Schedule EV-1

(Grain Belt Express Comments on Ameren Missouri's 2023 Integrated Resource Plan)

BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION

In the Matter of Union Electric Company d/b/a Ameren Missouri's 2023 Utility Resource Filing Pursuant to 20 CSR 4240 – Chapter 22	)))	Case No. EO-2024-0020

GRAIN BELT EXPRESS COMMENTS TO AMEREN MISSOURI'S IRP

TABLE OF CONTENTS

I. Introduction

Grain Belt Express, LLC ("Grain Belt Express") appreciates the opportunity to provide comments regarding the materials presented and issues discussed in the triennial resource planning filing ("2023 IRP") of Union Electric Company d/b/a Ameren Missouri ("Ameren").

The United States recently passed the 1-year anniversary of winter storm Elliott this December 2023 and the 3-year anniversary of winter storm Uri this February 2024, and the need for investment in interregional transmission and a grid that is "larger than the weather," to access more geographically diverse resources, is more urgent than ever. The North American Electric Reliability Corporation ("NERC") recently issued its 2023 Long-Term Reliability Assessment,[1] which continues to identify areas at elevated or high risk of capacity and resource adequacy shortfalls, including the Midcontinent Independent System Operator ("MISO"), in which Ameren resides. NERC's Assessment noted that the "capability for electricity supplies to be transferred between areas may play a significant part in overall energy adequacy when the system may have highly variable electricity supply resources and more weather-sensitive demand." Recent reports also indicate that the United States is entering a period of high electrification and unprecedented load growth which will increase the magnitude of the problem.[2] In addition, on October 30, 2023, the Department of Energy ("DOE") issued its National Transmission Needs Study[3] which noted "today's grid cannot adequately support 21st century challenges—including the integration of new clean energy sources and growing transportation and building electrification—while remaining resilient in the face of extreme weather exacerbated by climate change," and that, "increasing interregional transmission results in the largest benefits." This Study also found that interregional transfer capacity must more than *double* to meet moderate load and high clean energy growth and must *quadruple* to meet a high load growth future by 2035. Disappointingly, Ameren has not taken steps in the 2023 IRP to evaluate how it might access geographically diverse supply side resources or how advanced transmission technologies might be deployed across regional transmission organization ("RTO") regions to address the above-mentioned risks. This lack of foresight puts Missourians at risk.

Ameren's 2023 IRP is deficient given its failure to evaluate, identify, consider or analyze Grain Belt Express' approximately 800-mile, overhead, multi-terminal ±600 kilovolt ("kV") high-voltage, direct current ("HVDC") transmission line and associated facilities including converter stations and alternating current ("AC") connector lines delivering high capacity factor renewable energy from Kansas with the delivery capacities of 2,500 MW into Missouri, including 1,500 MW into Ameren's service territory and an additional 1,000 MW into Associated Electric Cooperative, Inc. ("AECI") (the "Project") and associated renewable energy resources to be located in southwest Kansas. Because of that deficiency, Ameren's 2023 IRP fails to comply with the

[1] NERC 2023 Long-Term Reliability Assessment (Dec. 2023), *available at* https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2023.pdf

[2] Grid Strategies, the Era of Flat Power Demand is Over (Dec. 2023), *available at* https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf

[3] U.S. Department of Energy, National Transmission Needs Study (Oct. 2023), *available at* https://www.energy.gov/sites/default/files/2023-12/National%20Transmission%20Needs%20Study%20-%20Final_2023.12.1.pdf

requirements of *Chapter 22 — Electricity Utility Resource Planning* of the Missouri Public Service Commission's ("Commission's") regulations.

Additionally, Grain Belt Express has several concerns with the methodologies and analyses performed by Ameren related to its reliance on natural gas units and its generator replacement strategy. The assumptions used by Ameren to model these resources are unrealistic and not supported by actual data.

II. The 2023 IRP is Deficient Because It Fails to Evaluate, Identify, Consider, or Analyze All Existing Supply-Side Resources—Namely, Grain Belt Express and Associated Renewable Energy Resources—In Accordance with 20 CSR 4240-22.040.

Ameren's 2023 IRP is deficient because it fails to evaluate, identify, consider, or analyze all existing supply-side resources—namely, the Grain Belt Express Project and associated renewable energy resources in southwest Kansas—in accordance with 20 CSR 4240-22.040. Renewable energy resources in southwest Kansas, which can be delivered directly to Ameren's service territory by the Project, feature unique characteristics that are not reflected in the generic MISO wind resources modeled by Ameren in the 2023 IRP. The failure to model the unique characteristics of these resources, despite their impending direct interconnection with Ameren, is a significant deficiency that must be addressed.

Grain Belt Express' assertion that the 2023 IRP is deficient is based upon the definition in the governing regulations. 20 CSR 4240-22.020(9) defines "deficiency" as: "deficiencies in the electric utility's compliance with the provisions of this chapter, any major deficiencies in the methodologies or analyses required to be performed by this chapter, and anything that would cause the electric utility's resource acquisition strategy to fail to meet the requirements identified in Chapter 22."

Here, the 2023 IRP is deficient because it fails to comply with the requirements set forth in 20 CSR 4240-22.040.1, which states:

> The utility shall evaluate all existing supply-side resources and identify a variety of potential supply-side resource options which the utility can reasonably expect to use, develop, implement, or acquire, and, for purposes of integrated resource planning, all such supply-side resources shall be considered as potential supply-side resource options. . . . The utility shall collect generic cost and performance information sufficient to fairly analyze and compare each of these potential supply-side resource options, including at least those attributes needed to assess capital cost, fixed and variable operation and maintenance costs, probable environmental costs, and operating characteristics.

As explained further below, by failing to model Grain Belt Express and associated renewable energy resources, Ameren did not 1) evaluate and identify all supply-side resources that Ameren could reasonably expect to use; or 2) collect generic cost and performance information sufficient to fairly analyze and compare the Project and associated renewable energy resources. As the Project and associated renewable energy resources in southwest Kansas are supply-side resources, Ameren's failure to evaluate, identify, consider, or analyze them results in a deficiency.

A. Project Background

The Grain Belt Express Project and the renewable energy resources in southwest Kansas that it will directly connect to Ameren's service territory are supply-side resource options because they provide high capacity factor, low-cost energy, and grid reliability services to the regions they serve, and therefore are a "device or method by which the electric utility can provide to its customers an adequate level and quality of electric power supply" pursuant to 20 CSR 4240-020(58). This assertion is supported by the evidentiary record in Case No. EA-2023-0017, in which the Commission granted the Project an amended certificate of convenience and necessity ("CCN").

As detailed in Case No. EA-2023-0017, Grain Belt Express is a Commission-approved highly efficient HVDC transmission line that can directly deliver 2,500 MW of dedicated clean energy from exceptionally strong new wind and solar resources in southwest Kansas to Missouri customers in the Ameren and AECI service territories.[4] Specifically, the Project will deliver 1,500 MW into the Ameren service territory, which is part of the MISO wholesale power market operating across 15 Midwestern U.S. states and Manitoba.[5] The Project is in advanced stages of development and has targeted for Phase I to commence construction in early 2025.

The Project will be built in two phases. In relevant part to this proceeding, Phase I of the Project connects solar, wind, battery, and hybrid renewable energy resources to a converter station in southwestern Kansas where the HVDC portion of the Project will cross approximately 370 miles in Kansas to the Kansas-Missouri border and will then traverse approximately 156 miles in Missouri to a converter station in Monroe County, Missouri.[6] At the Monroe County converter station, an AC tie line will traverse Monroe County, through Audrain County, and ultimately terminate in Callaway County at a point of interconnection with the MISO system along Ameren's 345 kV AC transmission line connecting the McCredie substation and the Montgomery substation.[7] The Project has all state-level permits, has acquired 96% of right of way needed for the HVDC portion of Phase I, has executed and effective interconnection and transmission connection agreements, and is in advanced stages of engineering and environmental permitting.

The Grain Belt Project offers a host of advantages when compared to regional wind and solar resources (Missouri specific or within MISO). These advantages include:

[4] The Project's total capacity is 5,000 MW. 2,500 MW will be delivered into Missouri. An additional 2,500 MW will be delivered into the PJM markets at an AEP substation in Sullivan County, Indiana.

[5] Case No. EA-2023-0017, Exhibit 3, Direct Testimony of Mark Repsher, Schedule MR-2 at 7 (hereafter, "MR-2").

[6] Case No. EA-2023-0017, October 12, 2023 Report and Order, at ¶ 10 ("2023 CCN Order"). Phase II of the Project will comprise construction from the converter station in Monroe County approximately 58 miles in Missouri to the Illinois border. 2023 CCN Order, at ¶ 13. Phase II will continue approximately 207 miles through Illinois to the Indiana border terminating at the substation in Sullivan County, Indiana. *Id.*

[7] 2023 CCN Order at ¶ 11. The proposed converter station will also interconnect with the AECI system at the McCredie 345 kV substation.

- Provision of stronger dedicated clean solar and wind resources in western Kansas compared with relatively lower quality renewable resources in Missouri, transmitted directly via efficient, controllable HVDC technology to the MISO, Southwest Power Pool ("SPP"), PJM Interconnection ("PJM"), and AECI service territories, lowering energy costs in states including Missouri;

- Displacement of more emission-intensive generation in the Midwest – including the State of Missouri – helping local utilities achieve their decarbonization goals;

- A significant increase in the geographic diversity of renewable resources feeding the Ameren system via an HVDC line that can be controlled by MISO and other system operators, which increases the reliability and resiliency of a grid becoming more intermittent as it quickly decarbonizes;[8] and

- Grid reliability and resiliency benefits because of its advanced technological capabilities and its connectivity to the SPP and PJM markets.

i. *The Project Provides Stronger, Dedicated Solar and Wind Resources from Southwest Kansas*

The renewable resources delivered by the Project have considerably higher capacity factors than typical Midwestern (including Missouri) resources – particularly when the complementary production profiles of these wind and solar assets are collectively transmitted over the Project.[9] The Project's average all-hours capacity factor of 74% is even more notable considering that this value is "post-clipping," *i.e.*, the Project's renewables are oversized relative to the line, and therefore there are times (*e.g.*, April afternoons) during which the renewable overproduction must be curtailed ("clipped") and the Project is at 100% utilization.[10]

The incremental clean energy injected by the Project will result in reduced around-the-clock zonal power prices in MISO Zone 5 (northern and eastern MO), SPP Zones, (western and southern MO), and AECI (MO-wide).[11] These reduced prices are the result of low-cost energy delivered by the Project displacing higher cost power from inefficient generators at the top of the dispatch stack in SPP, MISO, and AECI.[12] From 2027-41, the Project is expected to reduce around-the-clock ("ATC") annual power prices by an average of 2.7% in MISO Zone 5, 1.1% in

[8] MR-2 at 7–8.

[9] *Id.* at 12, figs. 3-1 & 3-2.

[10] *Id.* at 12.

[11] *Id*.

[12] *Id*. at 13.

SPP South, and 4.1% in AECI, thereby saving State residents electricity costs.[13] As noted in Section 3.4 below, these benefits are further accentuated on a load-weighted basis.[14]

In transmitting low-cost solar and wind resources into the Midwest and adjacent service territories, the Project has the ability to reduce energy and capacity costs in Missouri by over $17.6 billion over the 2027-66 period.[15]

ii. *The Project Displaces Emission-Intensive Generation in the Midwest (including Missouri)*

In addition to savings in the energy and capacity markets, the Project delivers substantial additional benefits to Missouri residents in the form of emissions reductions, environmental justice, and enhanced grid resilience.[16] These benefits are particularly relevant in light of utility decarbonization commitments, such as Ameren's targets of 60% carbon emissions reductions by 2030, 85% by 2040, and net-zero by 2045 (all versus 2005 levels).[17]

For example, the Project facilitates nearly 67 million tons of emissions reductions within the State of Missouri, by reducing emissions of CO_2, SO_2, and NOx in Missouri by 9.3%, 19.2%, and 17.2%, respectively over the 2027-66 period.[18] For comparison, in-state CO_2 emissions savings facilitated by the Project from 2027-66 are approximately equivalent to removing over 13 million gasoline cars from Missouri roads for one year.[19] Quantifying these emissions benefits to the state, the Project offers Missouri over $7.6 billion in social benefits from 2027-66.[20]

iii. *The Project Provides Ameren Access to Geographically Diverse Renewable Resources*

Grain Belt Express effectively expands the geographic footprint of MISO Zone 5 to include western Kansas and the significant renewable energy development potential in that region. Access to that resource-rich area materially increases generation and capacity capabilities in MISO and in Ameren Missouri's service territory. For example, to replicate the energy associated with 1,000 MW of wind/solar hybrid energy delivered by the Project, Ameren would need to procure 2,700 MW of solar within its territory.[21] To replicate the capacity associated with 1,000 MW of a

[13] *Id*.

[14] *Id*. Note that power prices referenced here are based on short-run marginal costs/market clearing prices (that reflect the variable dispatch costs of the price-setting generator in any given time-period). *Id.* at 13, n.11. These do not, however, factor-in any ancillary services or uplift components. *Id.*

[15] *Id.* at "Executive Summary".

[16] *Id*. at 15.

[17] *Id*.

[18] *Id*.

[19] *Id*.

[20] *Id.* at "Executive Summary".

[21] Case No. EA-2023-0017, Exhibit 2, Surrebuttal Testimony of Shashank Sane at 6.

wind/solar hybrid delivered over the Project, Ameren would need to procure 2,700 MW of solar and 200 MW of four-hour battery storage in its territory.[22]

Beyond providing direct access to a greater volume of renewable resources, the resources that are made accessible by the Project also provide a better fit to local capacity needs than local solar resources. The most pressing capacity need is for winter peak capacity. This typically occurs from 7:00 to 8:00 a.m. during the winter. While solar has not yet reached high capacity at this time, those early morning hours are typically the strongest for Kansas wind resources, providing on average a 52% capacity factor. The resources can provide year-round capacity value as well. When summer peak (4:00 to 6:00 p.m.) capacity is required, the wind/solar portfolio provided through the Project offers on average a 67% capacity factor during those hours. The value of time-shifted solar in Kansas provides superior load carrying capacity than local solar because it better aligns with system peak. In fact, 160 MW of solar in Kansas provides the same capacity value as 450 MW of local solar, saving Missouri ratepayers approximately $600 million just in avoided capital costs.[23]

Additionally, renewable energy provided through the Project will provide an ideal complement to increasing solar penetration in MISO. There are currently 145,560 MW of solar in the queue in MISO, with 5,393 MW specifically within Zone 5. As these resources are built out, MISO will experience challenges similar to those experienced in other markets with high solar penetration, including high ramping needs in the evening and correlated supply risk with solar conditions.[24] The Project can deliver wind from Kansas which is uncorrelated to solar production within MISO.[25] This relationship will reduce the risk of supply shortfall and therefore reduce the need for backup generation.[26] The solar from Kansas transmitted by the Project will continue producing at a higher capacity factor nearly 2 hours later than solar within Missouri, reducing the pace of ramping required in the evening.[27]

iv. *The Project Increases Grid Reliability and Resiliency Because of its Advanced Technological Capabilities and its Connectivity to the SPP Markets and PJM Markets*

Not only will the Project help Missouri and its utilities diversify its resource mix by providing a direct line to uncorrelated, high-capacity renewable power supply, it will also strengthen the regional and interregional grid. Generation resources within Ameren's service territory (and MISO) and other local solar resources will all be equally impacted by the same regional weather patterns, time zone realities, and other regional grid-related challenges. Linking Ameren, Missouri and the MISO grids to Kansas wind and solar to the west and the PJM market to the east will allow Ameren to cast a net for electricity that is larger than a storm, larger than

[22] *Id*. at 6-7 (*and see* figure on p. 7).

[23] *Id*. at 7-8 (*and see* figure on p. 8).

[24] *Id*. at 7.

[25] *Id*.

[26] *Id*.

[27] *Id*.

local wind patterns, larger than local solar availability and where solar, wind, or other generation resources may be working better than in the region. Based on recent weather events throughout the country, there is no doubt that interregional transmission could be invaluable in keeping the lights on and in saving lives.

More specifically, the Project will increase the reliability of electricity provided to customers, the resiliency of the electric grid based on current observed market and operating conditions, and mitigate high energy prices during extreme weather events.

The Project will increase grid reliability and enhance grid resiliency through its unique technical capabilities, which include: 1) voltage sourced converter ("VSC") technology, which can quickly reverse the direction of current, and 2) its converter stations capable of bidirectional flow. For example, the three DC/AC converter stations associated with the Project will have the capability to inject or withdraw capacity to or from different markets, providing reliability during periods of supply shortages.[28] These technical capabilities provide resource outage protection, energy diversity, power flow control, interregional transfers, black start/system restoration support, and increased energy independence. Serving as the backbone of the grid, HVDC can act as both an extension cord bringing electricity to customers impacted by disruptive events and jumper cables needed to restart grids suffering from outages.

All of these facts and conclusions were referenced by the Commission in issuing Grain Belt Express an amended CCN stating, "Grain Belt will provide Missouri utilities with a superior generating resource pool with higher capacity factors, better availability during times of need and the geographic diversity necessary to balance potential extreme grid conditions in the SPP, AECI, and MISO regions."[29] In other words, the Commission expressly recognized the Project and the renewable generation it will enable as a potential supply-side resource option to meet Ameren's specific needs.

In addition to the Commission's grant of authority, the Project has also obtained all needed grants of authority in Kansas, Illinois, and Indiana. Further, on February 20, 2024 the project received FAST-41 designation by the Federal Permitting Improvement Steering Council. FAST-41 designation signifies the national priority importance of Grain Belt Express to improving grid reliability and energy affordability, particularly in the Great Plains and Midwest. The designation applies to Grain Belt Express Phase 1, and the project profile is accessible on the Permitting Dashboard for federal infrastructure projects.[30]

There are no similar projects on the market or in development that will offer Ameren and other load interests direct access to a geographically diverse supply of high-capacity renewable energy across multiple RTO regions via a permanently uncongested path (at scale). Further, there are no other projects in development that address sustainability, reliability and capacity needs in a

[28] *Id.* at 8.

[29] 2023 CCN Order at ¶ 57.

[30] *See* https://www.permits.performance.gov/permitting-project/fast-41-covered-projects/grain-belt-express-transmission-phase-1.

cost-effective manner that will be available on the timeline set forth in the 2023 IRP, and during the critical hours when this capacity is most needed.[31]

Given the operating capabilities of the Project and its associated renewable energy resources, they are supply-side resources that Ameren could reasonably expect to use, develop, implement, or acquire.[32] As such, Ameren was required to evaluate them and identify them as a potential supply-side resource in its 2023 IRP.[33]

B. The 2023 IRP is Deficient Because It Fails to Model the Project and Associated Renewable Energy Resources in Conflict with Ameren's Stated Goals

Ameren's failure to evaluate or identify the Grain Belt Express Project and associated renewable energy resources as supply-side resources is a deficiency[34] because the requirements of Chapter 22 state:

> The utility shall **evaluate** all existing supply-side resources and **identify** a variety of potential supply-side resource options which the utility can reasonably expect to use, develop, implement, or acquire, and, for purposes of integrated resource planning, all such supply-side resources shall be considered as potential supply-side resource options.[35]

Despite these regulatory requirements to *evaluate* and *identify* "all existing supply-side resources," Ameren did not include the Grain Belt Express Project and associated renewable energy resources in its 2023 IRP. In fact, in response to data requests, Ameren stated it only "studies generic resources in its IRP" and that it "did not explicitly analyze resources assumed to be outside of the MISO footprint."[36]

The failure to model the Project in the 2023 IRP is in contrast to the Project's modeling in the 2020 IRP. Specifically, Ameren included the Project in the 2020 IRP as Plan Y in its Additional Alternative Resource Plans.[37] In the 2020 IRP, after scoring all the Alternative Resource Plans, the plan that included the Project received the second highest score.[38]

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[31] Case No. EA-2023-0017, Exhibit 600, Rebuttal Testimony of Michael Goggin at 19, 24–25.

[32] 20 CSR 4240-22.040.1.

[33] 20 CSR 4240-22.040.1.

[34] 20 CSR 4240-22.020(9) defines "deficiency" in the context of IRPs as "any major deficiencies in the methodologies or analyses required to be performed by this chapter, and anything that would cause the electric utility's resource acquisition strategy to fail to meet the requirements identified in Chapter 22."

[35] 20 CSR 4240-22.040.1 (emphasis added).

[36] *See* Attachment A, Ameren's Response to Grain Belt Express Data Request No. 1.2.

[37] 2020 IRP at Chapter 10, pp. 5–6.

[38] *Id*. at Chapter 10 at 11.

Here in its 2023 IRP Ameren largely maintained the framework utilized in both the 2017 and 2020 IRPs, with the significant alteration being the replacement of the dispatch model by PowerSIMM. It is evident from the 2020 IRP that renewable energy and Grain Belt Express renewables were distinctly modeled and evaluated based on a range of economic and diversity parameters, all of which were appropriate given their unique characteristics.

The Project was reasonably and logically included in the 2020 IRP given Ameren's stated goals. In the 2020 IRP, Ameren stated it was "embarking on a transformation of its generation portfolio over the next twenty years while also considering portfolio implications through 2050," which included:

> Our largest ever expansion of renewable wind and solar generation, bringing us to 3,100 MW of wind and solar by 2030 and 5,400 MW by 2040. This allows us to begin providing clean renewable energy to our customers now and mitigate significant risks associated with changes in energy policy, including policies that establish a price on carbon dioxide ("CO2") emissions. . . . Our plan supports more aggressive reductions in CO2 emissions, resulting in a 50% reduction by 2030 from 2005 levels and an 85% reduction by 2040, with a goal of achieving Net Zero CO2 emissions by 2050.[39]

Ameren's 2023 IRP announces even more ambitious goals. The 2023 IRP states:

> Our plan includes continued expansion of renewable wind and solar generation, bringing us to over 3,500 MW of wind and solar by the end of 2030 and over 5,400 MW by 2036. This allows us to replace energy no longer generated from coal-fired resources with the lowest cost alternative, clean, emission free renewable energy, while mitigating significant risks associated with changes in energy policy, including policies that establish a price on carbon dioxide (CO2) emissions. . . .
>
> Our plan results in reductions in CO2 emissions of at least 60% by 2030 from 2005 levels and 85% by 2040, with a goal of achieving Net Zero CO2 emissions by 2045. . . .
>
> Our implementation plan for the next three years includes steps necessary to add an additional 1,800 MW of solar generation and 1,000 MW of wind generation to our portfolio by the end of 2030, approval and implementation of energy efficiency and demand response programs beyond our current plan, steps to implement new simple cycle gas-fired generation by the end of 2027 and new combined cycle gas generation by the end of 2032, and actions to preserve contingency resource options and enable us to quickly respond to changing needs and conditions while continuing to ensure safe, reliable and cost-effective service to our customers.[40]

There is no question that the 2023 IRP specifically outlines a need for the type of supply-side resource(s) the Project will provide. Yet, despite acquiring all remaining regulatory approvals

[39] *Id*. at Chapter 10 at 1.

[40] 2023 IRP, Ch. 10, Highlights.

for its current configuration and significantly advancing interconnection requests and land acquisition since the 2020 IRP, the 2023 IRP fails to evaluate or identify the Project and the unique generation it will interconnect.

As justification for the change in modeling since the 2020 IRP, Ameren states that it has:

> determined that the best path for evaluation of specific renewable projects is to evaluate them as part of its implementation efforts, such as an RFP process, given that 1) the IRP process is focused on identifying generic resources or resource types for inclusion in the Company's preferred resource plan, 2) the implementation process is not constrained by the statutory deadlines that govern the IRP process, and 3) the Company had already established the potential viability of an option like GBX at a high level in its 2020 IRP.[41]

While Grain Belt Express appreciates Ameren's acknowledgement of the viability of the Project and Ameren's statement that it will evaluate the Project and its interconnected resources in Kansas alongside other wind resources that also bid into company request-for-proposals ("RFP"), Ameren fails to capture all the benefits of the Project in its long-term planning. If Ameren does not incorporate the appropriate assumptions about the Project and its interconnected generating resources in southwest Kansas into its IRP modeling process, the model will not suggest those resources as a part of the preferred plan or an alternative resource portfolio. To be clear, these resources have different energy production, availability and pricing characteristics and cannot be lumped in with other generic MISO resources. Moreover, the energy, capacity and other beneficial attributes of the high output wind and solar generation resources in southwest Kansas that Grain Belt Express will deliver to Ameren's service territory would otherwise be inaccessible to Ameren and its customers.

If the Project and its interconnected resources are not part of Ameren's preferred plan or alternative resource portfolios, then Ameren may not issue an RFP seeking energy and capacity with the characteristics that can be provided by the Project and its interconnected resources, because it will instead have used generic assumptions for wind (or solar) that do not align with or show the characteristics of the Project's interconnected resources as advantageous. In short, the narrow representation of "diverse" renewables, as observed in the 2023 IRP, dilutes the inherent benefits of truly diverse renewable sources.

Because Ameren failed to evaluate or identify the Project and its interconnected resources as a unique supply-side resource, its 2023 IRP is deficient and does not meet the requirements of 20 CSR 4240-22.040.1.

[41] *See* Attachment B, Ameren's Response to Grain Belt Express Data Request No. 2.3.

C. The 2023 IRP is Deficient Because It Did Not Collect Generic Cost and Performance Information on Supply-Side Resources Outside of MISO to Fairly Analyze the Benefits of Geographic Diversity or Compare the Project Against Other Supply-Side Resource Options in the 2023 IRP

Ameren's failure to collect generic cost and performance information to analyze and compare supply-side resources is another deficiency in its 2023 IRP because Chapter 22 also states:

> The utility **shall collect generic cost and performance information sufficient to fairly analyze and compare each of these potential supply-side resource options**, including at least those attributes needed to assess capital cost, fixed and variable operation and maintenance costs, probable environmental costs, and operating characteristics.[42]

Specifically, Ameren did not collect generic cost information on resources in Kansas, despite a shovel-ready project capable of directly interconnecting such resources into Ameren's transmission system. The 2023 IRP and Ameren's discovery responses to Grain Belt Express demonstrate that it only analyzed wind and solar in Missouri and MISO, with a strong focus on projects in Missouri.[43] This is a serious flaw and indicates that Ameren is not seeking geographic diversity in a meaningful way. Further, Ameren states it is considering resources in the Ameren region[44] and reference maps of wind and solar resources in the 2023 IRP.[45] These statements and references only pay lip-service to geographic diversity. The conclusory statements and references are not supported by additional information and were not included in actual modeling.[46]

Ameren claims that their plan is to consider geographic diversity later, during "implementation."[47] Again, if Ameren has not considered the Project and associated generation

[42] 20 CSR 4240-22.040.1 (emphasis added).

[43] *See* Attachment A, Ameren's Response to Grain Belt Express Data Request No. 1.2; Attachment B, Ameren's Response to Grain Belt Express Data Request No. 1.3; Attachment C, Ameren's Response to Grain Belt Express Data Request No. 1.11a-c. In its response to Data Request 1.2, Ameren states: "The Company did not explicitly analyze resources assumed to be outside of the MISO footprint."

[44] Ameren defines the "Ameren region" as "Missouri plus states bordering Missouri." *See* Attachment E, Ameren's Response to Grain Belt Express Data Request No. 1.6.

[45] 2023 IRP, figs 6.4 & 6.7.

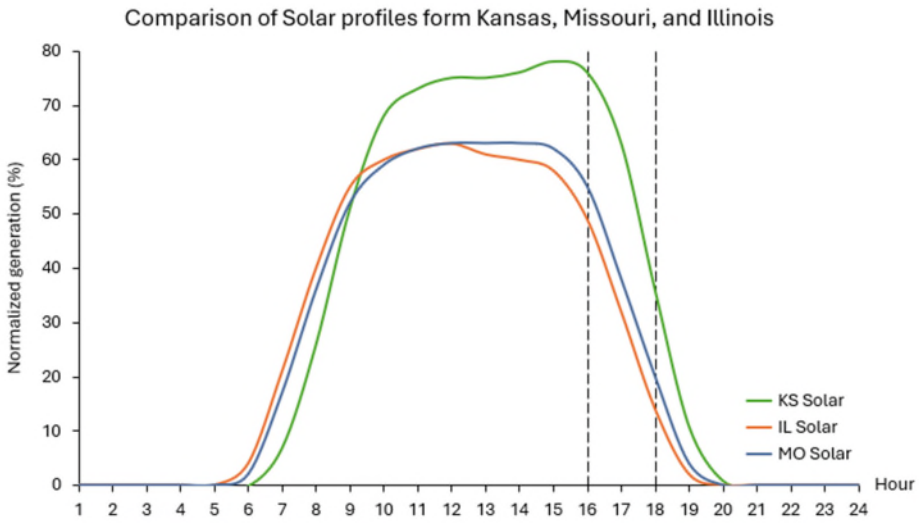
[46] *See* Attachment F, Ameren's Response to Grain Belt Express Data Request No. 1.4; Attachment E, Ameren's Response to Grain Belt Express Data Request No. 1.6; Attachment G, Ameren's Response to Grain Belt Express Data Request No. 1.9; Attachment H, Ameren's Response to Grain Belt Express Data Request No. 2.1; and Attachment I, Ameren's Response to Grain Belt Express Data Request No. 2.2.

[47] *See* Attachment D, Ameren's Response to Grain Belt Express Data Request No. 1.11b; and Attachment H, Ameren's Response to Grain Belt Express Data Request No. 2.1. In Grain Belt Express Data Request No. 2.1, Ameren defines "project implementation" as "the Company taking actions (e.g., issuing RFPs, reviewing RFP responses, negotiating contracts, applying for CCNS)

in the underlying modeling and analysis, then implementation of its IRP will only involve the acquisition of modeled resources. These are all serious deficiencies if Ameren truly is seeking a geographically diverse generation mix, as it claims to be.

To examine resource adequacy needs for its system, Ameren worked with Astrape Consulting. The purpose of this analysis was to calculate a portfolio Effective Load Carrying Capability ("ELCC") for renewable penetrations up to 2,700 MW wind and 2,700 MW solar seasonally.

The Astrape study only evaluated Missouri solar as opposed to evaluating diverse solar.[48] If Astrape studied Kansas solar and wind profiles in their study, they would have achieved higher ELCC because of uncorrelated solar and wind energy production patterns in Kansas compared to solar and wind energy production patterns in MISO/Missouri. The figure below illustrates the benefits of uncorrelated solar energy production patterns in Kansas, compared to Missouri and Illinois:



As a result, the 2023 IRP is deficient because Ameren did not collect generic cost information on resources located outside of Missouri and MISO, despite the availability of a direct tie to MISO through Ameren's own system via the Project. Accordingly, Ameren failed to fairly analyze the benefits of geographic diversity or compare the Project against supply-side resource options in the 2023 IRP, and therefore, does not meet the requirements of 20 CSR 4240-22.040.1.

to either purchase or build new near-term resources in its preferred plan consistent with assumed in-service dates."

[48] 2023 IRP, Ch. 2, § 2.4.

III. Ameren's 2023 IRP is Deficient Because It Fails to Consider Siting and Permitting Costs for Certain Interconnection Related Costs and System Upgrades in Accordance with 20 CSR 4240-22.060.

Ameren's failure to consider siting and permitting costs for new generation and generation-related transmission is another deficiency because Chapter 22 states:

> The utility **shall describe and document its analysis of the interconnection and any other transmission requirements** associated with the preliminary supply-side candidate resource options identified in subsection (2)(C).[49]

Further, Chapter 22 states:

> The utility shall describe and document its selection of the uncertain factors that are critical to the performance of the alternative resource plans. The utility **shall consider at least the following uncertain factors: Siting and permitting costs** and schedules for new generation and generation-related transmission facilities for the utility, for a regional transmission organization, and/or other transmission systems.[50]

In its 2023 IRP, Ameren did not consider important components of interconnection related costs or affected system upgrades associated with MISO generation and more specifically associated with potential generation replacement projects.

With respect to interconnection costs, Ameren failed to accurately consider and quantify the interconnection costs for renewable generation it may choose to locate at retiring generation sites.[51] Ameren admits that it is likely that generation tie lines would be needed to utilize the interconnection service that will become available at these points of interconnection,[52] particularly given that these sites are significantly land constrained and have significant environmental mitigation issues[53] but did not include any estimates as to what might be required to site these tie lines, their costs, and the degree of difficulty in siting such tie lines. Ameren only states that it "used generic supply-side cost assumptions when evaluating the cost of generation tie lines."[54] It is critical that Ameren incorporate realistic assumptions into its IRP planning process. Without realistic assumptions, again, the modeling will not select the best supply side portfolio, which is what Ameren will seek during "implementation" of its IRP.

[49] 20 CSR 4240-22.040 (emphasis added).

[50] 20 CSR 4240-22.060.

[51] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10.

[52] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10c.

[53] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10f.

[54] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10e.

With respect to system upgrade costs, Ameren failed to consider non-MISO system upgrade costs.[55] Ameren states that "[t]hey are not responsible for studying the impact to their system due to the connection of generators within the neighboring MISO system."[56] Therefore, Ameren states they "do not have adequate information to determine the non-MISO affected system upgrade costs."[57]

Affected system upgrade costs can make up a significant portion of the costs associated with the interconnection process and system upgrade costs can differ between regions. For example, an ACORE report from March 2021 notes:

> MISO is known to assign similarly high network upgrade costs. In the 2017 MISO West February 2017 cluster study, two generation projects, a 45 megawatt (MW) solar project and a 200 MW wind project, yielded $261 million in Affected Systems Costs and $14 million in network upgrade costs. Examples of excessively high network upgrade and affected systems costs are abundant in the generator interconnection process. Project economics frequently cannot support the high upgrade costs and as a result, generators are often forced to drop out of the queue.[58]

The ACORE report is informative because it shows what a large percentage of total upgrade costs affected system upgrades can make up for a MISO project.

Also, MISO and SPP are currently pursuing the Joint Targeted Interconnection Queue process (known as JTIQ). JTIQ is meant to replace the current affected system study process between MISO and SPP. Currently, the proposed share of JTIQ costs per MW for applicable generator interconnection requests is $1,170.5M/40,500MW = $28,901.2/ MW. At a minimum Ameren could have used this estimate in its IRP planning process.[59]

Regardless, a failure to include affected system upgrade costs means that the Commission does not have a full picture of the potential upgrade costs associated with the supply side resources in Ameren's plan. Different RTO regions or different generating assets may have different

[55] *See* Attachment K, Ameren's Response to Grain Belt Express Data Request No. 1.15a; *and* Attachment L, Ameren's Response to Grain Belt Express Data Request No. 2.12b.

[56] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.15a.

[57] *Id*.

[58] *How Transmission Planning & Cost Allocation Processes Are Inhibiting Wind & Solar Development in SPP, MISO, & PJM*, American Council on Renewable Energy (ACORE) at 49 (Mar. 2021), *available at* https://acore.org/wp-content/uploads/2021/03/ACORE-Transmission-Planning-Flaws-in-SPP-MISO-and-PJM.pdf.

[59] *See SPP-MISO Joint Targeted Interconnection Queue Cost Allocation and Affected System Study Process Changes* at 9 (Aug. 17, 2022), *available at* https://www.spp.org/documents/67740/spp-miso%20joint%20targeted%20interconnection%20queue%20cost%20allocation%20and%20affected%20system%20study%20process%20changes%20whitepaper.pdf.

exposure to affected system upgrade costs depending on their proximity to RTO seams. If such costs were taken into account in the underlying analysis, the results may be significantly different.

There can be no doubt that there are increasing complexities, delays and controversies surrounding siting and permitting for new generation and new transmission, and these costs must be accounted for. In contrast, the Grain Belt Express Project has all state-level permits, has acquired 96% of right of way needed for the HVDC portion of Phase I, has executed and effective interconnection and transmission connection agreements, and is in advanced stages of engineering and environmental permitting.

Because Ameren fails to consider interconnections costs and system upgrade costs, the 2023 IRP is deficient and does not meet the requirements of 20 CSR 4240-22.060.

IV. Ameren's 2023 IRP is Deficient Because It Fails to Recognize Grain Belt Express as an Advanced Transmission System Technology in Accordance with 20 CSR 4240-22.045 and 20 CSR 4240-22.070.

Ameren's failure to recognize the Grain Belt Express Project as an advanced transmission system technology is another deficiency because Chapter 22 states:

> The utility **shall develop, and describe and document, plans for transmission upgrades to incorporate advanced transmission technologies** as necessary to optimize the investment in the advanced technologies for transmission facilities owned by the utility.[60]

Chapter 22 also provides:

> The preferred resource plan **shall satisfy at least the following conditions: Invest in advanced transmission and distribution technologies** unless, in the judgment of the utility decision-makers, investing in those technologies to upgrade transmission and/or distribution networks is not in the public interest.[61]

Here, not only did Ameren fail to consider the Project and the renewable resources it will interconnect as supply-side resources, but Ameren also failed to recognize the Project itself as an advanced transmission system technology, has not assessed how it will incorporate this technology onto its system, and has further not explained why investment in such technology would not be in the public interest.[62]

Grain Belt Express is concerned that Ameren does not have a full understanding of HVDC technology (Ameren admits "our understanding and application of the technology is not mature"[63])

[60] 20 CSR 4240-22.045 (emphasis added).

[61] 20 CSR 4240-22.070 (emphasis added).

[62] Notably, in Case No. EA-2023-0017, the MPSC has already found that the Project (and by extension the technology being deployed) is in the public interest. 2023 CCN Order at 60–64.

[63] See Attachment M, Ameren's Response to Grain Belt Express Data Request No 1.16.

and that it fundamentally misunderstands how the Project specifically will be interconnected to SPP, MISO, AECI and PJM, as well as how the line will function once it is operational. Grain Belt Express is also concerned that even if Ameren modeled the project and associated renewable generation in its IRP that it would do so using incorrect assumptions.[64]

In Case No. EA-2023-0017, the Commission recognized that the Project can provide black-start capability without dependency on local generation and onsite fuel, citing the Surrebuttal Testimonies of Shashank Sane and Carlos Rodriguez.[65] The Commission noted that "[t]he Project has this potential because of its technical capabilities: 1) voltage source converter technology, which can quickly reverse the direction of current, and 2) its converter stations capable of bidirectional flow."[66]

The unique resiliency and grid support benefits of HVDC VSC technology are outlined in great detail in Guidehouse's Grain Belt Express (GBX): Resilience and Reliability Values report and include but are not limited to:

- Active and reactive power controlled electronically accurate in real-time to the millisecond;
- Voltage and frequency control;
- Dynamic voltage support (reduces losses);
- Emergency power control and power modulation; and
- Damping of electro-mechanical oscillations.[67]

The Commission should direct Ameren to rectify this deficiency by requiring Ameren to evaluate HVDC technology and specifically to work with Grain Belt Express to ensure the correct assumptions are used. Grain Belt Express is willing to make its HVDC vendor Siemens and its owner's engineer, RTEi, available to Ameren in order to educate the utility on the technology and the grid services it can provide.

[64] Ameren has incorrectly referred to the Project as a "one-way lead line from a wind farm in Kansas." *Id*. As established in Case No. EA-2023-0017, bidirectional power flow is inherent to the selected technology type and the contract between Grain Belt Express and Siemens (the converter station supplier) provides for delivery of bidirectional converter stations. 2023 CCN Order at p. 25. Further, the Project will connect more than "a wind farm" – it will connect a combination of wind, solar and battery, capable of delivering at a 74% capacity factor.

[65] 2023 CCN Order at p. 24

[66] *Id*. (citing the Direct Testimony of Aaron White, pp. 4–5).

[67] Case No. EA-2023-0017, Exhibit 11, Schedule ap-2, pp. 35–37

V. Concerns

In addition to the deficiencies discussed above, Grain Belt Express has several concerns as well. Chapter 22 defines concerns as:

> any major concerns with the methodologies or analyses required to be performed by this chapter, and anything that, while not rising to the level of a deficiency, may prevent the electric utility's resource acquisition strategy from effectively fulfilling the objectives of Chapter 22.[68]

Discussed below are Grain Belt Express' concerns with Ameren's reliance on natural gas units and its generator replacement strategy.

A. Ameren's Failure to Accurately Model Grain Belt and its Associated Geographically Diverse, High Capacity Renewable Generation Has a Direct Impact its Proposed Near Term Investment in Natural Gas Facilities

In order to address customer demand during extreme grid conditions, Ameren's IRP contemplates acquisition of 800MW of simple cycle gas-fired combustion turbine generators by 2027, 1,200MW of combined cycle generation by 2032 and 1,200MW of as-yet-unspecified clean dispatchable generation in each of 2040 and 2043.[69]

Renewable resources delivered to Ameren's service territory via Grain Belt Express offer many of the same benefits and even additional benefits relative to a combined cycle natural gas power plant. Those benefits of renewable resources delivered via Grain Belt Express would not be apparent in analyzing generic wind and solar resources within Ameren's service territory. Those resources underestimate the capacity factor that could be achieved with renewable resources and also the reliability provided by uncorrelated energy resources. Ameren's failure to analyze geographically diverse, high capacity factor renewable generation has led to the misleading conclusion that a significant quantity of combined cycle natural gas generation is required. High quality renewable resources also eliminate the fuel risk associated with combined cycle generation for Ameren's customers.

While simple cycle gas-fired combustion turbines may be required to address capacity requirements, the sizing of those facilities is closely related to the composition of the overall Ameren generation mix. By failing to analyze renewable energy delivered via Grain Belt Express, Ameren overestimated the need for simple cycle generation. Geographically concentrated renewables will exhibit high correlation and therefore require more backup generation during periods of low generation than geographically distributed and uncorrelated renewable resources.

[68] 20 CSR 4240-22.020(6).

[69] 2023 Integrated Resource Plan, Executive Summary, page 4.

B. Ameren Failed to Address the Risk Associated with Reliance Upon Natural Gas Units, Particularly Combined Cycle Units

Ameren failed to address the risk associated with investment in and reliance on natural gas units in winter and during extreme weather events when those assets are *particularly* vulnerable to interruptions in fuel supply, and when they will be needed by Ameren customers most. This risk is clearly illustrated by the events that occurred in PJM during Winter Storm Elliott and in SPP and ERCOT during Winter Storm Uri. These RTO,[70] FERC and NERC[71] analyses, conducted after recent extreme storms, show that "[g]enerating unit outages and natural gas fuel supply and delivery were inextricably linked."[72] The FERC, NERC and Regional Entity Staff Report states, "[e]ighty-seven percent of the fuel issues involved natural gas fuel supply issues," and that "[n]atural gas fuel supply issues alone caused 27.3 percent of the generating unit outages." All the reports clearly outline that while having a firm gas supply *and* firm gas pipeline transportation contracts helped some units to perform, it did not guarantee a generating unit remained online or did not have its service interrupted. PJM explicitly noted it is not unexpected for gas distribution companies to interrupt gas generation customers in favor of higher priority residential commercial human needs customers during very cold temperatures.[73] In response to data requests, Ameren acknowledges that during extreme grid conditions gas supply could be interrupted to serve heating customers.[74]

In PJM's Winter Storm Elliott Event Analysis and Report, the RTO notes that in contrast "… wind generation on average performed above its expected capacity. This is not unexpected and something PJM sees on the coldest winter days where the wind speed also increases customer demand due to increased heating needs."[75]

To be clear, no generating asset is 100% reliable in all seasons but the risks of each generating technology type, based on when that asset will be relied upon to meet Ameren's load must be clearly outlined and explained to the Commission via the IRP and later CCN processes. Furthermore, Ameren excluded the characteristic most resilient to extreme weather events—geographic diversity. By excluding geographically diverse resources delivered via Grain Belt Express, Ameren ignored a key potential source of resilience to extreme weather.

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[70] *See generally* Winter Storm Elliot Event Analysis and Recommendation Report, PJM (July 17, 2023), *available at* https://www.pjm.com/-/media/library/reports-notices/special-reports/2023/20230717-winter-storm-elliott-event-analysis-and-recommendation-report.ashx.

[71] FERC, NERC and Regional Entity Staff Report, *available at* https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and.

[72] *Id.*

[73] *Winter Storm Elliott Event Analysis and Recommendation Report, July 17, 2023, page* 61.

[74] *See* Attachment N, Ameren's Response to Grain Belt Express Data Request No. 2.13.

[75] Winter Storm Elliott Event Analysis and Recommendation Report, July 17, 2023, page 57.

Ameren should be required to run sensitivities on the cost and availability of gas during recent extreme storms (Uri, Elliott) and a comparison of renewable resources from southwest Kansas via HVDC against the 2023 IRP's plan to add new dispatchable resources.

C. Ameren's Plan for Renewable Generator Replacement at Retiring Dispatchable Energy Sites is Not Realistic

Ameren states that it "will also be evaluating the potential for new wind (and other technologies) around its retiring generation station using the MISO generator replacement process or combining wind (or solar) with its existing combustion turbine generation facilities to leverage the transmission capacity."[76] However, Ameren has not evaluated the suitability of those sites for hosting wind or solar facilities.[77]

Based upon Ameren's responses to data requests, retiring generation sites are not realistic candidates for grid-scale wind and solar projects. The expected buildable acreage at the Meramec and Rush Island sites are 86 acres and 127 acres, respectively.[78] At those sites, for a solar facility, assuming 5-10 acres per MW, the sites could hold roughly 9 to 17 MW at Meramec and 13 to 24 MW at Rush Island.[79] Neither the Meramec nor Rush Island sites are practical for a wind facility.[80] Thus, those are not suitable locations for the grid-scale wind and solar facilities that the 2023 IRP calls for.

By contrast, the resources that will be made available to Ameren via Grain Belt Express' MISO interconnection avoid these siting constraints and the line can provide a volume of renewable energy and capacity that would meaningfully contribute to Ameren meeting its decarbonization goals.

VI. Conclusion

Had Ameren modeled the Grain Belt Express Project and the generation it will interconnect directly to Ameren's service territory, the results of its 2023 IRP would have been vastly different. By failing to include the Project and its associated generation in its 2023 IRP, Ameren has presented a plan to the Commission that does not comply with the fundamental objective of the resource planning process, which is that electric utilities shall be able to provide the public with energy services that are safe, reliable, and efficient, at just and reasonable rates, and in a manner that serves the public interest and is consistent with state energy and environmental policies.[81]

[76] *See* 2023 IRP, § 6.1.2.

[77] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10a–b.

[78] *See* Attachment J, Ameren's Response to Grain Belt Express Data Request No. 1.10b, *and* Attachment O, Ameren's Response to Grain Belt Express Data Request No. 2.14.

[79] *See* Attachment O, Ameren's Response to Grain Belt Express Data Request No. 2.14.

[80] *Id*.

[81] 20 CSR 4240-22.010(2).

Ameren's failures as described throughout these Comments display Ameren's lack of interest in assessing resources that could reduce the potential for disaster when—not if—the next extreme weather event occurs. Specifically, Ameren has failed to consider the Project and the renewable resources it will interconnect as geographically diverse supply-side resources. It has failed to consider how it and its customers could benefit from accessing an advanced transmission system technology (like what the Project provides). Last, Ameren continues to over-rely on traditional energy sources that are quickly becoming outdated, more expensive, and too localized to solve for the energy supply that Missouri needs.

Respectfully submitted,

/s/ Andrew O. Schulte

Frank A. Caro, Jr. MBN 42094
Anne E. Callenbach MBN 56028
Andrew O. Schulte MBN 62194
Sean Pluta MBN 70300
Jared Jevons MBN 75114
Polsinelli PC
900 W. 48th Place, Suite 900
Kansas City, Missouri 64112
(816) 572-4754
fcaro@polsinelli.com
acallenbach@polsinelli.com
aschulte@polsinelli.com
spluta@polsinelli.com
jjevons@polsinelli.com

ATTORNEYS FOR GRAIN BELT EXPRESS LLC

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was filed on EFIS and sent by email on this 28th day of February, 2024, to all parties on the Commission's service list in this case.

/s/ Andrew O. Schulte

Andrew O. Schulte

ATTACHMENT A

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.2
Date of Response: 1/2/2024
Witness: N/A

Question:For purposes of drafting its IRP, and more specifically as it relates to Chapter 6 of the IRP, did the Company study supply-side resources outside of MISO? If so, please describe. If not, please describe why other resources were not studied.

Response:

Prepared By: Matt Michels
Title: Director, Corporate Analysis
Date: December 18, 2023

Ameren Missouri studies generic resources in its IRP, as required by the Commission's IRP rules. The Company did not explicitly analyze resources assumed to be outside of the MISO footprint.

ATTACHMENT B

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.3 C
Date of Response: 2/13/2024
Witness: N/A

Question:2.3 Please identify all changed circumstances and other factors that explain Ameren Missouri's
decision to model GBE as a resource option in its 2020 Triennial IRP but not in its 2023 Triennial IRP, especially in light of the facts that (1) the portfolio utilizing GBE was the second-highest scoring portfolio in the 2020 Triennial IRP and (2) the development, land acquisition, and regulatory approvals for GBE are significantly more mature in 2023 than they were in 2020.

Response:

Prepared By: Matt Michels
Title: Director, Corporate Analysis
Date: January 30, 2024

Since the filing of its 2020 IRP, Ameren Missouri determined that the best path for evaluation of specific renewable projects is to evaluate them as part of its implementation efforts, such as an RFP process, given that 1) the IRP process is focused on identifying generic resources or resource types for inclusion in the Company's preferred resource plan, 2) the implementation process is not constrained by the statutory deadlines that govern the IRP process, and 3) the Company had already established the potential viability of an option like GBX at a high level in its 2020 IRP.

(Note: The Company uses the abbreviation "GBX" for the Grain Belt Express project for consistency with its prior IRP materials)

ATTACHMENT C

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.3
Date of Response: 12/29/2023
Witness: N/A

Question:In Chapter 6, Section 6.1, the IRP section only references projects within the MISO queue. Why does this Section not include a discussion of renewable resources outside the MISO queue?

Response:

Prepared By: Matt Michels
Title: Director, Corporate Analysis
Date: December 18, 2023

Please see response to GB 1.2.

ATTACHMENT D

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.11
Date of Response: 1/11/2024
Witness: N/A

Question:The IRP provides several statements indicating that the Company is seeking to ensure reliable energy service for customers in all hours and under all conditions, including extreme weather (see for example Chapter 1, page 6).
a. Did the Company consider further investment in regional or alternatively interregional transmission to address such sustainability and resiliency concerns?
b. Did the Company consider investment in geographically diverse supply-side resources to support reliability? If the Company did not consider either or both of these investment strategies, explain why not.
c. Did the Company evaluate the resource adequacy impact associated with highly correlated renewable resources in its service territory? If not, why not?
d. In periods of time when solar projects in Ameren Missouri's "region" or "service territory" are not available, what generating facilities does the Company anticipate will serve its load?
e. How does the Company intend to address challenges associated with natural gas access during periods of extreme weather, particularly in the winter when demand for gas by residential heating customers is high?

Response:

Prepared By: Matt Michels
Title: Director, Corporate Analysis
Date: December 19, 2023

a. Yes, in conjunction with the addition of resources (both demand side and supply side) to ensure sufficiently reliable supply for meeting load. This is detailed in the discussion of the transmission system and transmission upgrades, including those needed to interconnect and deliver energy from new resources, included in Chapter 7 of the 2023 IRP. The costs to Ameren Missouri customers for investments expected as part of MISO's long-range transmission plan (LRTP) are included in the Company's IRP modeling, as are the costs for transmission system investments needed for new resource additions and retirements of existing resources.
b. Yes. While IRP analysis typically involves evaluation of generic resources, including generic resources across a multi-state region, without regard to location, the implementation of the Company's IRP preferred plan includes specific

consideration of the benefits of geographically diverse resources. This is discussed in Chapter 10 of the 2023 IRP on pages 9 and 18.

c. No. The Company does not expect to be able to implement the entirety of its planned renewable resources additions solely in its franchised service territory. Rather, it expects that resources will indeed be geographically dispersed. Selection and execution of projects will happen throughout the course of the planning horizon. Therefore, analysis of resource correlation due to geographic proximity was not performed for the IRP.
d. The Company's IRP analysis, including reliability analysis using Astrape's SERVM model, is performed at a portfolio level. As a result, the needs would be met with a diverse mix of resources whose output would vary depending on market and resource conditions at any given time, so specific dispatchable, storage and renewable resources that may operate at times of low solar production would vary at any given time.
e. Ameren Missouri includes the cost of firm natural gas transportation for new combined cycle gas generators and oil backup for new simple cycle gas generators. The Company also continues to consider the role that hydrogen may plan in generator reliability and emissions reductions.

ATTACHMENT E

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.6
Date of Response: 1/5/2024
Witness: N/A

Question:In Chapter 6, Section 6.1.2, the IRP section appears limited to potential wind projects within Ameren Missouri's region and/or within Missouri. Why does this Section not include a discussion of wind resources outside Ameren Missouri's region and Missouri?

Response:

Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: January 4, 2024

Ameren Missouri is focused on potential wind development in the "Ameren Missouri region" which for purposes of wind development can be defined as Missouri plus states bordering Missouri with projects that can demonstrate deliverability to the Ameren Missouri load (NRIS MISO interconnection). Consideration of new resource development might *start* with a focus on Missouri or Ameren Missouri's service territory specifically, but it certainly does not end there. Section 6.1.2 does include a map (Figure 6.7) that shows wind resource potential (capacity factor, existing and planned developments, and existing and planned transmission lines) across four states: Iowa, Illinois, Missouri, and Kansas. Section 6.1.2 also includes an overview of the MISO 2022 DPP cycle projects and a discussion of how many of those projects are planned for MISO Central or MISO South.

ATTACHMENT F

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.4
Date of Response: 12/29/2023
Witness: N/A

Question:In Chapter 6, Section 6.1.1, the IRP section appears limited to considering potential solar
resources within Ameren Missouri's service territory and/or within Missouri. Why does this Section not include a discussion of solar resources outside Ameren Missouri's service territory and Missouri?

Response:

Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: 12/20/2023

Ameren Missouri has not limited its consideration of potential solar resources to only Ameren Missouri's service territory or even just to Missouri. Consideration of new resource development might *start* with a focus on the AMO service territory, but it certainly does not end there. Section 6.1.1 does include a map (Figure 6.4) that shows solar resource potential (capacity factor, existing and planned developments, and existing and planned transmission lines) across multiple states – Missouri, Illinois, Iowa, and Kansas. Section 6.1.1 also includes a description of the Boomtown Solar project, which Ameren Missouri received regulatory approval to acquire in early 2023. This project is located outside of both the Ameren Missouri service territory and outside of Missouri. Ameren Missouri is also currently seeking a CCN for another project outside of its service territory, the Cass County solar facility in Cass County, Illinois – again demonstrating that the Company is in no way limiting its consideration of solar resources as this question suggests.

ATTACHMENT G

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.9
Date of Response: 1/2/2024
Witness: N/A

Question:Describe each reason the Company believes justifies the statement that "wind project opportunities in Ameren Missouri's region appear more limited than solar project opportunities."
a. Has the Company studied whether its conclusion that "wind project opportunities … appear more limited than solar project opportunities" is applicable to regions outside of "Ameren Missouri's region" or Missouri?
b. Unless the response to 1.9(a) is an unequivocal "no," what regions were studied and what were the conclusions of such studies?

Response:

Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: 12/20/2023

This statement is based on data collected by the Company through competitive solicitations (RFPs) for solar and wind projects, ongoing conversations with project developers in the Ameren Missouri region, and publicly available data about project and technology make-up of the MISO queue.

a. The Company is focused on pursuing wind and solar opportunities in the Ameren Missouri region, as defined in the Company's response to GB 1.6. To the extent that "studied" refers to the data gathering described above: yes, the Company has and continues to study opportunities for solar and wind across the broader Ameren Missouri region. The Company has not extensively studied solar and wind opportunities for regions *beyond* the Ameren Missouri region.
b. The Ameren Missouri region continues to be the area of focus for assessing future solar and wind opportunities, and the data collection described above is ongoing.

ATTACHMENT H

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.1 C
Date of Response: 2/13/2024
Witness: N/A

Question:2.1 Ameren Missouri's response to MECG 1.3 indicates "at the time of project implementation, GBE may be analyzed along with other specific wind projects." How does Ameren define "project implementation" in this response?

Response:

Prepared By: S. Hande Berk
Title: Manager, Electric Resource Planning
Date: January 31, 2024

'Project implementation' means that the Company is taking actions (e.g., issuing RFPs, reviewing RFP responses, negotiating contracts, applying for CCNs) to either purchase or build new near-term resources in its preferred plan consistent with assumed in-service dates.

ATTACHMENT I

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.2 C
Date of Response: 2/13/2024
Witness: N/A

Question:2.2 Per MECG 1.3, Ameren Missouri states that it did not conduct an analysis of GBE as a candidate resource option in the 2023 IRP filing and by way of justification, explains that "Ameren Missouri has analyzed generic wind resources in the IRP" and that "[a]t the time of project implementation, GBE may be analyzed along with other specific wind projects." Please explain why Ameren considers "generic wind resources" comparable to GBE and why Ameren would only compare GBE to "other wind projects" when high capacity solar or hybrid solar + storage may also be resource options interconnected to GBE?

Response:

Prepared By: S. Hande Berk
Title: Manager, Electric Resource Planning
Date: February 7, 2024

For its IRP analysis, the Company includes portfolios of resources, including wind, solar and battery storage. Implementation of such resources may involve locating combinations of these resources in close geographic proximity. That determination would be made as part of the implementation process.

ATTACHMENT J

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.10
Date of Response: 1/16/2024
Witness: N/A

Question:In Chapter 6, Section 6.1.2, the IRP section provides that "Ameren will also be evaluating
the potential for new wind (and other technologies) around its retiring generation station using the MISO generator replacement process or combining wind (or solar) with its existing combustion turbine generation facilities to leverage the transmission capacity."
a. Has the Company evaluated the suitability of those sites for hosting solar or wind facilities? If yes, please provide the evaluation.
b. How much suitable/buildable land exists in and around retiring generating stations to host large wind or solar facilities?
c. Does the Company anticipate that a generation tie line would be needed to interconnect renewable generation at the points of interconnection (POIs) associated with retiring combustion turbine generation facilities?
d. What would be the cost associated with such generation tie lines?
e. Has the Company incorporated the cost of generation tie lines into its supply side cost assumptions for local wind interconnecting to POIs associated with retiring generation?
f. Are there environmental mitigation issues in and around the retiring generation sites that would preclude siting wind or solar facilities on the same site?

Response:

Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: 1/12/2024

a. No.
b. Buildable land at retiring sites is limited. For the Meramec Energy Center, approximately 86 acres are available (avoiding coal ash). At the Rush Island Energy Center site, approximately 127 acres are available (avoiding coal ash).
c. Most likely yes, dependent on the specific details of the site and project.
d. The cost of a generation tie line will be dependent on the specific details of the site and project.
e. Supply side cost assumptions for solar and wind utilized in the IRP include generic assumptions for interconnection costs.

f. All sites have unique environmental mitigation requirements, some of which may impact solar or wind development. At this time no sites have been specifically ruled out due to environmental mitigation issues.

ATTACHMENT K

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.15
Date of Response: 1/16/2024
Witness: N/A

Question:In Chapter 7, Section 7.1.4, the Company notes high level interconnection costs "do not include costs for non-MISO affected systems."
a. Given the significant and well documented costs associated with affected system upgrades for MISO generators, why did the Company choose to exclude these costs from its analysis?
b. Is the Company able to include an adder to its supply side resource options that includes an average estimate of affected system upgrade costs for all generation types? If so, please provide.

Response:

Prepared By: Justin Davies
Title: Director, Transmission Planning
Date: January 11, 2024

a. To clarify, non-MISO affected systems represent neighboring transmission systems, which are neither Ameren owned nor part of MISO. Each of these entities have their own Planning criteria and interconnection processes. They are responsible for studying the impact to their system due to the connection of generators within the neighboring MISO system. We do not have adequate information to determine the non-MISO affected system upgrade costs. The cost to connect varies based on the MW amount of the GI, the POI, the higher queued generation, the other GIs in the same DPP and the topology of the models used. The cost is unknown and can vary greatly. It can be a small amount, if the GI is not too big and at a POI with greater outlet capability or it can be a large amount if the GI MW amount significantly exceeds the capability at the chosen POI. The affected system is responsible to determine that in the interconnection process.

b. No, we are not able to include an average estimate of non-MISO affected system upgrade costs; there are too many variables, including type, size, available transmission capacity, number of generators in the queue, potential connection points, potential generation retirements, MISO queue reform, and too many of them are unknown to make an estimate.

ATTACHMENT L

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.12 C
Date of Response: 2/16/2024
Witness: N/A

Question:2.12 In response to GB 1.15 Ameren Missouri states that it did not include affected system
upgrade costs in its supply side analysis because, "[t]he cost is unknown and can vary greatly." Please answer the following questions with regard to that response:
a. 20 CSR 4240-22.040, Supply-Side Resource Analysis, Section (3) states, "The utility shall describe and document its analysis of the interconnection and any other transmission requirements associated with the preliminary supply-side candidate resource options identified in subsection (2)(C)." and that the "… purpose of this analysis shall be to ensure that the transmission network is capable of reliably supporting the preliminary supply-side candidate resource options under consideration, that the costs of the transmission system investments associated with preliminary supply-side candidate resource options, as estimated pursuant to 4 CSR 240-22.045(3), are properly considered and to provide an adequate foundation of basic information for decisions…" (emphasis added). Please explain how excluding affected system upgrade costs, costs which fall directly under the definition of "transmission system investments associated with supply side candidate resource options" is consistent with the requirements under 20 CSR 4240-22.040.
b. If the costs are unknown and can vary, it is Ameren Missouri's position that all those costs (which will eventually be paid for via ratepayers) should be excluded from its analysis? Said another way, if the costs are difficult to estimate, it is Ameren Missouri's position that they should be zero?

Response:

Prepared By: Justin Davies
Title: Director, Transmission Planning
Date: February 2, 2024

The question mischaracterizes Ameren Missouri's response to GB 1.15, which stated non-MISO affected system upgrade costs are not included.

a. Ameren Missouri has estimated interconnection costs for new resources as contemplated by the referenced rules above and provided those in Chapter 7 of the 2023 IRP filing as well as in response to data requests.
b. Ameren Missouri's position is that trying to include the non-MISO affected system upgrade costs would add no value to the IRP analysis of generic resources.

ATTACHMENT M

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 1.16
Date of Response: 1/16/2024
Witness: N/A

Question:In Chapter 7, Section 7.1.6 "Advanced Transmission System Technologies" the Company notes "Flexibility will be key to maintaining reliable service in the face of various uncertain future scenarios." Has the Company conducted an analysis of the flexibility benefits associated with highly-controllable high voltage direct current (HVDC) systems, including but not limited to (1) resource diversity value; and (2) costeffective blackstart capability, as outlined in Schedule AP-2 in Docket No. EA-2023-0017? If yes, please provide the analysis. If no, explain why this analysis was not conducted.

Response:

Prepared By: Justin Davies
Title: Director, Transmission Planning
Date: January 10, 2024

Ameren as a company has looked at HVDC systems as a future possible technology, along with discussions with manufacturers and a site visit to an HVDC facility, which had blackstart, grid forming technology. However, our understanding and application of the technology is not mature. Ameren was involved in the MISO study of the HVDC system of Grainbelt, both the HVDC interconnection (H104, H105) and the generation interconnection system study for DPP2019.

(1) For the HVDC interconnection of Grainbelt, the interconnection is a one-way lead line from a wind farm in Kansas. Having another blackstart unit added to the Ameren system could potentially be beneficial, assuming that the source of energy is there when it is needed. A wind farm typically has a less than 50% availability, which limits it functionality as a blackstart unit, which requires availability approximating 100%. An optimal placement of a blackstart resource is one that is close to the load, with a fuel source that is available even if the grid is non-functional. The existing blackstart resource for the Ameren system is located to the West of the system, so geographically having another black start system on the North, South, Central would provide the most geographical diversity and benefit the customers the most. Having an interconnection that spans the Eastern Interconnection into the Western Interconnection or ERCOT, could provide a highly reliable blackstart path, however Grainbelt is situated

entirely within the Eastern Interconnection, so it is possible that if the entire eastern connection blacked out, it would be able to provide blackstart service as long as the wind farm had wind generation, had its own available blackstart capability and also had grid forming inverters.

Ameren is currently studying a future additional blackstart resource but has not made any firm decisions. The estimates to add that capability to existing or future Ameren units are less than a $50 million.

ATTACHMENT N

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.13 C
Date of Response: 2/16/2024
Witness: N/A

Question:2.13 In response to GB 1.11(e), which asked how Ameren Missouri intends to address gas availability in the winter when demand for gas by residential heating customers is high, Ameren Missouri responded that it includes the cost of firm natural gas transportation for new combined cycle gas generators and oil backup for new simple cycle gas generators in its assessment of supply side resources.
a. Please explain if, under the firm gas contracts, residential heating customers still would be prioritized in the event of a fuel shortage. If yes, please revise Ameren's response to GB 1.11(e). If no, please provide additional details on this product/contract.
b. Please explain how many hours of oil backup would be available to new simple cycle gas generators.

Response:

Prepared By: Trevor Pettus | Thomas P Callahan
Title: Director, Energy & Fuel Management | Director, Combined Cycle Execution
Date: February 5, 2024

a. Interstate pipeline transportation and storage rights for residential heating customers are contracted for separately from natural gas used for electric generation. The Company's gas supply plan for electric generation is set up to satisfy generation needs irrespective of gas used for residential heating customers' peak load. It is possible that in extreme circumstances electric or gas requirements could be prioritized for human needs through special requests.

b. Ameren Missouri's current simple cycle gas turbine project in development will be designed for 72 hours of fuel oil back-up with all engines operating at full load.

ATTACHMENT O

Ameren Missouri
Case Name: EO-2024-0020
Docket No(s): 2023 IRP

Response to Discovery Request: GB-GB 2.14 C
Date of Response: 2/16/2024
Witness: N/A

Question:2.14 With reference to Ameren Missouri's response to GB 1.10(b), how much of the land listed
as available (86 acres at Meramec and 127 acres at Rush Island) is actually buildable? Please provide an analysis that explains how many megawatts of generation capacity this acreage translates to for a wind project or a solar project.

Response:

Prepared By: Lindsey Forsberg
Title: Strategy Consultant, Renewable Energy Development
Date: February 6, 2024

The acres listed in response to GB 1.10(b) reflect expected buildable acreage (86 acres at Meramec, 127 acres at Rush Island).

For a solar facility, assuming 5-10 acres per MW, the sites could hold roughly the following:

Meramec – approximately 9 to 17 MW
Rush Island – approximately 13 to 25 MW

Placing a wind facility on either physical site would not be practical given the acreage requirements of approximately 60-100 acres per MW.