONTEMPORARY ISSUES

COMES NOW the Office of the Public Counsel and, in response to the September 4, 2024, order in the above-captioned case opening it and ordering, "Any party wishing to suggest a special contemporary issue that Union Electric Company d/b/a Ameren Missouri should consider in its next annual update report shall file its written suggestion no later than September 15, 2024," suggests in the attached verified memorandum certain special contemporary issues that Ameren Missouri should consider in its next (2024) annual update report.

Respectfully,

/s/ Nathan Williams

Nathan Williams
Chief Deputy Public Counsel
Missouri Bar No. 35512

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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing have been mailed, hand-delivered, transmitted by facsimile or electronically mailed to all counsel of record this 13th day of September 2024.

/s/ Nathan Williams

MEMORANDUM

To: Missouri Public Service Commission Official Case File,
Case No. EO-2025-0077 Ameren Missouri

From: Geoff Marke, Chief Economist
Lena Mantle, Senior Analyst
John Robinett, Utility Engineering Specialist
Missouri Office of the Public Counsel

Re: Special Contemporary Issues for Ameren Missouri in its Next Annual Update Report

Date: 9/15/2024

Issue #1: Literature Review of Data Center IRP Modeling

Background:

Increased internet usage, including AI, requires data centers to use more electricity and pose unique challenges including:

- Data centers are highly incentivized to interconnect as quickly as possible but face significant interconnection congestion and delays.
- Large new point loads can require substantial grid upgrades, forcing utilities to make potentially risky decisions about allocating scarce capital and managing ratepayer impacts.
- Data centers may consume large quantities of energy (both from existing and new electricity generators), which may challenge grid reliability if unmanaged.
- Data center demand forecasts may be over-estimated (e.g., due to technological efficiency gains) which could result in unneeded build-out.
- The importance of minimizing inequitable cost allocation, so that those receiving the benefits of grid upgrades to interconnect these new loads and generation undertake the financial responsibility and attendant risks.

Load growth is likely here to stay, even if the exact nature, timing, and scale is unclear. According to an EPRI study, data centers could consume up to 9% of U.S. electricity generation by 2030 — more than double the amount currently used.[1]

Ameren Missouri should be working with regulatory stakeholders to ensure transparency and early identification of energy needs and interconnection requirements by both utilities and data center companies. As such, IRP modeling should consider the electricity rate impact and resource mix implications of this unique load.

[1] EPRI (2024) Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption. https://www.epri.com/research/products/000000003002028905.

Request for modeling:

OPC requests that the Commission order Ameren Missouri to perform a literature review of best practices from around the country on how other utilities are accounting for the addition of data centers in their IRPs and on how risks can be minimized. OPC recommends this topic be included as a separate appendix to Ameren Missouri's 2025 IRP update filing and include, at a minimum, the afore-listed bullet points.

Issue #2: High Load Growth Scenarios Related to Data Centers

Background:

A recent McKinsey & Company study found that data center power demand is expected to more than double across the country from 17 GW to 35 GW from 2022 to 2030.[2] During the all day "Power MO" seminar hosted by the Public Service Commission August 13, 2024 (to discuss securing Missouri's Energy Future), Missouri Economic Development Director Michelle Hataway provided the following information regarding proposed projects and their electrical demand requirements in Table 1 in her presentation:

Table 1: Potential Economic Development Projects and Estimated Electric Demand

Jobs	Capex	Site Acreage Requirement	Building Square Footage Requirement	Electric Requirements
1,500	$5,200,000,000	820		480 MW 100% Renewable
650	$3,300,000,000	2,200		1.28 GW
675	$2,000,000,000	260		1 GW 100% Renewable
3,240	$1,500,000,000	200		80 MW
388	$550,000,000	300	1,500,000	12 MW
802	$199,000,000		760,000	15 MW
		150		200 MW
150	$800,000,000	175		500 MW
205	$599,000,000	30	450,000	50 MW
100	$320,000,000	650		45 MW
200	$140,000,000	50	526,262	9.5 MW portion attributed to renewables
308	$121,000,000	50	275,000	12 MW
5,000	TBD	1,000		1.2 GW by 2042
1,000	$1,000,000,000	150		400 MW by 2028
326	$455,000,000	80		100 MW

Request for modeling:

OPC requests that the Commission Order Ameren Missouri to include in its 2025 IRP update filing an analysis of varying levels of new data center loads in the load forecasting section of its IRP. OPC requests that Ameren Missouri model the addition of data centers with a demand of 30 MW

[2] McKinsey & Company (2024) Why invest in rising data center economy. https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/investing-in-the-rising-data-center-economy.

or greater. OPC recommends the following load increases, assuming a 0.85 capacity availability factor, for consideration:

- 60 MW
- 90 MW
- 250 MW
- 500 MW
- 1 GW
- 2 GW

The analysis should include explanation of whether or not Ameren Missouri can reasonably accommodate a customer that requires the aforementioned loads and, if not, how long such an activity would reasonably take given the known constraints, including MISO generation interconnection approval, transmission and distribution build-out, and assumed generation resource procurement.

Additionally, Ameren Missouri needs to be modeling what, if any, impact data centers will have on ratepayers if the AI load materializes in neighboring utilities within MISO instead of within Ameren Missouri. Specifically, the level of exposure Ameren Missouri ratepayers may experience from a more resource constrained MISO world.

OPC believes this information is relevant for both the load forecasting section of the Commission's IRP rules and the appendix OPC requests the Commission order Ameren Missouri to include in its issue #1 discussion above.

Issue #3: Carbon Sequestration

Background:

On April 25, 2024, The EPA announced a series of final rules targeting reduction of fossil fuel-fired power plant pollution.[3]

The suite of final rules to be in effect by 2032 includes:

- A final rule for existing coal-fired and new natural gas-fired power plants that would ensure that all coal-fired plants that plan to run in the long-term and all new baseload gas-fired plants control 90 percent of their carbon pollution.
- A final rule strengthening and updating the Mercury and Air Toxics Standards (MATS) for coal-fired power plants, tightening the emissions standard for toxic metals by 67 percent and finalizing a 70 percent reduction in the emissions standard for mercury from existing lignite-fired sources.
- A final rule to reduce pollutants discharged through wastewater from coal-fired power plants by more than 660 million pounds per year, ensuring cleaner water for affected communities, including communities with environmental justice concerns that are disproportionately impacted.

[3] US EPA (2024) Biden-Harris Administration Finalizes Suite of Standards to Reduce Pollution from Fossil Fuel-Fired Power Plants https://www.epa.gov/newsreleases/biden-harris-administration-finalizes-suite-standards-reduce-pollution-fossil-fuel.

- A final rule that will require the safe management of coal ash that is placed in areas that were unregulated at the federal level until now, including at previously used disposal areas that may leak and contaminate groundwater.[4]

This suite of rules affects both existing and new build facilities:

For new combustion turbines, the final rule establishes three subcategories based on how intensively they are operated. New base load turbines (defined as units that are generating at least 40% of their maximum annual capacity, i.e., greater than 40% capacity factor) are subject to an initial "phase one" standard based on efficient design and operation of combined cycle turbines; and a "phase two" standard based on 90% capture of CO_2 with a compliance deadline of Jan. 1, 2032.

New intermediate load turbines (defined as units that are generating between 20 and 40% of their maximum annual capacity, i.e., 20-40% capacity factor) are subject to a standard based on efficient design and operation of simple cycle turbines.

New low load turbines (defined as units that are generating less than 20% of their maximum annual capacity, i.e., less than 20% capacity factor) are subject to a standard based on low-emitting fuel. For existing coal-fired EGUs, the final rule establishes subcategories based on how far into the future the plant intends to operate, Including:

- Units that intend to operate on or after January 1, 2039 (i.e., “long-term” units) will have a numeric emission rate limit based on application of CCS with 90% capture, which they must meet on January 1, 2032.

- Units that have committed to cease operations by January 1, 2039 (i.e., “medium term” units) will have a numeric emission rate limit based on 40% natural gas cofiring that they must meet on January 1, 2030.

- Units that demonstrate that they plan to permanently cease operation prior to January 1, 2032, will have no emission reduction obligations under the rule.

- For existing units, states have the ability to provide a variance for individual sources based on consideration of remaining useful life and other factors. An alternative standard may be appropriate where an individual existing source has fundamentally different circumstances than those considered by EPA and the source cannot reasonably achieve this required degree of emission limitation.[5]

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[4] US EPA (2024) Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants. https://www.epa.gov/stationary-sources-air-pollution/greenhouse-gas-standards-and-guidelines-fossil-fuel-fired-power#rule-summary.

[5] US EPA (2024) Fact Sheet: Carbon Pollution Standards for Fossil Fuel-Fired Power Plants Final Rule. https://www.epa.gov/system/files/documents/2024-04/cps-111-fact-sheet-overview.pdf

Request for modeling:

OPC requests that the Commission order Ameren Missouri to provide a review of the technology and methods currently available as well as the dollar impact for relevant and projected resources to be compliant with the law.

Issue #4: Supercritical Carbon Dioxide Power Cycles

Background:

The Southwest Research Institute has built a 10M W Supercritical Transformational Electric Power (STEP) facility in San Antonio, Texas at a cost of $169 million. This project was built in partnership with US Department of Energy[6], General Electric GTI Energy[7], and the National Energy Technology Laboratory[8]. The objective of the STEP Demo is to demonstrate the highly efficient, so-called Brayton power cycle in a pilot-scale, grid-connected power plant.[9] The project broke ground in 2018, completed construction in 2023, generated electricity for first time in 2024.[10]

The pilot plant's supercritical CO_2 (sCO_2) turbomachinery is approximately one-tenth the size of conventional power plant components, which shrinks the physical footprint and construction cost of any new facilities. Additionally, the sCO_2 power cycles are compatible with many heat sources, including concentrated solar power, industrial waste heat, geothermal power, and advanced nuclear power plants.

Request for Modeling:

OPC requests that the Commission order Ameren Missouri to investigate the option of a supercritical carbon dioxide power cycle plant as a resource candidate in future supply-side generation planning and modeling scenarios.

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[6] US DOE (2024) Pilot Plant: Supercritical CO_2 Power Cycles. https://www.energy.gov/pilot-plant-supercritical-co2-power-cycles.

[7] Southwest Research Institute (2024) STEP Demo supercritical CO_2 pilot plant generates electricity for the first time. https://www.swri.org/press-release/step-demo-supercritical-co2-pilot-plant-generates-electricity-the-first-time.

[8] GTI Energy (2024) A STEP closer to transformational electric power https://www.gti.energy/step-demo/.

[9] GTI Energy (2024) STEP Demo Technology. https://www.gti.energy/step-demo/step-demo-project/technology/.

[10] Friedman, C (2024) Experimental power plant using CO_2 in San Antonio could be future of energy production. https://www.ksat.com/news/local/2024/06/26/experimental-power-plant-using-co2-in-san-antonio-could-be-future-of-energy-production/.

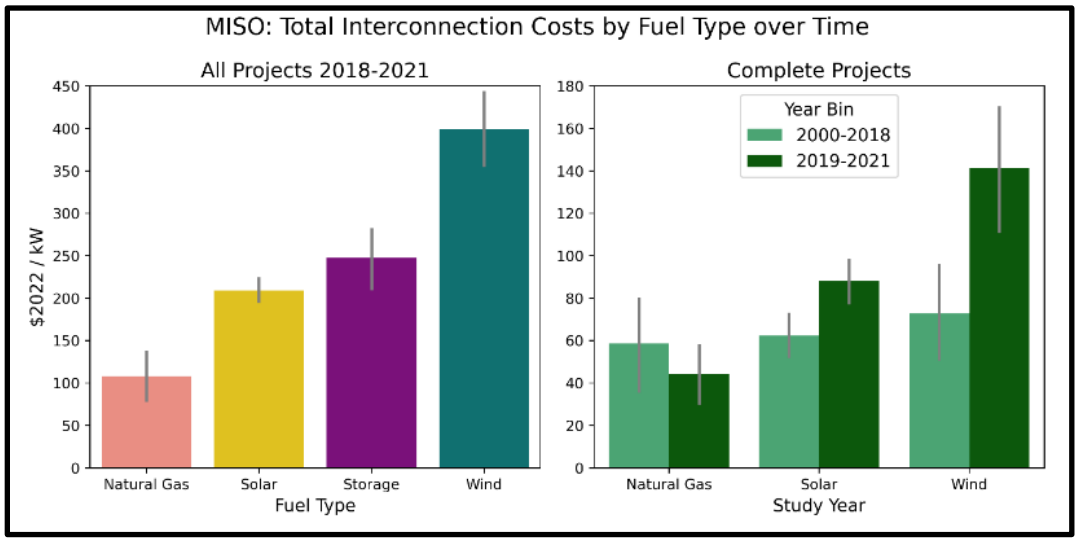
Issue #5: Estimated Generation Interconnection Costs and Project Delays

Background:

Active interconnection requests in RTO/ISOs have surged in the past year, increasing to approximately six times the capacity requested in 2014.[11] This has also led to increased wait times and as well as lower overall completion rates. Proposed energy storage, renewable and conventional dispatchable generation currently face lengthy delays and high costs to interconnect new generation to the transmission grid.

Moreover, interconnection costs vary considerably by generation type. In the Southwest Power Pool ("SPP") "potential interconnection costs of all solar ($157/kW) and wind ($154/kW) requests have been greater than those of storage ($109/kW) and natural gas ($97/kW) projects since 2010.[12] Interconnection costs between generation types have been even more pronounced in the Midcontinent Independent System Operator ("MISO") where historically the per kW cost of completed wind project interconnections have been more than three times those of completed natural gas project interconnections. Figure 1 provides an illustrative breakdown of Lawrence Berkeley National Lab's analysis of MISO's total interconnection costs by fuel type over time.[13,14]

Figure 1: MISO: Total Interconnection Costs by Fuel Type over Time



[11] MISO alone has 49 GW of approved interconnection agreements (mostly solar) but face nearly two-years in delays before they could reach commercial operation. This comes in the midst of a 2.1 GW of capacity shortfall starting in the 2025/2026 planning year according to the July 2023 Organization of MISO State/MISO survey results. https://cdn.misoenergy.org/20230714%20OMS%20MISO%20Survey%20Results%20Presentation629607.pdf.

[12] Lawrence Berkeley National Lab (2023) Generator Interconnection Cost Analysis in the Southwest Power Pool (SPP) Territory https://eta-publications.lbl.gov/sites/default/files/berkeley_lab_2023.04.20-_spp_interconnection_costs.pdf.

[13] Lawrence Berkeley National Lab (2023) Generator Interconnection Costs to the Transmission System https://emp.lbl.gov/interconnection_costs.

[14] See GM-1a for a copy of the LBNL technical briefs that provide historical cost estimates for MISO and GM-1b for SPP.

Request for Modeling:

Based on the total interconnection costs by fuel type across both MISO and SPP it is evident that interconnection costs vary considerably across resource type. This is not factored into the modeling cost assumptions necessary for evaluating new supply side resource candidates. As a result, omission of this information will necessarily overstate/understate the costs of various resource types when contemplating the net present value of revenue requirement ("NPVRR") across different resource types. Future modeling should account for this variable moving forward.

- OPC requests that the Commission order Ameren Missouri to include a model of low, medium, and high interconnection cost estimates that are supported by historic total interconnection costs by fuel type for MISO in its resource adequacy planning scenarios; additionally,
- OPC requests that the Commission order Ameren Missouri articulate the estimated project length for all generation resources given the current MISO backflow, and the overall demand for generation resources across the United States.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

AFFIDAVIT OF JOHN A. ROBINETT

STATE OF MISSOURI)
) SS.
COUNTY OF COLE)

COMES NOW JOHN A. ROBINETT and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Memorandum* and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

John A. Robinett
Utility Engineering Specialist

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 12th day of September, 2024.

TIFFANY HILDEBRAND
NOTARY PUBLIC - NOTARY SEAL
STATE OF MISSOURI
MY COMMISSION EXPIRES AUGUST 8, 2027
COLE COUNTY
COMMISSION #15637121

Tiffany Hildebrand
Notary Public

My Commission expires August 8, 2027.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) SS.
COUNTY OF COLE)

COMES NOW GEOFF MARKE and on his oath declares that he is of sound mind and lawful age; that he contributed to the foregoing *Memorandum* and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Geoff Marke
Chief Economist

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 13th day of September, 2024.

TIFFANY HILDEBRAND
NOTARY PUBLIC - NOTARY SEAL
STATE OF MISSOURI
MY COMMISSION EXPIRES AUGUST 8, 2027
COLE COUNTY
COMMISSION #15637121

Tiffany Hildebrand
Notary Public

My Commission expires August 8, 2027.