Exhibit No.: _____
Issue(s): Economic Development/Preferred Resource Plan/Risk Analysis/Large Load Customer Rate Plan
Witness/Type of Exhibit: Marke/Rebuttal
Sponsoring Party: Public Counsel
Case No.: ET-2025-0184

REBUTTAL TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of the Office of the Public Counsel

UNION ELECTRIC COMPANY
D/B/A AMEREN MISSOURI

CASE NO. ET-2025-0184

*** _____ ***
Denotes Highly Confidential Information that has been redacted

September 5, 2025

PUBLIC

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GEOFF MARKE

UNION ELECTRIC COMPANY

D/B/A AMEREN MISSOURI

CASE NO.: ET-2025-0184

I. INTRODUCTION

Q. Please state your name, title and business address.

A. Geoff Marke, PhD, Chief Economist, Office of the Public Counsel (OPC or Public Counsel), P.O. Box 2230, Jefferson City, Missouri 65102.

Q. What are your qualifications and experience?

A. I have been in my present position with OPC since 2014 where I am responsible for economic analysis and policy research in electric, gas, water, and sewer utility operations.

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

A. Yes. A listing of the Commission cases in which I have previously filed testimony and/or comments is attached in Schedule GM-1.

Q. What is the purpose of your rebuttal testimony?

A. To provide a rebuttal response to Ameren Missouri's proposed subclass of Large Load Customers ("LLC" or "hyperscalers") within the Company's Large Primary Service ("LPS") tariff into the following four sections:

- Economic Development
  - Ameren Missouri witness Rob B. Dixon
- Preferred Resource Plan
  - Ameren Missouri witness Matt Michels
- Risk Analysis
  - Ameren Missouri witness Steven M. Wills
- Large Load Customer Rate Plan
  - Ameren Missouri witness Ajay K. Arora

The Commission and parties should note that my silence in regard to any issue not addressed from the aforementioned Company testimony should not be construed as an endorsement of Ameren Missouri's position.

Q. Do you have any additional comments to make before you begin your sections?

A. It is highly probable that Missouri will soon face much higher electricity costs, reduced reliability, and increased negative externalities in its electric utility services. The promise of hyperscale customers partaking in more fixed cost recovery is an attractive solution, but we need to be careful that this desire to attract new load does not result in a monkey's paw outcome.[1] This, and Evergy Missouri's ongoing docket (Case No. EO-2025-0154) outcome, will be instrumental in determining the extent and severity of these anticipated challenges. As such, it is crucial to meticulously and honestly evaluate the potential economic advantages of attracting data centers, such as local tax revenue, job creation, and the potential for lower overall customer bills over time, against the potential adverse consequences for existing ratepayers if infrastructure is built and new load does not materialize or falls off.

The Commission's responsibility is not to eliminate risk entirely, as that is impossible, but to manage risk judiciously, transparently, and with an emphasis on assigning risk/costs to those parties most appropriate to bear it. This demands a clear assessment of the uncertainties surrounding future large load customers. It also requires a commitment to the statutory requirements stated in RSMo Section 393.130(7), including prohibitions against unjust or unreasonable preferences or disadvantages, and a firm obligation to safeguard the long-term interests of Missouri ratepayers.[2] Failure to do so would gamble with the state's energy future and overall economic stability.

[1] The term originates from W.W. Jacobs's short story, "The Monkey's Paw," where a magical monkey's paw grants its possessor three wishes. While the wishes are fulfilled, they are accompanied by terrible repercussions, highlighting the story's theme that unchecked greed and tampering with fate can lead to unhappiness and destruction.

[2] § 393.130(7), RSMo 2025: Each electrical corporation providing electric service to more than two hundred fifty thousand customers shall develop and submit to the commission schedules to include in the electrical corporation's service tariff applicable to customers who are reasonably projected to have above an annual peak demand of one

I urge the Commission to ask questions and have a healthy degree of skepticism from all parties on this issue as we are all operating in an unprecedented dynamic world. Ameren Missouri deserves praise for many of the elements it has put forward in this application. Frankly, their proposal made more sense in May when they filed the testimony, but the speed of the political, technological, and financial landscape, and even the ethical challenges associated with what is driving the large demand in energy (*e.g.*, artificial intelligence or "AI") necessitate modifications and more explicit protections to ensure a successful and sustainable long-term outcome for Missouri.

My recommendations largely adhere to enforcing the regulatory principle of cost causation (*i.e.*, "growth has to pay for growth") as well as elements of the precautionary principle (*i.e.*, "better safe than sorry") in an attempts to mitigate the risk to the public and ensure that revenue from serving the new large load customers must be equal to or greater than a hundred percent of the direct and indirect cost of serving those customers.

II. ECONOMIC DEVELOPMENT

Q. What is considered a "large economic development prospect" from Ameren Missouri's perspective?

A. According to Mr. Dixon, that would be new customers taking service at a voltage above the standard primary service at a load of 50 MW or more.[3]

hundred megawatts or more. **The schedules should reasonably ensure such customers' rates will reflect the customers' representative share of the costs incurred to serve the customers and prevent other customer classes' rates from reflecting any unjust or unreasonable costs arising from service to such customers.** Each electrical corporation providing electric service to two hundred fifty thousand or fewer customers as of January 1, 2025, shall develop and submit to the commission such schedules applicable to customers who are reasonably projected to have above an annual peak demand of fifty megawatts or more. The commission may order electrical corporations to submit similar tariffs to reasonably ensure that the rates of customers who are reasonably projected to have annual peak demands below the above-referenced levels will reflect the customers' representative share of the costs incurred to serve the customers and prevent other customer classes' rates from reflecting any unjust or unreasonable costs arising from service to such customers.

[3] Direct Testimony of Rob B. Dixon, p. 17, 5-8.

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Q. What is the peak demand of Ameren Missouri's largest customer today?

A. The largest individual customer on Ameren Missouri's system today is at 32 MW of peak demand.[4]

Q. What peak demand threshold would Ameren Missouri's proposed subclass within the LPS tariff be set if approved as filed?

A. 100 MW.

Q. Is this a concern?

A. Yes. To provide some context, the largest industrial customers today would now be closer to the smallest residential customers than the new large customers being contemplated to take service under this proposal.

Q. Are there benefits to the state and local community from the inclusion of data centers into the local economy?

A. Absolutely. The benefits, largely in the form of property taxes, equipment, and/or negotiated terms with a given community, can vary considerably but have the potential to be quite large, including potential knock-on economic benefits to neighboring businesses (*e.g.*, it's safe to assume out-of-state construction workers will eat locally). Of course, this is predicated on the assumption that the hyperscale customer maintains service long enough for the benefits to be realized.

Q. What about job creation?

A. The number of jobs created is a difficult number to capture, depending on how a "created job" is defined. For example, is it a temporary job or a permanent job? Is the construction job filled by an out-of-state worker, or is the job sourced locally? How much does the job pay? But even taking those parameters into consideration, the number of jobs created is very small relative to the amount of money being spent. Speaking to the *Wall Street Journal* early this year, John Johnson, Chief Executive of data-center operator Patmos Hosting said:

[4] Direct Testimony of Steven M. Wills, p. 4, 18-20.

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> Data centers have rightly earned a dismal reputation of creating the lowest number of jobs per square foot in their facilities.[5] [6]

Furthermore, according to Christopher Tozzi, from *DataCenter Knowledge*:

> Data centers have frequently been criticized for creating few permanent jobs in relation to their footprint – and this criticism might not be entirely unfounded. In general, data centers generate relatively few jobs compared to the cost of building and operating a typical facility or the amount of land it occupies. . . . It would be wrong to say that data centers are massive engines of job creation. The typical data center results in an almost negligible number of permanent jobs relative to its scale.[7]

Data centers can generate jobs in two primary ways:

1. **Temporary jobs:** Contracted employment opportunities during data center construction. A large facility might keep thousands of construction workers busy, at least for the year or two that it takes to build.
2. **Permanent jobs**: For staff inside data centers. Once a data center is up and running, it usually requires some on-site technicians to handle tasks like setting up and managing IT equipment. Typically, however, the total data center staff number is only several dozen.[8]

Focusing just on construction jobs, a data center can employ hundreds or even more than a thousand temporary and skilled labor positions for anywhere from a few months to a few years. Whether or not these jobs are sourced locally or performed by experts from out-of-state is another consideration in determining whether or not a "new" job was created.

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[5] Dotan, T. (2025) The AI Data-Center Boom is a Job-Creation Bust. *The Wall Street Journal*. Feb. 25, 2025. https://www.wsj.com/tech/ai-data-center-job-creation-48038b67

[6] Patmos Hosting is currently erecting a data center in Kansas City, Missouri that will employ 40 to 50 people in the former *Kansas City Star* downtown office building. *Ibid*.

[7] Tozzi, C. (2025) How Many Jobs Do Data Centers Create? It Depends. *DataCenter Knowledge*. https://www.datacenterknowledge.com/operations-and-management/how-many-jobs-do-data-centers-create-it-depends

[8] *Ibid*.

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Operational jobs, or permanent positions, are significantly smaller, ranging from a dozen to as much as fifty. To provide some context, the 4-year, 875-acre, $500 billion Stargate Project undertaken by OpenAI, SoftBank, Oracle, and MGX in Abilene, Texas will include an initial $100 billion spent in which the project must include at least 57 full-time positions earning an average wage of $57,600 annually (though the final tally could be higher).[9] This results in an annual net salary gain of $3,283,200.

For comparative purposes, an average Sam's Club associate's annual weighted salary in Missouri is around $39,520 (assumes $19 an hour over 2,080 hours), and a given Sam's Club employs, on average, 167 associates per club.[10] This results in an annual net salary gain of $6,586,666.66 or more than double what the Stargate Data Center is required to create.

Q. Then do you believe job creation can rightly be cited as justification for approving Ameren Missouri's amended tariff as proposed?

A. No. Especially given the context of what this specific load will likely mean in terms of impact over future job displacement.

Q. What do you mean?

A. The load most likely associated with this amended tariff is tied to support future AI buildout. A recent Reuters poll concluded that 71% of Americans are deeply concerned over the prospect that advances in AI will be "putting too many people out of work permanently," and 77% "said they worried the technology could be used to stir up political chaos." These numbers and more are included in Figure 1.

[9] Ford, B. et al., (2025) Trump's Big AI Goals Start Small: 57 Jobs at a Texas Data. *Bloomberg News* reprinted in *Financial Post*. Centerhttps://financialpost.com/pmn/business-pmn/stargates-first-data-center-site-is-size-of-central-park-with-at-least-57-jobs

[10] There are approximately 600 membership warehouse Sam's Club stores in operation that employ approximately 100,000 associates. This results in an average of 167 jobs per store. Sam's Club. (2025, August 25) In *Wikipedia*. https://en.wikipedia.org/wiki/Sam%27s_Club

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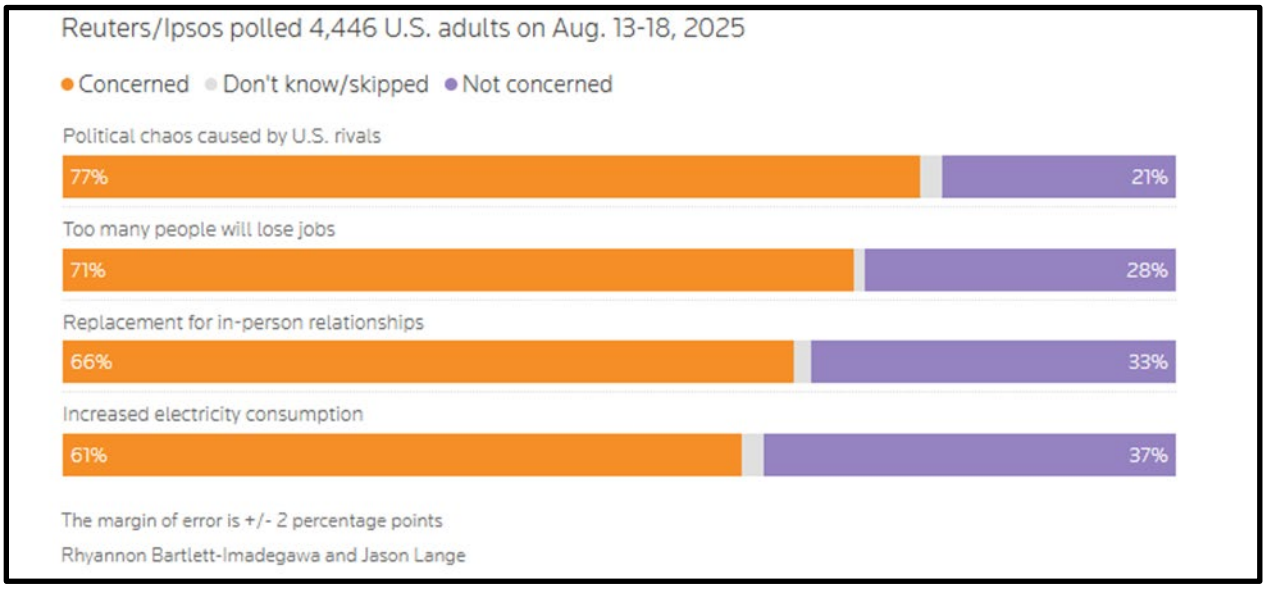
Figure 1: Americans concerns about artificial intelligence[11]



Q. Do you have other evidence to suggest that this is a real concern?

A. Consider the following statements:

- Anthropic CEO Dario Amodei warned in an interview in May that AI could wipe out half of entry-level white-collar jobs, resulting in unemployment rates of 10 percent to 20 percent within five years.[12]
- Ford CEO Jim Farley stated: "Artificial intelligence is going to replace literally half of all white-collar workers in the US," Farley said during an appearance at the Aspen Ideas Festival. “AI will leave a lot of white-collar people behind.”[13]

[11] Lange, S. & A. Alper (2025) Americans fear AI permanently displacing workers, Reuters/Ipsos poll finds. *Reuters*. https://www.reuters.com/world/us/americans-fear-ai-permanently-displacing-workers-reutersipsos-poll-finds-2025-08-19/

[12] Altchek A. & S. Perkel (2025) Anthropic CEO says AI could wipe out half of all entry-level white-collar jobs. *Business Insider*. https://www.businessinsider.com/anthropic-ceo-warning-ai-could-eliminate-jobs-2025-5

[13] Cutter C. & H. Zimmerman. (2025) CEOs Start Saying the Quiet Part Out Loud: AI Will Wipe Out Jobs. The Wall Street Journal. https://www.wsj.com/tech/ai/ai-white-collar-job-loss-b9856259

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- At JPMorgan Chase, Marianne Lake, CEO of JPMorgan Chase told investors in May that she could see its operations head count falling by 10% in the coming years as the company uses new AI tools.[14]
- Amazon CEO Andy Jassy wrote in a note to employees in June that he expected the company's overall corporate workforce to be smaller in the coming years because of the "once-in-a-lifetime" AI technology. "We will need fewer people doing some of the jobs that are being done today, and more people doing other types of jobs," Jassy said.[15]
- Shopify CEO Tobi Lütke recently told workers that the company wouldn't make any new hires unless managers could prove artificial intelligence isn't capable of doing the job.[16]
- "I don't think anyone is taking into consideration how administrative, managerial and tech jobs for people under 30 — entry-level jobs that are so important in your 20s — are going to be eviscerated," Steve Bannon, "War Room" podcaster who believes AI job displacement will be a major issue in the 2028 presidential campaign.[17]

Admittedly, it's easy to see how jobs could be lost, but harder to imagine jobs that haven't been created yet coming into existence.[18] Of course, this is predicated on the assumption that AI investment will be able to cover its enormous up-front and recurring direct and indirect costs and result in actual profit—not just revenue. Today, that assumption is not true and I will be discussing that more in my response to Ameren Missouri's risk analysis.

[14] *Ibid.*
[15] *Ibid*.
[16] *Ibid*.
[17] VandeHei, J. & M. Allen (2025) Behind the Curtain: A white-collar bloodbath. *Axios* https://www.axios.com/2025/05/28/ai-jobs-white-collar-unemployment-anthropic
[18] Also known as "creative destruction" or the process where innovations, new products, and processes replace older models. Examples include the smartphone overtaking landline phones, cars making horse-drawn carriages obsolete, streaming entertainment over taking video rental and movie theatres, etc…

Q. Given the size and scale of potential investment, have communities in Missouri embraced data centers?

A. I would say it has been a mixed response to date. Missouri has existing data centers, but nothing of the size and scale that is being contemplated.

In 2024, the citizens of Peculiar, Missouri rejected a proposed $1.5B data center project by Diode Ventures after strong opposition from residents who raised concerns about noise, environmental impacts, infrastructure strain, and non-disclosure agreements. Figure 2 shows a sign near the proposed location of the data center in Peculiar.

Figure 2: Peculiar, Missouri rejects $1.5B data center [19]

Less than 10 months later, the City of St. Charles, Missouri rejected a $1B data center proposal for many of the same reasons and took the additional step of becoming the first city in the United States to place a moratorium on data center development across the entire city's footprint.[20] Figure 3 shows an image of a group of protestors outside St. Charles City Council meeting.

[19] O'Donovan, C. (2024) Fighting back against data centers, one small town at a time. *The Washington Post*. https://www.washingtonpost.com/technology/2024/10/05/data-center-protest-community-resistance/
[20] Colbert, R. (2025) St. Charles bans data centers for 1 year. Residents push to make it permanent. *St. Louis Post-Dispatch*. https://www.stltoday.com/news/local/stcharles/article_cc69ee91-9269-42c1-8a23-5a93d1c05679.html

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Figure 3: Anti-data center protesters in St. Charles, Missouri[21]

Alternatively, Port KC recently approved a $100 billion data center campus that is expected to generate $110 M in new tax revenue over the 35-year life of the bond term or approximately $3.14M per year on average in revenue. $15.75 million of those expected funds are to be dedicated to helping train the area's workforce.[22]

III. PREFERRED RESOURCE PLAN

Q. Mr. Michels discusses the changes made to Ameren Missouri's preferred resource plan which also serves as the basis for Mr. Wills' risk analysis. Do you agree with Mr. Michels' analysis?

A. I do not.

IRPs are a necessary modeling exercise that I believe can directionally guide decision-making, but it should be held to a high degree of skepticism, in part, because we live in a very dynamic

[21] *Ibid*.
[22] Port KC (2025) $100 Billion Data Center Development to bring Infrastructure, Investment and Jobs to the Northland. https://portkc.com/100-billion-data-center-development-to-bring-infrastructure-investment-and-jobs-to-the-northland/

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world when it comes to energy policy. The inputs and assumptions are largely stale and outdated immediately following the filing of the plans. In the past, customers could account for resource errors and the costs incurred, in part, because the errors and their costs never approached the level of risk exposure that is being contemplated in this filing.

I have also largely been supportive of Ameren Missouri's IRP filings in the past. I believe Mr. Michels and his team mostly provide the most thorough and supportive assumptions for their planned investments relative to other IRPs I have reviewed, but I still disagree with many of the assumptions and inputs.

Q. Can you provide some illustrative examples for the Commission's consideration for this case?

A. The most immediate one is Ameren Missouri's assumptions surrounding the impact of a diminished MEEIA portfolio. According to Ameren Missouri, the Commission's rejection of its proposed MEEIA application will result in an additional 375 MW of generation in 2032 and 875 MW of generation in 2043. I believe this is an absurd conclusion, and it immediately calls into question the underlying assumptions later used to validate Mr. Wills' risk analysis.

I have spoken at length on this topic in past filings and do not need to restate my objections in this docket; however, I am frankly confused as to why Mr. Michels would elect to call out these specific investments in his testimony, given the Commission's feedback and order. To be clear, adding those costs into the analysis directionally favors the expected outcome in Mr. Wills' risk analysis. Equally concerning is that Mr. Michels is silent on the inclusion of deferred investment associated with the mass adoption of time-of-use rates. This, too, is an issue that the Commission has also largely rejected, even though it would materially minimize future rate increases and mitigate increasingly volatile fuel-related expenses if deployed.

The Commission should also take into consideration changes to Ameren Missouri's historical planned capital investments over time. For example, Figures 4 and 5 show planned scenarios for 2025 and 2020 respectively.

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Figure 4: Ameren Missouri 2025 Preferred Resource Plan Scenario[23]

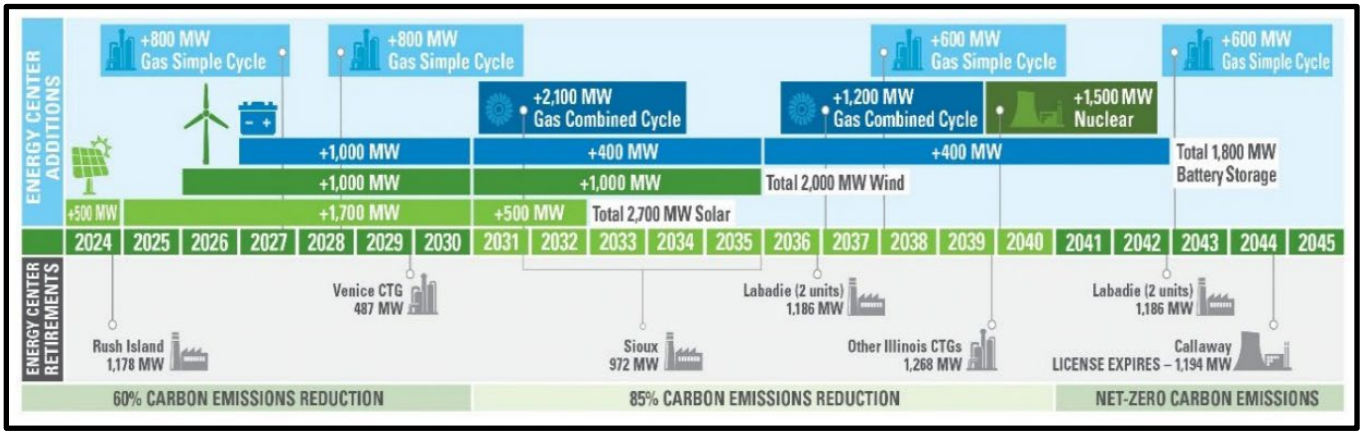
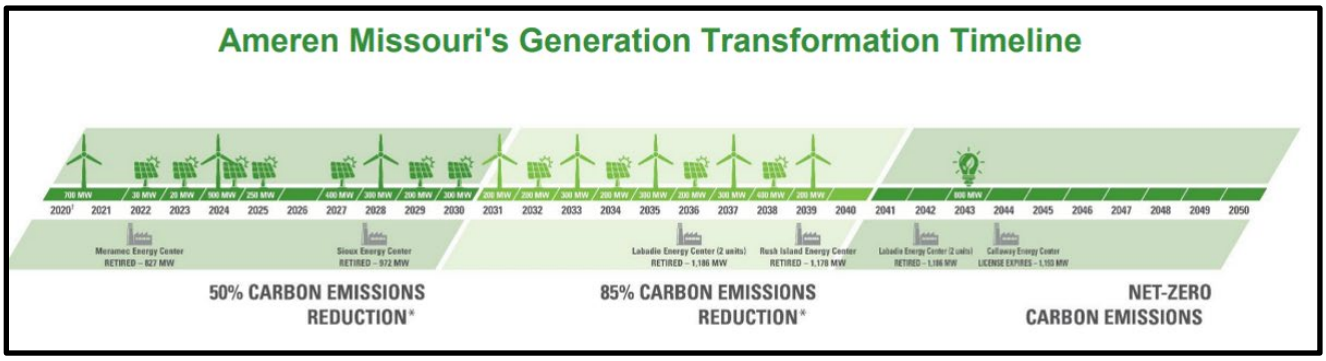


Figure 5: Ameren Missouri 2020 Preferred Resource Plan Scenario[24]



For those who are viewing this on a paper copy, you will note that the 2020 Preferred Resource Plan (PRP) involved retiring approximately 4.2 GW of dispatchable base load generation from Meramec (827 MW) Sioux (972 MW) Labadie (1,186 MW) and Rush Island (1,178 MW) by 2039 and replacing it all with 4.9 GW of intermittent renewable generation. That was the plan, only five-years ago… to retire all fossil fuel power plants and replace them entirely with renewables. Of course, the Commission knows that if that plan were actually executed, Ameren Missouri's customers would simply not have reliable power.

[23] Direct Testimony of Matt Michels p. 4, 6.
[24] Case No. EO-2021-0021 Ameren Missouri 2020 IRP, Executive Summary p.2

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Effectively, this is a roundabout way of saying that long-range planning works best in the short term and sometimes not even that. I recommend that the Commission temper the likelihood that Ameren Missouri's 2025 PRP will be close to actual realized future resource generation build out, and should take that to heart when contemplating the validity of the "risk analysis" of Mr. Wills testimony which I will discuss later.

Q. Do you have any further comments on Mr. Michels' testimony?

A. Yes. Mr. Michels includes blacked-out price assumptions for three different natural gas power plants, combined cycle, combined cycle with carbon capture sequestration, and simple cycle units. Embedded within those are the cost assumptions from the 2023 Triennial IRP and the 2025 update. It is worth reprinting them here again for emphasis. I have also added the percent increase for these units over time which was not included in Mr. Michels' testimony:

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Q. What should the Commission note from these tables?

A. In the course of two years, the cost of dispatchable natural gas generation, regardless of the unit type, has increased approximately ***___ ***

Q. Why did costs increase so much in such a short amount of time?

A. There are a number of reasons why costs have increased for natural gas power plants, including (but not limited to): higher interest rates, inflation, supply-chain constraints, international conflict, *etc.* All of these variables have contributed to the increased costs of continued generation procurement. However, I would argue the single biggest variable that has caused costs to increase for generation has been the unexpected and unprecedented demand for generation from the proliferation of data centers. In essence, if the load growth from data centers did not exist, there would not be this level of demand for natural gas units.

Restated, even if a new data center load never sets foot in Missouri, data centers are already causing immense cost increases for Missouri's captive customers. The build-out of data center load growth has created a market run for dispatchable generation, driving up prices on securing (multiple years of lead time) and building "cleaner" dispatchable generation. Data centers, even before they enter into the revenue requirement equation, are causing costs to increase. This fact should not be lost on the Commission as it contemplates unjust and unreasonable costs being imposed on existing customers in designing this tariff as required by Missouri statute.

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IV. RISK ANALYSIS

Q. Mr. Wills performs a "risk analysis" examining the impact on existing customers. Can you summarize the analysis and his conclusions?

A. Mr. Wills provides an analysis that looked at estimated costs and revenues that would exist if hyperscale customers were to come online at either 1.5 GW or 2 GW in the next few years, and none of the load is terminated, as well as what would happen if possible terminations of some or all of the contracts occurred at various points in the future. The basis for Mr. Wills' assumptions and inputs is from Ameren Missouri's recently updated annual 2025 IRP as discussed above. Under the 2 GW acceleration case, Mr. Wills assumes an estimated increase to the net present value of revenue requirement ("NPVRR") of $8.8 billion based on Probability Weighted Average ("PWA") assumptions.

Mr. Wills then assures the Commission that this cost increase omits the revenues that are expected to be generated from the addition of the 2 GW of customer load. To quote Mr. Wills:

> Said another way, if the revenue requirement increases by an amount less than or equal to the new revenue, existing customers will either benefit from or be neutral to the Company providing service to large customers.

Unstated in this assertion is that the inverse is also true. If the revenue requirement increases by an amount more than the new revenue from the hyperscaler users, existing customers will be worse off.

Mr. Wills then correctly follows up this insight by stating that the end result is subject to many possible variables that can cause the magnitude of exposure to be unknown, but for purposes of providing an analysis with information that we know today (*e.g.*, today's rates, the historic rate of retail growth, *etc*.) it serves as a reasonable proxy.

Mr. Wills then assumes outcomes at various levels of NPVRR growth (at 3%, 4%, and 5% respectively) and concludes that if the annual growth rate to the revenue requirement is on the

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low end, existing customers may be harmed, but if they are on the high end, existing customers would likely benefit. This "either-or outcome" is tempered by Mr. Wills' explanation that additional revenue can be generated from Ameren Missouri's proposed clean energy options to offset those risks. Working off of these assumptions, in the second phase of his analysis, he concludes that existing customers are better off under all potential future retail rate growth estimate scenarios, even under full terminations of contracts, as long as revenue is being generated as expected until at least 2030. The overall conclusion is that existing customers are slightly better off with the increased load.

Q. Do you agree with this risk analysis?

A. I struggle with the idea of accurately calling this a risk analysis because it takes no consideration of the direct and indirect risk associated with this unique load type.

Q. What do you mean?

A. Data center build-out is largely associated with the proliferation of AI. As of late 2025, the Magnificent Seven (Google, Amazon, Apple, Meta, Microsoft, Tesla, and Nvidia) collectively held a market capitalization of approximately $19.3 trillion, representing 34% of the total S&P market value. This combined valuation is greater than almost every country on earth, with the exception of the U.S. and China.

It is also becoming clear that AI spending is lifting the real economy as well. Not because companies are using the technology, but rather the sheer amount of investment in data centers, semiconductor facilities, and power supply needed to support the computing power that AI demands.

The investment bank SBS estimates that companies will spend $375 billion in 2025 on AI infrastructure with it projecting to rise to $500 billion next year. According to the U.S. Commerce Department, investment in software and computer equipment, not counting the data center buildings, accounted for a quarter of all economic growth this past quarter.[25] The

[25] DePillis, L. (2025) The AI Spending Frenzy Is Propping Up the Real Economy, Too. *The New York Times*. https://www.nytimes.com/2025/08/27/business/economy/ai-investment-economic-growth.html

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challenge becomes whether or not revenues can grow fast enough to keep up with the CAPEX boom.

No doubt, revenue has been created from the mass deployment of AI, but I am unaware of any AI-centric company that has made a profit from its service to date.[26] At some point, investors are going to want to profit from their investment.

Q. What do you mean?

A. Today, tech companies have the choice to either sit out of the boom entirely or spend big and hope they can figure out how to make a profit at some point. Roughly speaking, Apple has chosen the former while Google, Meta, Microsoft, Amazon, and Tesla are choosing the latter. As it presently stands, these companies also operate services at a loss to grow their user base and establish a dominant position. They offer their service at prices that do not come close to covering the expenses of developing and running their large language models ("LLMs").

To date, major AI services like OpenAI and Anthropic have reportedly lost billions of dollars while pursuing market dominance. In 2024, OpenAI expected about $5 billion in losses on $3.7 billion in revenue. In 2025, OpenAI's annual recurring revenue is now on track to pass $20 billion, but the company is still losing money (although it is not clear how bad it is, due to the opaque nature of their reporting).[27] According to OpenAI CEO Sam Altman following the release of ChatGPT-5:

> "As long as we're on this very distinct curve of the model getting better and better, I think **the rational thing to do is to just be willing to run the loss for quite a while**," (emphasis added)

[26] Revenue is the total income a business earns from selling its goods or services (i.e., the "top line" of a Company's income statement), while profit is the money left over after all expenses are paid (i.e., the "bottom line" of a Company's income statement).
[27] Capoot, A. (2025) OpenAI's Altman is still looking to spend after GPT-5 launch and is 'willing to run the loss' CNBC. https://www.cnbc.com/2025/08/08/chatgpt-gpt-5-openai-altman-loss.html

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Q. If the AI models are getting better and better over time, does it make sense to incur losses for quite a while?

A. Maybe, maybe not. But understand that this is the unique load that is coming on, and if proper cost allocation and consumer protections are not in place, then it will be a very risky bet for captive customers, who Ameren Missouri will no doubt want to recover costs from if the load fails to materialize or data centers can't cover their costs.

Long-term financial viability depends on generating profit rather than incurring losses, and there is no guarantee that AI will continue to get better or that the subscription pricing models used to generate revenue are sustainable (they are clearly not today) to justify an ever-increasing CAPEX investment to support "better" AI models.

Q. What reason do you have to believe that AI will not continue to get better?

A. In June, Apple researchers released a paper titled "The Illusion of Thinking," which found that state-of-the-art "large reasoning models" demonstrated "performance collapsing to zero" when the complexity of puzzles was extended beyond a modest threshold.[28] The study serves as a critical reality for policymakers and investors, reminding them not to mistake fluent language for genuine comprehension. Researchers at Arizona State University reached an even blunter conclusion: claiming what AI companies call reasoning "is a brittle mirage that vanishes when it is pushed beyond training distributions."[29]

Importantly, I am not suggesting that AI cannot be useful or can't get "better," but there is no guarantee that it will, and there is a very real risk of diminishing returns in scale, which we may already be experiencing. The term "irrational exuberance", a phrase coined by former Fed Chairman Alan Greenspan to describe the dot-com bubble, comes to mind as a very real

[28] Shojaee, P. et al. (2025) The Illusion of Thinking: Understanding the Strengths and Limitations of Reasoning Models via the Lens of Problem Complexity. *Apple*. https://ml-site.cdn-apple.com/papers/the-illusion-of-thinking.pdf
[29] Zhao, C. et al., (2025) Is Chain-of-Thought Reasoning of LLMs a Mirage? A Data Distribution Lens. *Data Mining and Machine Learning Lab* https://arxiv.org/pdf/2508.01191

warning that AI stock may be overvalued and that an AI bubble of historic proportions may be at play.

Q. Ok, there a number of things to unpack here. What reason do you have to believe that the current subscription-based model employed by most AI firms is not sustainable?

A. Because these models do not cover the costs to provide their service today (and those costs are rapidly increasing). Unlike our investor-owned utilities, AI companies are operating in a competitive market where there will be winners and losers. Neither the subscription (e.g., $20 a month) nor the "freemium" (free like GPT-4o or Google AI Mode) models are sustainable because the revenues are simply not covering the costs of their product, but moving to a usage-fee model will almost certainly result in their business collapsing. For example, a usage model would more accurately reflect cost-causation and ensure revenue certainty, but as observed by TextQL CEO Ethan Ding, this creates an untenable prisoner-like dilemma scenario as follows:

- If everyone charges usage-based service → sustainable industry
- If everyone charges flat-rate service → race to the bottom
- If Company X charge usage, and others charge flat →Company X will fail because users will flock to a flat fee.
- If Company X charges flat, and others charge usage → Company X wins but will then fail because it can't cover its costs.[30]

[30] The Prisoner's Dilemma is a game theory scenario where two individuals, acting in their rational self-interest, fail to cooperate for a mutually better outcome, resulting in a worse result for both. If they both cooperate, they receive a moderate punishment or benefit, but if one "defects" (betrays) and the other cooperates, the defector gains a significant advantage while the other suffers greatly. The dilemma is that even though collective cooperation is optimal, individual self-interest drives each person to defect, creating a less-than-ideal outcome (aka, Nash equilibrium) for the group as a whole.

The classic scenario is as follows:

- Two suspects are arrested and held separately, where they cannot communicate
- The police offer each prisoner a deal in which the outcome depends on the other prisoner's response.
  - Cooperate (Stay silent): If both remain silent, they receive a mild sentence for a lesser charge.
  - Defect (Confess): If one confesses and the other stays silent, the confessor goes free, and the silent one receives a severe sentence.
  - Mutual Defection: If both confess, they both receive a moderate sentence, but worse than the mild sentence for mutual cooperation.

Absent some demonstrably positive win in efficiency gains or the creation of some as-of-yet unheard-of discovery as a result of AI (*e.g.*, a cure for cancer), I struggle to see how the ever-expanding demand from data centers necessary to support this technology covers its expenses. That should concern everyone involved in this docket, as stakeholders determine what "unjust and unreasonable costs to be imposed on other customers" means in designing these large load tariffs.

Q. What about companies that have adopted AI features in their workplace?

A. To date, it has been less than glowing. For example, there is reason to have a healthy degree of skepticism here as well. A recent Massachusetts Institute of Technology ("MIT") study analyzing 300 public AI deployments found that 95% of AI pilot projects failed to deliver financial benefits. The study concluded that "the biggest thing holding back AI is that most AI tools don't learn and don't integrate well into workflows."[31]

Moreover, concerns have been raised about the long-term ramifications AI will have on human cognition and the possible erosion of critical thinking skills. Such fears appear to be supported by another MIT study that asked 54 adults to write a series of three essays using either AI (ChatGPT), a search engine, or their own brains. The cognitive engagement of those who used AI was significantly lower than the other two groups. Moreover, the AI-assisted group also had a harder time recalling quotes and had an overall lower sense of ownership over the work product. Interestingly, participants switched roles for a final fourth essay (the brain-only group used AI and vice versa). The AI-to-brain group performed worse and had engagement only slightly better than the other groups during the first essay. The researchers claim this demonstrates how prolonged use of AI leads to participants accumulating "cognitive debt". Restated, when AI-enabled participants had to rely on their brains, they were unable to perform as well as the other two non-AI groups.

The most optimal outcome would be for both prisoners to remain silent, but since both prisoners are rational and self-interested, they will both choose to confess, leading to the mutual defection (or worse) outcome.

[31] Challapally, A. et al., (2025) The GenAI Divide: State of the AI in Business 2025. MIT NANDA https://mlq.ai/media/quarterly_decks/v0.1_State_of_AI_in_Business_2025_Report.pdf

One small study does not prove that AI is making us collectively dumber, but it does suggest that efficiency gains may come at the cost of actual learning (*i.e.*, the requirement that one has read and understood the topic they are opining on).

One niche area that has seen profits from AI has been "the creators" of AI slop.

Q. What is AI slop and why is it relevant to this discussion?

A. "AI slop" refers to mass-produced, low-quality videos created using generative AI tools like Runway, Synthesia, Google's Veo 3, or OpenArt, and it is slowly taking over the internet and making it less reliable moving forward.[32] Figure 6 provides an illustrative example of AI slop.

Figure 6: Example of AI Slop[33]

AI slop is relevant to this discussion because it is ever-increasing and intensifies the strain on existing data centers, and is accelerating its explosive growth. The resources consumed by

[32] This premise is part of a larger construct titled, "the dead internet theory" which is an idea that the internet, especially social media, is no longer primarily populated by humans and is instead dominated by bots and automated, AI-generated content. Proponents of this conspiracy theory suggest that organic human activity has been minimized or is being actively manipulated—through the rise of bots and AI, algorithmic manipulation, and growing believability in images and text similar to what is seen in Figure 6. Di Placido, D. (2024) The Dead Internet Theory, Explained. *Forbes*. https://www.forbes.com/sites/danidiplacido/2024/01/16/the-dead-internet-theory-explained/

[33] During Hurricane Helene, opponents of President Joe Biden cited AI-generated images of a displaced child clutching a puppy as evidence of the administration's purported mishandling of the disaster response. Nerneroff. A. (2025) What is AI slop? A technologist explains this new and largely unwelcome form of online content. *The Conversation*. https://theconversation.com/what-is-ai-slop-a-technologist-explains-this-new-and-largely-unwelcome-form-of-online-content-256554

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generating, storing, and transmitting this low-value content contribute significantly to the massive energy and water demands of data centers. How much is not entirely clear as the companies behind the models have largely kept their carbon emissions and power usage secret.[34] In 2023, an MIT study suggested the following comparative examples:

- An AI-generated image uses as much energy as powering a smartphone
- Creating an AI-generated text response uses as much energy as 16% of a full smartphone charge
- A search engine inquiry uses 1/10 the amount of energy as an AI-generated text[35]

Because tech companies are largely relying on subscription models, entrepreneurs have an enormous incentive to constantly generate slop for personal gains. This, of course, comes at the cost of increased CAPEX build-out, but also results in a loss in the quality of content pushed to users on the internet and can serve as a vehicle for misinformation.

Q. Earlier you suggested that there are signs that the US economy may be in an AI bubble. Can you explain?

A. Sure, there is a disconnect between the large valuation for AI companies despite the limited AI profits. There is also a disconnect between AI stock prices and a weakening broader economy. These "disconnects" between AI market enthusiasm and the real economy create significant downside risk, potentially leading to a market correction or crash.

A market correction would mean that everyone takes losses and then moves forward; a crash would hurt the entire economy.

Q. Are there any signs that suggest a crash could be a more likely outcome?

A. Writing in the National Bureau of Economic Research, Jorda, *et al.* (2015) find that debt is a key predictor of whether or not a bubble ends up hurting the entire economy. Specifically, whether it is in the form of bank loans. In the 2008 credit default housing crisis a wave of

[34] Taft, M. (2025) How Much Energy Does AI Use? The People Who Know Aren't Saying. *Wired.* https://www.wired.com/story/ai-carbon-emissions-energy-unknown-mystery-research/

[35] Heikkila, M. (2023) Making an image with generative AI uses as much energy as charging your phone. *MIT Technology Review*. https://www.technologyreview.com/2023/12/01/1084189/making-an-image-with-generative-ai-uses-as-much-energy-as-charging-your-phone/

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defaults threatened the solvency of the banking system, causing the entire economy to freeze up. This was not the case in the dot-com bubble in which banks were not heavily involved but the bond market was.[36] U.S. economist Noah Smith suggests that in the case of AI, the concern largely rests around "private credit" in the form of Business Development Companies ("BDC's") that are one large source of funding.[37] A recent article out of the Boston Fed argues that bank lending to private credit funds might pose systemic risk to the banking system:

> The meteoric rise of private credit presents important questions about the role of banks going forward and the implications for stability in the US financial system…Our analysis of Federal Reserve and proprietary loan-level data indicates that the growth of private credit has been funded largely by bank loans and that banks have become a key source of liquidity, in the form of credit lines, for PC lenders. Banks' extensive links to the PC market could be a concern because those links indirectly expose banks to the traditionally higher risks associated with PC loans.[38]

If private credit goes bust, banks get paid first, but the authors caution:

> [B]anks would suffer losses [on their private credit lending] only in severely adverse economic conditions, such as a deep and protracted recession. But losses could also occur in a less adverse scenario if the default correlation among the loans in PC portfolios turned out to be higher than anticipated—that is, if a larger-than-expected number of PC borrowers defaulted at the same time. Such tail risk may be underappreciated.[39]

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[36] Jorda, O. et al., (2015) Leveraged Bubbles. National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w21486/w21486.pdf
[37] Smith, N. (2025) Will data centers crash the economy? *Substack*. https://www.noahpinion.blog/p/will-data-centers-crash-the-economy
[38] Filllat J.L. et al., (2025) Could the Growth of Private Credit Pose a Risk to Financial System Stability? https://www.bostonfed.org/publications/current-policy-perspectives/2025/could-the-growth-of-private-credit-pose-a-risk-to-financial-system-stability.aspx
[39] *Ibid*.

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Noah Smith suggests that this creates a scenario where the U.S. banking system could be exposed if private credit funds are all lending to data centers and AI goes bust.[40] Smith suggests that the basic conditions of a financial crisis are starting to fall in place:

1. We have a big story about why "this time is different" — the idea that AI will change everything, and that data centers will thus earn huge returns.
2. We have a large and increasing amount of debt being used to fund one single sector of the economy (data centers), meaning that the loans' default probability is probably highly correlated.
3. We have an opaque corner of the financial system (private credit) that has recently grown from a tiny piece of the system to a very significant piece.
4. We have systemically important lenders (banks, and possibly insurance companies) enmeshed in the new sector in a multitude of ways.[41]

I would add a fifth point:

5. We have investor-owned natural monopolies that already have a perverse incentive to build-out investment (cost plus regulation), investing billions of dollars to support data centers with captive ratepayers likely absorbing all of the risk if this busts.

I would argue that these aforementioned considerations are glaringly absent from Mr. Wills' risk analysis and should be considered in properly designing this tariff moving forward.

[40] We may already be in that precarious position. On September 4th, *Bloomberg* reported that Morgan Chase & Co. and Mitsubishi UFJ Financial Group Inc. are leading a roughly $38 billion debt package to fund data centers connected to Oracle Corp. in Wisconsin and Texas. This announcement followed an earlier one where several banks committed to financing $23 billion loan for the a data center in Shackelford County, Texas.

Carpenter, S. et al, (2025) Banks ready $38 Billion of Debt for Oracle-Tied Data Centers. Bloomberg. https://www.bloomberg.com/news/articles/2025-09-04/banks-ready-38-billion-of-debt-for-data-centers-tied-to-oracle

[41] Smith, N. (2025) Will data centers crash the economy? *Noahpinion*. https://www.noahpinion.blog/p/will-data-centers-crash-the-economy

Q. Then do you believe that AI investment is not warranted?

A. No, but growth has to pay for growth and risks need to be offset by immediate benefits and transparent information. Absent, those features I fear for Missouri ratepayers. To quote NASUCA president David Springe in a recent Public Utilities Fortnightly article:

> As part of this ongoing dialogue, we need to talk about some of the legacy regulatory mechanisms we've relied on for many years. For example:
>
> Are the cost allocation models we use at the state level up to the task of isolating and protecting existing customers from cost increases as we build to meet new load?
>
> Are the RTO/ISO transmission cost allocation procedures any better? Especially when everyone agrees the current load forecasts that are driving transmission costs are dubious at best.
>
> In states that have it **– should Construction Work in Progress (CWIP) be allowed for plant needed to meet these new loads – won't this alone raise customer rates long before any plant is online and the large load revenue is being received to offset those costs?** (emphasis added)
>
> Stranded costs risk – where utilities must seek state approval before building new plant, can any approval order be drafted in a way that delineates that the plant is prudent for only the large customer needs, but not deemed prudent (or at least create a presumption against prudence) if that load doesn't show up, or leaves the system?
>
> If utilities go to the market for billions of dollars of capital to fund facilities to meet these new loads, will Wall Street want higher returns and debt coverage levels?
>
> Of course they will. But can we design rates in a way that allocates this higher cost of capital to the class that caused it – a large load tariff design with an

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> eleven percent ROR, and a residential tariff designed with a seven percent ROR, for example?
>
> Is our reliability and resilience framework up to the task of dealing with these large single-point load sinks, or will new investment be needed to bolster the bulk power system? And what behind-the-meter solutions should we require, so that these large load customers are active in pursuing solutions that can lessen the stress on the bulk power system?[42]

I would strongly encourage any combination of Mr. Wills, Mr. Arora, Mr. Michels, Evergy, and/or Liberty to answer Mr. Springe's questions, as I share all of his concerns moving forward.

V. LARGE LOAD CUSTOMER RATE PLAN

Q. Mr. Arora states that Ameren Missouri has an obligation to provide service to those who desire to locate in its service territory. Do you agree?

A. I do. The "duty to serve" compels public utilities to provide non-discriminatory service to all customers in their monopoly territory. According to economist Severin Borenstin:

> This duty may at first seem like a fair burden in exchange for being a monopolist that supplies an essential service while being assured of a regulated rate of return on their investment. But the doctrine has always been problematic economically, because "non-discriminatory" has been used to argue that customers who actually impose different costs on the system – whether due to different locations, demand profiles, or predictability of future needs – should be charged similar rates. Hyperscalers have highlighted this problem, because a single facility can dwarf

[42] Spring, D. (2025) Navigating Large Load Rates: Growth Has to Pay for Growth. Public Utilities Fortnightly. August. See GM-2.

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all other demand growth that a utility faces, and cancellation of such a facility can completely change a utility's demand outlook.[43]

I share these concerns, and my recommendations attempt to mitigate these and earlier aforementioned concerns.

Contract Terms

Q. Mr. Arora proposes that customers contract for at least fifteen years. With the possibility of a five-year ramp-up period and an additional 12 years. Do you agree?

A. No. Most new build generation have a deprecation schedule of thirty years or greater. Locking in LPS customers into a shorter term than the life of the assets being built or procured to serve them can result in cost shifting to other customers should the data center load depart.

Q. What do you recommend?

A. I recommend that the terms of service be set at 20 years. This recommendation is consistent with what the Kentucky Public Service Commission approved in Kentucky Power's large load tariff.[44]

Tariff Applicability

Q. Mr. Arora suggests that a 100 MW threshold is the appropriate level in which we should consider hyperscale consumers. Do you agree?

A. I do not. I am recommending that a 50 MW threshold be set, and I would recommend that this tariff only apply to data centers given their unique present circumstances. Keep in mind that the largest customer on Ameren Missouri's grid has a peak capacity of 32 MW. That is a 56%

[43] Borenstin. S. (2024) Is there a "Duty to Serve" Hyperscale Loads? Energy Institute Blog. Energy Institute at Haas. https://energyathaas.wordpress.com/2024/12/02/is-there-a-duty-to-serve-hyperscale-loads/
[44] Case No. 2024-00305. Order. Kentucky Public Service Commission. https://psc.ky.gov/pscscf/2024%20Cases/2024-00305/20250318_PSC_ORDER.pdf

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increase and it is also the threshold Mr. Dixon identified as the Company's self-imposed large economic development prospect level.

Minimum Demand Charge

Q. Mr. Arora recommends a minimum level of demand charges to be reflected on their monthly bill for the terms of the contract that is equal to 70% of the contracted capacity. Do you agree?

A. From a precedential standpoint, that level is well below recently approved or agreed to thresholds in Kansas (80%), Ohio (85%) and Kentucky (90%). I recommend the tariff be amended to cover 90% of the contracted capacity.

Collateral

Q. Mr. Arora recommends that participants meet certain credit ratings or be subject to collateral security in the form of cash, a letter of credit, or a guaranty from a creditworthy affiliate. Do you agree?

A. I do not support any waiver for higher creditworthiness. My concern around the long-term sustainability of data centers as presently contemplated is not based on the creditworthiness of the customer but on the volatile nature of the business as a whole and the probability of future stranded assets. I recommend a cash collateral requirement equal to two years of minimum monthly bills.

Early Termination

Q. Mr. Arora recommends that participants be allowed to terminate, but only effective 2 years after they have given written notice to the Company, and if they do so they will be subject to various termination payments. Do you agree?

A. I am conceptually supportive of this feature, dependent on other provisions within the tariff.

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Q. Mr. Arora recommends that four new clean energy program offerings be applied to this tariff? Do you agree?

A. Again, I am conceptually supportive of these features, but need to speak with Ameren in greater detail about the interplay of these features, the Renewable Energy Standard requirement, the RESRAM, and renewable siting concerns. That being said, I am confident that a path forward can be bridged.

Stranded Assets

Q. Can you expound on what you mean by "stranded asset"?

A. Yes. A "stranded asset" is a term that has different meanings depending on the context. For example, regulation-based stranded assets differ from market-based stranded assets. The latter simply compares the book value of an asset relative to some future market value of the asset. For example, if an oil reserve has $1 billion book value but sliding demand due to carbon taxes or other environmental regulations reduces its market value to $400 million, the result is $600 million in stranded assets. By contrast, regulation-based assets for utilities in the United Stated are assets that are subject to cost of service regulation. Government regulators at some point, have explicitly approved the asset in the past that includes prudent cost recovery and a reasonable opportunity to earn a return over a defined period of time—typically in line with the Company's depreciation schedule and subsequent rate cases; however, assets can and should remain useful above and beyond the point they have been paid off. If that does not occur, meaning the asset leaves service before it has been fully paid off, then it is considered a stranded asset.

In this case, the concern is that the pipeline demand for service is roughly the equivalent of building out a brand-new utility. If the investment is made to meet that demand but those new customers don't materialize, go out of business, or significantly reduce their energy usage the investments built to serve them may become stranded assets. In that case, either ratepayers, shareholders or both will be left footing that bill.

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Q. Are there additional unique risks present with data centers you have not addressed?

A. I have spoken already about the speculative nature of data centers,[45] the concerns around vast water and energy usage,[46] and fears surrounding energy infrastructure buildout that may be stranded due to rapidly evolving technology[47]and alternative solutions.[48] There are other concerns that should give regulators pause, including public backlash. A select list of headlines (with links) paints a disturbing narrative:

- ChatGPT Gave Instructions for Murder, Self-Mutilation, and Devil Worship[49]
- She wanted to save the world from AI then the killings started[50]
- Sam Altman [OpenAI CEO] says "don't trust ChatGPT—it hallucinates." Here's what that means for everyday users[51]
- Elon Musk's AI firm apologizes after chatbot Grok praises Hitler[52]
- Study highlights dangers AI poses to mental health of children and adolescents[53]
- The Emerging Problem of "AI Psychosis"[54]

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[45] Martucci, B. (2025) A fraction of proposed data centers will get built. Utilities are wising up. *UtiltyDive*. https://www.utilitydive.com/news/a-fraction-of-proposed-data-centers-will-get-built-utilities-are-wising-up/748214/

[46]Schulz, J. Water and energy use is growing as data centers are built across the Midwest and Great Plains. *NPR Kansas City*. https://www.kcur.org/news/2025-07-21/data-centers-water-electricity-growing-usage

[47] Marshall, C. (2025) 'Game Changer'? What 'DeepSeek' AI means for electricity. *E&E News.* https://www.eenews.net/articles/game-changer-what-deepseek-ai-means-for-electricity/

[48] Xiaying, Y. (2025) China is putting data centers in the ocean to keep them cool. Scientific American. https://www.scientificamerican.com/article/china-powers-ai-boom-with-undersea-data-centers/#:~:text=Partly%20to%20address%20water%20concerns,one%20of%20China%27s%20AI%20hubs.

[49] Shroff, L. (2025) ChatGPT Gave Instructions for Murder, Self-Mutilation, and Devil Worship. *The Atlantic*. https://www.theatlantic.com/technology/archive/2025/07/chatgpt-ai-self-mutilation-satanism/683649/

[50] Beam. C. (2025) She wanted to save the world from AI then the killings started. NY Times.https://www.nytimes.com/2025/07/06/business/ziz-lasota-zizians-rationalists.html

[51] White, A. (2025) Sam Altman [OpenAI CEO] says "don't trust ChatGPT—it hallucinates." Here's what that means for everyday users. *VegOut*. https://vegoutmag.com/lifestyle/nat-sam-altman-says-dont-trust-chatgpt-it-hallucinates-heres-what-that-actually-means-for-everyday-users/#:~:text=%E2%80%9CHallucination%E2%80%9D%20sounds%20like%20a%20psychedelic,that%20are%20flat%2Dout%20wrong.

[52] Yang, M. (2025) Elon Musk's AI firm apologizes after chatbot Grok praises Hitler. *The Guardian*. https://www.theguardian.com/us-news/2025/jul/12/elon-musk-grok-antisemitic

[53] Limon, R. (2025)Study highlights dangers AI poses to mental health of children and adolescents. *El Pais*. https://english.elpais.com/technology/2025-01-22/study-highlights-dangers-ai-poses-to-mental-health-of-children-and-adolescents.html

[54] Wei, M. (2025) The Emerging Problem of "AI Psychosis" *Psychology Today*. https://www.psychologytoday.com/us/blog/urban-survival/202507/the-emerging-problem-of-ai-psychosis

- People Are Becoming Obsessed with ChatGPT and Spiraling Into Severe Delusions[55]
- He Had Dangerous Delusions. ChatGPT Admitted It Made Them Worse[56]
- A rural Missouri town fights big tech, and itself[57]
- There aren't enough AI chips to support data center projections, report says[58]
- Artificial Intelligence Hallucinations Threaten Cybersecurity Operations[59]
- Delta Air Lines is using AI to set the maximum price you're willing to pay / Delta's president says the quiet part out loud[60]
- People who use AI may pay a social price, according to new psychology research[61]
- AI could steal many more jobs than previously thought. Here's why[62]
- In race to attract data centers, states forfeit hundreds of millions of dollars in tax revenues to tech companies.[63]
- OpenAI CEO Same Altman warns of AI fraud crisis 'very soon'[64]
- 'I can't drink the water'—life next to a US data center[65]

[55] Dupre, MH (2025) People Are Becoming Obsessed with ChatGPT and Spiraling Into Severe Delusions. *Futurism* https://futurism.com/chatgpt-mental-health-crises
[56] Jargon, J. (2025) He Had Dangerous Delusions. ChatGPT Admitted It Made Them Worse. *The Wall Street Journal*. https://www.wsj.com/tech/ai/chatgpt-chatbot-psychology-manic-episodes-57452d14
[57] Tan. E. (2025) A rural Missouri town fights big tech, and itself. *The New York Times*. https://www.nytimes.com/2024/10/29/technology/data-center-peculiar-missouri.html
[58] Walton, R. (2025) There aren't enough AI chips to support data center projections, report says. *UtilityDive*. https://www.utilitydive.com/news/not-enough-ai-chips-to-support-data-center-projections-london-economics/752371/
[59] Kaur, H. (2025) Artificial Intelligence Hallucinations Threaten Cybersecurity Operations. *BizTech*. https://biztechmagazine.com/article/2025/07/artificial-intelligence-hallucinations-threaten-cybersecurity-operations
[60] Weatherbed. J. (2025) Delta Air Lines is using AI to set the maximum price you're willing to pay *The Verge*. https://www.theverge.com/news/709556/delta-air-lines-ai-ticket-price-rollout
[61] Dolan, E.W. (2025) People who use AI may pay a social price, according to new psychology research. *PsyPost*. https://www.psypost.org/people-who-use-ai-may-pay-a-social-price-according-to-new-psychology-research/
[62] Eaton, K. (2025)AI Could Steal Many More Jobs Than Previously Thought. Here's Why. *Inc*. https://www.inc.com/kit-eaton/ai-could-steal-many-more-jobs-than-previously-thought-heres-why/91212573
[63] Tortorelli, P. et. al (2025) In race to attract data centers, states can forfeit hundreds of millions of dollars in tax revenue to tech companies. *CNBC*. https://www.cnbc.com/2025/06/20/tax-breaks-for-tech-giants-data-centers-mean-less-income-for-states.html
[64] Genovesse, D. (2025) OpenAI CEO Sam Altman warns of AI fraud crisis 'very soon' Fox Business https://www.foxbusiness.com/lifestyle/openai-ceo-sam-altman-warns-ai-fraud-crisis-very-soon
[65] Fleury, M & N. Jimenez (2025) I can't drink the water'—life next to a US data center. BBC. https://www.bbc.com/news/articles/cy8gy7lv448o

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- AI bubble today is bigger than the IT bubble in the 1990s[66]
- With AI warning, Nobel winner joins ranks of laureates who've cautioned about the risks of their own work[67]
- There's a '10% to 20% chance' that AI will displace humans completely, says 'godfather' of the technology[68]

Q. What should the Commission take away from these headlines?

A. Simply put, that the risk associated with AI is married to the risk associated with data centers.

I have no easy answer for the Commission, and I am not recommending that we bury our heads in the sand and ignore progress, but I do believe risks can at least be offset by a degree of immediate benefits created for existing customers.

Community Benefits

Q. Do you have a specific recommendation in mind to help alleviate these concerns?

A. I do. Given the risks described above, I am recommending that parties begin discussing a community benefits program to inject direct support into Missouri. As the Commission is well aware, the federal government has recommended that states are in a better position to determine whether or not funding is necessary for many of the U.S.'s historically federally funded social service benefits programs, including funding for the Low Income Home Energy Assistance Program ("LIHEAP") and the Low-Income Weatherization Assistance Program ("LIWAP"). I believe it is more than appropriate to explore outside funding from data center customers as a means of offsetting some of the perceived risk and helping ease the societal transition they are supporting. I do not have any specific recommendations on

[66] Slok, T. (2025) AI bubble today is bigger than the IT bubble in the 1990s. *Apollo Academy*. https://www.apolloacademy.com/ai-bubble-today-is-bigger-than-the-it-bubble-in-the-1990s/

[67] Tirrell, M. (2025) With AI warning, Nobel winner joins ranks of laureates who've cautioned about the risks of their own work. *CNN*. https://www.cnn.com/2024/10/13/health/nobel-laureate-warnings-ai

[68] Jackson A. & Huddleston, T. (2025) There's a '10% to 20% chance' that AI will displace humans completely, says 'godfather' of the technology. CNBC. https://www.cnbc.com/2025/06/17/ai-godfather-geoffrey-hinton-theres-a-chance-that-ai-could-displace-humans.html

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what that would mean in the short and long-term but am willing to speak with stakeholders to this case about whether such an idea is feasible.

I also believe that is consistent with Missouri law (§ 393.130(7), RSMo) and is also consistent with recent legislation passed in the State of Texas[69] and Oregon.[70]

Mandatory Emergency Curtailment

Q. Do you have additional recommendations that are aligned with the issue of demand response?

A. I do. I recommend that service under this tariff be subject to mandatory emergency curtailments as warranted.

Q. Are you aware of any states that have enacted such a requirement?

A. Yes. The recent passage of Texas Senate Bill 6 requires data centers to be subject to mandatory curtailment during firm load emergency events and provides a voluntary demand response procurement program with loads of 75 MW or more that could ramp down or switch to backup generation at utilities' request.[71] Evergy is already proposing a demand response rider which I generally support, but the ability to curb hyperscale load in the face of an emergency is a non-negotiable issue from my perspective given the recent history of excess fuel costs Evergy and Empire customers are currently paying today and well into the future from Winter Storm Uri.

[69] Chernicoff, D. (2025) Texas Senate Bill 6: A Bellwether On How States May Approach Data Center Energy Use. *Data Center Frontier*. https://www.datacenterfrontier.com/energy/article/55298872/texas-senate-bill-6-a-bellwether-on-how-states-may-approach-data-center-energy-use

[70] Skidmore, Z. (2025) Oregon House passes bill shifting power infrastructure costs to data centers. *Data Center Dynamics*. https://www.datacenterdynamics.com/en/news/oregon-house-passes-bill-shifting-power-infrastructure-costs-to-data-centers/

[71] Martucci, B. (2025) Texas law gives grid operator power to disconnect data centers during crisis. *UtilityDive*. https://www.utilitydive.com/news/texas-law-gives-grid-operator-power-to-disconnect-data-centers-during-crisi/751587/

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Q. Is work currently being undertaken to help guide future discussion around mandatory curtailments?

A. Yes. Missouri's investor-owned utilities are currently engaged in a large-scale Value of Lost Load ("VOLL") Study with Lawerence Berkeley National Labs. The results of that study should be completed by the end of this year and emergency curtailment tariffs should be modified thereafter and be applicable to all customer classes to reflect the results of that study.

Power Usage Effectiveness

Q. What is a PUE?

A. The Power Usage Effectiveness (PUE) score is a metric that measures the energy efficiency of a data center or large energy-intensive facility and helps recognize any opportunity to improve energy usage over time. It's calculated by dividing the total energy used by the facility by the energy used by the IT equipment (servers, storage, networking, etc.). A lower PUE indicates better energy efficiency, meaning a larger proportion of the facility's energy is used directly by the IT equipment.[72]

Q. Why is it necessary to include this in the in-take process for applicable customers?

A. The obvious reason is that there is not enough energy to meet the expected demand on the grid today. To quote MISO CEO John Bear: "[T]he number of gigawatts coming online is insufficient for what we're seeing coming." He added, "We've got a lot of work to do to slow down the retirements and speed up the additions coming onto the system."[73]

Second, that demand is largely being driven by the emergence of AI and the vast amount of power that is required to serve it. In the early aughts there was a similar concern that

[72] Fleitas, A.G. (2023) What is Data Center PUE? Defining Power Usage Effectiveness. DataCenter Knowledge. https://www.datacenterknowledge.com/sustainability/what-is-data-center-pue-defining-power-usage-effectiveness
[73] Count on coal (2024) MISO Warns it's Going to be Woefully Short of Power. https://www.countoncoal.org/2024/07/miso-warns-its-going-to-be-woefully-short-of-power/

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energy demands to support the proliferation of the internet would not be sustainable. To quote a *Forbes* piece from 1999:

> SOUTHERN CALIFORNIA EDISON, meet Amazon.com. Somewhere in America, a lump of coal is burned every time a book is ordered on-line.
>
> The current fuel-economy rating: about 1 pound of coal to create, package, store and move 2 megabytes of data. The digital age, it turns out, is very energy-intensive. The Internet may someday save us bricks, mortar and catalog paper, but it is burning up an awful lot of fossil fuel in the process. . . .
>
> The infoelectric convergence is already having a visible impact on overall demand. At least 100 million nodes on the Internet, drawing from hundreds to thousands of kilowatt-hours per year, add up to 290 billion kWh of demand. That's about 8% of total U.S. demand. Add in the electric power used to build and operate stand-alone
>
> (unnetworked) chips and computers, and the total jumps to about 13%. It's now reasonable to project that half of the electric grid will be powering the digital-Internet economy within the next decade.[74]

What happened next instead was server farms and computing got exponentially more efficient through miniaturization and increased transistor density.[75] The industry got a lot more efficient and the electric grid and accompanying investments reverted back to a largely flat growth line.

Much of the same rhetoric heard during the early stages of the internet are now being repeated with the discussion regarding AI. And like the early aughts, efficiency gains are being found. In January, US news was awash with the implications of China's open-source AI platform, DeepSeek, and its energy consumption and cost relative to US firms:

[74] Huber, P & M. Mills (1999) Dig more coal—the PCs are coming. *Forbes*. https://rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reprts_E99-18_MMABLInternet.pdf
[75] See Moore's Law https://en.wikipedia.org/wiki/Moore%27s_law and Dennard Scaling: https://en.wikipedia.org/wiki/Dennard_scaling

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> Compared to the exorbitant costs of AI development in the U.S., DeepSeek's efficiency is staggering. The company reports that training its v3 model—the predecessor of the latest R1—cost just $5.576 million. By contrast, Meta's AI training costs for 2024 are projected at $65 billion, while Microsoft's investment is expected to reach $80 billion.
>
> Since training costs are directly linked to energy consumption, this efficiency has profound implications. According to DeepSeek's own research papers—pending third-party validation—their servers consume 50% to 75% less energy than Nvidia's latest GPU units. This reduction is especially crucial for data centers, which require vast amounts of electricity to power AI models.[76]

This is important to note because the lead time to build a data center is much quicker than the lead time to build out the generation, transmission and distribution system used to support it. Benchmarking Power Usage Effectiveness (PUE) isn't going to induce a Moore's Law-like[77] outcome that changes an industry, but it will place a heightened emphasis on reducing costs, enhancing sustainability, supporting the *necessary* electric service build-out, and allow regulators, customers and the utility the ability to make more informed planning decisions moving forward.

Q. What do you anticipate would be included in the pre-construction study and post-construction reporting?

A. The pre-construction study would be a comprehensive report conducted before construction begins to predict and optimize a data center customer's energy consumption and efficiency. It essentially aims to estimate the Power Usage Effectiveness the data center will achieve once operational and identify strategies to maintain or minimize it moving forward.

[76] Editorial Team (2025) How energy-efficient is DeepSeek, China's AI disruptor? Rinnovabaili https://www.rinnovabili.net/business/markets/deepseeks-energy-consumption-ais-75-power-cut/

[77] Moore's law is the observation that the number of transistors on a computer chip doubles about every two years. This exponential growth has historically led to computers becoming smaller, faster, and cheaper over time. For an analogy: Think of a kitchen table. When computers were first invented, the entire table could only hold one bowl. As technology improved, engineers found ways to make the bowls smaller and smaller. Moore's law is like predicting that every couple of years, you could fit twice as many bowls on that same kitchen table.

Including this element in the in-take process should reduce operational costs and help ensure energy is not being needlessly wasted.

Given the scale of expected demand coming online and the potential for shortfalls within the SPP market, it is imperative that future load is benchmarked for performance and energy waste is minimized. Placing an emphasis on this metric at the front-end of the construction process and adopting best practices in the design phase should enable prospective data center customers to significantly influence and improve the long-term PUE and overall sustainability of their facilities and provide greater assurance of future continuity of operations.

A pre-construction study would specifically investigate (at a minimum) the cooling systems, power distribution, hardware efficiency, airflow management, and explore the option of employing modular design for expansion (to minimize oversizing facilities at the outset) or explain why such a design is not necessary.

Additionally, the pre-construction study should explore how demand response capability can be incorporated into the customer's operations. Public sentiment and continuity of operations will depend in large part on minimizing peak demand moving forward. Although I am not recommending it in this docket, I struggle to see how cost of service will be at all affordable if that is not a mandatory feature in the very near future.

Best practices in a competitive environment suggest that maximizing operational efficiencies should not be controversial—I am merely looking for assurance that this will be done and benchmarked moving forward in the face of demand outstripping available supply. I further recommend that these metrics be reported to Ameren Missouri on a quarterly basis and that Ameren Missouri consolidate this information across its LPS customers in an annual public report to the Commission.

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Water Usage Effectiveness

Q. What is a WUE?

A. The Water Usage Effectiveness (WUE) score is a metric that measures the water efficiency of a data center or large energy-intensive facility and helps recognize any opportunity to improve this over time. It's calculated by dividing the total annual water consumed by the data center (in liters) by the energy used by its IT equipment (in kilowatt-hours) over the same period. A lower WUE indicates more efficient water usage, with the ideal theoretical WUE being zero, signifying no water use.

WUE and PUE scores are interrelated insofar as there are inherent trade-offs in cooling choices that will likely raise one score and lower the other (*e.g.*, if water or air is used to cool data center load). The concern here is the trade-off between more energy or more water usage—especially freshwater usage. By tracking and benchmarking this information over time, Ameren Missouri and various stakeholders will be better able to make informed planning decisions across the service territory in regard to valuing finite natural resources and assuring the surrounding areas are sustainable.

Q. Why is it necessary to include this in the in-take process for applicable customers?

A. According to the University of California, Riverside, each 100-word AI prompt is estimated to use roughly one bottle of water (or 519 milliliters).[78] Furthermore, according to the Environmental and Energy Study Institute:

> Large data centers can consume up to 5 million gallons per day, equivalent to the water use of a town populated by 10,000 to 50,000 people.[79]

Missouri is generally considered a water-rich state thanks to the vast amount of surface and groundwater resources due in part to consistent rainfall and two major river systems. Water

[78] Verman, P & S. Tan. (2024) A bottle of water per email: the hidden environmental costs of using AI chatbots. *The Washington Post*. https://www.washingtonpost.com/technology/2024/09/18/energy-ai-use-electricity-water-data-centers/

[79] Yanez-Barnuevo, M. (2025) Data Centers and Water Consumption. EESI. https://www.eesi.org/articles/view/data-centers-and-water-consumption

resources are also considered vital to the state's economy and future. This fact has been underscored by the recent passage of SB 82 that makes it unlawful for any person to export water resources outside of the state unless the person holds a water exportation permit issued by the Missouri Department of Natural Resources.[80]

Q. Why is it necessary to include this in the in-take process for applicable customers?

A. Given the realized and projected water appetite of large data centers I believe it is best to be proactive in addressing this challenge rather than being reactive. Benchmarking that information is a relatively low-cost means of monitoring and assessing future planned investment and I would argue also helps minimize the possibility of future stranded assets.

Q. What do you anticipate would be included in the pre-construction study and post-construction reporting?

A. As a finite resource, water's value will only grow with the increasing reliance of energy-intensive customers needing it for cooling. To ensure long-term sustainability and responsible resource management, a pre-construction water usage study is crucial. This study would determine pre-construction water availability, analyze historical and projected weather patterns, assess the continued rise in demand from data center customers, and identify potential shortfalls. Furthermore, considerations for on-site water treatment and sustainable management practices are vital, aligning with site selection, cooling system (including closed-loop cooling systems), and facility design considerations outlined in the Power Usage Effectiveness study.

The pre-construction should include feedback from the Missouri Department of Natural Resources and relevant local water authorities (*e.g.*, water utility) for input on current and future adequacy levels under a range of assumptions.

Finally, I am recommending the inclusion of pre-construction study and future post-construction WUE benchmarking scores to emphasize the importance of operational

[80] Missouri Senate (2025) Truly Agreed to and Finally Passed. Summary SB 82. https://www.senate.mo.gov/25info/BTS_Web/Summary.aspx?SessionType=R&SummaryID=12468851&BillID=193

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efficiencies in the face of limited supply. As such, the studies should set clear WUE targets for participants, potentially with varying levels based on the region's water stress and the size of the facility. I recommend that these metrics be reported to Ameren Missouri on an annual basis and that Ameren Missouri consolidate this information across its data center customers in an annual public report to the Commission as well as include this information in the Company's Integrated Resource Plan.

Total Harmonic Distortion

Q. What is harmonic distortion?

A. Harmonic distortion is the presence of unwanted frequency components in a power system. These unwanted components are integer multiples of the fundamental frequency (usually 50 or 60 Hz) and can significantly impact the performance and reliability of the distribution system.[81] Total Harmonic Distortion ("THD") is the measurement of this phenomenon.

Q. Why is this a concern?

A. Poor harmonic distortion of the distribution system is strongly correlated in areas with significant data center buildout. Analysis from Whisker Labs and DC Byte Data concluded that more than three-quarters of highly distorted power readings across the country are within 50 miles of significant data center activity. *Bloomberg News* states:

> Bad harmonics can force home electronics to run hot, or even cause the motors in refrigerators and air conditioners to rattle. It's an issue that can add up to billions of dollars in total damage . . . the worse power quality gets, the more the risk increases. Sudden surges or sags in electrical supplies can lead to sparks and even home fires. Left unaddressed, one problem can morph into another. That means the bad harmonics today can be a sign of potential disaster down the road. . . . The grid has never faced the kinds of strain that comes with data

[81] MPS (2025) Harmonic Distortion in Power Systems. https://www.monolithicpower.com/en/learning/mpscholar/power-electronics/power-quality-and-harmonics/harmonic-distortion-in-power-systems?srsltid=AfmBOoozaTybr5iHA898qIjdtYMKn9WOfLouBOPLHS1uY5Wr_wRQkOyG

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> centers. These city-sized users can pop up very quickly, within a year or two, which is much faster than grid planning usually happens. Even during population booms, the rise in power demand paled in comparison to the expected installation in the coming years of hundreds, perhaps thousands, of these facilities to power AI.[82]

Figure 7 provides a visual representation of acceptable and bad harmonic levels comparing York County, Virginia against Prince William County, Virginia (home of "data center alley")

[82] Nicolettie, L. et al. (2024) AI needs so much power, it's making yours worse. *Bloomberg News*. https://www.bloomberg.com/graphics/2024-ai-power-home-appliances/

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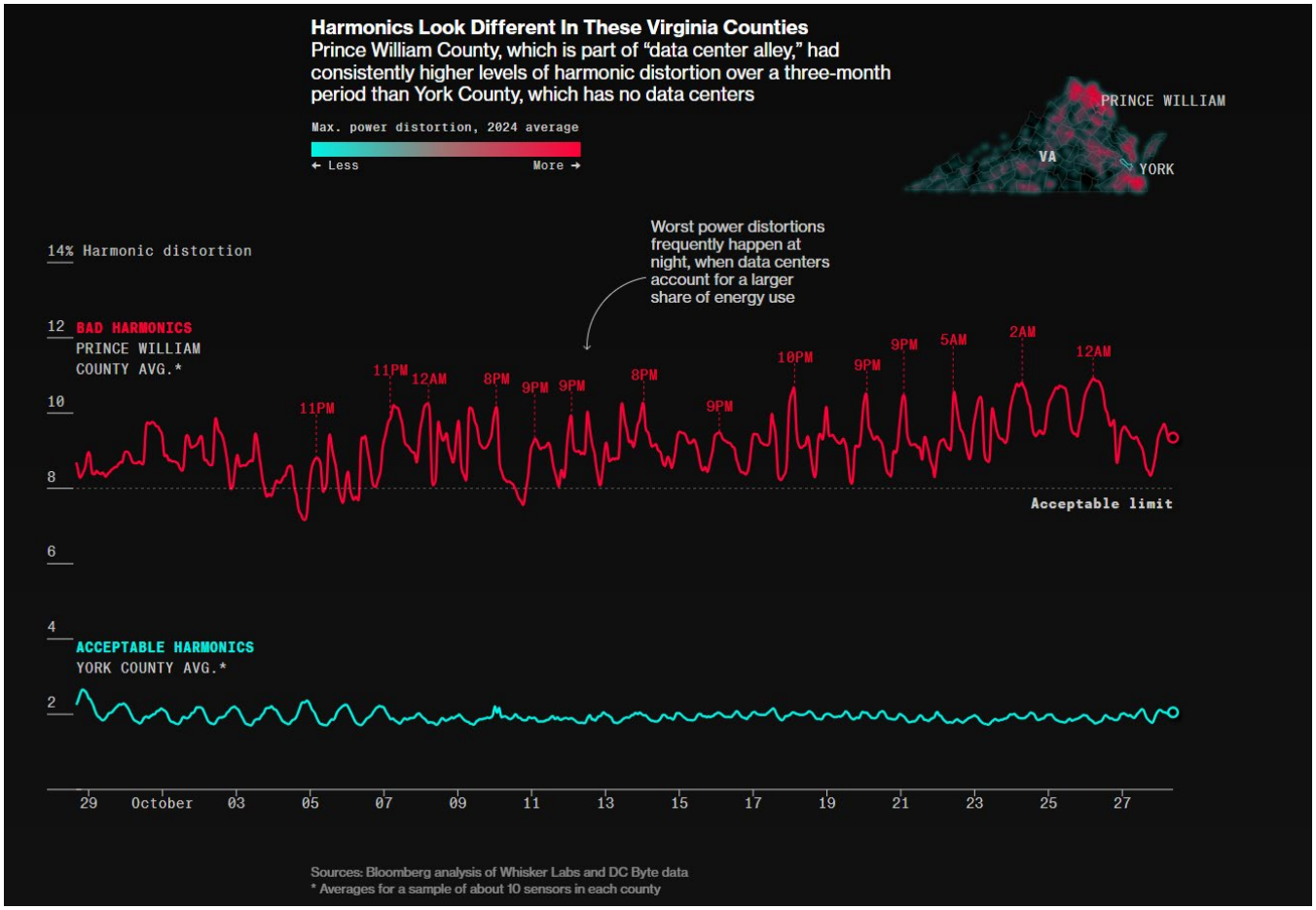
Figure 7: Illustrative example of harmonics levels[83]



The inclusion of LPS customers being placed on Ameren Missouri's system should not come at the expense of power quality of the surrounding area.

Q. What do you anticipate would be included in the pre-construction analysis and post-construction reporting?

A. First, a baseline measurement would need to be conducted on the existing distribution system at the proposed site to identify any existing issues and also to serve as a reference moving forward. This would include identifying any existing harmonic sources such as nearby industrial facilities or legacy infrastructure with nonlinear loads. The customer

[83] *Ibid*.

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would then work with Ameren Missouri to study and simulate what the impact of future large load would be on the distribution system.

The results of this analysis should help inform right-sizing equipment and load patterns to minimize harmonic distortions moving forward. The hope here is that by proactively measuring and controlling for this issue we can maximize the reliability and efficiency not only of the large load customers but ensure that customers within the surrounding areas are not materially harmed.

I am also recommending the inclusion of pre-construction study and future post-construction harmonics benchmarking scores to minimize future reliability and power quality issues. Additionally, I believe such proactive efforts on the part of the utility and LPS customers will improve local community "buy-in" for future projects. I recommend that these metrics be reported to Ameren Missouri on an annual basis and that Ameren Missouri consolidate this information across its hyperscale customers in an annual public report to the Commission.

Finally, data center customers should shoulder any costs associated with installing and maintaining CAPEX necessary to prevent their operations from degrading power quality or injecting harmful harmonics into the local grid.

Q. Who is responsible for paying for these studies and how can you confirm the independence of the researchers?

A. The costs should be borne by prospective hyperscale customers. Furthermore, for cost savings and consistency across utilities I recommend a joint request for proposal be issued for each of the three studies in conjunction with Liberty Utilities, Evergy Missouri West and Metro, the PSC Staff, and OPC.

Q. If the pre-construction studies reveal serious deficiencies, what are the remedies?

A. Ameren Missouri should demonstrate that they are taking specific actions to remedy any deficiencies found in the pre-construction results before a contract can be entered into.

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Q. If the post-construction data reveals serious deficiencies, what are the remedies?

A. Hopefully, by addressing these concerns on the front-end we will not realize major deficiencies post-construction. Additionally, the mere fact that these issues are being continually monitored suggests that regulators and the community at large should not be overly surprised. However, if post-construction data reveals that these customers are responsible for inducing poor power quality on its neighbors, then hyperscalers should be responsible for the costs necessary to remediate it.

Q. Do you believe these conditions will inhibit customers from selecting Missouri to locate?

A. No. My sense is that there was an element of competition perhaps when the Company filed its direct testimony, but since then commissions across the country and various state assemblies, including Missouri, have become more cognizant of the liability inherent in bringing on speculative large load customers and are now much more sensitive to adopting hold harmless safeguards for its ratepayers/citizens. Each of the three studies are effectively canaries in the coal mine. They are providing pre- and post-data to confirm that hyperscale customers are not unduly placing direct or second-order harm on the state of Missouri and its citizens. They are necessary actions given the unique circumstances and finite resources we have available today. To the extent possible, my recommendations are attempting to future-proof what appears to me are obvious issues that could inhibit future cost recovery, performance, and long-term sustainability.

Q. Do you anticipate making all of these reports public?

A. That would be my recommendation.

Staff Recommendations from the Evergy Large Load Tariff Docket

Q. In the Evergy docket (Case No. EO-2025-0154) you supported the Company's System Support Rider. Are you recommending a similar feature here?

A. I am not. Instead, I was generally supportive of Staff's proposed features that sought to ensure recovery of fixed costs, ISO capacity shortfall penalties, and offsets to economic

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development discounts. Based on ongoing conversations with Staff I understand that there are some amendments that will likely be included in their Ameren testimony. I raise this all to say that I am directionally supportive of Staff's recommendations and will await any changes they propose.

Q. Can you summarize your recommendations?

A. Yes. I recommend the following additions and/or modifications:

1. Pre-Construction Analysis and Post-Construction Reporting Metrics on
    - Power Usage Effectiveness
    - Water Usage Effectiveness
    - Total Harmonic Distortion
2. Terms of service to be extended from 15 to 20-years with a five-year disconnection notice
3. Amend tariff so that it only applies to data centers of 50 MW or greater
4. Minimum Billing to cover 90% of contract capacity
5. No waiver for higher creditworthiness within the collateral requirement
6. Future Funding of a Community Benefits Program as an offset to societal risk
7. Mandatory Emergency Curtailment Feature
8. General support of Staff's recommendations in the Evergy docket applied to this case
9. Conceptually supportive of the four clean energy program offerings subject to further discussion/discovery

Q. Does this conclude your testimony?

A. Yes.

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BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Approval of New Modified Tariffs for Service to Large Load Customers	))))	Case No. ET-2025-0184

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Chief Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my rebuttal testimony.

3. I hereby swear and affirm that my statements contained in the attached testimony are true and correct to the best of my knowledge and belief.

Geoff Marke
Chief Economist

Subscribed and sworn to me this 4th day of September 2025.

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.