2022 Integrated Resource Plan Update

Ameren MISSOURI

1. Executive Summary

Ameren Missouri continues to execute on the preferred resource plan presented in its June 2022 Notice of Change in Preferred Resource Plan filing.[1] Our plan is focused on transitioning our generation fleet to a cleaner and more fuel diverse portfolio in a responsible fashion and achieves reductions in carbon dioxide (CO_2 or carbon) emissions of 60 percent by 2030, and 85 percent by 2040 compared to 2005 levels, with a goal of achieving net-zero carbon emissions by 2045. The plan includes continued customer energy efficiency program offerings, retiring three of our four coal-fired energy centers by the end of 2030, accelerating the retirement of 1,800 MW of gas-fired peaking generation, adding efficient natural gas-fired combined cycle generation by 2031, accelerating our expansion of renewable generation, with the addition of 2,800 MW of renewable generation by 2030 and reaching total wind and solar generation of 5,400 MW by 2040, and deploying 800 MW of battery energy storage by 2040. By executing our plan, we will ensure that our customers' long-term electric energy needs are met in a safe, reliable, cost-effective and environmentally responsible manner.

Key steps that Ameren Missouri has taken since the filing of our 2020 triennial Integrated Resource Plan (IRP) include:

- Acquired 400 MW High Prairie wind facility in northeast Missouri in December 2020 and 300 MW Atchison wind facility in northwest Missouri in January 2021.
- Filed an application with the Missouri Public Service Commission (MPSC) for a certificate of convenience and necessity (CCN) for the 200 MW Huck Finn solar project to comply with Missouri's Renewable Energy Standard (MoRES).
- Filed an application with the MPSC for a CCN for the 150 MW Boomtown solar project and approval of our proposed Renewable Solutions Program, which, if the Program is approved, will provide subscribers (municipalities and large customers are eligible) with the ability to source all or a portion of their energy from renewable sources and, that in any event, provides Ameren Missouri with additional renewable energy resources to meet customer needs in the long-term as part of transitioning our generation fleet.
- Applied and received approval for two, one-year extensions for the energy efficiency programs and the addition of demand response programs under the Missouri Energy Efficiency Investment Act (MEEIA), which extended the current MEEIA cycle through 2023.

[1] Ameren Missouri filed its Notice of Change in Preferred Resource Plan on June 22, 2022, pursuant to 20 CSR 4240-22.080(12), in File No. EO-2022-0362.

- Continued to implement customer energy efficiency and demand response programs to provide customers with the ability to manage their use of energy and reduce their energy bills.
- Continued projects to close coal ash basins.
- Published our report on climate-related risks, *Committed to Clean: Transformational Changes Toward Net-Zero*, in May 2021.
- Continued to implement our Smart Energy Plan pursuant to Missouri Senate Bill 564, passed in 2018. This forward-looking plan is designed to replace aging infrastructure and modernize the electric grid for the long-term benefit of our customers. The plan includes $8.4 billion of electric infrastructure investments from 2022 through 2026 that, among other things, accelerates our upgrades of aged infrastructure, invests in smart grid technologies, and supports the transition to renewable energy as we build the grid of the future, while keeping electric rates stable and affordable. The plan also accelerates smart energy infrastructure construction that is driving job creation and economic development in Missouri.

As we continue to execute on our plan, we are mindful of events and evolving issues that could impact our future planning. These include the following:

- Passage of climate-related legislation in the United States (U.S.) Congress – Congress passed the Inflation Reduction Act (IRA) in August 2022, which includes provisions to support the transition of the U.S. generation fleet to cleaner energy sources and reduce CO_2 emissions. These include extensions and expansions of clean energy tax credits to support the development of new renewable, nuclear and other clean energy resources, and the development of energy storage resources. The IRA also includes nuclear production tax credits (PTCs) to support the continued operation of existing carbon-free baseload nuclear generation.
- Continued steps to retire Rush Island Energy Center – In December 2021, the Company announced it would retire its Rush Island Energy Center rather than install expensive pollution controls that would otherwise be required pursuant to an August 2021 federal court decision. The MidContinent Independent System Operator (MISO) determined that the Rush Island units should remain available to ensure the reliability of the transmission system, until such time that the necessary transmission upgrades could be implemented. MISO has filed the System Support Resource (SSR) agreement with FERC. In addition to the MISO filing, Ameren Missouri filed with FERC for recovery of its fixed costs associated with maintaining Rush Island's availability in the market. This SSR determination was communicated to the U.S. District Court, and Ameren Missouri anticipates a revised opinion from the court that recognizes the need for reliability-based operating commitments. The Company has reflected expected retirement of Rush Island by the end of 2025 in its updated preferred plan filed in June. Any changes

regarding the expected operation and retirement of Rush Island will be discussed and analyzed as part of the preparation of the Company's 2023 IRP.

- Illinois clean energy legislation – In September 2021, the Illinois General Assembly passed the Climate and Equitable Jobs Act (CEJA), which includes provisions requiring the phasing out of fossil-fueled generation by 2045 and affects gas-fired peaking generation units owned by Ameren Missouri and located within Illinois. The Company's recently updated preferred resource plan reflects the requirements of CEJA, including unit-level limits on emissions based on historical emissions for the period 2018-2020. The updated preferred plan also reflects retirement of the Venice Energy Center by the end of 2029 (due to its proximity to an environmental justice community) and the retirement of all other Ameren Missouri gas-fired energy centers in Illinois by the end of 2039 as a result of stringent emission rate reduction requirements that would effectively render these units un-operable.
- More robust assessment of reliability needs – While Ameren Missouri is meeting its obligations in MISO to ensure sufficient resources are available to serve our customers' needs, MISO's planning resource auction (PRA) results for planning year 2022-2023 indicated a broader shortfall of capacity under MISO's current resource adequacy (RA) construct and resulted in capacity prices set at the cost of new entry (CONE). MISO also filed a proposed seasonal capacity construct with the Federal Energy Regulatory Commission (FERC) in late 2021 that would adopt a more granular approach to RA and better ensure year-round reliability and received FERC approval in August 2022. Ameren Missouri included consideration of MISO's proposed seasonal construct in analysis supporting the Company's recent change in preferred plan. Ameren Missouri has also performed more detailed reliability analyses in support of its new preferred plan with the help of Astrapé Consulting. The Company continues to evaluate reliability needs and the resources that will be necessary to ensure reliable year-round service for our customers.[2]
- Energy market volatility – Recent world events have contributed to volatility in energy markets, including natural gas and electricity. As part of its analysis supporting the Company's recent change in preferred resource plan, Ameren Missouri revised its scenario probabilities for its key power price drivers – natural gas prices and carbon prices – and affirmed its long-term assumptions for capacity prices. We continue to monitor and evaluate changes in the market and will reflect any further changes in assumptions as part of the development of the Company's 2023 triennial IRP filing.

[2] File No. EO-2022-0054 1.F

Because resource planning is an ongoing process, we continually monitor and assess the planning environment and how it may affect our continued resource planning. One of the hallmarks of our planning process is maintaining flexibility to respond to changing conditions, mitigate risk, and take advantage of opportunities on behalf of our customers. Should Ameren Missouri determine that changes to some portion or portions of our preferred plan are appropriate, we will make such determinations in the context of our overall strategy and planning objectives, and in accordance with the MoPSC's IRP rules. We will continue to pursue the transition of our resource portfolio to one that is cleaner and more fuel diverse in a responsible manner that benefits customers, shareholders, the environment, and the communities we serve.

2. Compliance Overview

2.1 Purpose of Annual Updates

Annual updates are required by 20 CSR 4240-22.080(3). The rules indicate that the purpose of annual updates is to ensure that members of the stakeholder group have the opportunity to provide input and to stay informed regarding the items listed below.

- The utility's current preferred resource plan (see section 1)
- The utility's progress in implementing the resource acquisition strategy (see section 2.3)
- The status of the identified critical uncertain factors (see section 3.7)
- Analyses and conclusions regarding any special contemporary issues identified by the Commission (see Compliance References at the end of this report for the location of specific discussion on each issue)

Ameren Missouri has created this annual update report to satisfy the intended purpose established in the IRP rules and has updated its assessment of general planning conditions. Each item explicitly cited in the rules is addressed in the referenced chapter or section of this report as noted above.

2.2 Ameren Missouri's Approach to its Annual Update

In its Order in File No. EO-2012-0039 establishing special contemporary issues to be evaluated by Ameren Missouri in its 2012 IRP Annual Update, the Commission noted that, "the requirement to examine special contemporary issues should not be allowed to expand the limited annual update report into something more closely resembling a triennial compliance report." The Commission continues to adhere to this view regarding annual updates. Ameren Missouri agrees with the Commission that the scope and depth of an IRP Annual Update should not be comparable to that for a triennial IRP filing. Also,

in its Order in File No. EO-2022-0054 establishing special contemporary issues for Ameren Missouri's 2022 IRP Annual Update, the Commission stated if the Company believes it has already adequately addressed some of these issues in its IRP filing or some other filing, then it does not need to undertake any additional analysis because of the special contemporary issue designation. The Commission stated the same approach is acceptable if the Company intends to address any of the issues in a future triennial IRP filing.

On that basis, Ameren Missouri has relied heavily on the groundwork developed in its 2020 IRP and its 2022 Notice of Change in Preferred Resource Plan as a basis for reviewing its assumptions and analysis and reporting its findings.

The Company also views the IRP Annual Update in its proper role as just that, an update on the nature of key variables and the conclusions that follow. Based on the conclusions drawn from the review and analysis discussed here, the Company believes that its preferred resource plan, as presented in its 2022 Notice of Change in Preferred Resource Plan filing, is still appropriate at this time. Should the Company's continued planning and consideration of relevant issues lead to a conclusion that its Preferred Resource Plan is no longer appropriate and should be replaced with a new Preferred Resource Plan, the Company will notify the Commission of its decision in accordance with 20 CSR 4240-22.080(12).

2.3 Implementation of Current Preferred Resource Plan

Ameren Missouri adopted a new preferred resource plan with its 2022 Notice of Change in Preferred Resource Plan filing. In that filing, the Company indicated that its new Preferred Resource Plan includes the addition of 2000 MW of new wind generation and 2700 MW of new solar generation and implementation of energy efficiency and demand response programs, as well as continued pursuit of demand side management (DSM) programs throughout the entire planning horizon at the Realistic Achievable Potential level. The Company also indicated that the implementation of future programs will depend on policies that reflect timely cost recovery, proper alignment of incentives, and appropriate earnings opportunities, as required by the MEEIA. Also included in the filing was an updated implementation plan. Following is an item-by-item update on the status of the implementation steps listed in the Company's 2022 preferred plan change filing.

Demand-Side Resources Implementation

Ameren Missouri operates its DSM programs under MEEIA. MEEIA requires that utility incentives for DSM programs be aligned with comparable supply side investments in order to help customers use energy more efficiently. MEEIA does this by providing for the timely recovery of program costs, the elimination of the throughput disincentive and

creating performance incentive earnings opportunities for successful program implementation.[3]

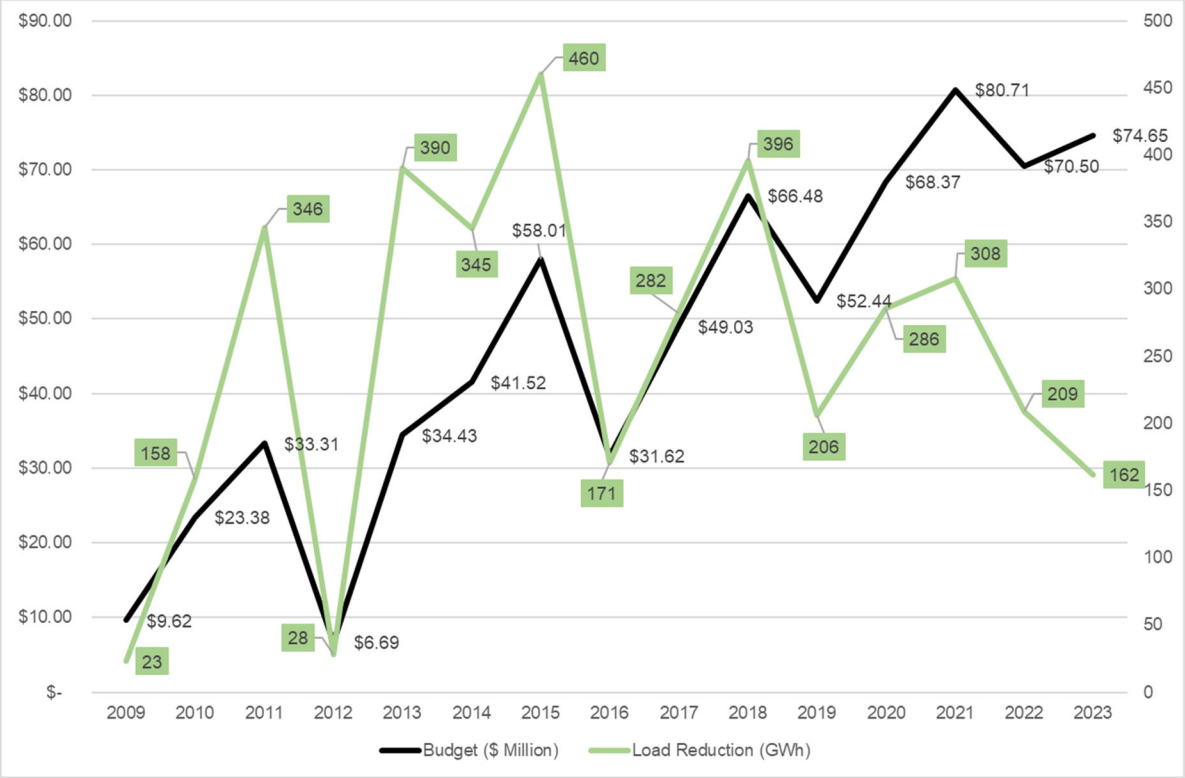
Ameren Missouri has successfully operated DSM programs to the benefit of customers since 2009, consistent with the goals of MEEIA and guidance from the Commission.[4] Figure

Figure 2.1 provides the incremental annual net load reductions and the associated program budgets for each year.

In 2018, Ameren Missouri received continued support from the Commission via approval of its third MEEIA cycle, covering the period 2019 to 2021 for its residential, business and demand response programs and the period 2019-2024 for its low-income programs. On August 5, 2020, the Company received approval to extend its current MEEIA cycle to program year 2022 (PY22), for all programs and on October 27, 2021, the Company received approval to extend its current MEEIA cycle to program year 2023 (PY23). Combined, approvals in EO-2018-0211 represent the largest commitment to DSM in the state of Missouri to date.

[3] In recent years, the Commission has provided additional guidance, noting that utilities should "be endeavoring to increase customer participation in energy efficiency programs" and recognized that "benefits from a reduction in a customer's bill is not the only benefit to customers. There are also societal benefits, such as improved health and safety, investment in local economies, and local job creation." See File No. EO-2019-0132, Final Report and Order dated December 11, 2019, at ¶ 36 and ¶ 39.
[4] 2012 served as a "bridge" year, between the Company's pre-MEEIA programs and the Company's post-MEEIA programs.

Figure 2.1: Annual DSM Program Budgets and Load Reductions



Note: This figure was originally provided as 8.4 in Chapter 8 of the 2020 IRP. It has been updated to include actual savings for program year 2020. Values for 2021 - 2023 represent net as filed values approved as part of program filings.

Ameren Missouri has successfully implemented the first three years of this program cycle, for 2019, 2020[5], and 2021, meeting or exceeding its portfolio savings targets in the first two years, and nearly meeting the target in the third.

Table 2.1 and Table 2.2 provide the final net energy and demand savings, respectively, as determined by the independent evaluator, Opinion Dynamics.

Table 2.1: Net Energy Savings Compared to Goal, 2019, 2020 and 2021 (MWh)

	2019			2020			2021		
	Goal Net Savings (MWH)	Ex Post Net Savings (MWH)	% of Goal	Goal Net Savings (MWH)	Ex Post Net Savings (MWH)	% of Goal	Goal Net Savings (MWH)	Ex Post Net Savings (MWH)	% of Goal
Low Income	10,443	4,382	42%	13,858	12,560	91%	15,202	9,939	65%
Residential	112,823	118,985	106%	119,700	153,592	128%	116,246	153,321	132%
Business	78.696	83,458	107%	152,847	120,206	79%	204,544	145,141	71%
Portfolio Total	201,962	206,824	102%	286,405	286,358	100%	335.992	308,402	92%

Table 2.2: Net Demand Savings Compared to Goal, 2019, 2020 and 2021 (MW)

[5] During the COVID-19 pandemic in 2020, the Company modified many of its program offerings to ensure the safety of both customers and contractors, while also focusing on maintaining its best in class program delivery.

	2019			2020			2021		
	Goal Net Savings (MW)	Ex Post Net Savings (MW)	% of Goal	Goal Net Savings (MW)	Ex Post Net Savings (MW)	% of Goal	Goal Net Savings (MW)	Ex Post Net Savings (MW)	% of Goal
Low Income	2	1	42%	3	3	89%	4.06	2.06	51%
Residential	57	53	92%	74	77	104%	49.40	54.37	110%
Business	44.37	72	162%	89	91	101%	52.39	45.55	87%
Portfolio Total	104	126	121%	167	171	102%	105.85	101.98	96%

Opinion Dynamics found that these programs delivered net lifetime benefits to customers of more than $174, $205, and $184 million in 2019, 2020, and 2021, respectively, as measured by the Total Resource Cost (TRC) test.

These programs incentivized:

- Over 8.5 million LED bulbs
- Over 40,000 residential HVAC systems
- Over 50,000 learning thermostats
- Over 60,000 school kits
- Measures at over 7,000 income eligible homes and tenant units, and
- Over 8,000 projects at commercial and industrial facilities.

Opinion Dynamics also found that Ameren Missouri's low-income programs saved an average of 17 percent and 23 percent on customer bills, for the single-family and multi-family programs, respectively.

In 2020 and 2021, the Company also made important progress with respect to co-delivering its multi-family and single-family low-income programs, by partnering with natural gas utilities. Notably, the programs have been able to offer incentives that cover up to the full replacement cost for an inefficient natural gas furnace. By partnering on the front end and aligning incentives, the co-delivery program creates important synergies, which provide significant benefits for low-income customers and increases the likelihood of program adoption by residents and multi-family property owners.

Ameren Missouri continues to work with its stakeholders and customers to expand and refine its program offerings. Select highlights include but are not limited to:

- In January 2021 the Company launched its new on bill financing program known as the "Pay As You Save" (PAYS®) program, making it among the first investor owned utilities in the country to do so.[6] The Company currently has approval to offer this innovative new program through 2023. In 2022, the Company launched co-delivery of the program with gas utilities.
- Beginning in 2022, the Company transitioned its current lighting program to become a dedicated low-income program, with a specific purpose of reducing the gap in the penetration and saturation of LED lightbulbs between market rate and low-income customers. This gap was first identified in the 2020 Market Potential Study. The new targeted community lighting program will provide discounted bulbs in community retailers, in zip codes within the Ameren Missouri service territory where at least 30 percent of the population is at or below 200 percent of the Federal Poverty Level as defined by the U.S. Census Bureau American Community Survey.
- In 2020, the Company launched a new midstream HVAC program. The midstream program provides rebates directly to equipment distributors for high efficiency units (defined as those central air conditioners or heat pump units with a seasonal energy efficiency rating (SEER) greater than 18), with the intent to drive changes in stocking patterns and help accelerate market transformation. Opinion Dynamics found that distributors "have already made stocking changes and are also optimistic, expecting to make even bigger stocking changes next year."[7]

Renewables

In February 2022, Ameren Missouri finalized a build-transfer agreement with developer Invenergy for the 150 MW Boomtown Solar Project located in White County, IL. An application for a CCN for the project was filed with the PSC on July 14, 2022. In addition to supporting the execution of the generation transition plan, the project is initially intended to support the Renewable Solutions Program, a voluntary renewable energy purchasing program for commercial, industrial, and governmental customers. The Boomtown Solar Project is expected to be in service by the end of 2024.

In June 2022, Ameren Missouri finalized a build-transfer agreement with developer EDF to acquire the 200 MW Huck Finn Solar Project, located in Audrain and Ralls Counties in Missouri. The Huck Finn Solar Project is necessary for ongoing compliance with the

[6] On August 5, 2020, the Commission approved a unanimous stipulation and agreement in File No. EO-2018-0211. Chapter 8 of the 2020 IRP provides an overview of some of the program changes anticipated for PY22.
[7] See Opinion Dynamics, "Ameren Missouri Program Year 2020 Annual EM&V Report. Volume 2: Residential Portfolio Report", June 10 2021, at p. 33.

MoRES. A CCN application for the project was filed with the PSC on July 7, 2022, and the project is expected to be in service by the end of 2024.

Ameren Missouri recently solicited competitive proposals from renewable energy developers through a request for proposal (RFP) process for regional wind and solar projects of at least 100 MW in size to support the continued execution of the generation transition plan. Ameren Missouri is currently evaluating the project bids received as part of this RFP. The Company expects to file several CCN applications annually as competitive wind and solar projects are developed and acquired on behalf of our customers.

Meramec Energy Center

Ameren Missouri is on track to retire the Meramec Energy Center by the end of 2022. Necessary steps have been implemented to facilitate retirement, including the implementation of required transmission system upgrades, the closure of several ash ponds, the construction of a new storm water retention basin, and the demolition of a barge unloader. The Company has also made all required notifications to MISO. Plans have been made to safely secure the main power block in 2023, close two remaining ash ponds, and demolish numerous yard structures by the end of 2024.

Rush Island Energy Center

In August 2021, the U.S. Eighth Circuit Court of Appeals (Appellate Court) affirmed in part the prior ruling of the U.S. District Court of the Eastern District of Missouri (District Court), which had found that certain projects implemented at the Rush Island Energy Center had violated the New Source Review (NSR) provisions of the Clean Air Act (CAA). The Company carefully evaluated options in light of the court opinion and announced in December 2021 that it had decided to retire the Rush Island Energy Center as soon as required transmission system upgrades could be implemented. Discussions are currently ongoing between Ameren Missouri and the U.S. District Court to determine a final retirement date. The Company expects to operate the plant as necessary to support grid reliability as outlined by MISO and agreed upon by the U.S. District Court. Final shutdown and decommissioning plans will be developed and implemented once a retirement date is finalized.

Environmental

The Company continues to implement its plan to safely close ash basins. As part of that plan, dry fly ash systems and new wastewater treatment plants have been implemented at Labadie, Rush Island, and Sioux Energy Centers. A new state-of-the-art ash basin

cover system was recently completed at Rush Island, while similar projects at Labadie, Sioux, and Meramec are on-target to be completed this year and through 2023. An industry-leading groundwater remediation pilot project was installed at Rush Island in late 2020, with the full-scale project completed in 2022. Similar projects are now being designed and constructed at Sioux and Labadie Energy Centers. Sioux's treatment facilities are on schedule to be complete by the end of 2022, with Labadie following.

3. Planning Environment

3.1 Federal and State Energy and Climate Policy

Federal Energy and Climate Policy

Since the filing of our 2020 triennial IRP, the federal policy landscape has been influenced by the changes in control of the U.S. Congress and the presidency. Addressing climate-change is a top priority for the Biden administration, and the Democrat controlled Congress. Given this priority, the U.S. rejoined the Paris Agreement and committed to an economy-wide 50 percent to 52 percent reduction of carbon emissions by 2030, with an ultimate goal of achieving net-zero carbon emissions by 2050. In light of this commitment, the Biden administration and other policymakers have called for the power sector to reduce its carbon emissions far more aggressively than other sectors of the economy. Notably, the power sector is being called on to achieve net-zero carbon emissions by 2035 and reduce carbon emissions by 80 percent below 2005 levels by 2030.

To support achievement of these goals, Congress recently passed the Inflation Reduction Act, which includes significant incentives for the further development and operation of carbon-free electric generation and storage resources, including the following:

- Extends the availability of PTCs for projects beginning construction through 2032
- Restores the availability of PTCs for solar projects
- Extends the availability of clean energy Investment Tax Credits (ITCs) for projects beginning construction through 2032
- Expands the availability of the ITC for stand-alone energy storage projects
- Provides for enhanced credits for new clean energy projects placed in low-income communities or at former coal power plant sites
- Creates a new nuclear production tax credit for existing nuclear generators of up to $15/MWh for the years 2024-2032
- Creates a clean hydrogen tax credit for clean hydrogen production facilities constructed before January 1, 2032
- Provides options for direct pay of credits and opting out of tax normalization provisions

The IRA also provides for transferability of credits between tax-paying entities. In most cases a base level credit is available as well as a bonus credit level if certain conditions are met with respect to domestic manufacturing and prevailing wages. Clean energy PTCs and ITCs are subject to an earlier phase-out if CO_2 emissions reach a 75% reduction from 2022 levels. The IRA also includes tax provisions supporting the adoption of electric vehicles and energy efficiency measures.

While passage of new statutes has provided greater support for the transition to cleaner energy and a decarbonized economy, we are mindful of the continuing trend in sentiment among customers, investors, policy makers and the general public toward achieving cleaner energy resources as quickly as possible. As we continue to monitor the policy landscape and consider potential impacts on our resource decisions, we must consider that while further specific policy proposals may or may not come to fruition, the drivers of policy continue to point toward a cleaner and more sustainable energy future. As a result, we must continue to execute on our planned transition to best position our portfolio for success and ensure the benefits of reliable, affordable, and sustainable service for our customers now and in the future.

State Energy and Climate Policy

In September 2021, the Illinois General Assembly passed the Climate and Equitable Jobs Act. The law includes requirements for emissions reductions from fossil-fueled generators, among other provisions. CEJA includes emission limits on fossil-fueled units based on actual emissions for the period 2018-2020 and enforced on a rolling 12-month basis, with exceptions for emergency operation to support grid reliability. It also includes requirements for eliminating CO_2 emissions from fossil-fueled units. Based on the Company's review of the statutory requirements, this effectively requires the retirement of simple cycle gas-fired combustion turbine generators (CTGs) by January 1, 2040. Accelerated emission reduction requirements are imposed on units near statutorily defined Environmental Justice Communities. This provision affects Ameren Missouri's Venice Energy Center, which effectively requires retirement of its units by January 1, 2030. The Company's recently filed Notice of Change in Preferred Resource Plan reflects retirement of Venice by the end of 2029 and all other Ameren Missouri CTGs in Illinois by the end of 2039.

3.2 Environmental Regulations

Ameren Missouri has reviewed its assumptions on the eventual requirements for pending environmental regulations. Table 3.1 summarizes the current and pending environmental

regulations for which Ameren Missouri may need to implement mitigation measures, along with expectations for compliance requirements for certain potential regulations.

Ameren Missouri has made significant investments to comply with existing environmental regulations and maintain a sufficient compliance margin. Rules proposed or promulgated since the IRP filing in September of 2020 include revisions to the ozone season allowances under Cross-State Air Pollution Rule (CSAPR), final attainment designations for the national ambient air quality standards for ozone, revisions to the Coal Combustion Residual Rule, and implementation by Missouri of the Regional Haze Rule.

Table 3.1: Current & Pending Environmental Regulations

Regulatory Driver	Summary Requirements	Regulation Status	Compliance Timing
Current CSAPR Regulation	Created Group 3 Ozone Season Allowance Program for 12 states including IL reducing NOx ozone season banked allowances and allowance allocations for IL sources	Revised CSAPR Update was published on 4/30/2021 and went into effect on 6/29/2021. The rule reduces seasonal NOx allocations for IL EGUs for the 2021 ozone season and again in 2022 and 2023.	2021 ozone season and beyond
Proposed CSAPR Changes for 2015 Ozone Standard	Requires 26 states (including MO) to reduce NOx emissions that contribute to ozone pollution in other states.	Changes to CSAPR were proposed on April 6, 2022 and comments were requested. The EPA received 50,000 individual comments on the proposed rule. EPA's regulatory schedule includes promulgation of a final rule by March 2023 with compliance required beginning in the 2023 ozone season.	2023 ozone season and beyond
Revisions to National Ambient Air Quality Standards (NAAQS)	Lower PM, NOx and SO2 limits; Expansion of non-attainment areas	SO2 final rule June, 2010; EPA proposed redesignation from "unclassifiable" to attainment for area around Labadie based on 2017-2019 data; Redesignation of Jefferson County to attainment pending final action.	SO2: 2017 - 2020
		Fine particulate (PM2.5) lowered 1/15/2013; Attainment designations 03/2015; Missouri in attainment. EPA retained the current 12 mg/M3 standard in 2020. EPA announced it would conduct another review of the standard beginning in 2021.	PM2.5: 2025 - 2028

		Ozone standard lowered, final rule 12/2015; Attainment designations complete April 2018; EPA proposed to retain the standard in 2020. EPA announce it would reconsider that decision in 2021 under an executive order.	EPA proposed to retain standard in 2020
		St. Louis/Metro East area is a marginal nonattainment for the 2015 ozone standard and size of area was reduced. EPA proposed to bump up the St. Louis/Metro East ozone non attainment area to moderate nonattainment in 2022.	Ozone SIP for the St. Louis moderate non-attainment area will be required in early 2023
Mercury and Air Toxics Standards (MATS)	Reduction in emissions of Mercury, HCl (proxy for acid gases) and particulate emissions (proxy for non-mercury metals)	Final rule effective April 16, 2012. Compliance required by April 16, 2015.	Rush Island and Sioux Energy Centers compliant on Apr 16, 2015; Labadie and Meramec (units 3 & 4) Energy Centers received MDNR approved 1-yr extensions and compliant on Apr16, 2016.
Clean Air Visibility Rule (CAVR)/Regional Haze Rule	Application of Best Available Retrofit Technology (BART); Targets reduction in transported SO2 and NOx; status of CSAPR may require state to change approach.	EPA issued revisions in Jan 2017 and guidance in 2018; MO working with affected sources and federal land managers to develop an approvable state plan in early 2021. States submit plans for second compliance period in 2021.	MDNR consulting with Federal Land Managers on a draft state plan. Missouri state plan expected to be submitted in 2022.

Regulatory Driver	Summary Requirements	Regulation Status	Compliance Timing
Clean Water Act Section 316(a) Thermal Standards	Implementation through NPDES permit conditions	Evaluation covered by NPDES permits	New thermal requirements implemented at Labadie; other plants contain similar requirements in existing NPDES permits.
Clean Water Act Section 316(b) Protection of Aquatic Life	Case-by-case determination of controls required to meet entrainment standards; national standard for impingement	Studies 2015 - 2017; Compliance 2022 - 2024	Labadie NPDES Permit required intake modifications are in-progress. Other Plants NPDES permit requirements to be determined.
Waters of The United States (WOTUS)	Protection of additional streams and tributaries	The EPA and Corps of Engineers finalized revisions and issued the Navigable Waters Protection Rule: Definition of "Waters of the United States" in April 2020.	Final rule effective June 21, 2020
Revisions to Steam Electric Effluent Limitations Guidelines (ELG)	Dry ash handling and Installation of wastewater treatment facilities; Implemented through NPDES permit conditions	EPA linked ELG rule to CCR rule; EPA has stayed certain compliance deadlines during rulemaking to revise the final rule.	All ELG required modifications now complete.
Coal Combustion Residuals (CCR)	Conversion to dry bottom ash and fly ash; Closure of existing ash basins; Dry disposal in landfill	Final determination that CCRs are nonhazardous by EPA in December 2014; final rule April 2015, effective October 19, 2015.	Basin closures and corrective measures in process. Completion in

		Federal legislation (WINN Act) to revise rule signed December 16, 2016. USEPA rulemakings in progress to revise regulation in response to Court and to implement the WINN Act.	advance of regulatory deadline.
Clean Air Act Regulation of Greenhouse Gases (GHG)/Affordable Clean Energy Rule (ACE)	New Source Performance Standard (NSPS) for new, modified, reconstructed units; CAA 11(d) Existing Source Performance Standards; state emission limits (CO2) for existing sources	NSPS for GHG from EGUs promulgated on January 8, 2014. Clean Power Plan final rule was stayed by Supreme Court 2/9/2016; CPP Repealed in 2019 and repeal challenged in DC Circuit. DC Circuit Court dismissed CPP case in September 2019. Affordable Clean Energy Rule promulgated in 2019 and overturned by the DC Circuit on January 19, 2021.	CPP was not implemented due to Supreme Court stay; On 6/30/22, the SCOTUS issues a ruling in West Virginia v. EPA that noted the CPP is unlawful. However, the industry expects EPA to propose a new rule regulating GHG's by March, 2023.

Recent Judicial Rulings Regarding the Affordable Clean Energy Rule

On June 30, 2022, the Supreme Court of the United States (SCOTUS) issued a ruling regarding EPA's authority with respect to how it regulates greenhouse gases (GHG's) under a specific section in the Clean Air Act (West Virginia v. EPA). The June 30th opinion in *West Virginia v. EPA* holds that the Clean Power Plan (CPP), which relied on generation shifting to set GHG standards, is unlawful. However, it retains EPA's threshold authority to regulate GHG's under Section 111(d) of the air law. EPA is expected to propose new regulations to regulate GHGs for existing electric generating units by March 2023. We continue to evaluate the implications to Ameren as a result of this decision, as well as draft versions of any future proposed regulations.

CSAPR Ozone Season Proposed Revisions

Changes to CSAPR were proposed in April 2022 and comments were requested. The EPA received 50,000 individual comments on the proposed rule. EPA's regulatory schedule includes promulgation of a final rule by March 2023 with compliance required beginning in the 2023 ozone season. Assumptions on the proposed rule and mitigation options will be included in the 2023 IRP filing.

Attainment Designations for the National Ambient Air Quality Standard (NAAQS) for Ozone

The air quality in the St. Louis area continues to improve. The EPA re-designated the St. Louis and Metro-East Illinois area to be in attainment with the 2008 eight-hour ozone standard. The EPA further lowered the ambient standard for ozone from 75 ppb to 70 ppb in December 2015 (2015 ozone standard). The EPA made final designations for about 85 percent of the country in November, 2017, however those designations did not include the St. Louis/Metro-East Illinois area. The EPA released final designations for the St. Louis/Metro-East Illinois area as well as the other remaining areas of the country on April

30, 2018. The final designation for the St. Louis area reduced the size of the nonattainment area by removing Jefferson County in Missouri and Monroe County in Illinois, as well as all but a small portion (Boles Township) of Franklin County in Missouri. However, on July 10, 2020, the DC Circuit Court of Appeals remanded to EPA the final designations for Jefferson County, MO and Monroe County, IL in *Clean Wisconsin vs. EPA*. On May 24, 2021, EPA promulgated a final rule in response to the remand designating Jefferson County and Monroe County as nonattainment for the 2015 ozone standard.

The St. Louis area was initially classified as marginal nonattainment, which is the least severe category. Marginal areas have ozone design values from 71 ppb to 81 ppb and the St. Louis area had a design value of 72 ppb based on three years of monitoring data used at the time of classification. While the St. Louis area did attain the standard, the redesignation was not completed. In 2022, air quality monitoring at the Alton monitor indicated the area reverted to nonattainment, and the EPA is planning to reclassify the area as moderate nonattainment.

Coal Combustion Residuals

The federal Coal Combustion Residuals (CCR) rule was published on April 17, 2015 and became effective October 19, 2015. It establishes national standards for the management of CCRs. The CCR rule is self-implementing, and the Company continues to fully comply with the Rule requirements. Additionally, the EPA has initiated a series of rulemakings to revise the federal CCR rule in accordance with the Water Infrastructure Improvements for the Nation Act as well as recent court decisions.

Ameren Missouri continues to execute its compliance strategy in advance of the regulatory deadlines. The Company continues to monitor the potential for further changes in regulations that may impact resource planning decisions.

Groundwater Remediation

In late 2020 Ameren Missouri partnered with an outside consulting firm on a groundwater remediation project at the Rush Island Energy Center. The pilot project was set up to ultimately improve groundwater quality around the site by using a pump and treat method. Groundwater removed through extraction wells is treated in an above ground structure, then discharged through injection wells back into the ground. Removing groundwater impurities mechanically in conjunction with natural attenuation will speed up reductions of groundwater constituents. The full-scale project at Rush Island was completed in 2022. Similar projects are now being designed and constructed at Sioux and Labadie. Sioux treatment facilities are on schedule to be complete by the end of 2022, with Labadie following.

Ash Basin Closure Initiatives

In 2020, Ameren Missouri completed closure of the ash basin impoundment at Rush Island Energy Center and attained substantial completion of the impoundments at Labadie Energy Center. Closure of the remaining impoundments at Sioux Energy Center were completed in 2022, as well as several impoundments at Meramec Energy Center. After retirement of the Meramec Energy Center, the remaining CCR basins will be closed. The closure of these ash basins coincides with our conversion of coal-fired energy centers to dry ash handling, which will reduce our consumption of approximately 11 billion gallons of water per year. With regard to groundwater and drinking water concerns, extensive analyses and tests have been undertaken by an independent third-party expert (many of which are beyond regulatory requirements).

Those tests have concluded:

- There is no significant adverse impact on human health or the environment from our CCR management practices.
- There is no evidence of CCR impacts in rivers or streams close to our facilities or in groundwater used for drinking water.

While mitigation has been included in our analysis for current and certain potential future regulations, further changes in regulations are possible. The Company continues to monitor the potential for further changes in regulation that may impact resource planning decisions.

3.3 Supply-Side Resource Review

Ameren Missouri has analyzed the cost and performance characteristics of a wide range of supply side resources in its 2020 IRP and has documented its analysis in Chapter 6 of its 2020 IRP filing. New supply side resources that were evaluated in the alternative resource plans in the 2020 IRP include the following:

- Gas Combined Cycle
- Gas Simple Cycle Combustion Turbine
- Wind
- Solar
- Pumped Hydroelectric Energy Storage
- Battery Storage
- Nuclear

Ameren Missouri has revised its assumptions for combined cycle, solar and wind resources and determined that the 2020 triennial IRP assumptions were still appropriate for the remaining resource options.

Ameren Missouri continues to monitor changes in the market for renewable energy projects, both through its own engagement with developers and through evaluation of secondary information sources. Based on the most recent such information, Ameren Missouri has updated the assumptions for wind and solar project costs. For its updated cost assumptions, Ameren Missouri used the 2021 Annual Technology Basis (ATB) assumptions from the National Renewable Energy Laboratory (NREL), starting with the moderate cost scenarios for each technology and shifting the cost curves to ensure consistency with current market costs. The updated assumptions for wind and solar resources are shown in Figures 3.1 and 3.2, respectively, along with the assumptions that were used in the 2020 IRP for comparison. Both show a relatively consistent long-term cost path after 2030, with higher prices in the near term. While the assumptions for both wind and solar show an expected decline, future costs are subject to certain risks as explained in the Company's June 2022 Change in Preferred Plan filing.

Figure 3.1: 2020 IRP vs 2022 Update for Solar Capital Cost

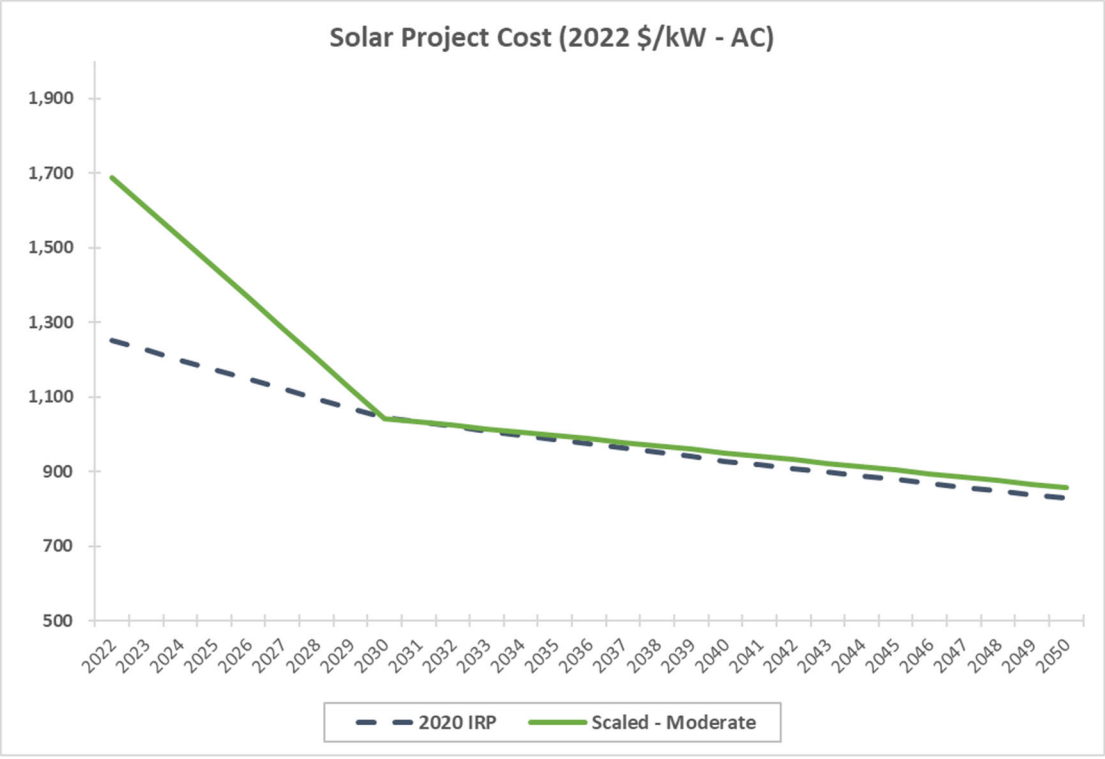
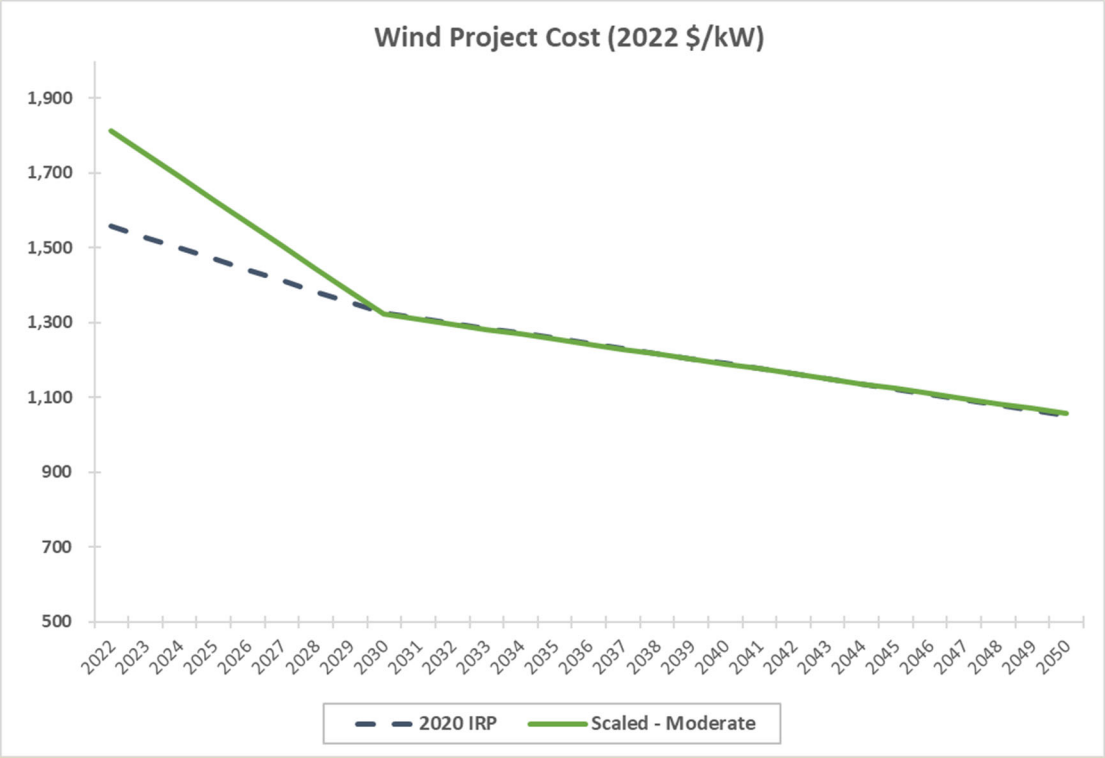


Figure 3.2: 2020 IRP vs 2022 Update for Wind Capital Cost



In addition to changes in the assumptions for the cost of renewable resources, Ameren Missouri has also updated its assumed overnight cost for CC generation to $1,106/kW from $1,321/kW in the 2020 triennial IRP (both in 2022 dollars).[8] This cost change reflects expectations for design and scale optimization based on review by internal subject matter experts.

Because this is an annual update and not a full triennial IRP, and because no changes in assumptions are expected to affect a screening analysis of supply side resources, Ameren Missouri has not performed a new screening analysis. A new supply side screening analysis will be performed as part of the development of Ameren Missouri's 2023 IRP. This will include both renewable and energy storage resources, which will be screened for inclusion in alternative plans, including any plans reflecting alternative retirement dates for existing coal-fired resources.

Renewable Energy Offerings

Ameren Missouri has developed a number of programs that are designed to increase access to renewable energy for all customers. Since filing the 2020 IRP, Ameren Missouri

[8] The 2020 IRP assumed CC capacity of 824 MW. Updated analysis reflects 1,200 MW.

has made meaningful progress on these programs and has initiated one new program offering:

Neighborhood Solar: The Neighborhood Solar Program aims to site solar generation at customer partner sites that will inclusively benefit customers through renewables education, visibility, and workforce opportunities. Ameren Missouri will own and operate all Neighborhood Solar systems for the benefit of all customers; host participants provide site access to the partnership. Since the 2020 IRP filing, Ameren Missouri has completed two Neighborhood Solar sites and is in the process of developing five additional sites. Each site's development will incorporate community solar education tours and equitable workforce development union pre-apprentice job opportunities for diverse candidates. The sites are as follows:

- Habitat for Humanity (192 kW-AC): In-service August 2021
- Southern Missouri State University (1.2 MW-AC): In-service July 2022
- City of Maryland Heights Community Center (approximately 500 kW-AC): In-service expected March 2023
- Delmar Divine Non-Profit Incubator: In-service expected Fall 2023
- Two Additional North and Central St. Louis City Projects: In-service expected Fall 2023
- One Jefferson County Project: In-service expected Fall 2023

Community Solar: In May 2020, Ameren Missouri received approval to expand its successful Community Solar Pilot Program. Shortly after the 2020 IRP filing, Ameren Missouri filed an application for a CCN for a 5.7 MW-AC solar system in Montgomery County to support the pilot program expansion, which the Commission approved in May 2021. The project is now in-service as of March 2022. In addition to the pilot expansion, Ameren Missouri included an application for approval of a permanent Community Solar Program within the electric rate review filed in March 2021. The program features a variety of improvements to enhance the participation experience for customers. This proposal was approved as part of the electric rate review settlement agreement, and, as a result, the permanent Community Solar Program will be rolled out to residential and small commercial customers in the latter half of 2022. The program redesign expands access and affordability by (1) lowering the program enrollment fee, (2) enabling customers to match up to 100% of their usage with solar energy, and (3) accelerating new facilities construction timelines.

Renewable Solutions: Ameren Missouri recently filed for approval of a new subscription renewable energy program, the Renewable Solutions Program. The program was filed with the CCN application for the Boomtown Solar Project, which will support Phase I of the program. Renewable Solutions is a voluntary renewable energy subscription program designed for larger commercial, industrial, and governmental customers. Many of Ameren

Missouri's larger customers have publicly expressed their desire for near-term access to renewable energy in the form of sustainability goals for both carbon dioxide emission reduction and renewable energy supply. The program is designed to offer those customers a pathway to meet their sustainability goals with local renewable energy while reducing cost and risk for all Ameren Missouri customers.

Securitization[9]

Ameren Missouri announced in December 2021 that it would retire its coal-fired Rush Island Energy Center and indicated in its Notice of Change in Preferred Resource Plan that the units are expected to be retired by the end of 2025, subject to ongoing review of reliability needs by MISO and the issuance of a revised decision by the U.S. District Court. The Company has further indicated that it plans to file an application with the MPSC in the second half of 2023 to securitize the remaining balance in rate base and other energy transition costs for Rush Island Energy Center. Because there is still uncertainty with respect to the details of such an application, including the extent to which certain equipment at the plant may be needed to ensure reliability following the end of electric generation operations, Ameren Missouri has not yet developed a detailed plan for the use of securitization.

3.4 Transmission and Distribution Review

Smart Energy Plan Update

Ameren Missouri is in year four of the Smart Energy Plan (SEP). The SEP commenced in 2019 and is a forward-looking plan to transform the grid to ensure customers have safe, reliable and increasingly cleaner energy to meet their growing needs and expectations.

In continuance of infrastructure investments, and compliance with Missouri Senate Bill 564, Ameren Missouri filed its update to the Smart Energy Plan in February 2022. The plan includes $8.4 billion of electric investments from 2022 through 2026 that will, among other things, support investments in smart grid technologies, system hardening efforts, and infrastructure upgrades.

The SEP provides critical support for Ameren Missouri in its efforts to combat an aging electrical grid. Much of Ameren Missouri’s existing system was built during the 1950s and 1960s. This build out was driven by an increase in electricity usage due to: 1) suburbanization, 2) increased use of air conditioners, and 3) industrial growth in Ameren Missouri’s service territory. Today, decades later, many of these assets have reached and exceeded their engineered lives as seen in Table 3.2 below, and Ameren Missouri

[9] File No. EO-2022-0054 1.A; File No. EO-2022-0054 1.D

must upgrade them, not only to reduce the risk of equipment failures, but also to meet the expanding needs of its customers.

Table 3.2: Summary of Distribution Asset Average Age

Asset Name	Asset Count	Assets Past Expected Life	Average Age	Expected Life	Customers Served by Aged Asset
Miles of Underground Cable	7,900	2,900*	30	40	370,000*
Miles of Subtransmission Overhead Conductor	4,200	1,600	35	45	460,000
Substation Transformers	800	315	41	50	430,000
Substation Oil Circuit Breakers	350	250	53	50	700,000
Substation Air Circuit Breakers	1,200	775	53	50	400,000

**The numbers provided are the sum of the distribution and subtransmission*

A prime example of aging assets is Ameren Missouri's substation fleet. When SEP investments began in 2019, about 250 of its distribution substations (Ameren has over 500 such substations) contained either a transformer or circuit breaker (critical components) that was installed more than 50 years ago. These substations, with aged critical components, serve over 500,000 of Ameren Missouri's 1.2 million customers. If Ameren Missouri had not begun upgrading its substation fleet in 2019, by 2023 over 50 additional distribution substations serving another 200,000 customers would have a critical component reach 50 years of age. Due to our replacement/upgrade efforts, the additional impact on customers and operations has been blunted.

While aged infrastructure is being modernized, weather patterns and changes in customer needs/expectations impact what types of upgrades are being made. Weather is becoming more of a challenge with new records being routinely set, like with the widespread flooding in St. Louis in July 2022 due to precipitation which surpassed the record for daily rainfall set in 1915 by 27%. To combat extreme weather events, aged assets are being replaced with storm-hardened alternatives and with larger capacity to support grid flexibility when the grid is damaged and outages do occur. In addition, Ameren Missouri incorporates resiliency into new designs to prevent catastrophic failures if there are significant stresses, like during extreme weather events.

Upgrades are also being impacted by changing customer expectations. With the predicted increase in electric vehicle penetration and electrification by end-users, additional capacity may be required in some areas of the distribution system to handle the increased load. As assets are upgraded, this additional capacity is considered, especially on assets which have expected lives of 45+ years and will likely be required to handle additional load in the future due to these customer changes. Customers are also

increasingly requiring constant power supplies and becoming less tolerant to any type of interruption – including momentary outages. In fact, some high-impact customers like hospitals and airports rely on technology which cannot tolerate even a momentary outage. To combat this, Ameren Missouri is upgrading assets on the sub-transmission system to improve reliability and eliminate disruptive outages. Underpinning Ameren Missouri's efforts are a number of outcome-driven strategic goals:

- Automate portions of the electric distribution system by deploying smart switching devices with associated circuit upgrades and accompanying communications technologies to help significantly reduce the length of outages. Circuits with smart switches installed have seen up to 40% reliability improvements.
- Harden the 34kV and 69kV electric distribution system with a stronger, more secure energy delivery backbone, strategically using stronger poles, standoff insulators, shield wire, and wind resistant conductor that will better withstand severe weather. Hardened circuits are designed to avoid momentary outages due to lightning strikes, as well as possibility of extended outages from high winds and other severe weather. In December 2021, a line of severe storms including an EF-3 tornado went through the southernmost portion of eastern Missouri. A new storm-hardened line was directly hit by the tornado. Composite poles prevented a cascading collapse and failure, allowing power to be restored in half the time.
- Upgrade aging and under-performing assets (e.g., substations, overhead and underground assets). Part of Ameren Missouri's plan is addressing the oldest and worst performing circuits across its service territory to improve reliability for its customers.
- Employ smart grid technologies (e.g., relaying, monitoring, fault information, communications) as Ameren Missouri upgrades aging and end of engineered life infrastructure to improve reliability, capacity for customers, and mitigate risk.
- Improve operating flexibility, increase capacity, and enable a bi-directional flow of power from future DERs by upgrading substations and lines and adding smart switches. When severe weather or other events occur, customers can have power restored through switching to prevent or reduce extended outages, but only if lines and substations have the capacity to serve additional load. Part of this work includes the strategic conversion of some 4 kV areas to a system-standard of 12 kV. This allows for the use of standardized equipment and increased operational flexibility through the ability to add ties between circuits to allow switching to occur. Additionally, this will allow us to serve customers' future needs that continue to change with the transition to electrification.
- Continue to execute the underground revitalization program in the City of St. Louis and surrounding communities. The program significantly reduces aging and end of engineered life infrastructure, some of which is over 100 years old, while

increasing route diversity, thus reducing the risk of very long and widespread outages due to a single incident.
- Develop a communications network to monitor and enable analytics from connected grid devices.
- Provide Smart Meter time-of-use rates, improving customer options for managing their bills and shifting load from peak to off-peak times to benefit the system.

As the grid of the future is built, Ameren Missouri is keeping electric rates as low as possible while protecting long-term energy reliability and resiliency for customers. Accelerated infrastructure from the Smart Energy Plan also continues to drive job creation and economic development. Recently, the Missouri Legislature passed Senate Bill 745, that was signed by Governor Parson on June 29, 2022. This legislation enables Ameren Missouri to maintain our commitment to modernizing the grid through at least 2028.

Smart Meter Program

The Ameren Missouri Smart Meter Program is upgrading all electric meters, gas modules, and the associated communication network in the Missouri service territory over approximately six years, from 2019 through 2024. This work includes:

- Installing 1.2 million Electric Advance Metering Infrastructure (AMI) meters (residential and commercial/industrial) which provide greater usage insights and capabilities for customers.
- Installing 132,000 Gas AMI modules (Residential and Commercial/Industrial).[10]
- Deploying a modern RF mesh network, enabling two-way communication.
- Launching an Advanced Meter Data Management System.
- Modernizing the Ameren Missouri Meter Shop to facilitate the receipt and quality testing of purchased meters.
- Creating an Ameren Missouri Network Lab and a Missouri Integrated Operations Center.

These upgraded electric meters and gas modules will replace all of the antiquated Automated Meter Reading (AMR) meters/modules. These AMR meters/modules use meter reading technology that is more than 20 years old, were installed between 1995 and 2000 and are past their expected life (projected to have a 15 to 20-year life).

These upgrades have a number of benefits associated with them:

[10] Gas module deployments are not funded through the Smart Energy Plan.

- Smart sensors, switches, self-healing equipment and smart meters work together to rapidly detect and isolate outages and more quickly restore power in the event of a service disruption.
- Smart meters enable Ameren Missouri to pinpoint outages, quickly restore customers' service, and inform customers of restoration progress.
- Smart meter rate options (e.g., time-of-use rates) help customers manage their bills and shift load from peak to off-peak times to benefit the system.
- Improved mobile and web-based tools provide customers with greater visibility into their energy usage and greater control to manage their energy costs.
- Customer rates are kept affordable through a reduction in meter infrastructure operating costs (e.g., eliminating the existing AMR system reduces meter reading, remote disconnect/reconnect capabilities).

Through the end of August 2022, Ameren Missouri has deployed 672,000 electric AMI meters, along with the 43% percent of the RF mesh network, the meter shop, network lab and integrated operations center.

Transmission Considerations for Long-term Portfolio Transition

In the Company's Notice of Change in Preferred Plan filing, it mentioned that significant expansion and investment in transmission infrastructure will be needed to support the decarbonization of the grid, a statement which has been acknowledged at the federal level and resulted in the issuance of a Notice of Proposed Rulemaking (NOPR) by FERC on the need to change Transmission Planning by implementing a process very similar to that used by MISO in its long-range planning. In July 2022, MISO's board approved the first tranche of its long-range transmission plan at an estimated cost of over ten billion dollars, with over one billion dollars for new transmission lines in Missouri. These infrastructure investments are necessary to meet the reliability needs of the transmission system based on the Future One scenario of the MISO Long Range Transmission Plan (LRTP) study. Three future scenarios were created using the IRPs of the utilities within MISO and current generation within the MISO queue to accelerate carbon output reduction. The in-service date for all the tranche one projects is expected to be on or before 2030.

Three further tranches of transmission expansion are planned, with the tranche two effort currently under way, which will result in an eventual potential carbon output reduction of 80% from 2005 levels and ensure that the energy needs of our customers are met and the reliability of the grid is maintained. As a result of some states within MISO more

aggressively pushing decarbonization than originally proposed, the need to build transmission is accelerated along the same timelines.

The penetration of intermittent renewable resources continues to grow within the MISO footprint and the energy provided by them is now around sixteen percent of total energy production annually, due to both the addition of new renewable generation and the retirement of existing fossil-fueled generation. The retirement of the fossil-fueled generation within MISO is expected to accelerate over the next few years, due to both federal and state regulations, which will result in a further increase in the percentage of renewable energy. This increase in renewable generation penetration will significantly impact grid performance with complexity increasing sharply after 30 percent renewable penetration levels are achieved, as laid out in MISO's Renewable Integration Impact Assessment (RIIA), which could occur as early as 2026. Significant investment in grid controlling devices such as statcoms, synchronous condensers and fast frequency response devices will be required to maintain grid strength and reliability. The transmission system is at a point where each plant retirement will impact reliability, as seen with the Attachment Y results for the retirement of Rush Island. Investments in grid controlling devices will be required ahead of further plant retirements to maintain the integrity of the grid.

The possibility of extreme weather events necessitates ongoing review of, and planning and investment to ensure, the resiliency of the grid.

In addition, supply chain issues and the increasing wide-spread need for long-lead items, such as transformers, which have seen their delivery times increase threefold during the supply chain crisis, has led to the need to employ new strategies to plan for system recovery in the event of a high risk-low probability event. One such change is the spare transformer strategy, which includes planning for a larger number of system failures, use of in-service spares, deployment of mobile transmission transformers and a specific strategy for long lead procurement.

Transmission Costs[11]

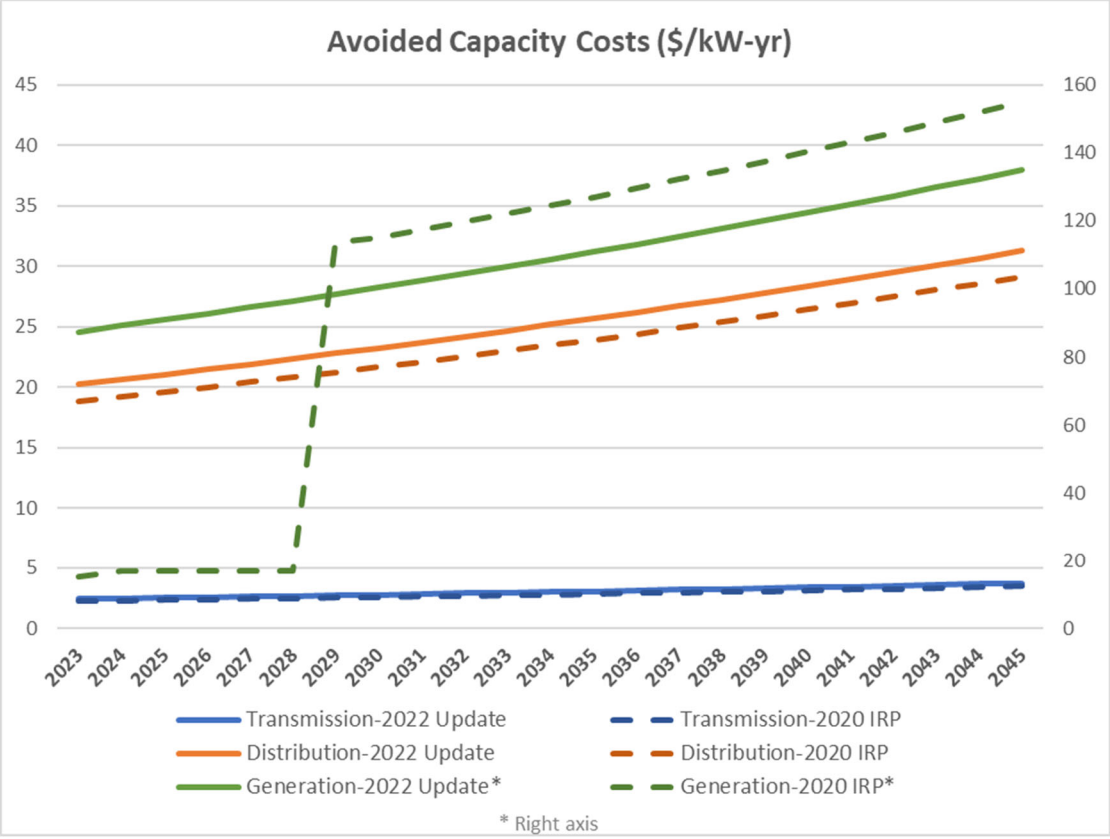
Ameren Missouri’s expectations on transmission interconnection costs for new supply-side resources as well as the transmission system upgrade costs that might be incurred following retirement of its other existing coal-fired energy centers have not materially changed since the 2020 IRP. These costs can be found in Chapter 7 of the 2020 IRP filing.

Avoided Costs

[11] File No. EO-2022-0054 1.E

Ameren Missouri has updated the avoided costs used for DSM cost effectiveness tests. For transmission and distribution avoided costs, the change is due to higher financing costs as interest rates have risen since the filing of the 2020 IRP. Avoided generation capacity cost has also been updated as MISO's latest capacity auction for planning year 2022-2023 set the capacity prices to the cost of new entry (CONE) for North and Central regions. The avoided cost assumptions for transmission, distribution and generation capacity for 2020 IRP and the updated assumptions are shown in Figure 3.6. Avoided energy cost is discussed in section 3.7.

Figure 3.6: Avoided Capacity Cost Comparison 2020 IRP vs 2022 Update



3.5 Demand Side Resource Review

The Company continues to offer energy efficiency programs. Products available to customers currently include heating and cooling, lighting, efficient products, direct install, and demand response. Energy efficiency programs have been promoted for both residential and business customers, and programs have been tailored specifically for income eligible customers.

In October 2021, the MoPSC issued an order approving Ameren Missouri's request to implement PY23 of its current MEEIA cycle. This will ensure seamless program delivery for customers, while the Company develops, files, and discusses the 2023 triennial IRP filing with stakeholders. This is an important and necessary step, because the IRP defines the avoided costs that will be used to evaluate cost-effective measures for inclusion in the next resource portfolio.

It can take up to 12 months to develop a multi-year MEEIA plan and filing. The Company began planning for its MEEIA 4 cycle in late 2021 for filing in late 2022 or early 2023. This will allow time for review and Commission approval, ahead of the start of the 2024 program year. At this time, future resource plans are expected to be consistent with maintaining progress towards RAP levels of DSM, as defined by the preferred resource plan identified in the 2020 IRP and future updates informed by 2023 IRP sensitivity analysis. Such plans will also take into account program changes made during the planning and implementation of the 2022 and 2023 program years, particularly with respect to the role of lighting.

The Company, including stakeholders, is currently engaged in a feasibility Urban Heat Island (UHI) study to describe and identify the impact in the Company's service territory. The findings of the UHI feasibility study will be evaluated and any mitigation opportunities will be incorporated in its planning for MEEIA 4 cycle.[12]

The Company began planning for the 2023 Market Potential Study (MPS) in the fourth quarter of 2021. Following a similar schedule as in the triennial 2020 IRP, the next MPS will be developed, executed and finalized between the second quarter of 2022 and the second quarter of 2023. This lead time is necessary so that results can be included in the 2023 IRP. The next MPS will be developed consistent with the budget approved as part of the PY22 and PY23 extensions, and it will rely on the market research regarding customer adoption and willingness to participate factors developed as part of the 2020 MPS.

[12] File No. EO-2022-0054 1.C

Similar to the 2020 MPS, the 2023 MPS will estimate the maximum and realistic achievable potential (MAP and RAP, respectively) of DSM resources on an annual and peak day basis, consistent with all applicable rules and regulations. The Company also expects to develop a number of scenarios, with input from stakeholders to the base case MAP and RAP estimates for annual and peak day reductions.

The 2023 MPS will also begin to explore the potential of DSM resources to support system operations. This may include estimates of flexible load potential, to better match load and supply, or estimate the DSM resource potential available to help reduce load during specific daily or seasonal periods of operational need. This research will continue to support the longer-term development of integrated distribution plans and the evolution towards more targeted DSM measures.

3.6 Emergency Preparedness[13]

The Crisis Management Department is responsible for establishing crisis management as a core business competency across the organization and for increasing and refining Ameren's overall emergency and crisis preparedness, response, and recovery capabilities. To meet this obligation, the Crisis Management Department has responsibility for aligning and preparing Ameren to respond to crises of all natures and potential levels of severity or duration, validating Ameren's response readiness, educating, training, drilling, and exercising the organization to better learn and refine necessary skills across the organization, incorporating uniformity and consistency in planning efforts across Ameren's business segments, and confirming consistency in plan execution during times of crisis.

As such, Ameren created an official Ameren Crisis Management Plan (CMP) in April 2015. The CMP provides overarching guidance, structure, support, and stability of performance to Ameren's response and recovery to significant and/or isolated, catastrophic events. It also incorporates a communications strategy to provide an accurate, rapid response to a crisis in a manner that establishes accountability and transparency, minimize the negative impacts of the event to the business enterprise, and foster public confidence in Ameren's ability to manage the crisis. This part of the plan includes the Joint Information Center (JIC). Contained within the JIC is the role of Public Information Officer (PIO). The PIO is responsible for interfacing with the public, the media, and with other jurisdictions/organizations with incident-related information needs.

The plan covers an "all hazard" approach to include natural events such as significant earthquakes, catastrophic thunderstorm / multiple or wide-spread tornado outbreaks, winter storms, biological epidemics/pandemics, and man-made events such as civil

[13] File No. EO-2022-0054 1.B

disobedience or deliberate acts intended to damage. A review of this plan is performed on an annual basis by the Crisis Management Department to determine the need for any necessary modifications or adjustments to maintain alignment with the direction stated above and by Ameren's senior leadership.

System Operations

Ameren Missouri takes a proactive approach to ensuring supply-side resource generation is available during emergency events. This begins with development and execution of a major outage schedule, which utilizes a risk-based approach to address equipment maintenance. Also, Ameren Missouri conducts pre-summer and pre-winter readiness meetings with the energy centers, to identify any remaining maintenance issues that can be addressed prior to these seasons.

Ameren Missouri utilizes internal conservative operations indicators, in the form of an online stoplight system (green, yellow, red), to communicate to the energy centers the status of the Ameren Missouri system, or that of the broader electric grid. The selection of stoplight status is informed by conditions within the applicable Regional Transmission Organization, forecasted electric demand, generation fleet availability, and overall wholesale market conditions. During critical conditions, energy centers are instructed to avoid unnecessary maintenance that could jeopardize the stability of the units.

In addition, Ameren Missouri coordinates with the MISO and SPP for emergency notifications and procedures. Ameren Missouri maintains both a Capacity and Energy Emergency Plan (CEEP), and a Load Reduction Procedure (LRP), that are closely aligned with MISO's own emergency action plans. MISO uses structured and progressive emergency operating procedures that seek to both inform and act upon events expected to negatively impact system reliability, including a capacity or energy emergency. These steps include actions to notify, implement conservative operations, maximize regional generation, implement demand response, utilize contingency/emergency reserves, maximize imports, make public appeals, and as a last resort – shed firm load. To protect the public welfare, Ameren Missouri's LRP identifies circuits that include essential service customers, such that these customers are not impacted if customer curtailments are required. Ameren Missouri has codified its Emergency Energy Conservation Plan in tariff sheets that were recently approved by the Commission (in File No. EE-2022-0329).

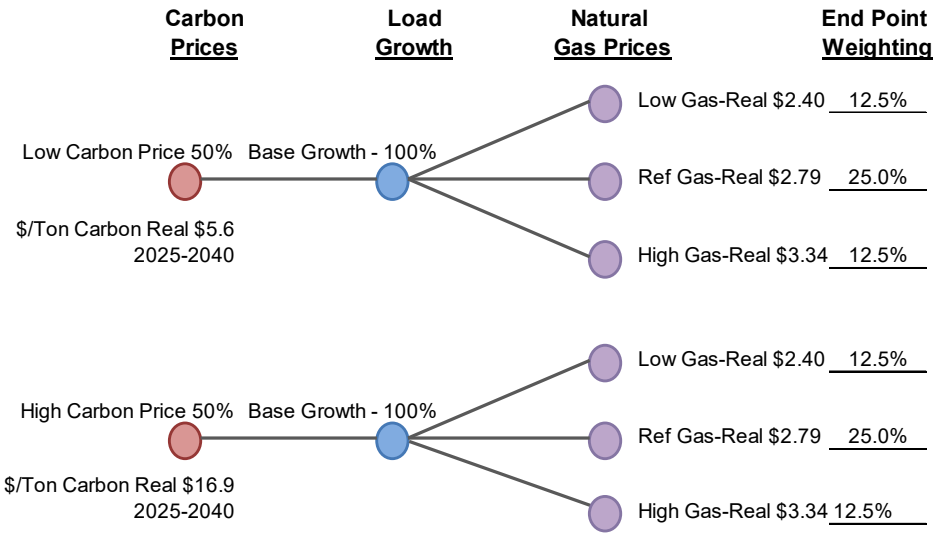
3.7 Uncertain Factors

3.7.1 Price Scenarios

As part of the analysis to support the change in preferred plan, for which Ameren Missouri provided notice in June 2022, Ameren Missouri has reviewed its assumptions for carbon prices and natural gas prices, which are the major drivers of power prices. As discussed

in more detail in this section, and consistent with the assumption changes reflected in our June 2022 Notice of Change in Preferred Resource Plan, Ameren Missouri has determined that probabilities assigned to ranges of these driver variables in the 2020 triennial IRP need to be revised. Figure 3.77 shows the updated scenario tree and the probabilities of each branch.

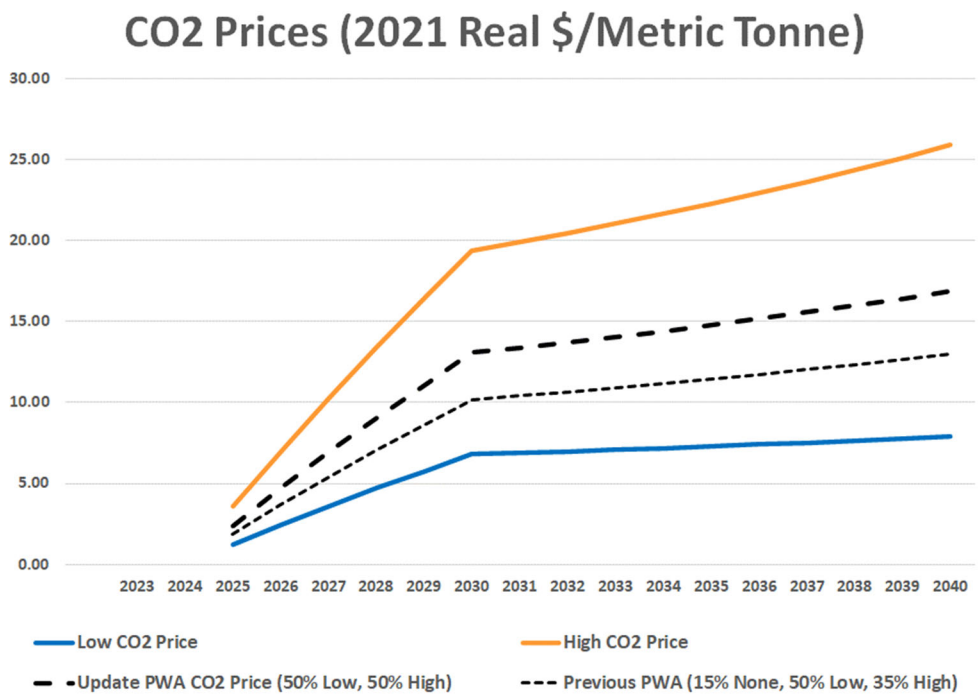
Figure 3.7: Scenario Tree



Carbon Dioxide Emission Prices

In the 2020 triennial IRP, the Company's management had assigned a 15% probability to the scenario with no carbon price, a 50% probability to the low carbon price scenario and a 35% probability to the high carbon price scenario. Following management review and discussion, management has revised the probabilities to reflect a 50% probability on each of the high and low carbon price scenarios with zero probability for the no carbon price scenario. The carbon price scenarios and the probability-weighted average (PWA) price under the prior and updated probabilities are shown in Figure 3.8.

Figure 3.8: CO_2 Price Assumptions

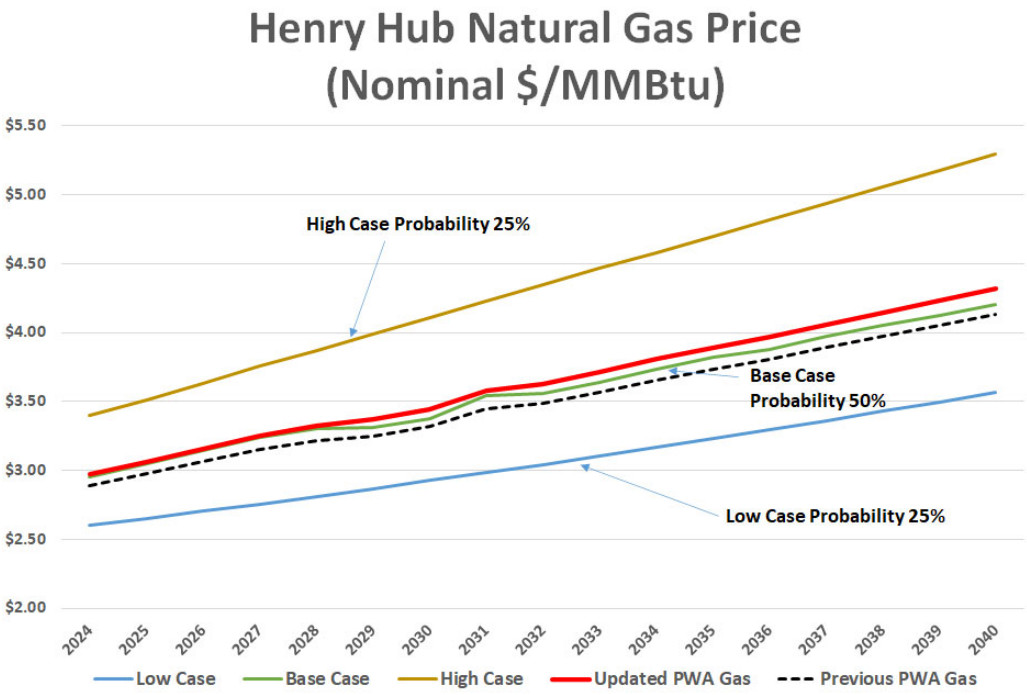


It should be noted that the price assumptions shown do not presume a particular mechanism (e.g., carbon tax, cap-and-trade program, etc.) by which the carbon price is implemented. It can be explicit or implicit and may reflect expectations regarding potential regulations, including those that target other emissions associated with carbon-emitting resources. Ameren Missouri continues to monitor policy proposals and developments that may affect assumptions for carbon pricing.

Natural Gas Prices

Ameren Missouri has also revisited its assumptions for natural gas prices, particularly in light of recent price increases. Based on management review of supply and demand fundamentals and the risk of a shift in market dynamics due to recent geopolitical events, Ameren Missouri's management has shifted the probabilities for the high, base and low gas price scenarios. Figure 3.9 shows the three price scenarios, the revised probabilities, the new PWA price, and the prior PWA price. Ameren Missouri continues to monitor factors that may affect assumptions for natural gas prices.

Figure 3.9: Natural Gas Price Forecasts

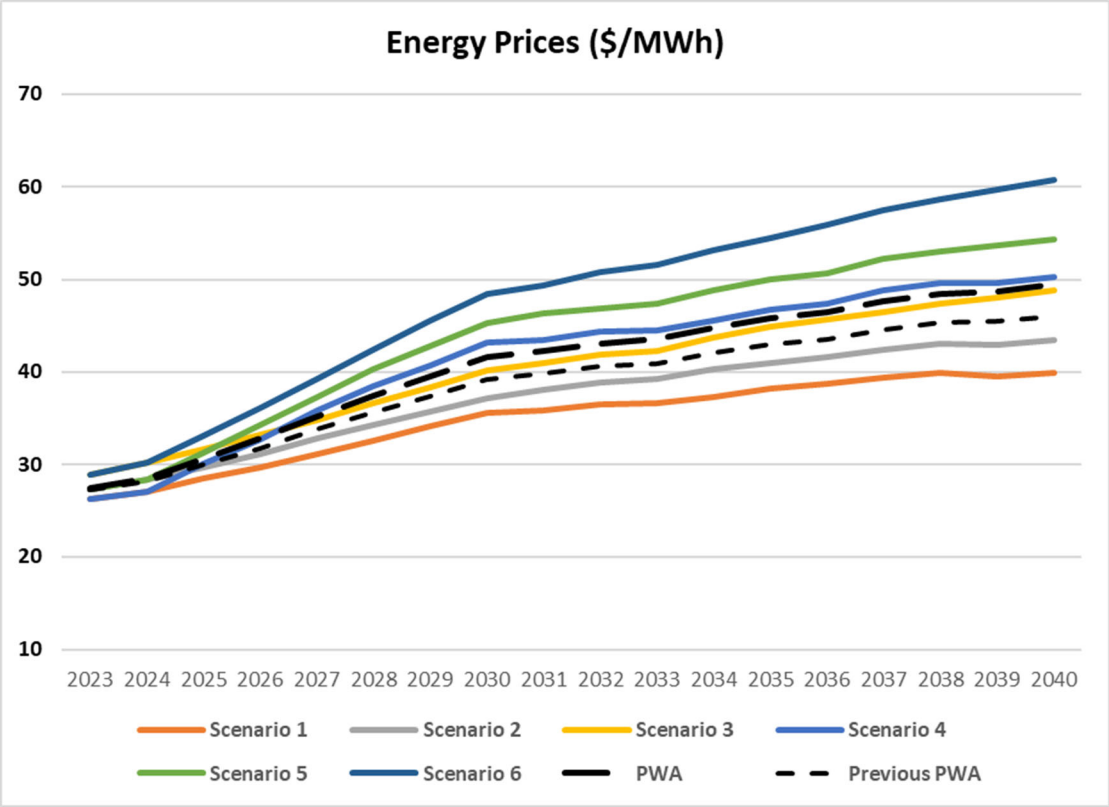


The changes in probabilities for natural gas prices and carbon prices carry through to joint probabilities for resultant power prices as shown in Figure 3.7.

3.7.2 Scenario Modeling

Based on review with Ameren Missouri management, the no-carbon price scenarios have been removed and probabilities on the remaining scenarios from the 2020 IRP have been revised. The power price forecasts for the six scenarios along with the current and triennial 2020 IRP probability-weighted average prices are presented in Figure 3.10 below.

Figure 3.10: **Market Price Scenarios**



3.7.3 Independent Uncertain Factors

Ameren Missouri reviewed a broad range of uncertain factors in its 2020 triennial IRP and selected two independent uncertain factors to be included in the risk analysis and presented in the 2020 IRP and in its 2022 Change in Preferred Plan filing: DSM costs and load forecast. The Company reviewed its expectations and previous value ranges for these critical uncertain factors and determined the percentage deviations for the low-base-high values from the expected values of each uncertain factor are still valid.

4. Compliance References

All references are to the ordering language in the *Order Establishing Special Contemporary Resource Planning Issues*, in File No. EO-2022-0054, beginning on page 3.