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VOLUME 1

EXECUTIVE SUMMARY

THE EMPIRE DISTRICT ELECTRIC COMPANY D/B/A LIBERTY ("LIBERTY-EMPIRE")

20 CSR 4240-22.080

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EXECUTIVE SUMMARY

Commission Rule 20 CSR 4240-22.080 provides in part as follows:

(2) The utility's triennial compliance filings shall demonstrate compliance with the provisions of this chapter and shall include at least the following items:

(E) An executive summary, separately bound and suitable for distribution to the public in paper and electronic formats. The executive summary shall be an informative non-technical description of the preferred resource plan and resource acquisition strategy. This document shall summarize the contents of the technical volume(s) and shall be organized by chapters corresponding to [MPSC Rules].

SECTION 1 INTRODUCTION

1.1 Purpose of the 2025 IRP

The Empire District Electric Company d/b/a Liberty ("Liberty-Empire" or the "Company") has conducted its analysis of future loads and resources for this triennial Integrated Resource Plan ("IRP") to comply with the requirements of 20 CSR 4240-22 ("Rule" or "IRP Rule"). This triennial IRP analysis is conducted at least once every three (3) years, in conjunction with Liberty-Empire's normal planning process, and assists Liberty-Empire in making decisions concerning the timing and type of system expansion that should ultimately occur.

Liberty-Empire's Preferred Resource Plan

Near-term retirement of the aging Riverton 10 and 11 natural gas-fired peaking units, which will be directly replaced by 27 MW of reliable, dual-fuel industrial gas turbines.

Continue to monitor the development of new utility-scale solar resource projects in or near the Company service territory with operation in the 2028 timeframe.

Additions of natural gas frame combustion turbines in the near- and medium-term to take advantage of SPP's Expedited Resource Adequacy Study (ERAS) or any other available means to achieve the target timeline and further bolster portfolio reliability to meet SPP's new resource adequacy constructs.

Pursuit of distributed energy resources where significant T&D avoided costs are identified.

Flexibility and optionality around long-term resource decisions to achieve significant carbon emissions reductions as policy and technology evolve.

Consistent with the fundamental objective as stated in the IRP Rule, Liberty-Empire's 2025 IRP and the selection of its recommended Preferred Plan have been guided by a commitment to providing customers 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. Based on a technically rigorous, balanced, and innovative analysis of potential future costs and market outcomes, Liberty-Empire believes that its recommended Preferred Plan carries out these objectives.

To develop this IRP, and the Preferred Plan and contingency plans that represent its core

conclusions, Liberty-Empire engaged in an extensive eleven-month process to assess how it can best meet its customers' needs for affordable energy that is highly reliable, safe, resilient, and environmentally sustainable. Liberty-Empire deployed state-of-the-art tools and techniques to help delineate and clarify choices and tradeoffs between technologies, parameterize the potential evolution of new sources of risk and opportunity, address some of the most relevant issues regarding the future of the market, and forecast and evaluate the interaction of important variables including customer load requirements, market and technology trends, and existing and potential environmental policy. The 2025 IRP analysis also applies a seasonal accredited capacity ("ACAP") resource adequacy construct being implemented and developed by SPP in addition to Performance Based Accreditation ("PBA") for thermal resources and Effective Load Carrying Capability ("ELCC") for wind, solar, and storage resources per SPP's anticipated future Planning Criteria changes.

With the 2025 IRP, Liberty-Empire built upon and confirmed the soundness of the direction laid out in its prior Preferred Plan, creating and extending specific commitments as part of a new near-term three-year implementation plan with key improvements based on recent portfolio and market developments. The 2025 IRP incorporates the advancement of thermal gas resources at the utility- and distributed-scale, continuation of utility scale renewable deployment, and the adoption of a broad energy efficiency plan as key parts of a reconfigured generation portfolio. As in the previous triennial IRP filing, the 2025 IRP Preferred Plan includes the extension of the operating life of Energy Center 1 and 2 units to 2035 with the option to take advantage of surplus existing interconnection at the site after the retirement of these units, and the retirement of the Riverton 10 and 11 units in 2026 to be replaced by new, highly reliable, dual-fuel ** [redacted] ** gas turbine resources.[1]

Finally, to facilitate a clear and transparent decision-making process around Preferred

[1] ** [redacted] **

Plan selection, Liberty-Empire deployed a scorecard approach in the 2025 IRP similar to that used in the previous triennial IRP filing. The scorecard identifies and documents key tradeoffs that drive Preferred Plan selection. This helps stakeholders clearly understand how Liberty-Empire has evaluated the attributes of various plan alternatives in arriving at its ultimate Preferred Plan. The scorecard is described in more detail in Section 9 of this executive summary.

1.2 Highlights of Liberty-Empire's Preferred Resource Plan

Thermal Peaking Resources

A key component of Liberty-Empire's Preferred Plan is the near-term retirement of the existing natural gas peaking units at the Riverton site. The existing Riverton units 10 and 11 provide value to Liberty-Empire's portfolio due to their ability to ** [redacted] ** operate on both natural gas and fuel oil. Although the units were installed by Liberty-Empire in 1988, the primary equipment used at Riverton 10 and 11 is of 1960s vintage. Based on the units' age, Liberty-Empire has determined that it is no longer appropriate to rely on these units for reliable dispatch, although the performance and operating characteristics of thermal generation ** [redacted] ** should be retained. This decision is consistent with findings from Liberty-Empire's 2022 IRP. Therefore, the Preferred Plan calls for the Riverton 10 and 11 units to be replaced directly at the site with 27 MW of more reliable, new dual-fuel ** [redacted] ** industrial gas turbines, taking advantage of existing interconnection rights. Liberty-Empire's Preferred Plan also includes the life extension of two of its dual-fuel-capable natural gas peaking resources, Energy Center units 1 and 2, until 2035 to maintain and improve the capability of its generation portfolio to provide reliable services during a wide range of market conditions. These resources provided significant value to customers and helped stabilize the system during the events of Storm Uri in early 2021 due to their ability to operate on fuel oil in addition to natural gas. Liberty-Empire believes maintaining Energy Center 1 and 2 through 2035 will significantly help to hedge market risks at a relatively low cost of investment. Moreover, retaining the units preserves key reliability services currently under study by several SPP Working Groups.

The backbone of the Preferred Plan is a pair of 240 MW of natural gas frame combustion turbines, the first of which will be added by 2029 which will attempt to utilize the Expedited Resource Adequacy Study ("ERAS") provision or any other available means to achieve the target timeline. The expedited addition of the frame combustion turbine in 2029 allows Liberty-Empire to ensure compliance with SPP's latest guidance for a winter reserve margin requirement. The assumptions of this IRP had the winter reserve margin requirement beginning at 36% in 2026 and increasing to 44% in 2029 and included PBA and ELCC components related to resource accreditation. The impact of both of these forces results in a substantial increase in the amount of reserves that a load-serving entity needs to carry while also decrementing generating facilities accredited capacity, thus leading to a need for additional generation in the near term. The plan adds a second 240 MW of natural gas frame combustion turbine in 2036 to bolster the portfolio after the retirement of Energy Center units 1 and 2. These gas combustion turbine additions will bolster Liberty-Empire's adequacy and dispatchable resource capability for the long-term.

Beyond 2040, 28 MW of small scale distributed reciprocating engine additions are planned to support incremental load growth.

Investment in Solar

The Preferred Plan calls for investment in solar as the primary medium- and long-term energy option. In the near term, Liberty-Empire will continue the evaluation of approximately 175 MW solar facility due for operation in the 2028 timeframe. However, given the changing dynamics surrounding the SPP's resource adequacy construct, evolving market dynamics, and the timing of this filing, it is not certain that this project will proceed, and an update will be provided during the next IRP Annual Update as appropriate. Two further utility scale solar developments will follow with 150 MW in 2035 and another 150 MW in 2041. The project in 2035 is expected to take advantage of federal investment tax credits through safe harboring provisions. Over the longer term, Liberty-Empire expects the cost of solar development to decline, improving the relative

economics of the technology even if tax credits are no longer available. Together, these additions signal the intention of Liberty-Empire to embark on an ongoing solar development program as a longer-term initiative.

Investment in Distributed Energy Resources

As a complement to a possible utility-scale resource, Liberty-Empire's Preferred Plan also includes investment in distribution-level resources to meet future resource requirements. Distributed reciprocating internal combustion engine ("RICE") and lithium-ion battery storage can avoid otherwise needed transmission and distribution system upgrades. Liberty-Empire estimates that distributed RICE is up to 50% more expensive than comparable utility-scale configurations but offers the benefit of potentially significant deferred substation upgrades, generator interconnection costs, and avoided transmission line losses. Further, Liberty-Empire believes there is value in investing in some level of distributed resources from an energy security and reliability perspective. This is because distributed resources can help improve local reliability, prevent blackouts and outages, and improve energy security in the event of large-scale disruptions at the transmission level. They may also provide further benefits, such as compliance with FERC Order 2222 implementation.

Investment in Demand-Side Management

Finally, Liberty-Empire remains committed to achieving pathways for its customers to use electricity wisely. The Preferred Plan includes a continuing role for Demand Side Management ("DSM") programs.

SECTION 2 IRP REPORT ORGANIZATION

This IRP filing contains eight (8) volumes in total, including this executive summary, a volume dedicated to the Missouri IRP filing requirements and an index of Rule compliance, and six (6) technical volumes. Their ordering and subject matter correspond to the IRP Rule sections as laid out in 20 CSR 4240-22.030 through 20 CSR 4240-22.070. The technical volumes contain the Rule reference and the Company's response as appropriate. The responses to Special Contemporary Issues can be found in the final section of Volume 6.

The eight volumes that comprise the IRP filing are summarized as follows:

Volume 1:	Executive Summary
Volume 2:	Missouri Filing Requirements and an Index of Rule Compliance
Volume 3:	Load Analysis and Load Forecasting
Volume 4:	Supply-Side Resource Analysis
Volume 4.5:	Transmission and Distribution Analysis
Volume 5:	Demand-Side Resource Analysis
Volume 6:	Integrated Resource Plan and Risk Analysis
Volume 7:	Resource Acquisition Strategy Selection

SECTION 3 COMPANY DESCRIPTION

1. A brief introduction describing the utility, its existing facilities, existing purchase power arrangements, existing demand-side programs, existing demand-side rates, and the purpose of the resource acquisition strategy;

3.1 Liberty-Empire Utility Overview

Liberty-Empire is a regulated utility based in Joplin, Missouri that provides electric service to approximately 184,000 customers as of December 31, 2024. In 2017, The Empire District Electric Company was acquired by Liberty Utilities (Central) Corp., a subsidiary of Liberty Utilities Co. ("Liberty"), itself a U.S. subsidiary of Algonquin Power & Utilities Corp. Liberty-Empire is part of Liberty's Central Region. The Liberty-Empire relationship provides many benefits to the Company, including opportunities to share corporate resources and engage in multi-company research efforts.

This IRP applies to the Liberty-Empire electric business. The electric operation generates, purchases, and distributes electricity to its customers in parts of Missouri, Kansas, Arkansas, and Oklahoma. As of December 31, 2024, based on KWh sales, the Liberty-Empire footprint is comprised as follows: Missouri 88.2%, Kansas 4.6%, Arkansas 3.7%, and Oklahoma 3.2%. Liberty-Empire is subject to the general regulatory authority of the Missouri Public Service Commission ("MPSC"), the Arkansas Public Service Commission ("APSC"), the Kansas Corporation Commission ("KCC"), the Oklahoma Corporation Commission ("OCC"), and the Federal Energy Regulatory Commission ("FERC"). Additionally, Liberty-Empire is a member of, and participates in, the electricity market managed by the Southwest Power Pool ("SPP").

Liberty-Empire's electric service territory encompasses approximately 10,000 square miles. Liberty-Empire serves portions of sixteen counties in Missouri, portions of three counties in Oklahoma, one county in Kansas, and a portion of one county in Arkansas. Most of Liberty-Empire's load and territory is located in southwestern Missouri. The largest urban area it serves is the city of Joplin, Missouri. Principal commercial activities

for its service territory are light industry, agriculture, and tourism. In addition to supplying retail electric service, Liberty-Empire also provides wholesale service to one municipally owned distribution system at the time of this filing.

3.1.1 Existing Generation Facilities and Purchase Power Agreements

Liberty-Empire meets its load requirements through a diverse combination of existing owned and contracted supply-side resources. Liberty-Empire's fleet of existing and committed supply-side resources includes both fully or jointly owned resources and resources for which Liberty-Empire has power purchase agreements ("PPA"). The existing owned resource fleet consists of a variety of fuel and ownership types, including partial ownership shares in two coal-fired plants, several wholly owned natural gas-fired combustion turbines ("CT"), a wholly owned natural gas-fired combined cycle ("CC") unit, a partial ownership share in a natural gas-fired combined cycle unit, a hydroelectric facility, and three wind farms. Additionally, Liberty-Empire meets its customer needs with long-term PPAs for coal or wind units. Table 1-1 provides a summary of the existing generating facilities owned or contracted by Liberty-Empire. The unit ratings represent summer operating capacity ratings at the time of the 2025 IRP analysis and reflect Liberty-Empire's ownership share of jointly owned units. Units are rerated from time to time as routine capability tests are performed.

Table 1-1 – Liberty-Empire Existing Supply-Side Resources – Owned and Contracted

Owned Resources	Fuel Type	State	% Owned	Summer Operating Capacity (MW)	Winter Operating Capacity (MW)
Iatan 1	Coal	MO	12%	76	69
Iatan 2	Coal	MO	12%	108	108
Plum Point (Owned)	Coal	AR	7.52%	50	50
Riverton 10 CT	Natural Gas/Oil	KS	100%	13	15
Riverton 11 CT	Natural Gas/Oil	KS	100%	15	15
Riverton 12 CC	Natural Gas	KS	100%	254	283
Empire Energy Center 1 CT	Natural Gas/ Oil	MO	100%	81	95
Empire Energy Center 2 CT	Natural Gas/ Oil	MO	100%	80	80
Empire Energy Center 3 CT	Natural Gas/ Oil	MO	100%	40	55
Empire Energy Center 4 CT	Natural Gas/ Oil	MO	100%	43	58
State Line CT	Natural Gas/ Oil	MO	100%	83	83
State Line CC	Natural Gas	MO	60%	299	312
Ozark Beach	Hydro	MO	100%	16	16
North Fork Ridge	Wind	MO	100%	149	149
Kings Point	Wind	MO	100%	149	149
Neosho Ridge	Wind	KS	100%	301	301
Total Owned Capacity:				1,794	1,875
Long Term PPAs	Fuel Type	State		Summer Operating Capacity (MW)	Winter Operating Capacity (MW)
Plum Point	Coal	AR		50	50
Elk River Wind Farm	Wind	KS		150	150
Meridian Way Wind Farm	Wind	KS		105	105
Total Contracted Capacity:				305	305
Capacity Sales	Fuel Type	State		Summer Operating Capacity (MW)	Winter Operating Capacity (MW)
MJMEUC Capacity Sale	Capacity	n/a		-78	-78
MJMEUC Capacity Sale	Capacity	n/a		-25	-25
Total Capacity Sales:				-103	-103

Table 1-2 summarizes the “baseline” (i.e., age-based) retirement and expected PPA expiration dates for the existing supply-side resources in Liberty-Empire’s portfolio for IRP purposes. For resources that are wholly or majority-owned and operated by Liberty-Empire, the retirement date represents the resource’s age-based end of life. For resources for which Liberty-Empire is a minority owner, the retirement date represents

the planned retirement date indicated by the joint and majority owners. PPA expiration dates represent the expected date of contract expiration with no assumed extensions.

Table 1-2 – Base Retirement and PPA Expiration Dates

Owned Unit Name	Commercial Online Year	Age of Facility As of 2025 (Years)	Baseline IRP Retirement Year
Iatan 1	1980	45	2039
Iatan 2	2010	15	n/a
Plum Point (Owned)	2010	15	n/a
Riverton 10 CT	1988[1]	58[1]	2026
Riverton 11 CT	1988[1]	58[1]	2026
Riverton 12 CC	2007 & 2016[2]	18 & 9	n/a
Empire Energy Center 1 CT	1978	47	2035
Empire Energy Center 2 CT	1981	44	2035
Empire Energy Center 3 CT	2003	22	n/a
Empire Energy Center 4 CT	2003	22	n/a
State Line CT	1995	30	n/a
State Line CC	1997 & 2001[3]	28 & 24	n/a
Ozark Beach	1913	112	n/a
North Fork Ridge	2020	5	n/a
Kings Point	2021	4	n/a
Neosho Ridge	2021	4	n/a
Long Term Power Purchases and Sales	PPA Start Year	PPA Term (Years)	Expected PPA Expiration Year
Plum Point	2010	30	2040
Elk River Wind Farm	2005	20	2025
Meridian Way Wind Farm	2008	20	2028
MJMEUC Capacity Sale[4]	2020 & 2025	5 & 2	2025 & 2027

Notes:

[1] Riverton 10 and 11 were installed at Liberty-Empire in 1988, but the equipment was manufactured in 1967.

[2] Combustion turbine Riverton 12 was installed in 2007. The steam cycle addition (combined cycle conversion) was completed in 2016.

[3] One of the gas turbines at State Line CC was installed in 1997. The other gas turbine and the steam turbine were installed in 2001.

[4] 25 MW MJMEUC Capacity Sale PPA that begins in 2025 is an amended and restated contract to the original MJMEUC capacity sale that began in 2020.

3.1.1.1 Long-Term Emissions Considerations

In 2021, Algonquin Power & Utilities Corp. established a goal of net-zero by 2050 for scope one and scope two emissions across its business operations.[2] This date is beyond the planning horizon of this twenty-year IRP. Today, a significant portion of Liberty-Empire's generation comes from its two existing natural gas-fired CC units, Riverton 12 and State Line CC. In addition to "baseline" retirement assumptions which assume that both CCs operate beyond 2050, Liberty-Empire evaluated earlier retirement/retrofit years for these units to assess the economic feasibility and cost impact of achieving long-term net zero carbon emissions by 2050.[3] While Liberty-Empire's selected Preferred Plan assumes no baseline retirement dates for the existing CCs, the Preferred Plan preserves the optionality to pivot toward a strategy that complies with the EPA's Greenhouse Gas ("GHG") rule in the long term, including the retirement of coal assets by 2032. Environmental sustainability (carbon reduction) was a key factor considered in the decision scorecard approach and the Preferred Plan is considered a pathway toward a longer-term lower emissions profile.

3.1.2 Existing Demand-Side Resources

As of 2025, Liberty-Empire offers demand-side programs in two of its four state jurisdictions, Missouri and Arkansas. Customer programs began in Missouri in mid-2007 and in Arkansas in October 2007. The current Missouri and Arkansas programs are shown in Table 1-3.

[2] Scope 1 emissions refer to direct greenhouse gas emissions from sources controlled or owned by Liberty-Empire. Scope 2 emissions refer to indirect greenhouse gas emissions associated with the purchase of electricity. Scope 3 emissions result from activities from assets not owned or controlled by the reporting organization. For Liberty-Empire, emissions associated with the owned portion of Plum Point and Iatan 1 and 2 are scope 3, while those from other portfolio resources are scope 1 and 2.

[3] "Net Zero" refers to the reduction of carbon emissions from Liberty-Empire's generating portfolio towards levels that are close to zero. Given the potential for "offsets" from outside the electric sector to cover small amounts of emissions from the portfolio, such as those from natural gas peaking units, the term *Net* Zero is used.

Table 1-3 – Demand-Side Programs by State

Missouri	Arkansas
Residential Efficient Products	Residential Products
Low-Income Weatherization	Residential Weatherization
Low-Income Multi-Family	School-Based Energy Education
HVAC Rebate	Online Audit and Energy Calculator
Pay As You Save (“PAYS”)	Commercial and Industrial Rebate Program
Small Business Direct Install (“SBDI”)	
Commercial and Industrial Rebate Program	

3.1.3 Transmission and Distribution Facilities

In addition to its existing supply-side resources, Liberty-Empire serves its customers through an interconnected grid of transmission and distribution (“T&D”) circuits and substations, which serve the needs of both its urban customers (located in areas of high service density like Joplin) as well as customers located along rural “feeder” circuits, where loads are low and circuits are long. This is an important physical characteristic of the Company’s service area.

SECTION 4 LOAD ANALYSIS AND LOAD FORECASTING

2. For each major class and for the total of all major classes, the base load forecasts for peak demand and for energy for the planning horizon, with and without utility demand-side resources, and a listing of the economic and demographic assumptions associated with each base load forecast;

Liberty-Empire and its load forecasting consultant, Itron, performed highly rigorous load analysis and forecasting as part of its triennial IRP analysis, consistent with the requirements set forth in the IRP Rule. Itron's load forecasts were developed using cost-of-service class energy models, cost-of-service class load profiles, and a system peak model. The forecast method employs at least ten years of historic load data and thirty years of historical weather data. Load profiles were calibrated to both class energy and system peak forecasts resulting in both energy and coincident peak forecasts for all classes and for the system.[4]

In forecasting load for the residential and commercial classes, Liberty-Empire used Itron's Statistically Adjusted End-Use ("SAE") modeling framework. The SAE models rely on end-use technology saturation and energy efficiency trend data for each census region based on data from the Energy Information Administration's ("EIA") 2023 Annual Energy Outlook ("AEO"), calibrated to Liberty-Empire's specific saturation and efficiency survey results. Calibrating to Liberty-Empire's historical saturation data included smoothing the transitions between known Liberty-Empire saturation levels and long-term trends. Both residential and commercial end-use data were adjusted to include the effects of historical DSM savings on loads, electric vehicles ("EV"), and customer-owned solar distributed generation ("DG"). The SAE models also included adjustments for economic and weather drivers and the price of electricity. Ultimately, these data were used to produce load forecasts by major class and for the system from 2025 through 2054.

[4] In addition to under standard load forecasts, Liberty-Empire assessed required resources and associated costs for a scenario with additional data center load as a part of the Special Contemporary Issue responses.

Based on the load analysis, Liberty-Empire forecasts its net system input ("NSI" or "net energy for load") and retail energy sales to remain relatively flat through the planning period. Retail energy sales, which exclude losses and the impact of customer-owned solar DG and EV load, are forecast to rise from **[redacted]** with an overall growth rate over the 20-year period of **[redacted]** NSI, which includes losses which are not billed, is forecast to rise from **[redacted]**

Figure 1-1 shows the Base Case NSI forecast for the planning horizon by each major class. Figure 1-2 shows the Base Case retail sales forecast for the planning horizon by each major class. These forecasts include the impacts of Liberty-Empire's existing DSM but exclude the impacts of future DSM.

Figure 1-1 – NSI Forecast 2025-2044 (GWh)

****Confidential in its Entirety****

Figure 1-2 – Retail Sales Forecast 2025-2044 (GWh)

****Confidential in its Entirety****

Figure 1-3 – RAP DSM Impact on Annual Energy Requirements (Low-, Mid-, and High-Cost RAP DSM Bundles)

****Confidential in its Entirety****

Figure 1-4 – RAP DSM Impact on Load (Low-, Mid-, and High-Cost RAP DSM Bundles)

****Confidential in its Entirety****

Figure 1-5 – Summer Peak MW

****Confidential in its Entirety****

Figure 1-6 – Winter Peak MW

****Confidential in its Entirety****

4.1 Load Forecast Variance Request

On April 1, 2024, one year in advance of the 2025 IRP filing, Liberty-Empire filed an application for variance of portions of 20 CSR 4240-22.030. The variance request was generally related to (1) no end-use information available for the Large Power (i.e., industrial) class, and (2) the definition of "major classes" as it relates to load forecasting for the IRP. On May 16, 2024, the MPSC Staff filed a response where they agreed with, and recommended approval of Liberty's request for a variance. In their response, the Staff stated the Company's variance request will not compromise the policy objectives of the resource planning process for electric utilities, will allow for a load forecasting methodology consistent with Liberty's last triennial IRP, will save time and expense in a time-consuming and detailed integrated resource planning endeavor, and therefore, approval of the Company's application is in the public interest. The MPSC issued an Order on May 30, 2024, effective June 29, 2024, in Case No. EO-2024-0280 approving Liberty-Empire's application for variance of portions of 20 CSR 4240-22.030.

SECTION 5 SUPPLY-SIDE RESOURCE ANALYSIS

5.1 Existing Supply-Side Resources

Consistent with the IRP Rule, Liberty-Empire performed an economic analysis of its existing portfolio of supply-side generation resources and of the candidate supply-side resources that it could reasonably expect to use, develop, or acquire during the planning horizon to serve future customer needs. Liberty-Empire's existing resources and assumed age-based retirement or PPA expiration dates were described in Section 3.1.1, and a detailed description of each of these resource facilities and contracts can be found in Volume 4.

During the 20-year study horizon covered by the 2025 IRP (2025-2044), the age-based resource retirements and expected PPA expirations of the existing resources were as follows:[5]

- Expiration of the Elk River Wind PPA in 2025;
- Expiration of the 78 MW MJMEUC Capacity Sale PPA in 2025;
- Retirement of Riverton 10 and 11 in 2026;
- Expiration of the 25 MW MJMEUC Capacity Sale PPA in 2027;
- Expiration of the Meridian Way Wind PPA in 2028;
- Retirement of Energy Center 1 and 2 in 2035;
- Retirement of Iatan 1 in 2039;
- Expiration of the Plum Point PPA in 2040.

All other existing Liberty-Empire generating units were assumed to continue operations throughout the planning horizon, and Liberty-Empire did not assume any extensions of PPA contracts for IRP purposes.

[5] As described in Section 3.1.1.1, the 2025 IRP also contemplated a set of "net zero" plans which assumed earlier retirement dates for Liberty-Empire's existing gas CCs, Riverton 12 and State Line CC, by 2050 in order to achieve net zero carbon emissions.

As indicated in the list above, Liberty-Empire included two key decisions in all alternative plans that maintain "baseline" retirements and assumptions modeled in the 2022 IRP. First, given the age of the original equipment at the Riverton 10 and Riverton 11 facilities, Liberty-Empire assumed the retirement of both units in 2026. To preserve the units' dual-fuel capability **[redacted]**, Riverton 10 and 11 were assumed to be replaced directly at the site by dual-fuel, **[redacted]** industrial gas turbines, taking advantage of Riverton 10 and 11's existing interconnection rights at the site.

Second, in the 2025 IRP, Liberty-Empire assumed a retirement date of 2035 for two of its older natural gas peaking units, Energy Center 1 and 2, as in the 2022 IRP. Their high potential reliability benefits, as demonstrated during Winter Storm Uri, suggest that maintaining them until 2035 with some capital investment could help provide reliable energy services to customers especially with anticipated changes to SPP resource adequacy requirements. Liberty-Empire intends to explore adding new resources at the Energy Center site after 2035 which would avoid incremental interconnection costs up to the 175 MW left vacant by the retiring units.

5.2 Candidate Supply-Side Resources

5.2.1 Overview of Supply-Side Resource Option Analysis

Consistent with the IRP Rule, Liberty-Empire considered a wide range of potential supply-side resource options for inclusion in its future portfolio resource mix, then narrowed the range down to a subset of feasible and commercially viable options to be evaluated in the fuller integrated portfolio analysis in conjunction with demand-side resources. Liberty-Empire began with a broad list of all potential resource types that it could reasonably expect to use, develop, implement, or acquire, including plants utilizing existing generation technologies, new generation technologies, emerging technology types expected to become commercially viable within the 20-year IRP horizon, distributed resources, any available existing resource upgrades or life extensions, and purchased

power from SPP. Liberty-Empire then used a screening process to narrow down the broader list of resource options to only those that were likely feasible to develop and operate in the Company's service territory. The potential supply-side resource options selected for further investigation were as follows:

1. Carbon Capture and Storage ("CCS") – supercritical coal CCS, natural gas-fired combined cycle with CCS, retrofit CCS on existing plants;
2. Natural gas-fired simple cycle – Aeroderivative CT and F-class frame CT;
3. Natural gas-fired combined cycle – 1 x 1 H Class;
4. Natural gas-fired RICE;*
5. Traditional nuclear and small modular nuclear reactor;
6. Wind – on-shore and off-shore, including re-powering of existing assets;
7. Biomass – wood waste and poultry waste;
8. Landfill gas;
9. Solar photovoltaic ("PV")* – fixed tilt and single axis tracking, with and without paired storage;
10. Energy storage – lithium-ion battery*, vanadium redox flow battery, molten salt, Energy Vault concrete block gravity storage, compressed air;
11. Combined heat and power ("CHP");* and
12. Hydrogen – retrofit on existing gas-fired combined cycle units and new combined cycle combustion turbine.

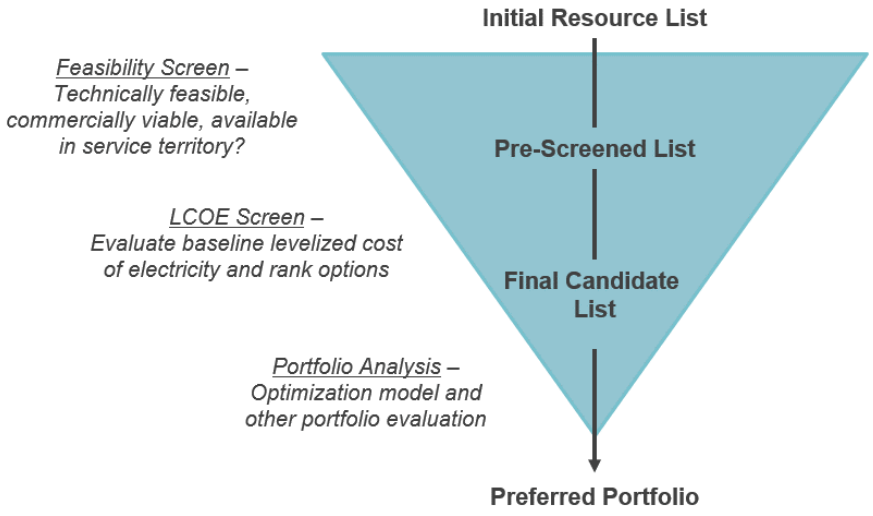
*Denotes a resource option evaluated as both a distributed and utility scale energy resource.

After the identification of the feasible supply-side resource options, planning-level cost and operating assumptions for each of the feasibility-screened resource options were collected and developed by Liberty-Empire's IRP consultant, Charles River Associates ("CRA"), with review and input by experts from a third-party engineering firm, Black and Veatch. Cost and operating estimates for the resource options were developed using a market scan approach for cost and operational parameters. The market scan approach involved in-depth research into recent cost data points from a variety of sources, including

public reports, other utility IRP filings and Requests for Proposals, proprietary subscription-based data sources, and Liberty-Empire's and Black and Veatch's internal view based on actual and recent project estimates. The results of the market research were used to develop current cost estimates for the technologies as well as projections for cost changes over time. Using the cost and operating parameters from this market scan analysis, Liberty-Empire evaluated the levelized cost of electricity ("LCOE") and levelized cost of capacity of the feasible resource options to determine whether any options were commercially unviable relative to other resources under consideration.

Based on the results of the two rounds of preliminary screening analyses, as well as considerations for probable environmental costs of each potential supply-side resource option, Liberty-Empire ultimately identified a "shortlist" of potential supply-side resource options, representing the preliminary supply-side candidate resource options to be included in the integrated resource planning analysis. The screening process is illustrated in Figure 1-7.

Figure 1-7 – Supply-Side Resource Screening Approach



5.2.2 Feasibility Screening

Based on Liberty-Empire's feasibility screen, the following supply-side resource options were eliminated from consideration:

- Off-shore wind, given the lack of the resource type in Liberty-Empire's region;
- Re-powering of existing wind assets, given feedback from owners of the projects currently under contract with Liberty-Empire that they are not exploring re-powering opportunities at this time;
- CHP options, given uncertainty regarding feasible sites within Liberty-Empire's service territory and the lack of potential partners that have shown interest in pursuing CHP relationships with Liberty-Empire;
- Traditional nuclear, given the large size of the option (~1,000 MW) and the inability to assume with confidence that Liberty-Empire would have access to a partial ownership interest in a new development in any proximity to its service territory;
- Biomass and landfill gas, given limited access to a reliable source of fuel near the Liberty-Empire service territory;
- Supercritical carbon dioxide power cycle plant, given the nascency of the technology, with only a single pilot project currently operational, and unlikeliness to be economically viable in the near term;
- Compressed air, given the engineering complexity of development and operation and the lack of natural geology in Liberty-Empire's region;
- Molten salt energy storage, given the scarcity of operating examples to draw upon;
- Iron air storage, given the difficulty in gauging scalability and economic viability due to early stages of commercial deployment; and
- CO_2 storage, given the lack of large-scale deployment and difficulty modeling the technology from a cost and operations perspective.

5.2.3 Cost Screening

Using the cost and operating parameters from the market scan analysis, Liberty-Empire evaluated the levelized cost of electricity and levelized cost of capacity of the feasible resource options to determine whether any options were commercially unviable relative to other resources under consideration. Figure 1-8 and Figure 1-9 summarize the results of the levelized cost analysis for select years, 2025 and 2035, in nominal dollars per MWh for LCOE (on the y-axis) and in nominal dollars per UCAP kW-year for the levelized cost of capacity (on the x-axis). Each graphic represents the projected cost for a resource that would enter into service in the indicated year. A resource in the lower left quadrant of the graphic has both a low levelized cost of electricity and low levelized cost of capacity relative to other resources; meanwhile, a resource in the upper right quadrant has both a high levelized cost of electricity and a high levelized cost of capacity relative to other resources. Further detail on this analysis can be found in Volume 4.

Figure 1-8 – LCOE and Levelized Cost of Capacity Projections (2025)

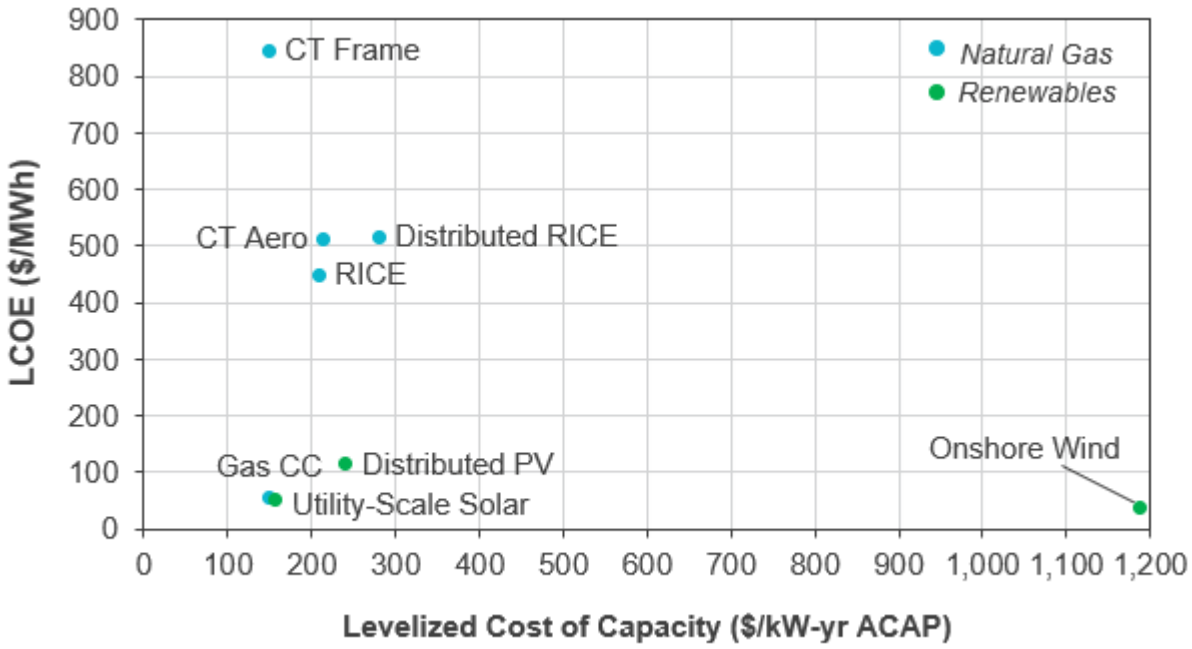
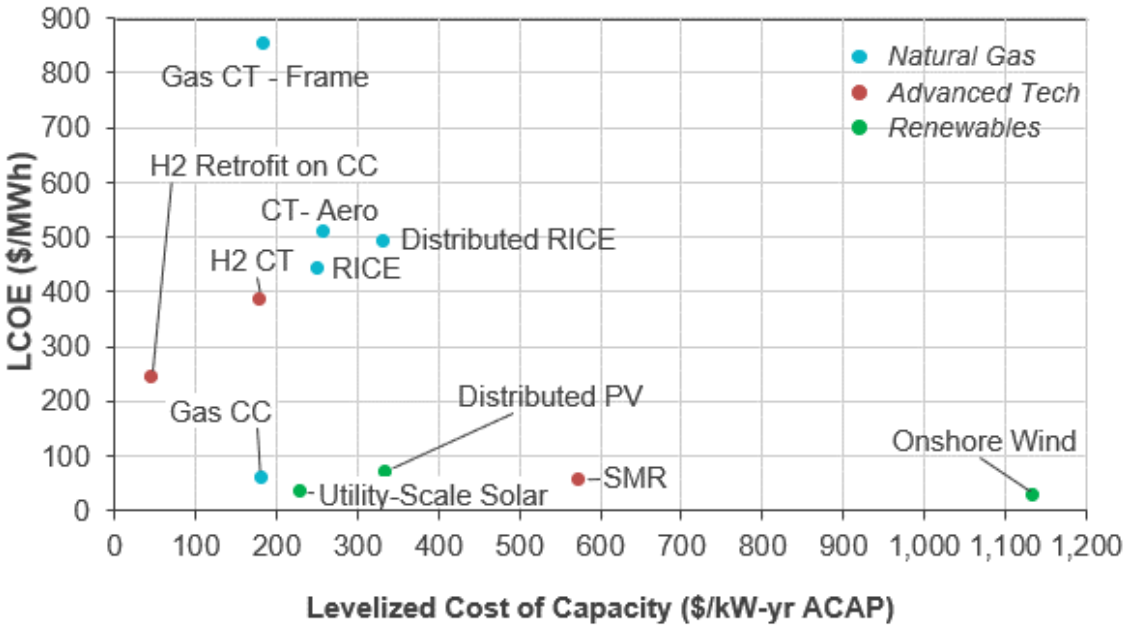


Figure 1-9 - LCOE and Levelized Cost of Capacity Projections (2035)



In addition to generation resources, Liberty-Empire also evaluated four energy storage technologies in the 2025 IRP: 4-hour lithium-ion battery storage, 8-hour lithium-ion battery storage, 8-hour vanadium flow battery storage, and Energy Vault concrete block gravity storage. Unlike typical generating resources, storage resources do not provide net energy to the grid, but instead shift energy during the day or even across a week to peak or high-priced hours. Because storage resources do not produce net generation, they cannot be appropriately evaluated in the traditional LCOE framework. Instead, Liberty-Empire assessed and screened storage options based on total cost of capacity, including capital, FOM, and ongoing capex, levelized over the lifetime of the resource. Liberty-Empire found that lithium-ion batteries were cost-competitive with standard generation resources on a capacity basis, although the value of the capacity is likely to erode over time as more storage is added to the system. The screening analysis also demonstrated that flow batteries and gravity storage were expected to be competitive with lithium-ion in the longer term, due in large part to the longer duration configuration of these technologies, which allowed them to provide more capacity value for deployment during times of peak demand. Liberty-Empire considered the development of flow batteries for 2035 and beyond and gravity storage only for net-zero portfolios in the same time frame. Liberty-

Empire will continue evaluating emerging storage technologies as markets evolve and potential use cases are further identified.

Overall, the supply-side candidate resource options were found to represent a wide range of costs. Due to a wide range of economic and performance benefits for the Liberty-Empire system, Liberty-Empire determined that nearly all generation technology types should advance to the next phase of analysis.[6] These benefits are summarized as follows:

- Energy – Wind, solar, CCGT gas, and nuclear small modular reactors ("SMR") offer low cost of levelized energy;
- Capacity – Hydrogen Retrofits and Hydrogen CTs, along with gas options including CCGT, CT have the lowest levelized cost of capacity ("LCOC");
- Clean baseload – For net-zero evaluation, hydrogen, SMR, and advanced storage technologies offer various energy and capacity value levels;
- Locational – Distributed options including solar, RICE, and storage are at a cost premium to their utility scale counterparts; however, they may provide benefits associated with avoided distribution system-level expenditures.

5.2.4 Final Candidate Supply-Side Resources

Based on the feasibility and cost ranking screening analyses, Liberty-Empire identified a final list of technologies representing the preliminary supply-side future candidate resource options to be included in the 2025 IRP. The final list of candidate supply-side resource options is as follows:

- Natural gas-fired simple cycle – Aeroderivative CT and F-class frame CT;
- Natural gas-fired combined cycle – 1 x 1 H Class;

[6] Fixed tilt solar PV was excluded from the candidate list because the small capital cost premium associated with single-axis tracking PV relative to fixed tilt PV is more than offset by a significantly improved expected capacity factor.

- Natural gas-fired RICE*;
- Small modular nuclear reactor;
- Onshore Wind;
- Solar PV*;
- Energy storage – lithium-ion battery*, vanadium redox flow battery, Energy Vault concrete block gravity storage; and
- Hydrogen – retrofit on existing gas-fired combined cycle units and new simple cycle combustion turbine.

*Denotes a resource option evaluated as both a distributed and utility scale energy resource.

5.3 Commodity Market Price Forecasts

Fuel, power, and emission allowance prices are key value drivers for Liberty-Empire's resource portfolios. These prices can dictate the competitiveness of different resource types and thus must be carefully evaluated in the IRP. Liberty-Empire's fuel, power, and emission price forecasts were developed primarily by third-party consultants in partnership with Liberty-Empire.

5.3.1 Fuel Price Forecasts

Coal price forecasts for Liberty-Empire's jointly owned units were based on the operator's most recent 5-year fuel projection in the near term, which incorporates the most recent coal contracts at each of the plants for those years. In the medium to longer term, the coal price forecasts were escalated based on forecasted growth rates for Powder River Basin ("PRB") coal costs as developed by Horizons Energy, combined with transportation adders for Liberty-Empire's coal units. Liberty-Empire did not develop high or low scenario coal price forecasts for two primary reasons. First, Liberty-Empire's coal-fired resources consist only of Iatan and Plum Point, both of which are minority-owned and are not operated by the Company. Second, Liberty-Empire did not consider adding any new coal

resources to the portfolio in the future.

To forecast natural gas fuel prices, Liberty-Empire relied on CRA to develop a set of market fundamentals-based natural gas price scenario forecasts (Base, High, and Low) for use in the portfolio analysis for both existing and new natural gas-fired resources. CRA developed natural gas prices using a set of fundamental market models, including the Natural Gas Fundamentals ("NGF") model, which produces bottom-up natural gas price and production projections in North America. Inputs to NGF include the latest views from public sources (e.g., EIA and PGC) on natural gas demand by sector, production forecasts, drilling costs, and oil prices under various fundamental potential market conditions. CRA also forecasted seasonal and regional basis over the long-term using the Gas Pipeline Competition Model ("GPCM") model, blended with market forwards over the near term to maintain consistency with observed market prices. More information on the development of the natural gas price forecasts can be found in Volume 4.

Figure 1-10 shows the forecasted Henry Hub natural gas prices for the Base, High, and Low Case price scenarios on a monthly basis. Figure 1-11 shows the forecasted Southern Star Delivered natural gas prices for the Base, High, and Low Case price scenarios on a monthly basis.

Figure 1-10 - Forecasted Base, High, and Low Natural Gas Prices (Henry Hub)

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Figure 1-11 - Forecasted Base, High, and Low Natural Gas Prices (Southern Star Delivered)

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5.3.2 Carbon Price Forecast

Three levels of possible future carbon costs were assumed in the 2025 IRP modeling, as shown in Figure 1-12 in both nominal and real 2023 dollars. Liberty-Empire's Base Case incorporated a modest price on carbon emissions of $13-14/short ton starting in 2031. This level of carbon pricing was intended to represent potential carbon regulation that would achieve 60-70% carbon-free generation from the U.S. power sector over the long-term relative to a historical year baseline, depending on other market factors and dynamics. Liberty-Empire also evaluated the EPA GHG Standards, which were modeled as the high-carbon stringency forecast, serving as an alternative to carbon pricing.[7] The Low Case carbon scenario assumes no carbon price through the study period.

Figure 1-12 – CO_2 Price Forecast

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7 The current EPA GHG Standards will test the most stringent possibility of the EPA. It is understood that this ruling has received pushback, will likely continue to face legal challenges, and the final rule may change over time.

5.3.3 Power Price Forecast

Based on the three fuel price scenarios and three carbon price scenarios, Liberty-Empire developed nine permutations of power market outcomes and resulting market power price trajectories to be used as inputs in the IRP analysis. Power prices were developed through CRA's fundamental modeling of the power market, which incorporates key assumptions regarding fuel forecasts, hourly load forecasts, resource additions and retirements, and power plant operations. The nine power price scenarios, summarized for SPP South Hub, are shown in Figure 1-13 on an annual average basis.

Figure 1-13 – SPP South Hub All Hours Power Prices

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SECTION 6 TRANSMISSION AND DISTRIBUTION SYSTEM ANALYSIS

The Transmission and Distribution Analysis section of the IRP Rule requires the utility to:

- Assess the adequacy of the existing T&D system;
- Consider opportunities to reduce T&D losses;
- Consider interconnection of new generation facilities;
- Consider the potential incorporation of advanced T&D network technologies;
- Develop avoided T&D capacity costs for demand-side analysis; and
- Describe participation with the utility's regional transmission organization ("RTO").

Liberty-Empire is a member of SPP and, as such, is reliant on SPP's determination of which transmission lines will be built and on what schedule. As a member of SPP, Liberty-Empire is assigned a cost sharing allocation of all lines that are built in the SPP. Volume 4.5 describes the provides copies of the RTO transmission expansion plan, describes utility-specific T&D projects, and identifies and describes any transmission projects under consideration by SPP for Liberty-Empire's service territory.

Liberty-Empire makes every effort to incorporate advanced technologies in presently budgeted projects. As demonstrated by its investments in Advanced Metering Infrastructure ("AMI"), Advanced Distribution Management Systems ("ADMS"), and distribution automation, Liberty-Empire is taking significant action to incorporate advanced technologies into its T&D network and is modernizing its grid to better set the stage for future advanced grid technologies. Organization-wide, Liberty is working to establish a platform of capabilities involving AMI, ADMS, and other capabilities that are important for the safe, compliant, and cost-effective operation of the distribution grid. Over time, Liberty-Empire will better understand the extent of implementation of these programs, determining Liberty-Empire's specific requirements in relation to load and

customer needs, and when said advanced technologies may become cost-effective. Liberty-Empire will continue to evaluate the possible influence these technologies may have within future filings.

SECTION 7 DEMAND-SIDE RESOURCE ANALYSIS

7.1 DSM Program Analysis

Liberty-Empire analyzed demand-side resources and supply-side resources on an equivalent basis as options for meeting load requirements. For the 2025 IRP, Liberty-Empire engaged Applied Energy Group ("AEG") to conduct a DSM Potential Study in the Company's service territory and develop DSM program inputs for the IRP analysis. The integrated portfolio analysis evaluated two levels of achievable potential for energy savings associated with DSM programs: realistic achievable potential ("RAP") and maximum achievable potential ("MAP"). Achievable potential embodies a set of assumptions about the decisions consumers make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for energy-consuming equipment, and the elements of building construction. MAP is defined as the maximum amount of savings that can be realized under ideal market, implementation, and customer preference conditions, and has higher incentives than RAP due to higher program participation. RAP reflects expected program participation given barriers to customer acceptance, non-ideal implementation conditions, and limited program budgets.

Within the RAP and MAP scenarios, AEG bundled DSM programs together based on the $/kWh cost of the programs (low, mid, and high-cost energy efficiency bundles plus a demand side rates bundle) for use in the integrated portfolio analysis. These DSM bundles were incorporated into the IRP as eligible resources in the portfolio optimization analysis along with supply-side resources in the alternative plan development stage. A summary of the demand-side program bundles used in the integrated analysis is presented below.

Table 1-4 – Description of DSM IRP Bundles

DSM	Program Bundle	Description
RAP	Low Cost	Programs with a five-year average $/kWh saved between $0.20 to $0.40 per kWh. Includes: • Commercial Custom • Commercial Prescriptive
	Mid Cost	Programs with a five-year average $/kWh saved between $0.40 to $0.55 per kWh. Includes: • Residential Prescriptive
	High Cost	Programs with a five-year average $/kWh saved above $0.55 per kWh. Includes: • SBDI • Income Eligible Lighting
	Demand Side Rates ("DSR")	DR and DSR programs. Includes: • Time of Use Rate (Res & Non-Res) • Critical Peak Pricing (Res & Non-Res) • DLC Battery Storage (Res & Non-Res) • DLC Smart Thermostat (Res & Non-Res) • DLC Smart Appliances • Grid-Interactive Water Heater (Res & Non-Res)
MAP	Low Cost	Programs with a five-year average $/kWh saved between $0.20 to $0.40 per kWh. Includes: • Commercial Custom • Commercial Prescriptive
	Mid Cost	Programs with a five-year average $/kWh saved between $0.40 to $0.55 per kWh. Includes: • Residential Prescriptive
	High Cost	Programs with a five-year average $/kWh saved above $0.55 per kWh. Includes: • SBDI • Income Eligible Lighting
	Demand Side Rates ("DSR")	DR and DSR programs. Includes: • Time of Use Rate (Res & Non-Res) • Critical Peak Pricing (Res & Non-Res) • DLC Battery Storage (Res & Non-Res) • DLC Smart Thermostat (Res & Non-Res) • DLC Smart Appliances • Grid-Interactive Water Heater (Res & Non-Res)

Recent Market Potential Study

As agreed during the previous IRP, the Company conducted residential and commercial surveys in partnership with AEG. On March 23, 2022, Liberty-Empire filed its 2021 Market

Study in Missouri's Electronic Filing Information System ("EFIS") in File No. EO-2021-0331. As anticipated, the data was not fully analyzed and available in time to be incorporated into the 2022 IRP analysis, but the market research was utilized for this 2025 IRP and will be available to inform the development of future MEEIA cycles and future IRP processes.

SECTION 8 INTEGRATED RESOURCE PLANNING AND RISK ANALYSIS

3. A summary of the preferred resource plan to meet expected energy service needs for the planning horizon, clearly showing the demand-side resources and supply-side resources (both renewable and non-renewable resources), including additions and retirements for each resource type;

The supply-side and demand-side candidate resource options described previously were used in the integrated resource planning analysis in conjunction with future load expectations to develop a set of optimized alternative resource plans. Each alternative resource plan was subject to resource acquisition strategy constraints that defined the type of resources that could be added to the portfolio over the IRP study period. Given these resource selection constraints, the additions in each portfolio were optimized in terms of their amount and timing using a long-term portfolio optimization model known as Aurora. Each alternative resource plan was then evaluated based on the performance measures required by the Rule.

8.1 Resource Adequacy Revisions

The 2025 IRP analysis applies an accredited capacity (ACAP) resource adequacy construct being implemented by SPP. The construct represents a major shift in resource adequacy with requirements for both summer and winter seasons along with resource accreditation revisions. Moreover, installed reserve margin requirements are increasing from 15% in 2024 to 17% by 2029 for summer, and being initiated at 36% in 2026 and increasing to 44% by 2029 for winter. The construct is still being developed by SPP and could evolve further. Liberty-Empire will follow these developments and implement them in future planning processes.

8.2 Development of Alternative Resource Plans

As a part of the 2025 IRP analysis, Liberty-Empire developed 12 alternative resource plans for purposes of the 2025 IRP analysis. Eight of the 12 alternative resource plans assumed “baseline” (i.e., age-based) retirement dates and expected PPA expirations for

the existing resources in Liberty-Empire's portfolio. Three of the remaining four plans were designed to achieve net zero scope 1 and 2 carbon emissions by 2050 and include the retirement or retrofit of Liberty-Empire's two existing gas CCs, Riverton 12 and State Line CC, in 2045 and 2050, respectively. The final plan was designed to meet the EPA's GHG rule, issued under section 111 of the Clean Air Act. This alternative resource plan involves retiring all coal units by 2032 while capping any new combined cycle gas turbine and single cycle gas turbine units at 40% and 20% capacity factor, respectively.

In addition to the assumed retirements of the existing resources, each resource portfolio was subject to constraints on resource acquisition strategy, which defined the type of resources that could be added to the portfolio over the IRP study period. The "baseline" portfolios included plans that allowed the addition of only thermal resources vs. only renewable and storage resources and plans that allowed the addition of RAP DSM vs. MAP DSM programs. For the "net zero" portfolios, the existing natural gas-fired CCs were assumed to be replaced by a combination of renewables and emerging technologies such as advanced storage, nuclear SMR, and/or hydrogen.

Table 1-5 - Summary of Alternative Resource Plans

Plan	Plan Description	Replacement Tech.	Key Retirements*	DSM Bundle
1	Gas Only – Utility-Scale + Distributed	Natural Gas		RAP
2	Gas Only – Utility-Scale + Distributed	Natural Gas		MAP
3	Gas/Renew Mix – Utility-Scale + Distributed	Natural Gas + Renew.		RAP
4	Gas/Renew Mix – Utility-Scale + Distributed + Frame CT (2029)	Natural Gas + Renew.		RAP
5	Gas/Renew Mix – Utility-Scale + Distributed + 5x Aero (2029)	Natural Gas + Renew.		RAP
6	Gas/Renew Mix – Utility-Scale + Distributed	Natural Gas + Renew.		MAP
7	Renewable – Utility-Scale + Distributed	Renewable		RAP
8	Renewable – Utility-Scale + Distributed	Renewable		MAP
9	Net Zero 2050 – Renewable + Storage	Renewable	Riverton CC 2045 Stateline CC 2050	RAP
10	Net Zero 2050 – Nuclear SMR	Nuclear + Renewable	Riverton CC 2045 Stateline CC 2050	RAP
11	Net Zero 2050 – Hydrogen	Hydrogen + Renewable	Riverton CC 2045 Stateline CC 2050	RAP
12	EPA GHG Rule – Advanced Tech	Advanced Tech. + Renew.	Iatan 1 2031 Iatan 2 2031 Plum Point 2031	RAP

DSM = “Demand-Side Management”
RAP = “Realistic Achievable Potential”
MAP = “Maximum Achievable Potential”
Renewable options include storage. Advanced storage options are allowed only in the net zero portfolios.

*Key Retirements are incremental to retirements and PPA expirations that are common across all plans:
Expiration of the Elk River Wind PPA in 2025
Expiration of the 78 MW MJMEUC Capacity Sale PPA in 2025
Retirement of Riverton 10 and 11 in 2026
Expiration of the 25 MW MJMEUC Capacity Sale PPA in 2027
Expiration of the Meridian Way Wind PPA in 2028
Retirement of Energy Center 1 and 2 by 2035
Retirement of Iatan 1 in 2039
Expiration of the Plum Point PPA in 2040

All alternative plans were required to meet both summer and winter resource adequacy needs. The results of the portfolio optimization analysis are described in detail in Volume 6.

8.3 Relative Performance of Alternative Resource Plans

Given the set of 12 alternative plans developed through the portfolio optimization analysis, Liberty-Empire evaluated all 12 plans with respect to the performance measures specified in the IRP Rule. Figure 1-14 displays the present value of revenue requirements ("PVRR") of all 12 plans under Base Case planning assumptions for the twenty-year planning period of the IRP. Table 1-6 shows the results of all alternative plans evaluated under Base Case market conditions for all key IRP performance metrics.

Of all alternative plans, Plan 4 was the lowest cost. Plan 12 (EPA GHG Rule with Advanced Tech + RAP DSM) is competitive with certain plans that assume age-based or retirements (Plans 1 through 6) on both a 20-year and 30-year PVRR basis, as further described in Volume 7. The early retirement of coal assets under the EPA GHG rule does not take place until 2031, and Plan 12 is similar to Plan 4 in technology buildout with an emphasis on gas turbine resources during the first six years of the IRP study period. Therefore, Plan 4 maintains flexibility and optionality to comply with the EPA GHG rule, assuming the necessary steps are taken in the near future.

Figure 1-14 – 20-Year PVRR for All Plans (2025-2044) ($ millions)

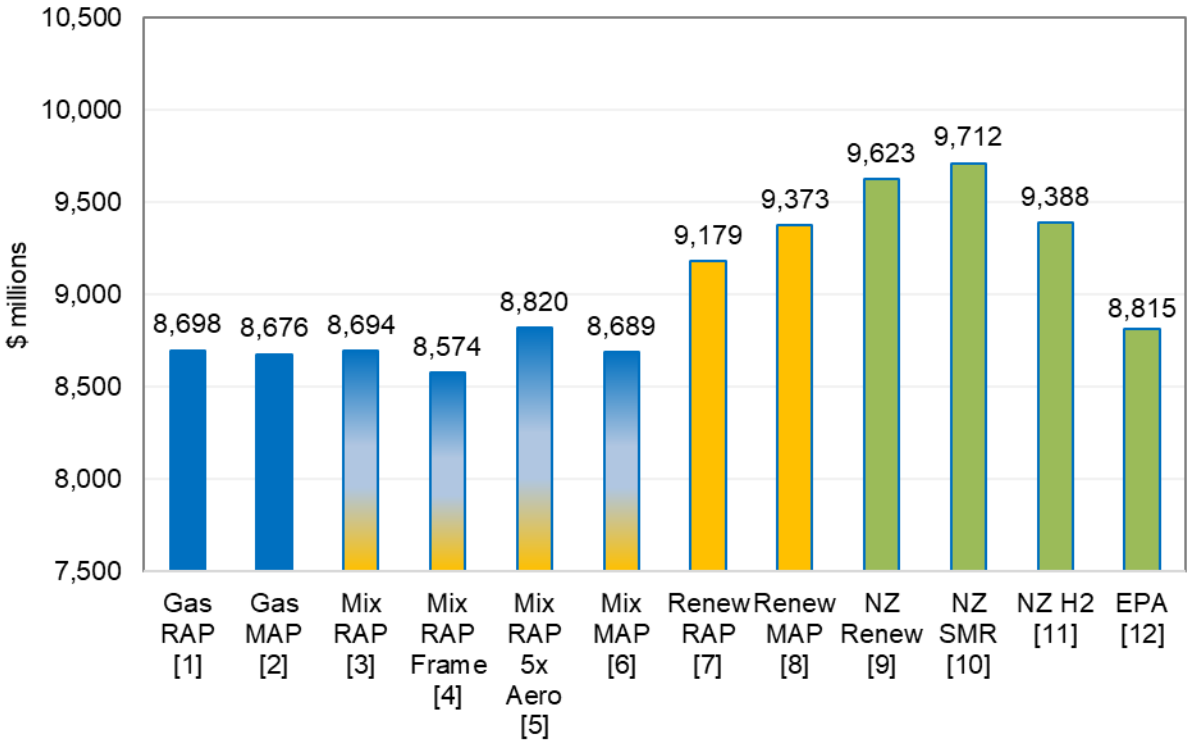

Table 1-6 - 20 Year Performance of Alternative Resource Plans

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[redacted]

8.4 Critical Uncertain Factors

4. Identification of critical uncertain factors affecting the preferred resource plan;

To assess each alternative plan's resiliency to a wide range of market risks, for the 2025 IRP, Liberty-Empire developed a list of uncertain factors that could potentially impact the performance of the resource plans. This list included, but was not limited to, the uncertain factors listed in the Rule. Liberty-Empire compiled information concerning the uncertain factors from subject matter experts within the Company and from its consultants. The subject matter experts and consultants developed wide but reasonable scenario ranges for each of the identified factors. Some of the uncertain factor scenarios were grouped together into a single uncertain factor for purposes of simplifying the analysis. Figure 1-15 lists the uncertain factors and factor groupings developed by Liberty-Empire.

Figure 1-15 – List of Uncertain Factors[8]

Uncertain Factor	Scenarios	Group
Load Growth	3	"Load"
Planning Reserve Margin	2	
Capital Cost Trajectories	3	"Cost of New Build" (CapEx, Interest Rate, Interconnection Cost, Tax Credits, FOM, CF)
Interest Rates	3	
Interconnection Costs	3	
Tax Credits	3	
FOM	3	
Renewable CF	3	
Carbon Prices	3	"Carbon / Emission"
SO2 and NOx Prices	3	
Natural Gas Prices	3	"NG Price"
Forced Outage Rates	3	"FOR"
Power / Capacity Prices	9 (based on market modeling)	"Power / A/S / ELCC" (Carbon / Emissions & NG Price permutations)
Solar & Storage ELCC	9 (based on market modeling)	
A/S Value	9 (based on market modeling)	

[8] "FOM" = Fixed O&M; "NG" = natural gas; "ELCC" = effective load carrying capability; "A/S" = ancillary service / sub-hourly. Solar and storage ELCC and A/S value were developed based on the nine power market outcomes described in Section 5.3.3.

Liberty-Empire tested the impact of changing one uncertain factor at a time on the PVRR rankings of a subset of thematically distinct replacement portfolios to determine whether an uncertain factor was critical. If the average PVRR values across the portfolios changed by more than 1% relative to the rankings under the Base Case (defined as the market scenario assuming the "base" scenario for all uncertain factors) because of the impact of a given uncertain factor, then that uncertain factor was deemed "critical." An illustration of the uncertain factor scenarios that were tested for critical impact on PVRR rankings is shown in Figure 1-16.[9]

Figure 1-16 – Uncertain Factor Testing Approach

Case	CO2, SO2, NOx	Gas Prices	Load	FOR	CapEx	Interest Rate	Interconnection	FOM	Renew CF
0 - Base	**Base**	**Base**	**Base**	**Base**	**Base**	**Base**	**Base**	**Base**	**Base**
1 - Low Emission Price	Low	Base	Base	Base	Base	Base	Base	Base	Base
2 - High Emission Price	High	Base	Base	Base	Base	Base	Base	Base	Base
3 - Low Gas Price	Base	Low	Base	Base	Base	Base	Base	Base	Base
4 - High Gas Price	Base	High	Base	Base	Base	Base	Base	Base	Base
5 - Low Load	Base	Base	Low	Base	Base	Base	Base	Base	Base
6 - High Load	Base	Base	High	Base	Base	Base	Base	Base	Base
7 - Low FOR	Base	Base	Base	Low	Base	Base	Base	Base	Base
8 - High FOR	Base	Base	Base	High	Base	Base	Base	Base	Base
9 - Low Cap Cost	Base	Base	Base	Base	Low	Base	Base	Base	Base
10 - High Cap Cost	Base	Base	Base	Base	High	Base	Base	Base	Base
11 - Low Interest Rate	Base	Base	Base	Base	Base	Low	Base	Base	Base
12 - High Interest Rate	Base	Base	Base	Base	Base	High	Base	Base	Base
13 - Low IC Cost	Base	Base	Base	Base	Base	Base	Low	Base	Base
14 - High IC Cost	Base	Base	Base	Base	Base	Base	High	Base	Base
15 - Low FOM	Base	Base	Base	Base	Base	Base	Base	Low	Base
16 - High FOM	Base	Base	Base	Base	Base	Base	Base	High	Base
17 - Low Renew CF	Base	Base	Base	Base	Base	Base	Base	Base	Low
18 - High Renew CF	Base	Base	Base	Base	Base	Base	Base	Base	High

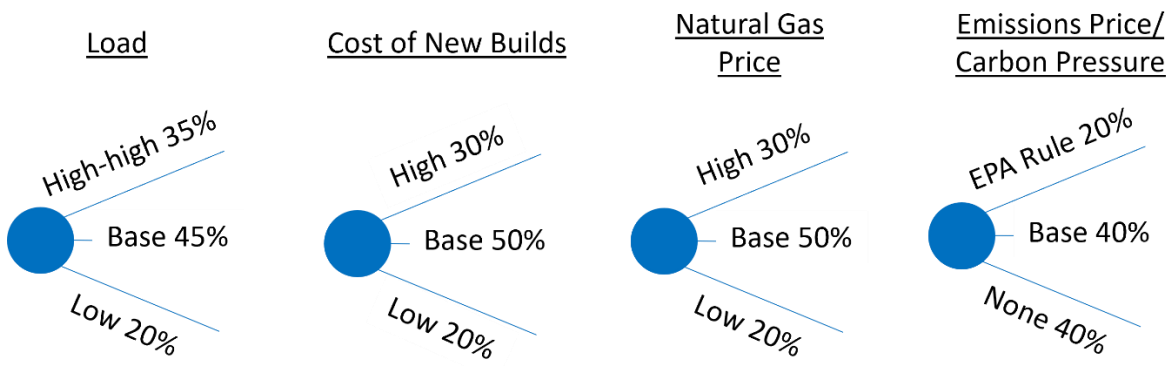
Based on this analysis, Liberty-Empire identified the following critical uncertain factors: load growth, carbon prices, natural gas fuel prices, and a grouping of factors related to the cost of new builds.[10] These uncertain factors were found to have the greatest potential

[9] Note that the variables related to the power market outcomes (i.e., power prices, ELCC, and ancillary service value) are dependent on the underlying market carbon price and natural gas fuel price scenario and were tested within the scenarios for those factors.

[10] As discussed in Volume 6, the cost of new builds CUF itself includes high, base, and low scenarios of component factors including capital costs, interconnection costs, interest rates, and tax credit provisions (if relevant).

influence on the selection of the Preferred Plan and were deemed to be the critical uncertain factors. These critical uncertain factors and their ranges form the nodes and the branches of the uncertainty tree in Figure 1-17.

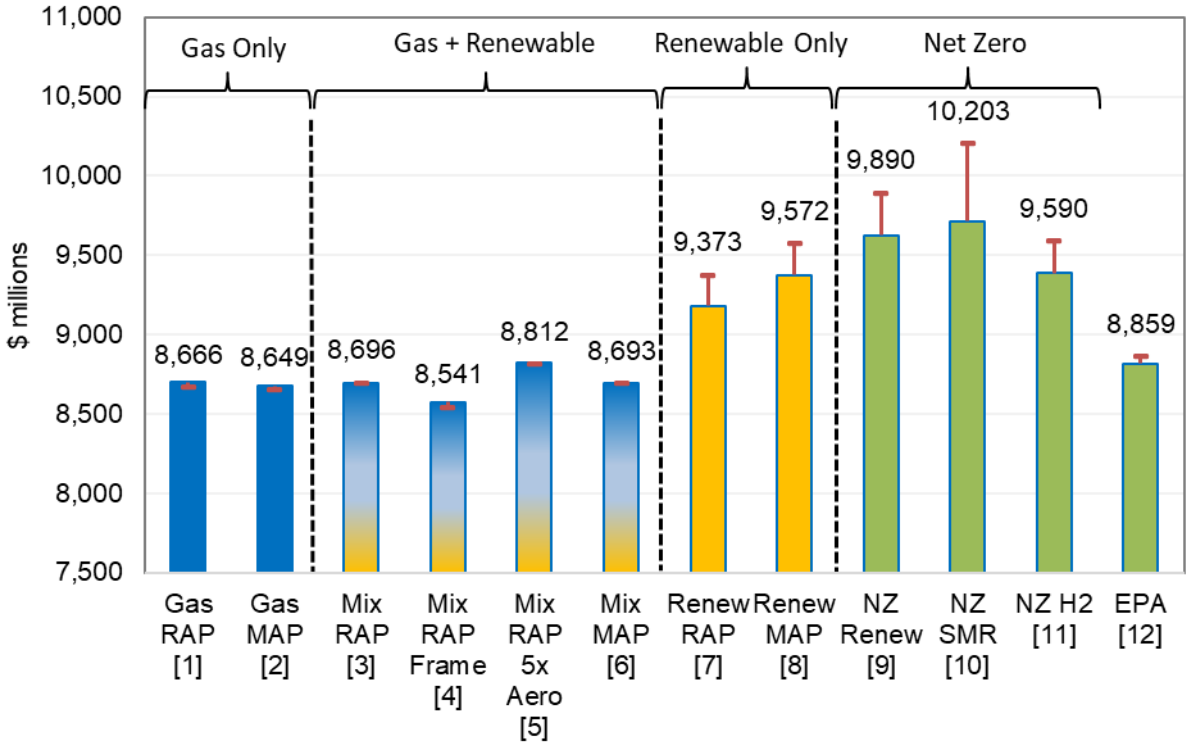
Figure 1-17 - Critical Uncertain Factors Tree



The subjective probabilities shown above were assigned by the utility decision-makers after review and discussion of the various critical uncertain factor scenario trajectories. The three potential endpoints for four critical uncertain factors resulted in 81 endpoints per plan, probability-weighted depending on the subjective probabilities of the scenario components. By calculating the PVRR of each plan on an expected value basis across all 81 subjective probability-weighted endpoints, Liberty-Empire determined the resilience of each plan to a wide range of risk for all critical uncertain factors.

Liberty-Empire found that Plan 4 performed best on an expected value basis for both 20-year and 30-year PVRRs, though several plans that assume age-based or baseline retirements have similar risk profiles, including Plans 1-3 and Plan 6. Overall, Plan 4 remained the lowest cost and preserves flexibility to pivot to the resource acquisition strategy under Plan 12 in the near- to mid-term. The expected value PVRRs for all plans are shown in Figure 1-18, with the red “whisker” lines representing risk values incremental to the Base Case PVRRs.

Figure 1-18 - PVRR with Risk Value for All Plans (2025-2044) – ($ millions)



SECTION 9 RESOURCE ACQUISITION STRATEGY SELECTION

9.1 Preferred Plan Selection Criteria

As described previously, Liberty-Empire's 2025 IRP analysis was intended to select a resource strategy that provides energy services that are safe, reliable, and efficient, at just and reasonable rates, consistent with state energy and environmental policies, in compliance with all legal mandates, and in a manner that serves the public interest. Consistent with 20 CSR 4240-22.010(2)(C), the selection of the resource strategy was based on the minimization of the present value of long-run utility costs and the mitigation of risks associated with critical uncertain factors, legal compliance, and rate increases. Finally, Liberty-Empire also considered the capability of the Preferred Plan to allow for the significant reduction of carbon emissions over the long term.

To document the process and rationale used by Liberty-Empire's decision-makers to assess the tradeoffs and determine the appropriate balance between minimization of expected utility costs and other resource planning considerations and metrics, Liberty-Empire's 2025 IRP deployed an IRP scorecard. The scorecard is a means of reporting key metrics for different alternative resource plans to facilitate the evaluation of relative portfolio performance and key tradeoffs. Liberty-Empire's scorecard did not produce a single ranking of portfolios but served as a tool to help facilitate structured tradeoff discussions and support the internal decision-making and approval process. As prescribed by the IRP Rule, minimization of the present worth of long-run utility costs was the primary selection criterion for the Preferred Plan, with all remaining planning objectives given equal consideration. In the judgment of utility decision-makers, the Preferred Plan represented an appropriate balance between the various planning objectives specified in 20 CSR 4240-22.010(2).

Liberty-Empire's 2025 IRP Scorecard is shown in Figure 1-19. While the scorecard does not include all performance metrics evaluated in Volume 6, it represents the criteria that utility decision-makers weighed most heavily in determining Liberty-Empire's Preferred

Plan. For each metric in the populated scorecard, values in darker shades of green illustrate a “stronger” performance of the plan (i.e., more favorable), and values in darker shades of red illustrate a “weaker” performance (i.e., more unfavorable). By design, all alternative resource plans adhere to legal mandates, energy policies, and safety standards. As such, these metrics have been omitted from Figure 1-19.

Figure 1-19 – Populated 2025 IRP Scorecard

Objective	Metric	Metric Description	Portfolio											
			1	2	3	4	5	6	7	8	9	10	11	12
Customer Affordability	Short-Term NPV Revenue Requirement	Total short-term (5-year) annual costs paid by ratepayers on a net present value basis under Base Case scenario	$2,765	$2,768	$2,765	$2,767	$2,792	$2,766	$2,852	$2,848	$2,850	$2,797	$2,850	$2,765
	Long-Term NPV Revenue Requirement	Total long-term (20-year) annual costs paid by ratepayers on a net present value basis under Base Case scenario	$8,698	$8,676	$8,694	$8,574	$8,820	$8,689	$9,179	$9,373	$9,623	$9,712	$9,388	$8,815
Risk Mitigation	Resilience to Critical Uncertain Factors	Expected value of 20-year PVRRs when evaluated against all critical uncertain factor probabilities	$8,666	$8,649	$8,696	$8,541	$8,812	$8,693	$9,373	$9,572	$9,890	$10,203	$9,590	$8,859
		Range (delta) between higher-cost (P95) and median (P50) PVRR outcomes when calculated against the CUF probabilities	$528	$523	$666	$657	$659	$672	$1,387	$1,452	$1,551	$2,300	$1,391	$822
Maintaining Reliability	Planning Reserves	% Reserve Margin, CUFs Average (Summer | Winter)	27.2% 25.9%	27.0% 25.6%	28.6% 25.7%	31.6% 28.9%	32.0% 29.4%	28.3% 25.4%	56.2% 32.2%	55.5% 31.9%	56.6% 33.5%	49.8% 34.3%	56.2% 32.2%	31.5% 26.2%
	Operational Flexibility	Dispatchable capacity (Summer UCAP MW) included in portfolio in 2044	1,351	1,347	1,328	1,330	1,334	1,324	847	847	847	1,147	847	1,313
Environmental Sustainability	Carbon Reduction	Million short tons CO2 emissions in 2044 (scope 1/2 only)	1,761	1,735	1,761	1,752	1,783	1,735	1,559	1,559	1,559	1,559	1,559	1,801

Based on this decision-making approach, Liberty-Empire selected Plan 4 as the Preferred Plan. The Preferred Plan for the 20-year IRP study period is shown in Table 1-7.

Table 1-7 - Preferred Plan Supply Side Resource Retirements and Additions

Year	Supply-Side Retirements and PPA Expirations	Supply-Side Additions
2025	Elk River Contract Expires (150 MW)	
2026	Riverton 10-11 Retires (27 MW)	
2027		RAP DSM* (Low-, Mid-, and High-Cost Bundles)
2028	Meridian Way Contract Expires (105 MW)	
2029		Gas Frame CT (240 MW)
2030		
2031		
2032		
2033		
2034		
2035	Energy Center 1 and 2 Expires (160 MW)	Utility-Scale Solar (150 MW)
2036		Gas Frame CT (240 MW)
2037		
2038		
2039	Iatan 1 Retires (84 MW)	
2040	Plum Point PPA Expires (50 MW)	
2041		Utility-Scale Solar (150 MW); Dist. RICE (2 MW)
2042		Dist. RICE (8 MW)
2043		Dist. RICE (8 MW); Dist. Storage (1 MW)
2044		Dist. RICE (10 MW)

* RAP DSM = Realistic Achievable Potential Demand Side Management
Note – In addition to the resources above, all plans include near-term firm additions established as a part of previous planning (27 MW gas CT at Riverton site in 2026, 175 MW solar in 2028)

The Preferred Plan will satisfy future capacity needs with a broad mix of utility-scale solar, distributed standalone storage, and natural gas resources at both the utility and distributed scale. The plan is to add 240 MW of natural gas frame combustion turbines by 2030 utilizing the ERAS provision or any other available means to achieve the target timeline. This process would allow for utilities to select any generation resource for a special one-time study conducted outside the regular generator interconnection ("GI") study queue, and requests accepted into the study will have priority over all GI requests

without signed agreements. By 2044, the plan will add another 240 MW of natural gas frame combustion turbines, 300 MW of utility-scale solar, 28 MW of distributed-scale natural gas RICE, and 1 MW of distributed 4-hour lithium-ion battery storage. The plan also adds the low-, mid, and high-cost bundles of RAP DSM. As in all alternative plans, the Preferred Plan assumes dual-fuel industrial gas turbine units replace Riverton 10 and 11 retirements in 2026. In addition, Plan 4 preserves flexibility to pivot to the resource acquisition strategy under Plan 12 in the near- to mid-term, should compliance with EPA GHG be required. Moreover, Plan 4 provides a straightforward contingency if the 175 MW firm solar addition in 2028 does not materialize, where the portfolio would remain adequate without this project and require only a modest amount of incremental gas in the 2030's to offset the lower solar capacity.

9.1.1 Enhanced Reliability Analysis

Liberty-Empire engaged, Astrapé Consulting (now part of PowerGem), to perform a resource adequacy study that includes post expansion plan reliability verification for selected portfolios including the preferred resource plan.

The objective of this effort was to prepare a comprehensive resource adequacy assessment utilizing the Strategic Energy Risk Valuation Model ("SERVM"). SERVM is a state-of-the-art multi-area reliability and economic simulation tool to support resource adequacy decisions.

The results of the simulations provide full distributions of reliability metrics in both summer and winter seasons, such as Loss of Load Expectation, Loss of Load Hours, and Expected Unserved Energy for a Base Case across 40+ years of weather, load forecast growth uncertainty, and thousands of unit performance draws. As the expansion plans were built, the plans were run through SERVM to understand the reliability for both near-term and long-term years. For the analysis, five of the portfolios were simulated for study years 2029, 2032, and 2040.

9.2 Performance Measures of the Preferred Resource Plan

5. For existing legal mandates and approved cost recovery mechanisms, the following performance measures of the preferred resource plan for each year of the planning horizon:
A. Estimated annual revenue requirement;
B. Estimated level of average retail rates and percentage of change from the prior year; and
C. Estimated company financial ratios;
6. If the estimated company financial ratios in subparagraph (2)(E)5.C. of this rule are below investment grade in any year of the planning horizon, a description of any changes in legal mandates and cost recovery mechanisms necessary for the utility to maintain an investment grade credit rating in each year of the planning horizon and the resulting performance measures of the preferred resource plan;

The performance measures of the Preferred Plan are shown in Table 1-8. Liberty-Empire does not anticipate below investment grade financial ratios based on the Preferred Plan presented.

Table 1-8 – Performance Measures of the Preferred Plan

****Confidential in its Entirety****

[redacted]

9.3 Implementation Plan

7. Actions and initiatives to implement the resource acquisition strategy prior to the next triennial compliance filing; and
8. A description of the major research projects and programs the utility will continue or commence during the implementation period; and

The implementation plan contains the descriptions and schedules for the major tasks necessary to implement the Preferred Plan over the implementation period, i.e., the time between the triennial compliance filings. The next triennial IRP filing is scheduled for 2028. Therefore, the implementation period is the period 2025-2028.

Major areas of focus in the Implementation Plan, which are described in Volume 7, are as follows:

- Make use of the recently completed Residential and Non-Residential Market Study to help develop primary data-driven demand-side programs for the next MEEIA Cycle ("MEEIA Cycle 2");
- Finalize development of the 27 MW of industrial gas turbines to directly replace the retirements of Riverton 10 and 11 in 2026;
- Perform feasibility and environmental studies, begin permitting as required, and issue a request for proposal ("RFP") in preparation for acquiring the 240 MW frame combustion gas turbine to begin operation for 2029;
- Continue evaluation of the approximate 175 MW new solar resource due for operation in the 2028 timeframe.[11] Report to Stakeholders in future IRP Annual Updates about the status of this project as appropriate.
- Prioritize the implementation of low-, mid-, and high-cost energy efficiency programs from MEEIA Cycle 2 and beyond, as appropriate;

[11] Liberty-Empire is considering a contingency plan without the assumed 175 MW firm solar addition in 2028. This plan would add a modest amount of incremental gas in the 2030's to offset lower solar capacity.

- Monitor federal tax credit policy, cost trends for renewable resources, and co-location opportunities at Liberty-Empire's existing generation resource sites to plan for anticipated additions.

SECTION 10 CONCLUSIONS

Liberty-Empire's 2025 IRP, its evaluation of alternative plans, and its recommendation for its Preferred Plan are offered to the MPSC and the wider community of Company stakeholders in full compliance with the legal requirements of 20 CSR 4240-22.

Based on the assumptions of this IRP study, Liberty-Empire believes that its Preferred Plan is in the best interest of its customers. It represents a low cost and low risk resource acquisition strategy that also prioritizes system safety, reliability and security. The Preferred Plan also meets customers' growing demand and interest in renewable energy, improved environmental performance, and distributed energy resources. The results of the IRP analysis documented in this report reflect only current and projected conditions as they were known at the time the results were developed. However, integrated resource planning is a fluid process and involves numerous assumptions about the future. Liberty-Empire will continually monitor critical uncertain factors and re-examine its decisions as the need for additional resources become more evident. The IRP will be subjected to ongoing evaluation as modeling assumptions change based on evolving business conditions.