NP

# VOLUME 7

# RESOURCE ACQUISITION STRATEGY SELECTION

## THE EMPIRE DISTRICT
## ELECTRIC COMPANY – A LIBERTY UTILITIES COMPANY
## (LIBERTY-EMPIRE)

## 4 CSR 240-22.070

## FILE NO. EO-2019-0049

## June 2019


****Denotes Confidential****

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**4 CSR 240-22.070 RESOURCE ACQUISITION STRATEGY SELECTION**

# RESOURCE ACQUISITION STRATEGY SELECTION

***4 CSR 240-22.070 Resource Acquisition Strategy Selection***

*PURPOSE: This rule requires the utility to select a preferred resource plan, develop an implementation plan, and officially adopt a resource acquisition strategy. The rule also requires the utility to prepare contingency plans and evaluate the demand-side resources that are included in the resource acquisition strategy.*

## SECTION 1 PREFERRED RESOURCE PLAN

*(1) The utility shall select a preferred resource plan from among the alternative resource plans that have been analyzed pursuant to the requirements of 4 CSR 240-22.060. The utility shall describe and document the process used to select the preferred resource plan, including the relative weights given to the various performance measures and the rationale used by utility decision-makers to judge the appropriate tradeoffs between competing planning objectives and between expected performance and risk. The utility shall provide the names, titles, and roles of the utility decision-makers in the preferred resource plan selection process. The preferred resource plan shall satisfy at least the following conditions:*

*(A) In the judgment of utility decision-makers, strike an appropriate balance between the various planning objectives specified in 4 CSR 240-22.010(2);*

*(B) Invest in advanced transmission and distribution technologies unless, in the judgment of the utility decision-makers, investing in those technologies to upgrade transmission and/or distribution networks is not in the public interest;*

*(C) Utilize demand-side resources to the maximum amount that comply with legal mandates and, in the judgment of the utility decision-makers, are consistent with the public interest and achieve state energy policies; and*

*(D) In the judgment of the utility decision-makers, the Preferred Plan, in conjunction with the deployment of emergency demand response measures and access to short-term and emergency power supplies, has sufficient resources to serve load forecasted under extreme weather conditions pursuant to 4CSR 240-22.030(8)(B) for the*

*implementation period. If the utility cannot affirm the sufficiency of resources, it shall consider an alternative resource plan or modifications to its preferred resource plan that can meet extreme weather conditions.*

## 1.1 Preferred Plan Selection Criteria

Liberty-Empire considered all IRP analyses and the objectives of the Chapter 22 ("IRP Rule") in selecting the Preferred Plan. The following summarizes the Preferred Plan selection guidance as supplied by the IRP Rule.

- Provide the public with energy services that are safe, reliable, and efficient, at just and reasonable rates, in compliance with all legal mandates, and in a manner that serves the public interest and is consistent with state energy and environmental policies;
- Analyze demand-side, renewable energy, and supply-side resources on an equivalent basis (subject to legal mandates);
- Minimize the present worth of long-run utility costs as the *primary criterion* in selecting a Preferred Plan;
- Identify, analyze, and document other considerations to the Preferred Plan selection such as risks associated with the critical uncertain factors, risks associated with new or more stringent legal mandates, and rate increases;
- Strike an appropriate balance between the various planning objectives;
- Invest in advanced T&D technologies unless not in the public interest; and
- Utilize demand-side resources to the maximum amount that comply with legal mandates, are consistent with the public interest, and achieve state energy policies.

## 1.2 Preferred Plan Selection Process

Liberty-Empire evaluated the 16 alternative resource plans described in Volume 6 using production cost modeling and financial modeling. Consistent with the IRP Rule, Liberty-Empire ran deterministic and stochastic analysis of the 16 plans. Each analysis produced a discrete "endpoint" with a unique present value of revenue requirements ("PVRR") and other required or relevant metrics.

The deterministic analysis evaluated each of the 16 plans against the base case assumptions. Hourly dispatch of the units and full financial modeling was performed over the planning horizon. Deterministic PVRRs were then calculated to compare plans against each other. The stochastic analysis evaluated each of the 16 plans against combinations of Critical Uncertain Factors ("CUF"). The stochastic analysis generated 54 endpoints for each plan analyzed. The results were used to develop risk profiles and tornado charts across all plans.

The results of the deterministic and stochastic analyses were considered by Liberty-Empire's decision-makers during the development of the Preferred Plan. The Preferred Plan represents a balance between the planning objectives, planning risks, and financial impacts examined.

The demand-side inputs were supplied by Applied Energy Group ("AEG"), Liberty-Empire's Demand Side Management ("DSM") consultant, to CRA International ("CRA"). AEG developed load shapes for each DSM program that were included as resource options for the portfolio modeling. The DSM programs were evaluated on an equal footing with supply-side resources as an option for meeting load requirements in the portfolio modeling. The DSM programs were also split into various bundles by cost, representing low, mid, and high cost-benefit ranges. The low- and mid-cost bundles of RAP DSM were found to be cost-effective in 15 of the 16 portfolios. Liberty-Empire also included a portfolio that incorporated the low- and mid-cost bundles of MAP DSM.

In addition to demand-side energy and coincident peak savings, AEG provided CRA with all program costs and the information required to calculate a net shared benefit. The costs

associated with the demand-side resources, including the net shared benefit, were input into the Aurora model, used by CRA in the portfolio modeling.

To determine the new Preferred Plan, Liberty-Empire analyzed the various costs, both deterministic and stochastic, and other attributes associated with each alternative resource plan and required under the IRP Rule. Liberty-Empire developed a set of base plans from the 16 alternative resource plans, and studied the various tradeoffs between these plans. Liberty-Empire then selected its Preferred Plan from these base plans. The alternative resource plans are shown in Table 7-1.

**Table 7-1 – Description of Alternative Resource Plans**

| Plan | Plan Description |
|---|---|
| 0 | Customer Savings Plan |
| 1 | Asbury End of Life - Least Cost |
| 2 | Early Asbury Retire - Central Scale Renewables |
| 2B | Early Asbury Retire - Central Scale Renewables - All 2023 Solar |
| 2 - MAP | Early Asbury Retire - Central Scale Renewables + MAP DSM |
| 3 | Early Asbury Retire - Central Scale Thermal |
| 4 | Early Asbury Retire - Distributed Renewable |
| 5 | Early Asbury Retire - Distributed Thermal |
| 6 | Early Asbury Retire - Central Scale Mix |
| 7 | Early Asbury Retire - Distributed Mix |
| 8 | Early Asbury, Peaker Retire - Central Scale Renewables |
| 9 | Early Asbury, Peaker Retire - Central Scale Thermal |
| 10 | Early Asbury, Peaker Retire - Distributed Renewable |
| 11 | Early Asbury, Peaker Retire - Distributed Thermal |
| 12 | Early Asbury, Peaker Retire - Central Scale Mix |
| 13 | Early Asbury, Peaker Retire - Distributed Mix |

## 1.3 Present Value of Revenue Requirements

Minimization of PVRR is the primary criterion for the selection of the Preferred Plan. Figure 7-1 displays the PVRR of all 16 plans utilizing the base assumptions, prior to introducing uncertainty,

for the twenty-year planning period of the IRP. Because so many resource decisions happen near the end of the twenty-year horizon, end effects were examined for the succeeding ten years. The 30-year PVRR of all the alternative resource plans are shown in Figure 7-2.

**Figure 7-1 - Deterministic PVRR for All Plans (2019-2038) ($ millions)**

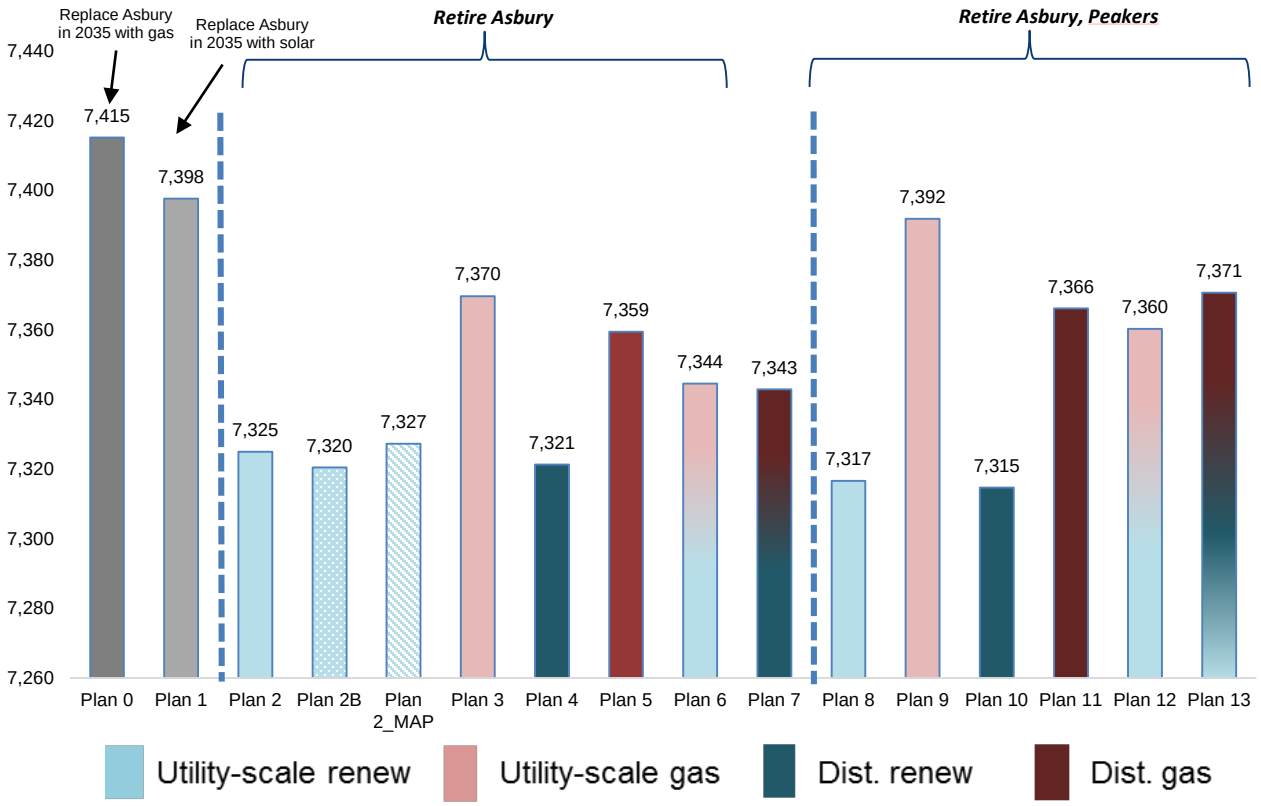
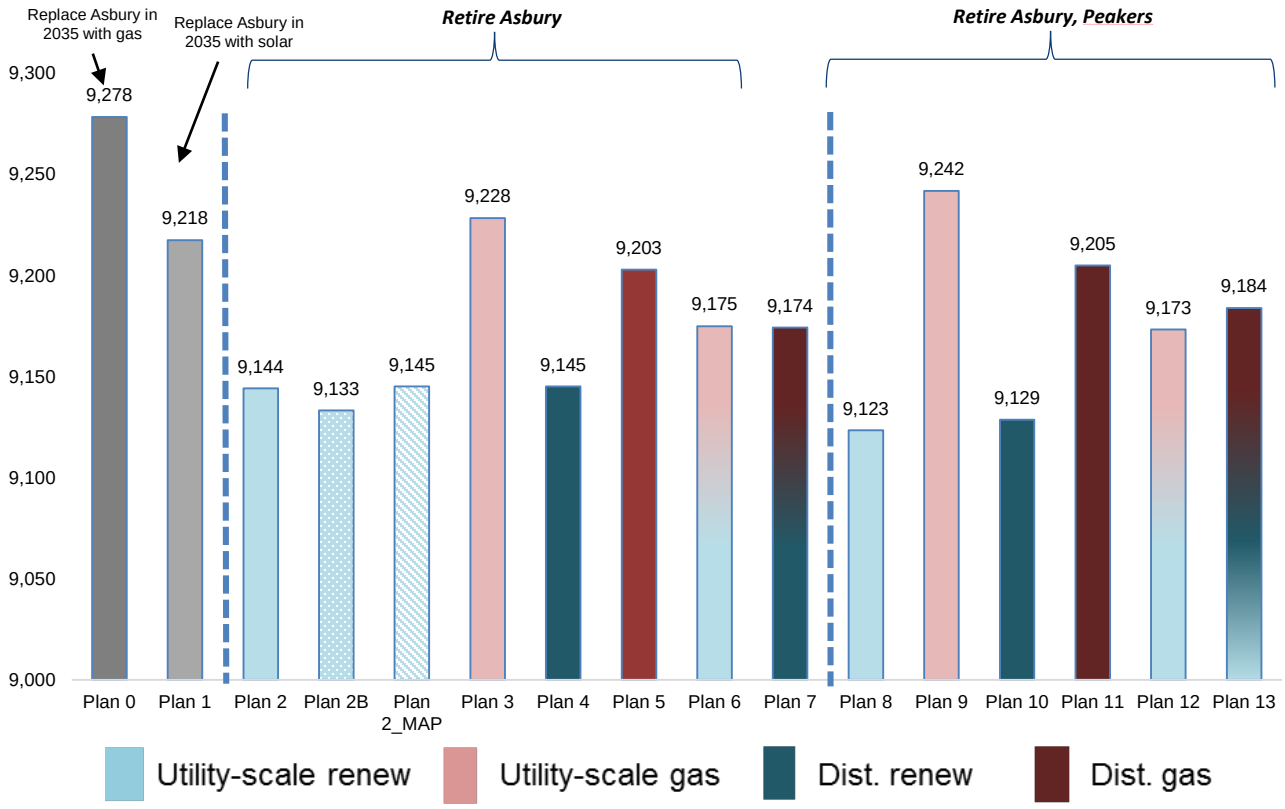
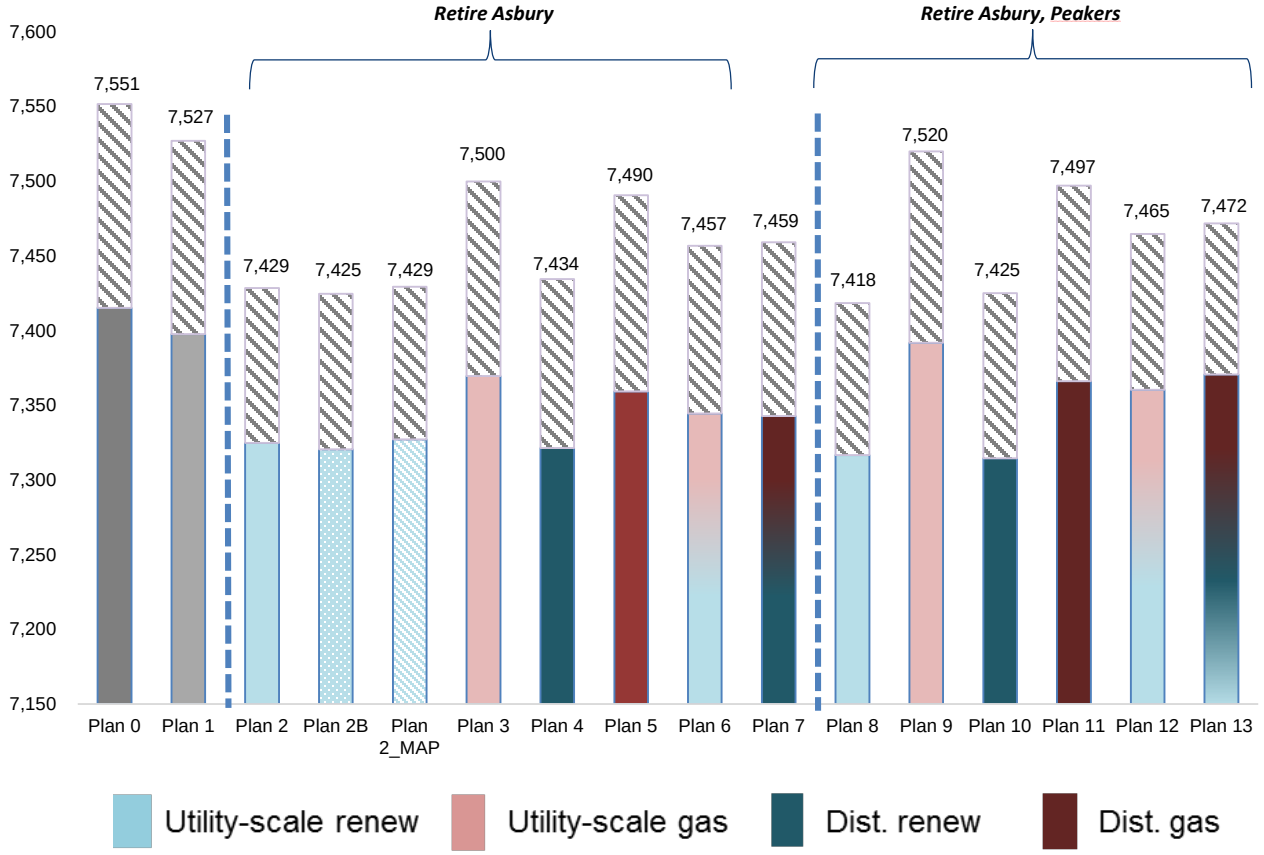


**Figure 7-2 - All Plans with End Effects –30-Year Deterministic PVRR (2019-2048) ($ millions)**




The results of the stochastic analysis provide the uncertainty range expressed in PVRR for each of the alternative resource plans, as shown in Figure 7-3.

**Figure 7-3 - PVRR with Risk Value for All Plans (2019-2038) – ($ millions)**




## 1.4 Preferred Plan Selection

Because finding a low-cost plan is the primary objective of the analysis, Liberty-Empire narrowed the Preferred Plan candidate list down to a set of low-cost plans that all added various amounts of utility-scale and distributed solar and storage, and where appropriate, considered early retirements of existing Liberty-Empire assets, as shown in Figure 7-4.

**Figure 7-4 – PVRR with Risk Value (Deterministic and Expected Value) of Base Plans – ($ millions)**

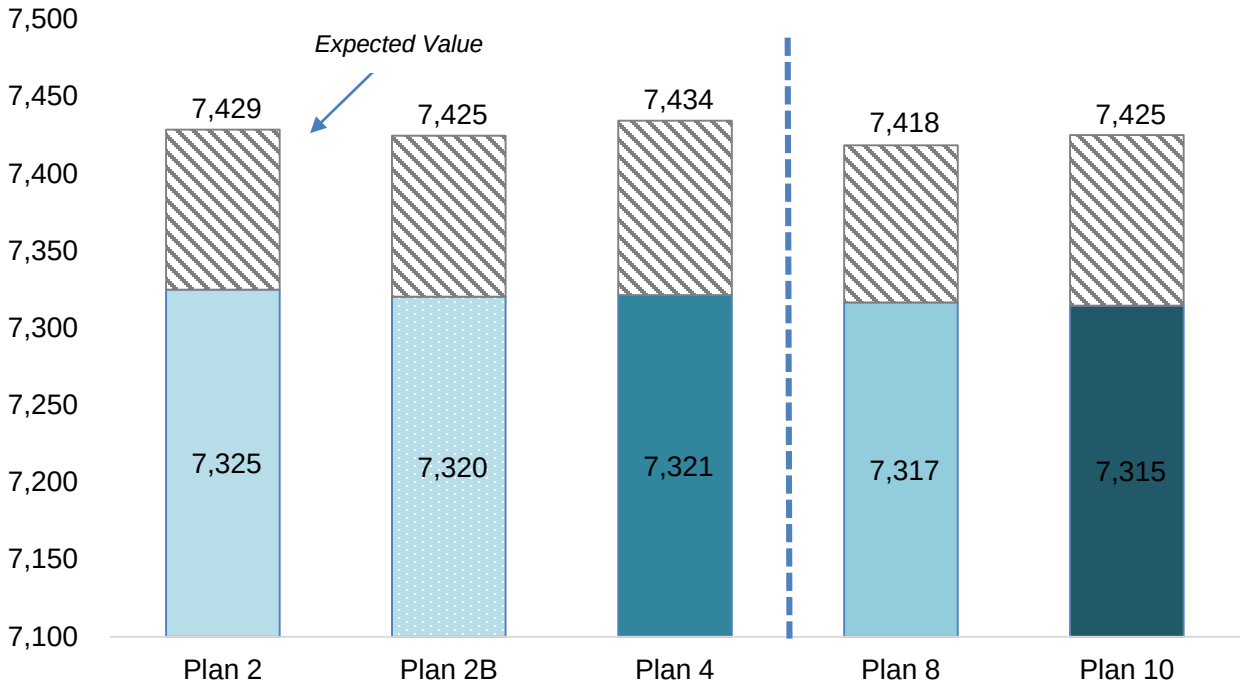



**Table 7-2 – Base Plans List**

| Plan | Plan Description |
|---|---|
| 2 | Early Asbury Retire - Central Scale Renewables |
| 2B | Early Asbury Retire - Central Scale Renewables – All 2023 Solar |
| 4 | Early Asbury Retire - Distributed Renewables |
| 8 | Early Asbury, Peaker Retire – Central Scale Renewables |
| 10 | Early Asbury, Peaker Retire – Distributed Renewables |

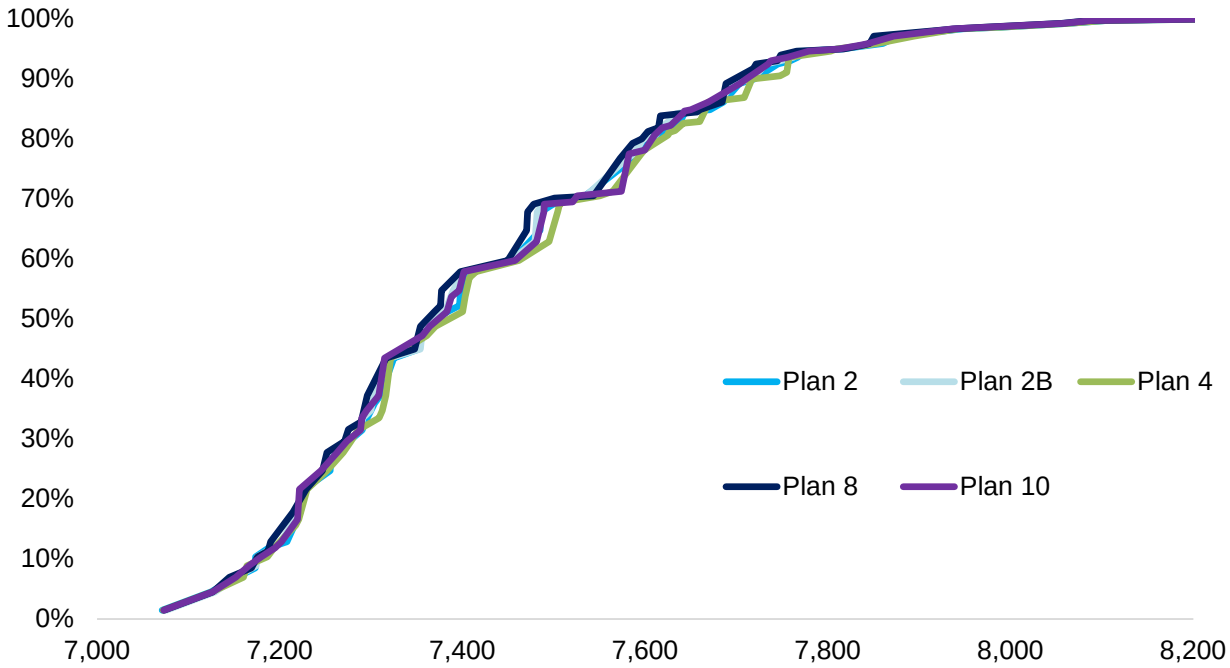
Liberty-Empire evaluated the difference in the 20-year and 30-year PVRR among these base plans to aid in its selection of the Preferred Plan. Plans 2, 2B, 4, 8, and 10 all have similar deterministic 20-year PVRRs, with only a $10 million difference between the most expensive and least expensive of the five plans. Plan 4 is lower cost than Plan 2. Plan 2B, 8, and 10 are all lower cost than both Plan 4 and Plan 2. However, Plan 2B requires that Liberty-Empire build large amounts of solar prior to 2023, bringing Liberty-Empire's reserve margin to above 30%

before 2027, after Energy Center 1 and 2 retire. Furthermore, while Plan 2B has a lower cost on a PVRR basis, it results in short-term rates that are higher than those in Plans 2 and 4.

Plans 8 and 10 require the early retirement of Energy Center 1 and 2 in 2021 and Riverton 10 and 11 in 2025 in addition to the retirement of Asbury in 2019. Liberty-Empire has determined that while the potential early retirement of these units could provide savings, the retirement of almost 400 MW of existing Liberty-Empire thermal capacity in the next six years could pose execution risk and remove resources that are currently providing ancillary services, like black-start, without viable alternatives in place. Plans 8 and 10 also result in higher short-term rates when compared with Plans 2 and 4.

After selecting all of the Preferred Plan selection criteria and attempting to strike a balance over all of the planning objectives, Liberty-Empire ultimately selected Plan 4 as the Preferred Plan. The risk profile graphic for the base plans considered is shown in Figure 7-5. The risk profile graphic plots PVRR for each of the base plans for each of the 54 stochastic endpoints. Each endpoint is then assigned a probability based on the combined probability of each uncertain variable.

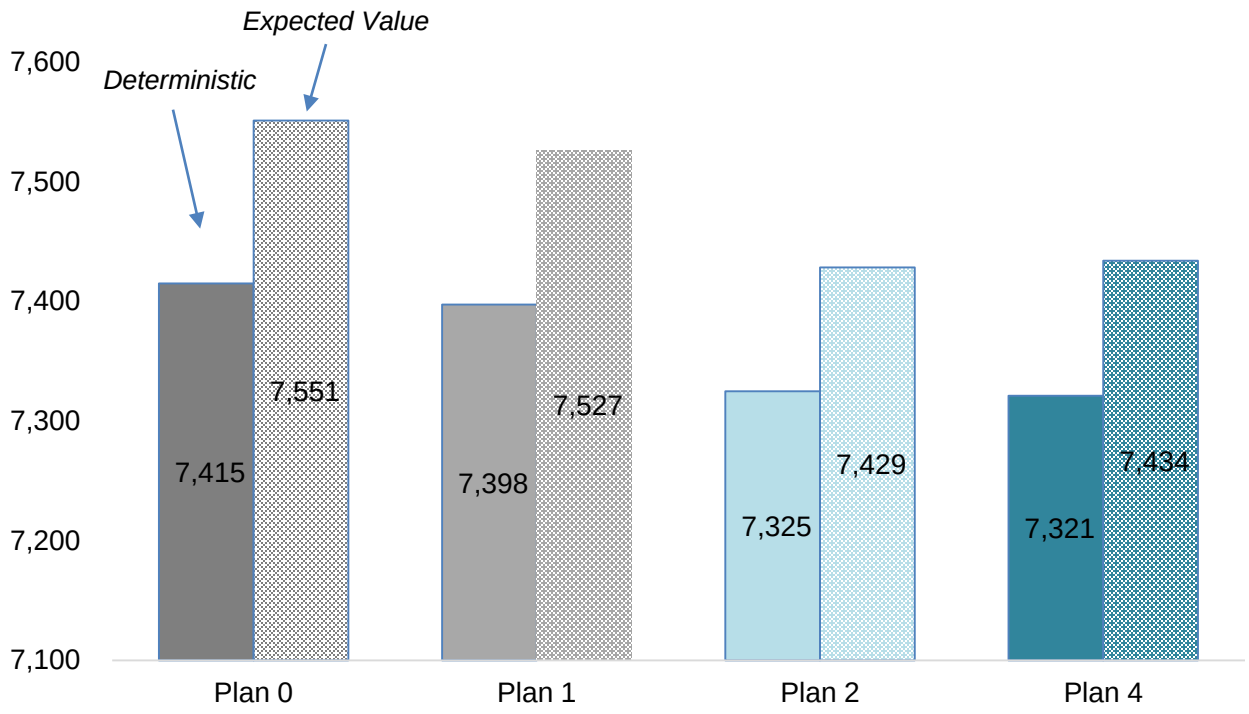
**Figure 7-5 - Risk Profiles of Select Plans ($ millions)**




***Asbury Retirement***

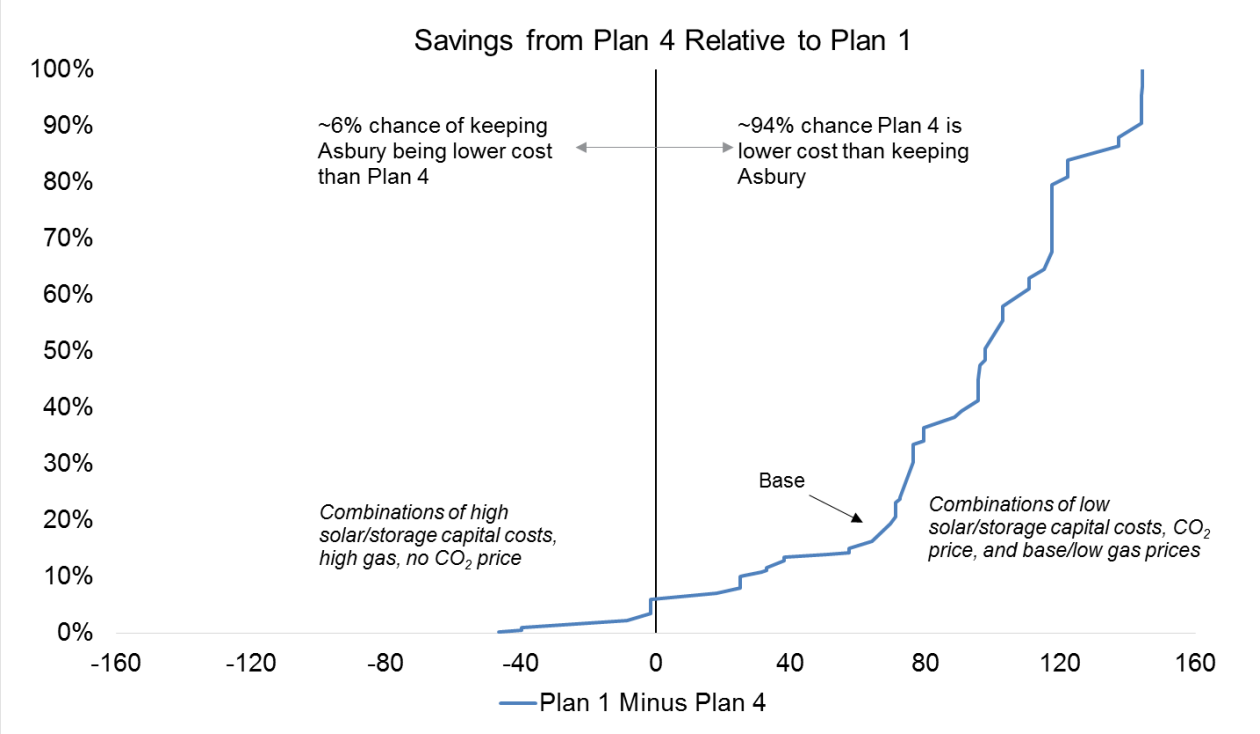
Liberty-Empire analyzed the early retirement of Asbury by comparing Plan 0 and Plan 1, which both retain Asbury through end of life, to Plans 2 through 7, which all retire Asbury in 2019. Retiring Asbury in 2019 saves Liberty-Empire customers $76 million on a 20-year deterministic basis and $93 million on a 20-year expected value basis (comparing Plan 1 to Plan 4). Relative to Liberty-Empire's prior Preferred Plan, retiring Asbury saves $94 million on a 20-year deterministic basis and $117 million on a 20-year expected value basis (comparing Plan 0 to Plan 4).

**Figure 7-6 – Deterministic and Expected Value Comparison of Plans that Retain and Retire Asbury ($ millions)**




From a risk perspective, retiring Asbury also demonstrates significant savings relative to the Preferred Plan. Under the 54 stochastic endpoints, Plan 4 results in savings over Plan 1 in 94% of the time, on a probability-weighted basis. Savings range from $18 million to $144 million. Only under limited combinations of high capital costs, high gas and power prices, and no carbon price is Plan 1 lower-cost than Plan 4.

**Figure 7-7 – Plan 1 vs. Plan 4 across All Stochastic Endpoints ($ millions)**




***Plan 2 vs. Plan 4***

Both Plan 2 and Plan 4 retire Asbury in 2019 and replace future capacity needs with a combination of solar and storage. The difference is that Plan 4 relies on a mixture of utility-scale and distributed resources, while Plan 2 relies only on utility-scale resources.

Plan 2 and Plan 4 have similar 20-year and 30-year deterministic PVRRs. Plan 4 is lower-cost than Plan 2 on a 20-year basis, but Plan 2 is lower cost than Plan 4 on a 30-year basis. On an expected value basis, Plan 2 is lower-cost than Plan 4 for both a 20-year and 30-year period. Differences in PVRRs between Plan 2 and Plan 4 reflect the amount and timing of buildouts of utility-scale and distributed solar + storage generation.

From a planning reserve margin perspective, utility-scale solar + storage can be built around the summer SPP peak, while distributed resources must consider that Liberty-Empire is primarily a dual peaking system. Utility-scale solar + storage has a 4:1 solar to storage ratio, while distributed

solar + storage has a 2:1 ratio. Plan 2 adds more nameplate solar capacity and benefits relatively more from wholesale power market revenues as well as ancillary market revenues, while Plan 4 benefits more from avoided distribution investment costs.

Figure 7-8 and Figure 7-9 show the differences in 20- and 30-year PVRR between Plan 2 and Plan 4, by component. Because Plan 2 builds more solar in the first 20 years, stochastic endpoints that include higher power prices and a carbon price result in Plan 2 having a lower 20-year PVRR than Plan 4. This is due to higher wholesale energy revenues. Low capital cost scenarios, which were given a higher probability than the high capital cost scenarios, also result in Plan 2 being lower-cost than Plan 4, as distributed resources cost more than utility-scale resources on a capital cost basis. Drivers of cost differences between Plan 2 and Plan 4 is further illustrated in Figure 7-10.

**Figure 7-8 – 20-Year Deterministic and Expected Value Comparison of Plans 2 and 4 ($ millions)**

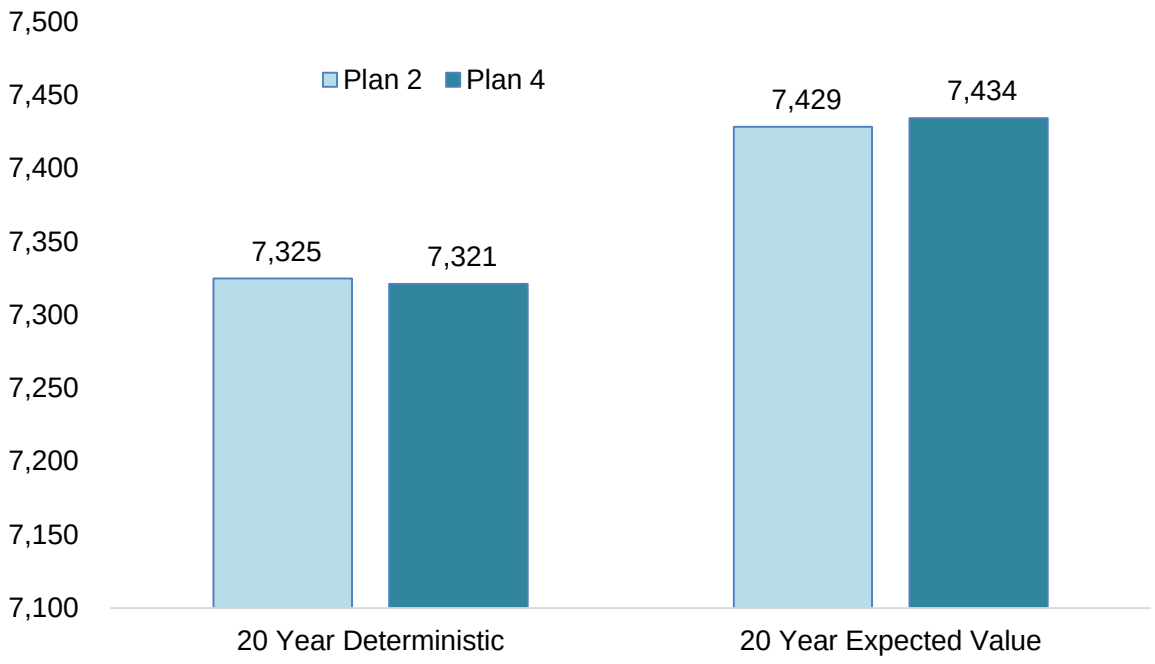


**Figure 7-9 – 30-Year Deterministic and Expected Value Comparison of Plans 2 and 4 ($ millions)**

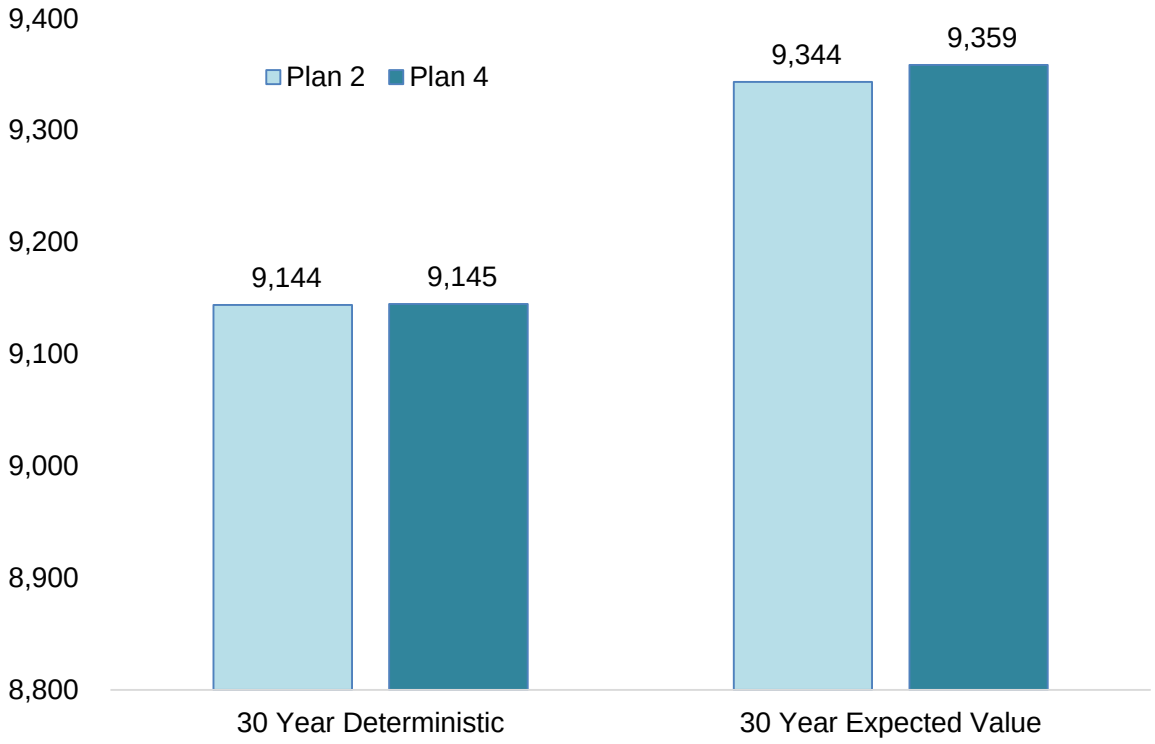
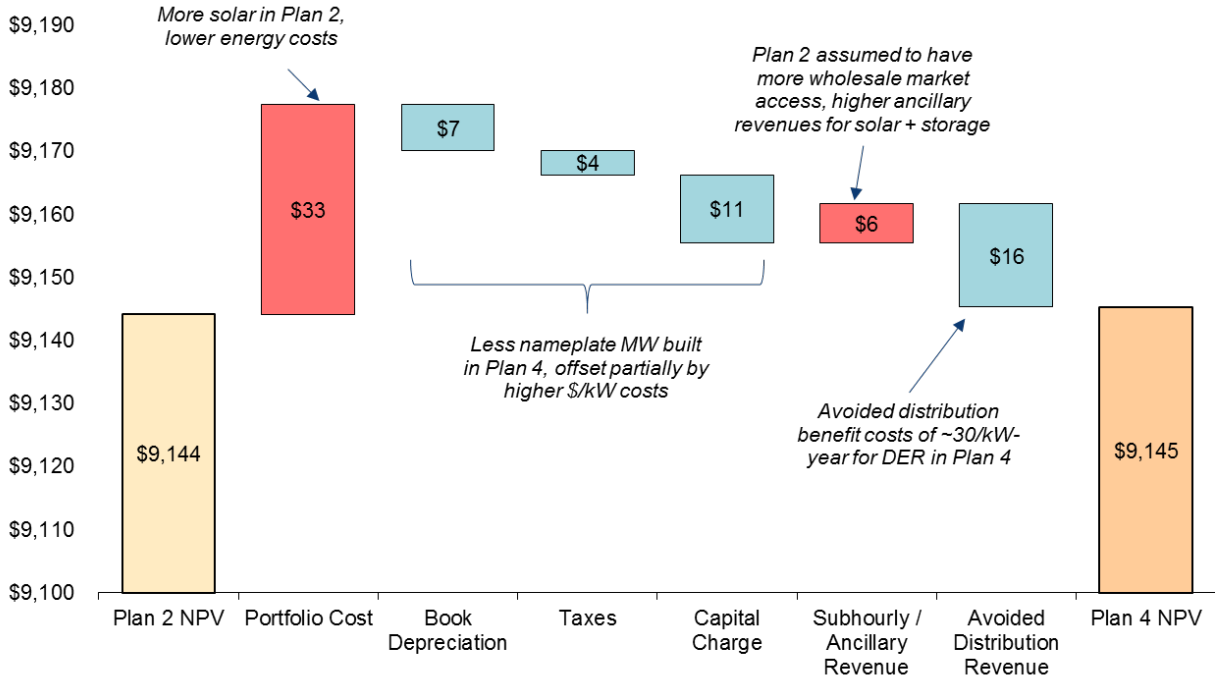



**Figure 7-10 – Drivers of Cost Difference between Plan 2 and 4 (30-yr NPVRR) ($ millions)**



Liberty-Empire's Plan 4 is lower-cost than Plan 2 on a 20-year deterministic basis and only slightly more expensive on a 30-year deterministic and 20- and 30-year expected value basis. Liberty-Empire believes there is value in investing in some level of distributed resources from an energy security and reliability perspective: distributed resources can help improve local reliability, prevent blackouts/outages, avoid distribution system investment, and improve energy security in the event of large-scale disruptions at the transmission level. Distributed energy resources are also becoming increasingly more important for customers and regulators, as customers continue to demand more flexibility and choice with regards to their energy needs.

Plan 4 aligns with the following Liberty-Empire planning objectives: providing safe, reliable electric service at just and reasonable rates; investing in advanced T&D technologies; minimizing present worth of utility costs; and balancing objectives around energy security, reliability, and anticipating future customer energy needs.

## 1.5 Preferred Plan Description

Liberty-Empire's decision-makers selected Plan 4 as the Preferred Plan. Plan 4 includes the near-term retirement of Asbury, as well as the low and mid-cost bundles of RAP DSM and a mix of utility-scale and distributed solar and solar + storage resources. Plan 4 also includes the addition of 600 MW of Liberty-Empire owned wind generation in place by the end of 2020, the upgrade of the Stateline Combined Cycle unit, and 10 MW of community solar in 2021.

### 1.5.1 Supply-Side Resources in the Preferred Plan

The Preferred Plan includes the following retirements of Liberty-Empire's existing units:

- The retirements of Energy Center 1 and Energy Center 2 in 2026;
- The retirements of Riverton units 10 and 11 in 2033; and
- The retirement of Asbury in 2019.

All other existing Liberty-Empire generating units are assumed to continue operations throughout the planning horizon. Liberty-Empire's two existing wind contracts are assumed to expire during the planning period. The 105-MW Meridian Way 20-year wind purchased power agreement ("PPA") will expire in December 2028, and the 150-MW Elk River 20-year wind PPA will expire in 2025. Liberty-Empire does not plan to extend either contract.

The Preferred Plan will satisfy future capacity needs with a mix of utility-scale solar, utility-scale solar + storage, and distributed solar + storage. 600 MW of wind is added at the end of 2020. Utility-scale solar is added in 2023 and 2034, distributed solar in 2021 (community solar), utility-scale solar + storage is added in 2027, and distributed solar + storage is added in 2022, 2028, 2032, and 2036. The Plan 4 supply-side additions are further illustrated in Figure 7-11.

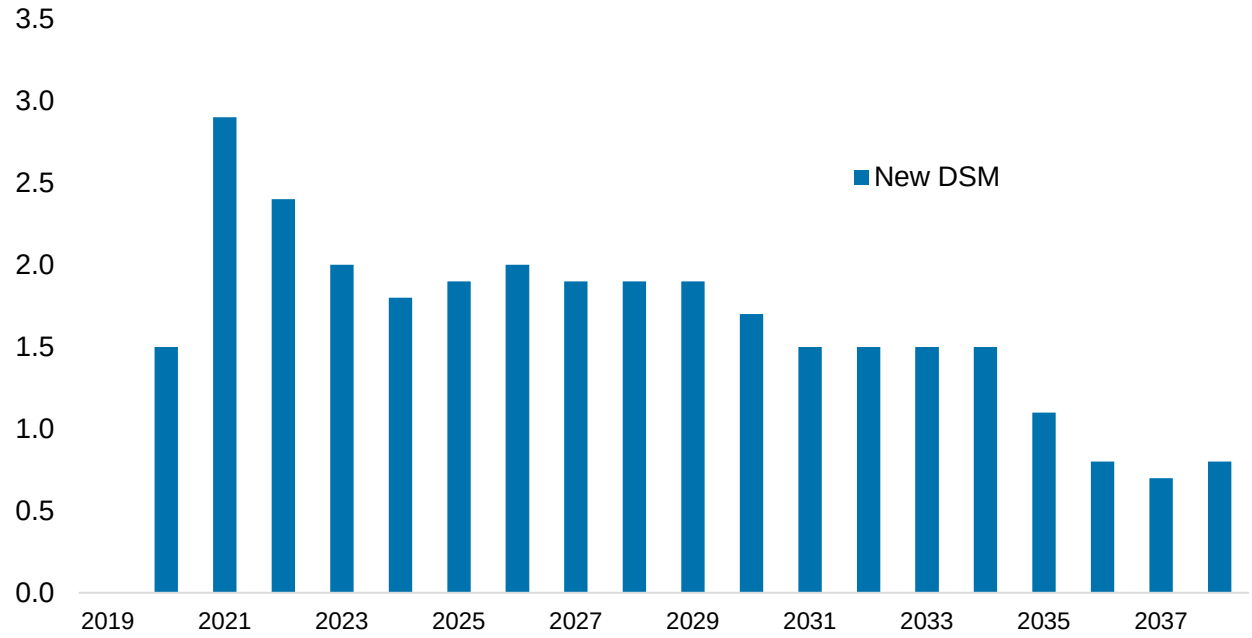
For purposes of evaluating distributed resource options, Liberty-Empire developed estimates for potential distribution system infrastructure projects that could be avoided by the presence of a distributed energy resource. These avoided distribution costs informed the availability, size and timing of potential distributed resource additions. Potential distributed renewable resource options included distributed solar, distributed storage, and distributed solar + storage.

**Table 7-3 - Preferred Plan Supply Side Resource Additions**

| Year | Supply-Side Retirements / PPA Expirations | Supply-Side Additions |
|---|---|---|
| 2019 | Asbury (200 MW) | |
| 2020 | | |
| 2021 | | Wind (600 MW)[1], Community Solar (10 MW) |
| 2022 | | Distributed Solar + Storage (19.5 MW) |
| 2023 | | Central-Scale Solar (50 MW) |
| 2024 | | |
| 2025 | Elk River Contract Expiration (150 MW) | |
| 2026 | Energy Center 1 and 2 (162 MW) | |
| 2027 | | Central-Scale Solar + Storage (50 MW) |
| 2028 | Meridian Way Contract Expiration (105 MW) | Distributed Solar + Storage (19.5 MW) |
| 2029 | | |
| 2030 | | |
| 2031 | | |
| 2032 | | Distributed Solar + Storage (13.5 MW) |
| 2033 | Riverton 10 and 11 (28 MW) | |
| 2034 | | Central-Scale Solar (50 MW) |
| 2035 | | |
| 2036 | | Distributed Solar + Storage (13.5 MW) |
| 2037 | | |
| 2038 | | |

[1] Construction on the wind is expected to be completed by December 31, 2020. For capacity planning purposes, the units are assumed online starting in 2021.

**Figure 7-11 - Preferred Plan Annual DSM Additions (MW)**




### 1.5.2 Demand-Side Programs in the Preferred Plan

Liberty-Empire's 2019 Preferred Plan includes the low-cost and mid-cost bundle of RAP DSM, described in Volume 5 and Volume 6.

### 1.5.3 Resources in the Preferred Plan

Table 7-4 and Table 7-5 present the forecasted capacity balance for the Preferred Plan and provide more detail about the timing of the resources planned to meet Liberty-Empire's load while complying with current legal mandates. Table 7-4 shows the capacity balance for the summer season, utilizing summer peaks and summer unit ratings. Table 7-5 shows the capacity balance for the winter season, utilizing winter peaks and winter unit ratings.

**Table 7-4 – Plan 4 Preferred Plan – Summer Peak**
****Confidential in its Entirety**[2]**

[2]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

**Table 7-5 - Plan 4 Preferred Plan – Winter Peak**
****Confidential in its Entirety**[3]**

[redacted]

[3]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

### 1.5.4 Advanced Transmission and Distribution Technologies in the Preferred Plan

Liberty-Empire is a member of the Southwest Power Pool ("SPP") and relies on SPP's determination of transmission line expansion projects and their schedules throughout the SPP region. Liberty-Empire is assigned its membership cost allocation for all lines that are built within SPP. Therefore, to the extent that SPP incorporates advanced transmission technologies into projects, Liberty-Empire is also a participant.

Liberty-Empire is pursuing several areas of investment in advanced transmission and distribution network technology ("ATDNT") that will support its customers well overtime, and that advance capabilities which will: (a) sustain and improve system reliability through such means as recloser and smart fusing operations; (b) improve system resilience through rebuilding core infrastructure such as substations; (c) improve day-to-day operations and customer care functions related to billing and other common customer energy account services; (d) reduce distribution system operational inefficiencies related to metering, billing accuracy, tamper and energy theft; (e) deliver energy efficiencies and power quality enhancements on the distribution system through the pursuit of voltage control capabilities; (f) improve the quality of information Liberty-Empire is able to provide customers about their energy use, therefore empowering customers to be better energy consumers; and (g) support new and expanded customer energy service choices through e.g., metering, rate programs and Liberty-Empire's situational awareness of grid performance.

Not all of these improvements will be readily visible to customers, and nor are they limited to the installation of physical devices. The ATDNT plans, for example, will lead to more grid self-healing through distribution automation, expanded and improved communication to substations and field devices, and improvements to day-to-day engineering functions due to improved circuit models and maps. Process improvements of these kinds are needed if Liberty-Empire is to operate and maintain the grid reliably and resiliently, supporting the delivery of the right energy product in the right place and time as demanded by the Liberty-Empire customers over time. In

this way, the ATDNT aspirations are best viewed from a systems point of view, involving, by necessity, field-located hardware, communications, integrated "back office" systems, and process improvements that apply the new functional capabilities to secure benefits.

As the next phase of Empire's ATDNT efforts, Liberty-Empire intends to improve customer care functions and related operational performance through the implementation of an AMI system reaching Liberty-Empire's approximately 172,000 residential and commercial electric meter customers. Liberty-Empire intends to continue its detailed implementation planning of its AMI initiative during 2019, followed by the network and meter installation sometime during the 2020-2021 timeframe. This AMI initiative is part of Liberty-Empire's 5-year capital plan and is coordinated with the Liberty Utilities' company-wide rollout of AMI. Liberty-Empire's AMI initiative is designed to occur in specific stages that are tied to integrations to billing, outage management, and other essential "back office" systems, which rely in part on advanced metering data. These stages occur over time and in a methodical and prudent step-wise fashion.

### 1.5.5 Extreme Weather Capability

Liberty-Empire examined the adequacy of the Preferred Plan to serve the load forecasted under extreme weather conditions pursuant to 4 CSR 240-22.030(8)(B). Liberty-Empire is a member of the Southwest Power Pool balancing authority and energy market. Because the ultimate responsibility of serving load under extreme weather scenarios belongs to SPP, Liberty-Empire's ability to serve load in extreme weather scenarios primarily relies on the fact that the utility meets the SPP required reserve margin, which all resource plans satisfy.

## 1.6 Utility Decision Makers

The Liberty-Empire 2019 IRP Team is composed of executives, directors, managers and specialists who were involved in the IRP development. To fulfill the requirements of 4 CSR 240-22.070, the

names, titles, and roles of the utility decision-makers and the team members are provided in Table 7-6.

**Table 7-6 – Liberty-Empire 2019 IRP Team**

| Name | Title | Primary IRP Function |
|---|---|---|
| David Swain | President, Central Region | Executive Staff - Utility Decision Maker |
| Peter Eichler | Vice President – Central Operations | Executive Staff - Utility Decision Maker |
| Tim Wilson | Vice President – Strategic Projects & Energy Supply | Executive Staff - Utility Decision Maker |
| Tisha Sanderson | Vice President – Finance and Administration | Executive Staff - Utility Decision Maker |
| Mike Beatty | Vice President – Gas | Executive Staff - Utility Decision Maker |
| Sarah Knowlton | General Counsel (Central Region) | Utility Decision Maker |
| Sheri Richard | Director – Rates and Regulatory Affairs | Director in charge of IRP |
| Jill Schwartz | Senior Manager – Rates and Regulatory Affairs | Manager in charge of IRP |
| Bethany Aborn | Regulatory Analyst | IRP Project Manager |
| John Woods | Central Region Director of Generation Operations | Supply-Side |
| Shaen Rooney | General Operations Project Manager | Supply-Side, Environmental, Renewable Energy |
| Aaron Doll | Director of Electrical Procurement | Energy Supply, Energy Trading, Next Day Market |
| Josh Tupper | Manager of Market Operations | Energy Supply, Energy Trading, Next Day Market |
| Robin McAlester | Manager, Electric – Business & Community Development | Community Involvement |
| Nate Morris | Manager of System Planning & Transmission | Transmission and Distribution |
| Kyle Slagle | Director of Dispatch, Meters and Substation Operations | AMI |
| Nate Hackney | Energy Efficiency Coordinator | Demand-Side |
| Todd Tarter | Manager of Market Settlements & Systems | Load Forecasting |
| Steve Williams | Planning-Eng Efficiency Analyst | Load forecasting |

## SECTION 2 RANGES OF CRITICAL UNCERTAIN FACTORS

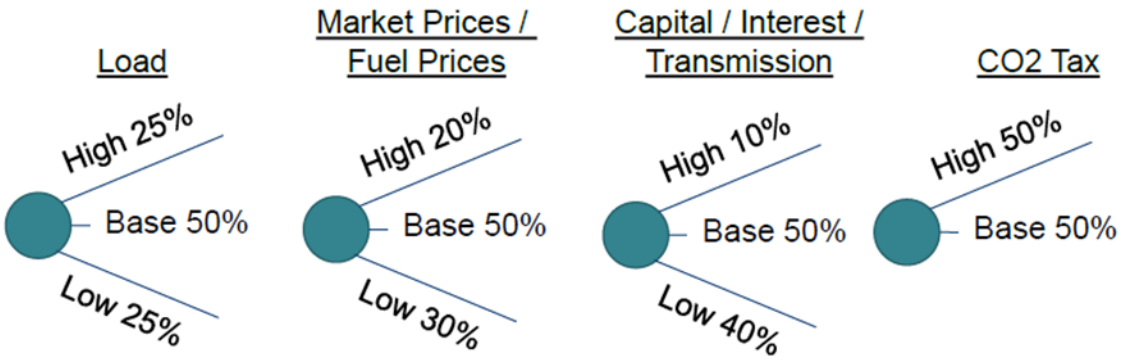
*(2) The utility shall specify the ranges or combinations of outcomes for the critical uncertain factors that define the limits within which the preferred resource plan is judged to be appropriate and explain how these limits were determined. The utility shall also describe and document its assessment of whether, and under what circumstances, other uncertain factors associated with the preferred resource plan could materially affect the performance of the preferred resource plan relative to*

*alternative resource plans.*

## 2.1 Critical Uncertain Factors

A critical uncertain factor is any uncertain factor that is likely to materially affect the outcome of the resource planning decision. As described in Volume 060, Liberty-Empire identified the following critical uncertain factors: environmental costs, market prices/fuel prices, load, and capital/transmission/interest costs. These critical uncertain factors and their ranges form the nodes and the branches of the uncertainty tree in Figure 7-12.

**Figure 7-12 - Critical Uncertain Factors Tree**




## 2.2 Ranges of Critical Uncertain Factors

Planning for future resources in the electric utility industry involves the consideration and evaluation of many uncertainties. For this IRP, Liberty-Empire developed 16 alternate plans. As discussed in Volume 6, these plans were developed to examine a variety of future options for Liberty-Empire's portfolio, including future preferred resource type, levels of distributed energy resources, levels of DSM, and retirement dates of existing Liberty-Empire units. Plan 4, selected as the Preferred Plan, includes the early retirement of Asbury and a future resource buildout consisting of utility-scale and distributed renewable resources. An analysis of the range of outcomes for the critical uncertain factors was performed to determine the limits within which the Preferred Plan is judged to be appropriate.

The PVRRs for the Preferred Plan, Plans 0 through 3, and Plans 5 through 7 are compared and ranked by isolating the extreme values for the critical uncertain factors in Figure 7-13. As discussed above, Plans 8 through 13 are not listed in the table below given that Liberty-Empire has determined that the potential savings for retiring existing Liberty-Empire peaking units early do not justify their early retirement. Liberty-Empire has isolated the combinations of uncertain variables that create the greatest difference between the performance of the Preferred Plan and those of Plans 0 through 3 and Plans 5 through 7. Under certain extreme combinations of high load, high power prices, and high/low capital costs, Plans 1, 2, 3, and 5 all have lower PVRRs than Plan 4.

**Figure 7-13 Risk Scenario PVRRs and Rankings for Select Plans ($ millions)**

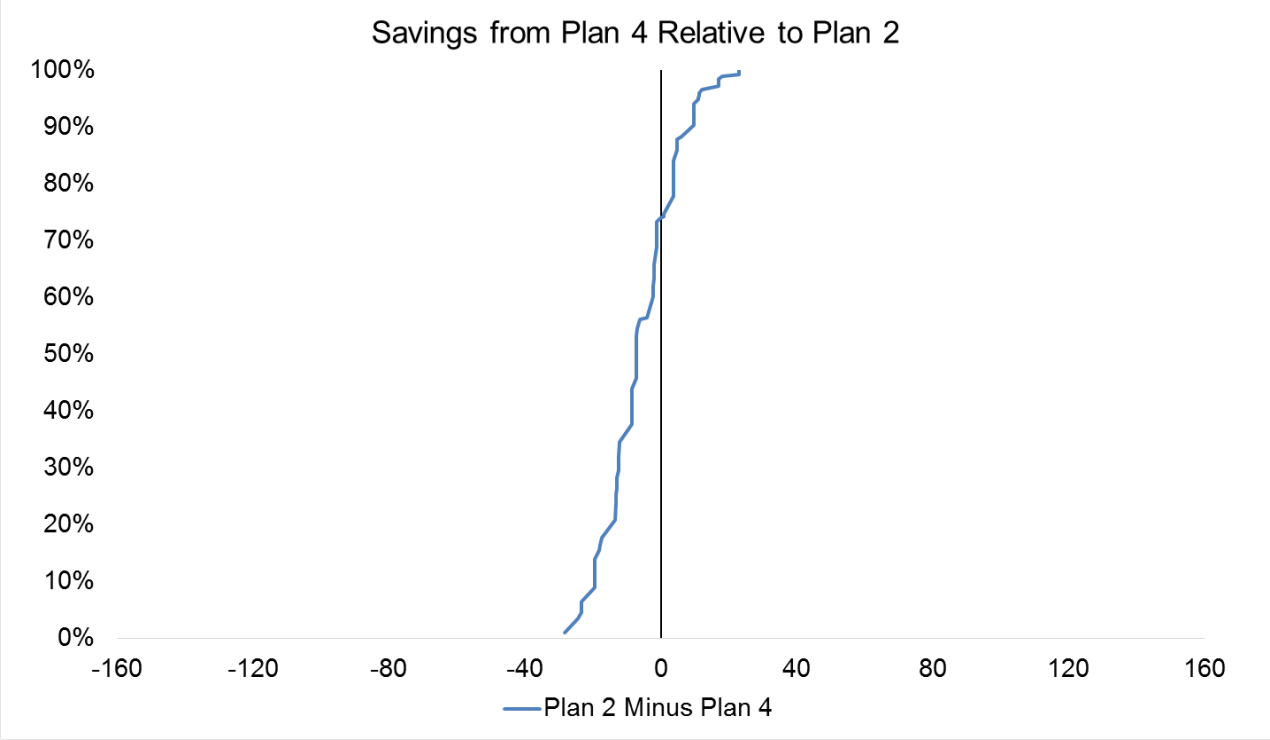
| **Load** | Base | | High | | High | | High | |
|---|---|---|---|---|---|---|---|---|
| **Gas / Power** | Base | | High | | Low | | High | |
| **CO2 Price** | Base | | High | | Base | | Base | |
| **Capital Costs** | Base | | Low | | High | | High | |
| Iteration | Iteration_1 | Rank | Iteration_32 | Rank | Iteration_44 | Rank | Iteration_41 | Rank |
| Plan 0 | 7,415 | 8 | 7,936 | 8 | 7,679 | 7 | 7,815 | 2 |
| Plan 1 | 7,398 | 7 | 7,894 | 5 | 7,683 | 8 | 7,807 | 1 |
| Plan 2 | 7,325 | 2 | 7,775 | 1 | 7,651 | 6 | 7,860 | 4 |
| Plan 3 | 7,370 | 6 | 7,915 | 7 | 7,627 | 2 | 7,889 | 8 |
| Plan 4 | 7,321 | 1 | 7,803 | 2 | 7,633 | 3 | 7,854 | 3 |
| Plan 5 | 7,359 | 5 | 7,908 | 6 | 7,619 | 1 | 7,880 | 7 |
| Plan 6 | 7,344 | 4 | 7,824 | 3 | 7,649 | 5 | 7,875 | 6 |
| Plan 7 | 7,343 | 3 | 7,835 | 4 | 7,642 | 4 | 7,871 | 5 |

As shown above, Plans 1, 2, 3 and 5 have lower 20-year deterministic PVRRs than Plan 4 under certain combinations of critical uncertain factor values. Liberty-Empire does not believe, however, that this materially alters the Company's Preferred Plan selection. Even in these extreme scenarios, Plan 4 is never worse than the third lowest-cost option.

Under conditions with no $CO_2$ price, high load, high capital costs, and high gas and power prices, retaining Asbury (Plan 1) is lower-cost than Plan 4. However, the early retirement of Asbury generates savings in almost 95% of the probability-weighted scenarios, leading Liberty-Empire to conclude that retirement is the appropriate path.

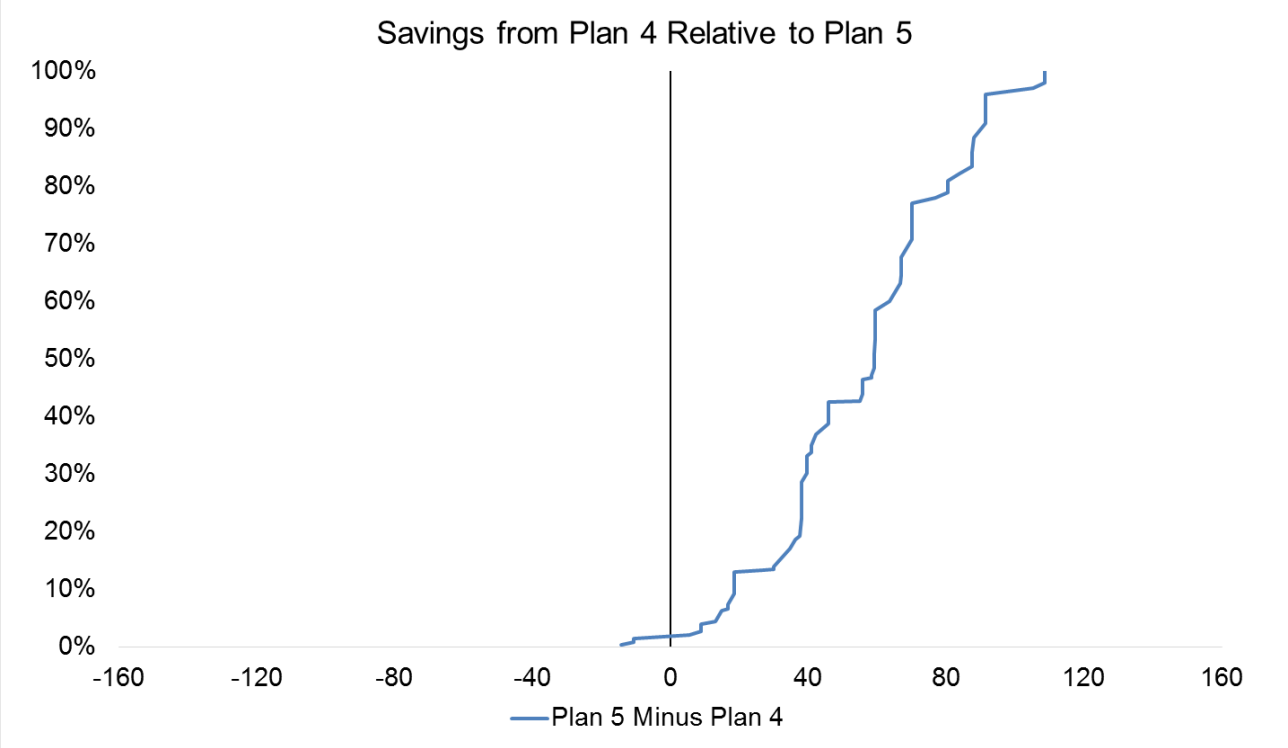
Under conditions with high load, high gas and power prices, a $CO_2$ price, and low capital costs, Plan 2 is lower cost than Plan 4. However, the range of cost differences between these plans across all endpoints is small, as shown in Figure 7-14. While the majority of probability-weighted endpoints result in Plan 2 having a lower PVRR than Plan 4, Plan 4 has a lower deterministic 20-year PVRR and is only $1 million more expensive than Plan 2 on a deterministic 30-year PVRR basis. Additionally, the majority of endpoints result in a difference of less than $15 million between Plan 2 and Plan 4. Liberty-Empire also believes there are numerous reasons, beyond cost, to choose Plan 4 as the Preferred Plan, as discussed above.

**Figure 7-14 – Cumulative Probability Delta for Plan 2 vs. Plan 4 – 20 Year PVRR ($ millions)**




Under conditions with high load, low gas and power prices, $CO_2$ prices, and high capital costs, Plan 5 is lower-cost than Plan 4. However, the combination of such conditions has a very low probability, as shown in Figure 7-15. Relative to Plan 5, Plan 4 is lower-cost in almost all probability-weighted endpoints, with a less than 2% chance that Plan 5 is lower-cost than Plan 4.

**Figure 7-15 – Cumulative Probability Delta for Plan 5 vs. Plan 4 – 20 Year PVRR ($ millions)**



## SECTION 3 BETTER INFORMATION

*(3) The utility shall describe and document its quantification of the expected value of better information concerning at least the critical uncertain factors that affect the performance of the preferred resource plan, as measured by the present value of utility revenue requirements. The utility shall provide a tabulation of the key quantitative results of that analysis and a discussion of how those findings will be incorporated in ongoing research activities.*

### 3.1 Expected Value of Better Information

To determine the maximum possible value that Liberty-Empire should pay for better information, it was assumed Liberty-Empire could obtain perfect information about the future trajectory of critical uncertain factors; that is, Liberty-Empire could determine with certainty which state of nature will occur. To make use of perfect information, a payoff table was developed, which is shown in Table 7-7. The payoff table illustrates the optimal resource alternative given perfect knowledge of the future.

To individually test each uncertain variable, all other variables were assumed to be the base value. For example, to test the value of perfect information for load, power and gas, capital costs and the CO2 price were all assumed as their base values, while load was varied between base, high and low. For this analysis, Liberty-Empire limited the study to Plans 0-7. As discussed above, Plans 8 and 10 are lower cost than Plan 4, but Liberty-Empire has determined that the early retirements of Energy Center 1 and 2 and Riverton 10 and 11 are not justified by the potential savings.

For each uncertain variable, Liberty-Empire determined the plan that had the least cost for each possible endpoint. The expected value of perfect information for each uncertain variable is calculated by taking the lowest-cost PVRR for each endpoint and weighting it by its probabilistic value. By taking the probabilistic expected value of Plan 4, and subtracting the expected value with perfect information, Liberty-Empire determined the expected value of better information ("EVBI") as shown in Table 7-7 through Table 7-11. EVBI represents the theoretical maximum amount of money Liberty-Empire could spend to obtain additional information about the states of nature.

**Table 7-7 – Summary of the Expected Values of Better Information ("EVBI")**

| ***Expected Value of Better Information*** | | | | |
|---|---|---|---|---|
| | **Load** | **Gas / Power** | **CO2 Price** | **Capital Costs** |
| *Expected Value Plan 4 ($M)* | 7,325 | 7,306 | 7,459 | 7,319 |
| *Expected Value Using Perfect Information ($M)* | 7,325 | 7,305 | 7,454 | 7,317 |
| *Expected Value of Better Information ($M)* | 0.3 | 0.4 | 4 | 3 |

**Table 7-8 – EVBI Load**

| **Load** | | | |
|---|---|---|---|
| *Load* | Base | High | Low |
| *Gas / Power* | Base | Base | Base |
| *CO2 Price* | Base | Base | Base |
| *Capital Costs* | Base | Base | Base |
| Endpoint | Endpoint 1 | Endpoint 2 | Endpoint 3 |
| Plan 0 | 7,415 | 7,494 | 7,346 |
| Plan 1 | 7,398 | 7,477 | 7,328 |
| Plan 2 | 7,325 | 7,406 | 7,255 |
| Plan 3 | 7,370 | 7,450 | 7,300 |
| Plan 4 | 7,321 | 7,408 | 7,252 |
| Plan 5 | 7,359 | 7,442 | 7,290 |
| Plan 6 | 7,344 | 7,423 | 7,275 |
| Plan 7 | 7,343 | 7,424 | 7,273 |
| | | | |
| | | | |
| Probabilities | | | |
| Load | 50% | 25% | 25% |
| | | | |
| Plan 4 | 3,661 | 1,852 | 1,813 |
| Perfect Information | 3,661 | 1,852 | 1,813 |
| | | | |
| **Expected Value Plan 4 ($M)** | 7,325 | | |
| **Expected Value Using Perfect Information ($M)** | 7,325 | | |
| **Expected Value of Better Information ($M)** | 0.3 | | |

**Table 7-9 – EVBI Market Prices**

| Gas / Power | | | |
|---|---|---|---|
| *Load* | Base | Base | Base |
| *Gas / Power* | Base | High | Low |
| *CO2 Price* | Base | Base | Base |
| *Capital Costs* | Base | Base | Base |
| Endpoint | Endpoint 1 | Endpoint 4 | Endpoint 7 |
| Plan 0 | 7,415 | 7,423 | 7,325 |
| Plan 1 | 7,398 | 7,399 | 7,313 |
| Plan 2 | 7,325 | 7,398 | 7,227 |
| Plan 3 | 7,370 | 7,470 | 7,246 |
| Plan 4 | 7,321 | 7,400 | 7,217 |
| Plan 5 | 7,359 | 7,459 | 7,236 |
| Plan 6 | 7,344 | 7,426 | 7,238 |
| Plan 7 | 7,343 | 7,426 | 7,234 |
| | | | |
| | | | |
| Probabilities | | | |
| Gas / Power | 50% | 20% | 30% |
| | | | |
| Plan 4 | 3,661 | 1,480 | 2,165 |
| Perfect Information | 3,661 | 1,480 | 2,165 |
| | | | |
| **Expected Value Plan 4 ($M)** | 7,306 | | |
| **Expected Value Using Perfect Information ($M)** | 7,305 | | |
| **Expected Value of Better Information ($M)** | 0.4 | | |

**Table 7-10 – EVBI Environmental Costs**

| CO2 Price | | |
|---|---|---|
| *Load* | Base | Base |
| *Gas / Power* | Base | Base |
| *CO2 Price* | Base | High |
| *Capital Costs* | Base | Base |
| Endpoint | Endpoint 1 | Endpoint 10 |
| Plan 0 | 7,415 | 7,745 |
| Plan 1 | 7,398 | 7,713 |
| Plan 2 | 7,325 | 7,587 |
| Plan 3 | 7,370 | 7,676 |
| Plan 4 | 7,321 | 7,596 |
| Plan 5 | 7,359 | 7,666 |
| Plan 6 | 7,344 | 7,621 |
| Plan 7 | 7,343 | 7,624 |
| | | |
| | | |
| Probabilities | | |
| CO2 Price | 50% | 50% |
| | | |
| Plan 4 | 3,661 | 3,798 |
| Perfect Information | 3,661 | 3,794 |
| | | |
| **Expected Value Plan 4 ($M)** | 7,459 | |
| **Expected Value Using Perfect Information ($M)** | 7,454 | |
| **Expected Value of Better Information ($M)** | 4 | |

**Table 7-11 – EVBI Capital Costs**

| Capital Costs | | | |
|---|---|---|---|
| *Load* | Base | Base | Base |
| *Gas / Power* | Base | Base | Base |
| *CO2 Price* | Base | Base | Base |
| *Capital Costs* | Base | High | Low |
| Endpoint | Endpoint 1 | Endpoint 37 | Endpoint 19 |
| Plan 0 | 7,415 | 7,709 | 7,357 |
| Plan 1 | 7,398 | 7,707 | 7,333 |
| Plan 2 | 7,325 | 7,686 | 7,222 |
| Plan 3 | 7,370 | 7,689 | 7,299 |
| Plan 4 | 7,321 | 7,669 | 7,230 |
| Plan 5 | 7,359 | 7,678 | 7,289 |
| Plan 6 | 7,344 | 7,695 | 7,253 |
| Plan 7 | 7,343 | 7,687 | 7,257 |
| | | | |
| | | | |
| Probabilities | | | |
| Capital Costs | 50% | 10% | 40% |
| | | | |
| Plan 4 | 3,661 | 767 | 2,892 |
| Perfect Information | 3,661 | 767 | 2,889 |
| | | | |
| **Expected Value Plan 4 ($M)** | 7,319 | | |
| **Expected Value Using Perfect Information ($M)** | 7,317 | | |
| **Expected Value of Better Information ($M)** | 3 | | |

## SECTION 4 CONTINGENCY RESOURCE PLANS

*(4) The utility shall describe and document its contingency resource plans in preparation for the possibility that the preferred resource plan should cease to be appropriate, whether due to the limits identified pursuant to 4 CSR 240-22.070(2) being exceeded or for any other reason.*

### 4.1 Contingency Resource Plans

The 16 alternative resource plans are described in detail in Volume 6. For reference, Table 7-12 provides a summary of each.

**Table 7-12 – Alternative Resource Plans**

| Plan | Plan Description | Renewable vs. Gas | Central Scale vs. Distributed | Retirements | DSM Port-folio |
|---|---|---|---|---|---|
| 0 | Customer Savings Plan | Gas | Central Scale | No Early Retirements | RAP |
| 1 | Asbury End of Life - Least Cost | Renewable | Central Scale | No Early Retirements | RAP |
| 2 | Early Asbury Retire - Central Scale Renewables | Renewable | Central Scale | Asbury 2019 | RAP |
| 2B | Early Asbury Retire - Central Scale Renewables - All 2023 Solar | Renewable | Central Scale | Asbury 2019 | RAP |
| 2 - MAP | Early Asbury Retire - Central Scale Renewables + MAP DSM | Renewable | Central Scale | Asbury 2019 | MAP |
| 3 | Early Asbury Retire - Central Scale Thermal | Gas | Central Scale | Asbury 2019 | RAP |
| 4 | Early Asbury Retire - Distrib-uted Renewable | Renewable | Distributed | Asbury 2019 | RAP |
| 5 | Early Asbury Retire - Distrib-uted Thermal | Gas | Distributed | Asbury 2019 | RAP |
| 6 | Early Asbury Retire - Central Scale Mix | Mix | Central Scale | Asbury 2019 | RAP |
| 7 | Early Asbury Retire - Distrib-uted Mix | Mix | Distributed | Asbury 2019 | RAP |
| 8 | Early Asbury, Peaker Retire - Central Scale Renewables | Renewable | Central Scale | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |
| 9 | Early Asbury, Peaker Retire - Central Scale Thermal | Gas | Central Scale | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |
| 10 | Early Asbury, Peaker Retire - Distributed Renewable | Renewable | Distributed | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |

| | | | | | |
|---|---|---|---|---|---|
| 11 | Early Asbury, Peaker Retire - Distributed Thermal | Gas | Distributed | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |
| 12 | Early Asbury, Peaker Retire - Central Scale Mix | Mix | Central Scale | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |
| 13 | Early Asbury, Peaker Retire - Distributed Mix | Mix | Distributed | Asbury 2019; Energy Center 1&2 2021; Riv 10&11 2025 | RAP |
| Notes: DSM – Demand-side Management; RAP – Realistic Achievable Potential; MAP – Maximum Achievable Potential | | | | | |

Liberty-Empire is considering Plans 2, 2-MAP, 3, 5, 6, and 7 as contingency plans. As discussed above, Liberty-Empire does not believe that the potential savings from retiring Liberty-Empire's peaking units prematurely justify their early retirement at this time, so Plans 8 through 13 are not considered contingency plans. Plans 0 and 1 are not considered contingency plans because they require the operation of the Asbury plant beyond 2019. Liberty-Empire's set of contingency plans may address differing futures for loads, fuel prices, environmental costs, and capital costs. Liberty-Empire will continue to monitor all uncertain factors, file annual updates, and file Triennial Integrated Resource Plans with plenty of advance notice should a new resource be required earlier than expected in this 2019 IRP Preferred Plan.

> *(A) The utility shall identify as contingency resource plans those alternative resource plans that become preferred if the critical uncertain factors exceed the limits developed pursuant to section (2).*

Liberty-Empire is well-positioned to develop contingency plans if the critical uncertain factors change enough to compel a different course of action. For example, should higher load, higher power prices and lower capital costs for utility-scale resources materialize, Liberty-Empire could adjust its planning to a course similar to Plan 2. Similarly, if no carbon price materializes, gas and power prices stay relatively flat, and capital costs for renewables are higher than expected, Liberty-Empire could adjust its planning to the portfolio contemplated in Plan 5. Liberty-Empire will monitor the continually changing costs of both distributed and utility-scale renewable resources, and a resource buildout somewhere between Plan 4 and Plan 2 could materialize.

In Section 2.2, Liberty-Empire includes an analysis of the range of outcomes for the critical uncertain factors to determine the limits within which the Preferred Plan is judged to be appropriate and explains how these limits were determined.

> *(B) The utility shall develop a process to pick among alternative resource plans, or to revise the alternative resource plans as necessary, to help ensure reliable and low cost service should the preferred resource plan no longer be appropriate for any reason. The utility may also use this process to confirm the viability of contingency resource plans identified pursuant to subsection (4)(A).*

Liberty-Empire is continually monitoring factors that could impact the Preferred Plan. This may involve additional analyses. Liberty-Empire updates its Missouri stakeholder group periodically through the filing of triennial IRPs and annual updates required under rule 4 CRS 240-22.080. Accordingly, Liberty-Empire's modeling and the effects of these factors on Liberty-Empire's plans are researched, recalculated and documented for the Commission every year. Additionally, if Liberty-Empire's Preferred Plan changed significantly, Liberty-Empire would notify the Commission as required by 4 CSR 240-22.080(12). Because of the ongoing nature of the cycle, Liberty-Empire is always focused on regulatory and industry developments, and both the Commission and stakeholders are continually apprised of how these developments may affect Liberty-Empire's performance and plans.

> *(C) Each contingency resource plan shall satisfy the fundamental objective in 4 CSR 240-22.010(2) and the specific requirements pursuant to 4 CSR 240-22.070(1).*

Both the Preferred Plan (Plan 4) and the contingency plans satisfy the Missouri renewable energy standard mandates. These plans also include the mid- and low-cost bundle of RAP DSM. Each of these alternative resource plans was configured to satisfy the stated requirements.

**SECTION 5 LOAD BUILDING PROGRAMS**

*(5) Analysis of Load-Building Programs. If the utility intends to continue existing load-building programs or implement new ones, it shall analyze these programs in the context of one (1) or more of the alternative resource plans developed pursuant to 4 CSR 240-22.060(3) of this rule, including the preferred resource plan selected pursuant to 4 CSR 240-22.070(1). This analysis shall use the same modeling procedure and assumptions described in 4 CSR 240-22.060(4). The utility shall describe and document-*

*(A) Its analysis of load building programs, including the following elements:*

*1. Estimation of the impact of load-building programs on the electric utility's summer and winter peak demands and energy usage;*

*2. A comparison of annual average rates in each year of the planning horizon for the resource plan(s) with and without the load-building program;*

*3. A comparison of the probable environmental costs of the resource plan(s) in each year of the planning horizon with and without the proposed load-building program;*

*4. A calculation of the performance measures and risk by year; and*

*5. An assessment of any other aspects of the proposed load-building programs that affect the public interest; and*

*(B) All current and proposed load-building programs, a discussion of why these programs are judged to be in the public interest, and, for all resource plans that include these programs, plots of the following over the planning horizon:*

*1. Annual average rates with and without the load-building programs; and*

*2. Annual utility costs and probable environmental costs with and without the load-building programs.*

Liberty-Empire does not have any load building programs in place at this time and does not contemplate adding load building programs during the 20-year planning horizon.

# SECTION 6 IMPLEMENTATION PLAN

*(6) The utility shall develop an implementation plan that specifies the major tasks, schedules, and milestones necessary to implement the preferred resource plan over the implementation period. The utility shall describe and document its implementation plan, which shall contain-*

*(A) A schedule and description of ongoing and planned research activities to update and improve the quality of data used in load analysis and forecasting;*

*(B) A schedule and description of ongoing and planned demand-side programs and demand-side rates, evaluations, and research activities to improve the quality of demand-side resources;*

*(C) A schedule and description of all supply-side resource research, engineering, retirement, acquisition, and construction activities, including research to meet expected environmental regulations;*

*(D) Identification of critical paths and major milestones for implementation of each demand-side resource and each supply-side resource, including decision points for committing to major expenditures;*

## 6.1 Implementation Plan

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 2022. Therefore, the implementation period is the period 2019-2022.

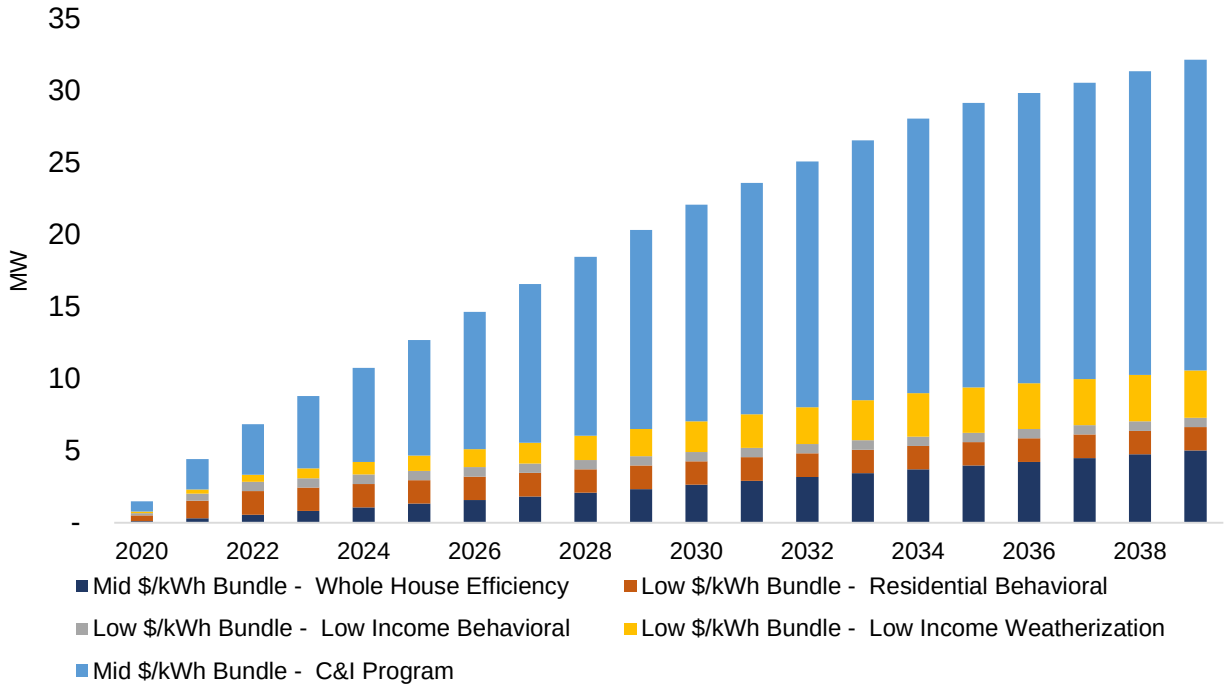
### 6.1.1 Planned Research Activities for Load Forecasting

Liberty-Empire plans to conduct its next Residential Appliance Saturation Survey at some point during the implementation period, ahead of the next triennial filing. Liberty-Empire also plans to produce its monthly energy usage and demand forecasts based on cost-of-service classes forecast retail sales on a rate class basis by the next triennial filing.

### 6.1.2 Demand-Side Implementation Plan

Demand-side offerings were bundled based on their performance and cost characteristics, then evaluated side-by-side with supply-side options using the Aurora model. Based on this analysis, Liberty-Empire selected the low-cost and mid-cost bundles of RAP DSM for inclusion in the Preferred Plan. The selected bundles are shown in Figure 16, on a cumulative basis over time.

**Figure 7-16 – Potential DER Benefits**




Liberty-Empire plans to file an application under the Missouri Energy Efficiency Investment Act ("MEEIA") before the next annual update. The exact timing and specific MEEIA request is currently being formulated by Liberty-Empire.

### 6.1.3 Supply-Side Implementation Plan

Liberty-Empire's implementation plan includes the retirement of the Asbury coal-fired plant, the addition of 600 MW of new wind in 2021, and the addition of new solar and solar + storage capacity between 2020 and 2023.

**Asbury Retirement**

The Preferred Plan retires Asbury in the near term because the plant is economically challenged under market conditions that are not expected to improve and because better options exist for meeting Liberty-Empire's capacity and energy requirements. While the IRP evaluated a 2019 retirement date, it may take longer to retire Asbury given notice requirements and shutdown procedures. Specifically, Liberty-Empire must provide six months of notice of a planned plant retirement to SPP, safely and reliably run the plant with minimum staff levels, and combust as much of the useable coal as possible.

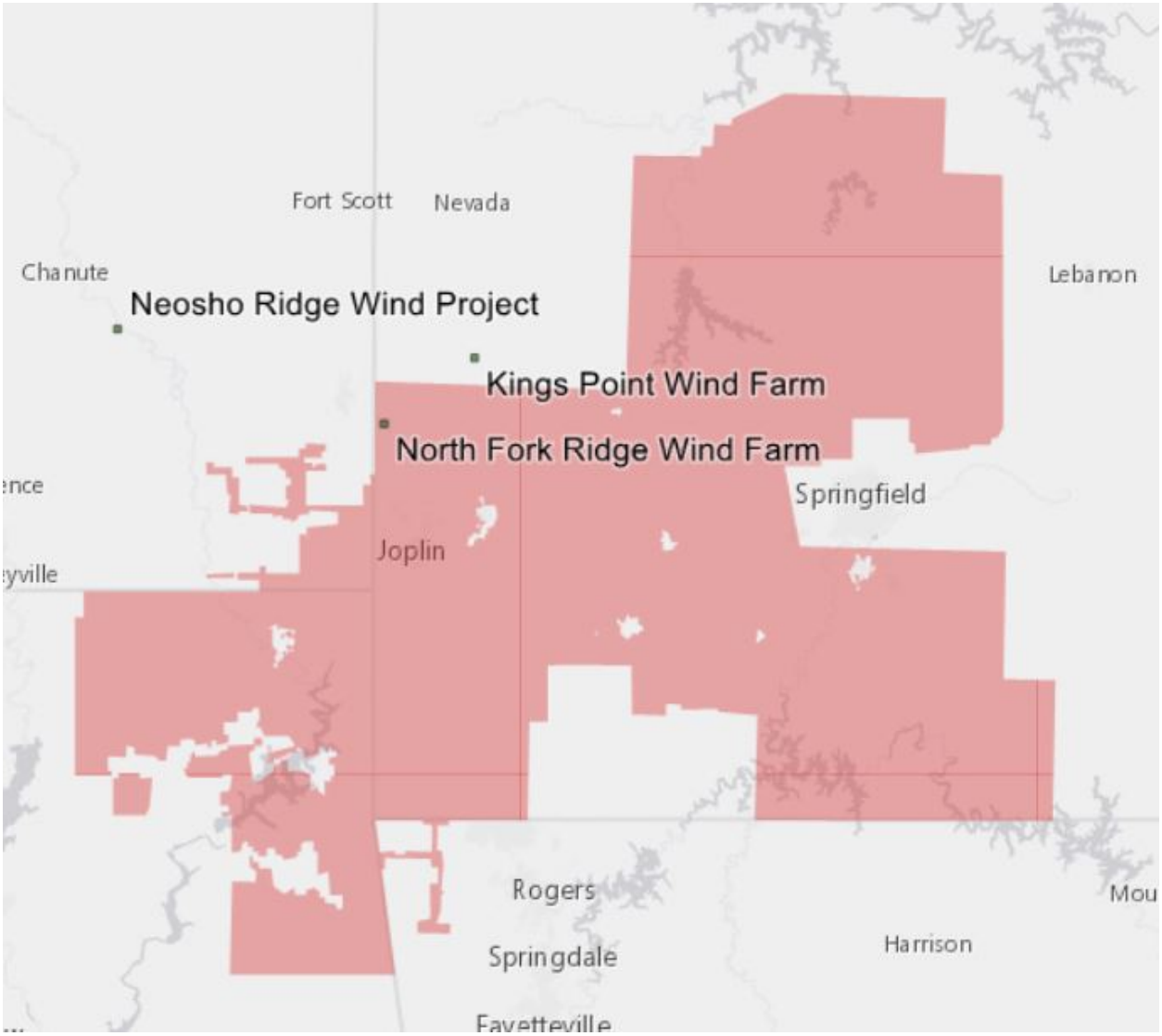
Liberty-Empire's decision-makers will continue to assess the best time to retire Asbury in the coming months. In the meantime, Empire is currently working with an independent engineering firm to assess the potential demolition costs as well as evaluate whether the plant can be sold and if not, what might be salvaged to help mitigate closure costs.

## 6.2 Wind Resource Additions

Liberty-Empire expects to add a total of 600 MW of low-cost wind in Missouri and Kansas during the implementation period. Liberty-Empire filed for certificates of convenience and necessity in EA 2019-0010 and received approval on June 19, 2019 from the MPSC. Liberty-Empire expects the three projects to come online before 2021 to achieve 100% eligibility for the production tax credits, although Liberty-Empire will not acquire the wind farms until early 2021. For the wind projects to be in service no later than December 31, 2020, physical construction is targeted to begin in the latter half of 2019.

The locations of the three wind projects are shown on the map below, which also highlights Liberty-Empire's service territory.

**Figure 7-17 – Map of Neosho, Kings Point, and North Fork Ridge Wind**




The Neosho wind project will consist of approximately 140 turbines located in Neosho County, KS, near to Liberty-Empire's service territory, with an installed capacity of approximately 300 MW.

The North Fork Ridge wind project will consist of approximately 70 turbines located in the southwest corner of Missouri in northwestern Jasper County and southwestern Barton County, Missouri. North Fork Ridge will have an installed capacity of approximately 150 MW.

The Kings Point wind project will consist of approximately 70 turbines located in southeastern Barton County, southwestern Dade County, northeastern Jasper County and northwestern Lawrence County, Missouri. Kings Point will have an installed capacity of approximately 150 MW.

**Table 7-13 – New Wind Implementation Plan**

| Milestone Description | Date Range |
|---|---|
| CCN Approval | June 2019 |
| Engineering commences | February 2019 |
| Initial project layout | March 2019 |
| Construction commences | September 2019 |
| First turbine deliveries | February 2020 |
| Project receives backfeed | March 2020 |
| Projects Online | December 31, 2020 |

## 6.3 Distributed Solar and Storage Additions

The Preferred Plan includes up to 10 MW of community solar by 2021. Liberty-Empire plans to file a community solar tariff that provides for 5 MW blocks starting in 2020.[4]

**Table 7-14 – Community Solar Implementation Plan**

| Milestone Description | Date Range |
|---|---|
| Community Solar Tariff Filing | 2019 Q3 |
| Community Solar Tariff Order | 2019 Q4 |
| Community Solar CCN Filing | 2020 Q1 |
| Community Solar CCN Order | 2020 Q2 |
| Community Solar Construction starts | 2020 Q3 |
| Project Online | 2020 Q4 |

The Preferred Plan also includes 19.5 MW in solar + storage projects in 2022. The 19.5 MW of solar + storage reflects the results of the 2019 IRP modeling. As part of its 2019 IRP analysis, Liberty-Empire identified potential circuits where significant capital could be deferred with the installation of distributed energy resources. Over the next three years, Liberty-Empire will conduct more detailed circuit studies to identify optimal site locations. In addition, Liberty-

[4] The planned tariff will call for 5 MW blocks, up to 30 MW.

Empire expects to secure safe harbored solar and storage resources by the end of 2019 in sufficient quantities in order to be ITC eligible.

**Table 7-15 – Distributed Solar + Storage Implementation Plan**

| Milestone Description | Date Range |
|---|---|
| Detailed circuit study and deferral analysis | January 2020 – June 2020 |
| Site specific analysis for key identified locations | June 2020 – December 2020 |
| Engineering and design | January 2021 – December 2021 |
| Construction | TBD |
| Project(s) Online | TBD |

### 6.3.1 Advanced Transmission and Distribution Network Technology Implementation Plan

Liberty-Empire is pursuing several programs that will bring advanced technology capabilities to its distribution system. These programs include AMI, *Customer First,* Distribution Automation, ADMS implementation, outage management system improvements, voltage control, and the installation of FCI and reclosers. Liberty-Empire is pursuing these grid capabilities against the backdrop of expanded, safe and secure communication at both transmission and distribution levels.

One of Liberty-Empire's principal advanced distribution network technology initiatives is to implement an AMI system covering its approximately 173,000 residential and commercial electric meter customers.[5] Liberty-Empire's AMI implementation planning is underway, in coordination with Liberty Utilities corporate-level support. Liberty-Empire expects to be in a position to deploy AMI during the 2020-2021 timeframe. Generally speaking, detailed planning will take approximately one year, followed by approximately 12-15 months of network and meter deployment activity.

[5] Liberty-Empire uses the MV-90 system to gather advanced billing determinants for its largest customers. These are excluded from the AMI implementation. Moreover, Liberty-Empire expects the MV-90 system, which utilizes cellular-based communication means, can be expanded to meet interim advanced metering needs until such time as the AMI network is operational. This includes integration to MDM and other back office systems.

This AMI initiative is part of Liberty-Empire's 5-year capital plan and is coordinated with the Liberty Utilities corporate-wide rollout of AMI. Liberty-Empire's AMI initiative is designed to occur in specific stages that are tied to integrations to billing, outage management, and other essential "back office" systems, which rely in part on advanced metering data. These stages occur over time and in a methodical and prudent step-wise fashion.

A key attribute of Liberty-Empire's AMI initiative is the leveraging of the considerable corporate-wide AMI investments and efforts of Liberty Utilities, including its installation of a meter data management ("MDM") system, its detailed planning of AMI meter installation and network rollout activities, and its creation of contractual partnerships with the required vendors and support service providers. These systems, assets, activities, and partnerships contribute to Liberty-Empire's ability to implement AMI in the 2020-2021 timeframe. Liberty Utilities, in conjunction with Liberty-Empire as one of its operating companies, is continuing throughout 2019 in its AMI and MDM implementation planning. This planning provides confidence to Liberty-Empire about the reasonableness of its AMI implementation schedule aspirations.

Broadly considered, Liberty-Empire's AMI and MDM initiatives fall within Liberty Utilities' over-arching *Customer First* corporate initiative. *Customer First* is a multi-year initiative with many components, stages, and milestones. As part of *Customer First*, Liberty Utilities is consolidating several systems, including its Enterprise Resources Planning ("ERP") system, its Geographical Information System ("GIS"), its Customer Information System ("CIS"), and its disparate meter reading systems. The CIS includes Liberty-Empire's customer billing system functions. As AMI is installed at Liberty-Empire, it will use a straightforward data and file transfer method to transmit meter reading information into the current Liberty-Empire billing platform. Eventually, the AMI data will be stored in and dispatched from Liberty Utilities' corporate-wide, shared MDM system, with further downstream integrations into the anticipated new Liberty Utilities' CIS system for billing and other customer care purposes.

Liberty-Empire intends to continue to plan its AMI system implementation during 2019, with the intention of deploying the field communications network and installing the advanced meters during the 2020-2021 timeframe. This work entails planning the size, location and other specific technical and business requirements of the field communications network. It also entails planning the host of requirements associated with the installation of approximately 15,000 to 20,000 meters per month.

As network communication devices and advanced two-way communicating meters are installed, communication pathways will be initiated and performance verified,[6] which in turn will allow Liberty-Empire to gradually transition to automated meter reading. Once this transition is complete, the AMI and MDM systems will permit Empire to collect, store and utilize sub-hourly metering information for billing and customer care purposes. For example, Liberty-Empire customer care representatives will eventually be able to quickly answer customer inquiries concerning their specific daily and hourly energy use by querying the MDM during and as part of an active customer inquiry telephone session.

AMI is also important as an operational tool to improve outage response activities. To this end, Liberty-Empire intends to integrate the AMI, MDM and outage management systems ("OMS"). This will permit Liberty-Empire to gain better intelligence on the nature of customer outage conditions, either as part of "single lights out" occurrences or as part of storm restoration events.

The table below provides a summary of key milestones for the Liberty-Empire AMI initiative.

[6] Two-way advanced meters will communicate across a local utility mesh or similar radio communication system. Empire expects that collector points will be equipped with 4g public cellular communications capabilities and will safely and securely collect and transmit data to a common system control point. Liberty-Empire expects that the AMI system hosting, control and monitoring responsibilities will be shared between Liberty Utilities and Liberty-Empire personnel.

**Table 7-16 – Summary of Key AMI Initiative Milestones**

| Activity or Milestone | Timeframe | Description |
|---|---|---|
| Detailed AMI Implementation Planning Period | Substantially complete prior to field network and meter deployment. | Completion of AMI implementation planning sufficient to enable the commencement of communication system network deployment and meter installation activities. Planning includes on-boarding the required communication system provider, field installation crews, and IT support resources. Empire will staff internal project management and business process change management resources during this time as well. |
| Installation of Field Communications Network | Liberty-Empire expects a 3-4-month activity, preceding meter deployment. | Deployment of 4g cellular capable field collectors and repeaters. Testing and initiation. |
| Meter Procurement | During the planning period, meter procurement requirements will be finalized, and procurement schedules established for needed meter stock. | Planning and procurement of required AMI meter stock must begin well ahead of the actual meter installation. Liberty-Empire will work with its meter manufacturer to anticipate the meter procurement and delivery requirements so as to provide the necessary orderly support of the meter exchange process. This work involves the establishment of meter testing protocols, meter exchange processes, and meter programming. |
| Meter Installation Period | Phased behind network deployment to allow for smooth transition from manual to network meter reads. | Liberty-Empire expects the complete meter installation period to last approximately 12-15 months. Empire will work closely with the meter installation contractor to train them to meet Empire's installation and customer contact requirements. Then, Liberty-Empire project and IT staff, the meter manufacturer and the install contractor will coordinate closely to ensure an orderly exchange of meters. |
| AMI System to Billing Integration | Integrations must be in place, tested and secured prior to first meter deployment. | Complete the "flat file" transfer protocols needed to support the transfer of AMI meter reading data to Empire's current billing system. |
| Cut-over to AMI for Billing Support Purposes | Phased and rolling process, proceeding in stages as meters are deployed. | Utilizing a phased transition from manual meter reading, Liberty-Empire will cut-over the manual meter reading routes to AMI once the AMI system has achieved satisfactory read performance |

| Activity or Milestone | Timeframe | Description |
|---|---|---|
| | | (typically 1 or 2 bill cycles to validate network and meter performance). Therefore, the number of meters transitioning from manual meter reading declines over this period as the number of AMI-support meters increases. |
| Transition to Operations | Occurs in stages as network and meter operational performance is validated. | Liberty-Empire expects transition of responsibilities to a steady state mode once the system is installed and performance is verified and stable. |
| Customer Engagement Activities | A progressive set of activities that involves building awareness, gaining input, addressing stakeholder questions, and ultimately gaining acceptance for the wide-ranging improvements that will be ushered in with AMI. Begins ahead of actual field deployment activities. | Liberty-Empire will begin an informal process of engaging with customers concerning the AMI initiative beginning in 2019-2020 timeframe and ahead of the actual field deployment activities. Efforts continue throughout the AMI system lifecycle. |

### 6.3.2 Preferred Plan Considerations beyond the Short-Term Implementation Period

The Preferred Plan contains significant solar and solar + storage resources in the latter part of the planning horizon. Liberty-Empire will be monitoring the costs of these technologies in relation to their value on the grid.

> *(E) A description of adequate competitive procurement policies to be used in the acquisition and development of supply-side resources;*

## 6.4 Competitive Procurement Policies

Prior to issuing requests for proposals, Liberty-Empire pre-screens potential bidders' qualifications and experiences to confirm that those who are allowed to propose on projects are capable of completing the work safely and adequately. Liberty-Empire utilizes the competitive bidding process and performs rigorous evaluations of the proposals submitted to secure the best

evaluated goods and services for implementing the development of its supply-side resources. As of December 2017, Liberty-Empire adopted the "Responsible Contractor Policy for Large Construction and Maintenance Projects." Solicitation and Procurement of new generation, and all large projects, will abide by this policy.

## 6.5 Monitoring Critical Uncertain Factors

*(F) A process for monitoring the critical uncertain factors on a continuous basis and reporting significant changes in a timely fashion to those managers or officers who have the authority to direct the implementation of contingency resource plans when the specified limits for uncertain factors are exceeded; and*

### 6.5.1 Monitoring Environmental Costs

Liberty-Empire personnel monitor environmental regulations and requirements to determine what actions need to be undertaken to ensure compliance and to determine the costs associated with that compliance. Among the environmental issues Liberty-Empire is currently tracking are issues relating to ozone; sulfur dioxide ($SO_2$); nitrogen dioxide ($NO_2$); the Clean Air Interstate Rule (CAIR) and/or the Cross State Air Pollution Rule (CSAPR); water; particulate matter; the Coal Combustion Residuals (CCR) rule relating to ash; mercury and hazardous air pollutants (Hg/HAPS); and carbon dioxide ($CO_2$). The information gathered is shared through discussions with senior management.

Environmental issues are monitored by the Energy Supply Services department. The Energy Supply Services department works with various other departments and management to monitor environmental costs and issues at Liberty-Empire's generation facilities. Energy Supply Services provides management with the Annual $NO_x$ Allocation Projection, the $SO_2$ Allowance Management Policy ("SAMP"), and the Greenhouse Gas Projections and Emissions Inventory, as well as a quarterly Environmental Key Issues Summary. Liberty-Empire also subscribes to JD Energy's environmental forecasting services. Personnel from the Environmental staff are in

regular contact with local, state and federal environmental agencies and attend various environmental events. Liberty-Empire is an active member of the Air and Waste Management Association, the EEI, the Regulatory Environmental Group for Missouri ("REGFORM"), the Missouri Electric Utilities Environmental committee ("MEUEC"), and various other state committees and organizations.

### 6.5.2 Monitoring Market and Fuel Prices

Power prices and fuel prices are regularly monitored by operational personnel. Both operational personnel and senior management are kept up-to-date of the processes and procedures being implemented in SPP that directly impact the availability and pricing of power. The price of natural gas is closely monitored. As documented in Volume 4, Liberty-Empire implemented a natural gas risk management policy that has an objective of minimizing the impact of natural gas price volatility. The risk management policy includes monitoring of natural gas prices. The natural gas risk management policy is overseen and positions taken are approved annually by senior management.

Liberty-Empire purchases fuel and power on a continuous basis. Each month, fuel and energy accountants prepare reports for management, such as the Summary of Fuel and Purchased Power Report, the Electric Fuel Report, and the Power Report. The Summary of Fuel and Purchased Power Report compares generation, fuel costs, market revenue, and purchase costs, actual to budget on a monthly, year-to-date and twelve-months-ended basis. The Electric Fuel Report contains detailed fuel usage and cost information by generating unit, plant and system on a monthly, year-to-date and twelve-months-ended basis. The Power Report is a detailed list of power purchases and sales for the month. Explanations for variances from budget are also reported to management. Liberty-Empire's Electric Gas Position Report is supplied to management on a weekly basis. It reports detailed natural gas price and natural gas hedged amount information. This report contains a natural gas position summary, trading detail, market detail, storage balance and other information. It tracks both hedged and spot market natural gas

activity. The market detail section lists current natural gas market futures prices and basis adjustment estimates for the next several years.

### 6.5.3 Monitoring Load Growth

Liberty-Empire's load forecast is revised annually and close attention is paid to the levels of peak demand during the summer and winter months. Scheduled reviews on the load forecast are held with senior management. Each month, Liberty-Empire prepares a variance report related to the demand and energy forecast and the actual results.

The Planning and Regulatory Department prepares a monthly Electric Sales and Revenue Variance Report for management. This report compares actual electric peaks, net system input ("NSI") sales and revenue versus the forecast of each. It also provides an explanation of variance. This comparison and variance reporting is done at both the revenue class and total system level on a monthly, year-to-date, 12-months-ended and same month as last year basis. Each month, the Customer Report and Weather Report is prepared by the Planning and Regulatory department and distributed to management. The Customer Report exhibits the number of customers and the change in customer growth by Commercial Operation Area. Since weather is a key factor for the monthly peak, NSI, sales, and revenue, a Weather Report shows how the current month's heating and cooling degree days compared to history. When the load forecasts are developed, input is provided from several areas of Liberty-Empire including management, Industrial and Commercial Services, and the Commercial Operations areas.

### 6.5.4 Monitoring Construction/Transmission/Interest Rates

The capital costs associated with generation and transmission projects are monitored by Liberty-Empire in a variety of ways. A project development team is formed for each major generation project with direct line reporting to a member of senior management. Finance personnel monitor the markets daily to track interest rates, are in frequent contact with the rating agencies, and are

kept well-informed of planned budgets for new projects. These efforts are coordinated with members of senior management.

Liberty-Empire monitors the state of current estimates of construction costs for supply-side resources via industry periodicals such as Platt's and the EIA Annual Energy Outlook. Liberty-Empire has contracted with engineering firms such as Black & Veatch, Burns and McDonnell, Sega, Inc., and others for construction cost estimates on an as-needed basis. Liberty-Empire has recent experience with several new generation construction projects with various technologies including combined-cycle, simple cycle combustion turbines, aeroderivative combustion turbines, and wind turbines. These types of construction projects are monitored by Project Managers. Energy Supply Services reports are provided to management on a monthly basis. Liberty-Empire actively participates in SPP RTO's transmission planning studies. SPP conducts several studies directly associated with transmission planning: the Balanced Portfolio Study, the Priority Projects Study, Aggregate Facilities Studies, the SPP Transmission Expansion Plan ("STEP"), and Integrated Transmission Plans (Near Term, 10-Year, and 20-Year Plans). A copy of each of these studies is provided in the appendices to Volume 4.5 – Transmission Distribution Analysis in response to rule 22.045(6). In addition to the aforementioned and attached studies, Liberty-Empire, through its representation on various working groups, participates in any applicable High Priority and special case studies as deemed necessary by the respective overseeing working groups.

## 6.6 Monitoring Preferred Resource Plan

*(G) A process for monitoring the progress made implementing the preferred resource plan in accordance with the schedules and milestones set out in the implementation plan and for reporting significant deviations in a timely fashion to those managers or officers who have the authority to initiate corrective actions to ensure the resources are implemented as scheduled.*

### 6.6.1 Preferred Plan Performance Measures

The performance measures of the preferred resource plan required by rule for each year of the planning horizon are presented below in Figure 7-17. These measures include: estimated annual revenue requirement; estimated level of average retail rates and percentage of change from the prior year; and estimated company financial ratios. The annual results of the performance measures are illustrated in Figure 7-28 through Figure 7-34 that follow.

****Confidential in its Entirety**[7]**

**Table 7-17 – Preferred Plan Performance Measures**

[redacted]

[7]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

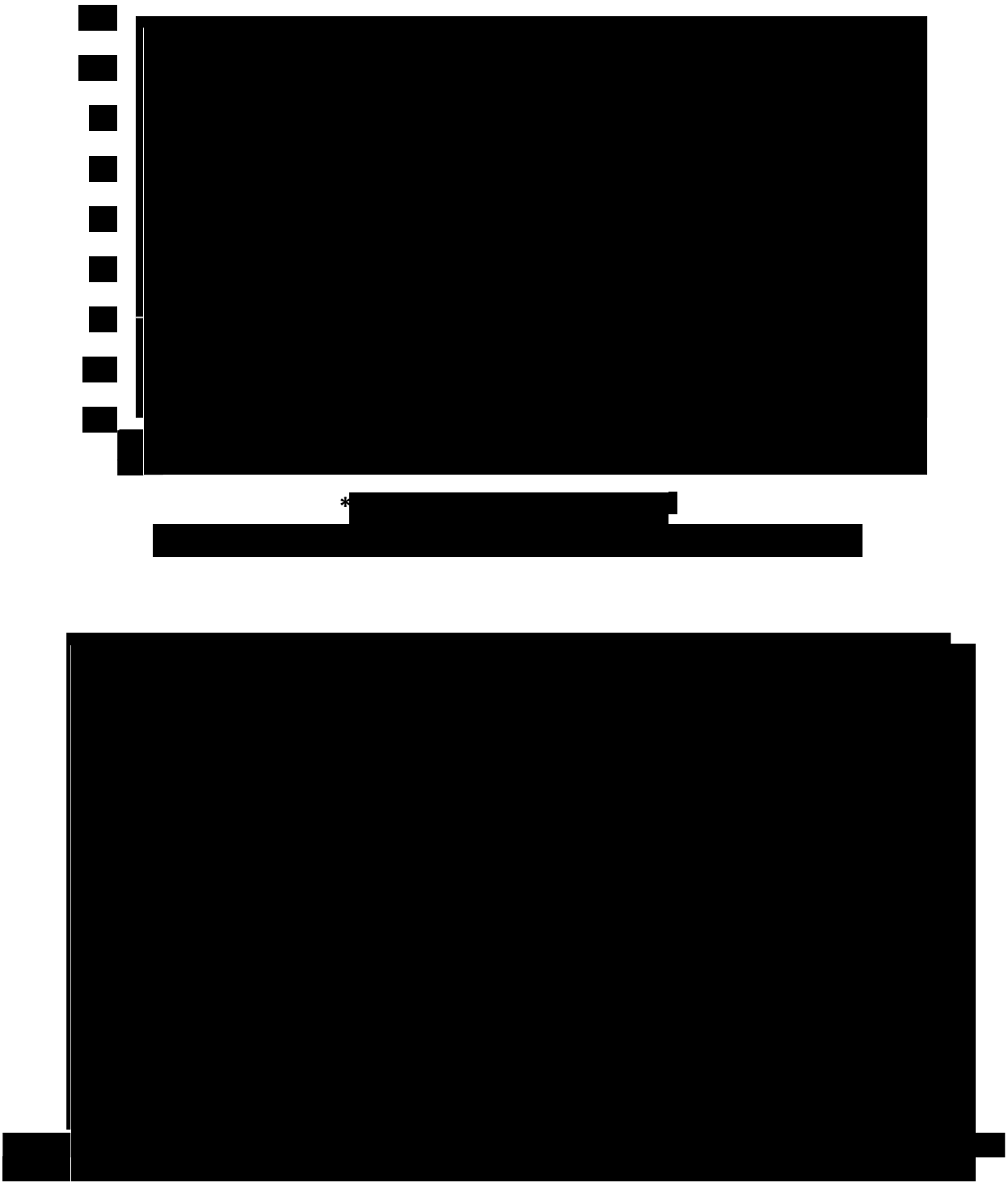
****Confidential in its Entirety**[8]**

**Figure 7-18 - Average System Rate Revenue (cents/kWh)**

[8]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

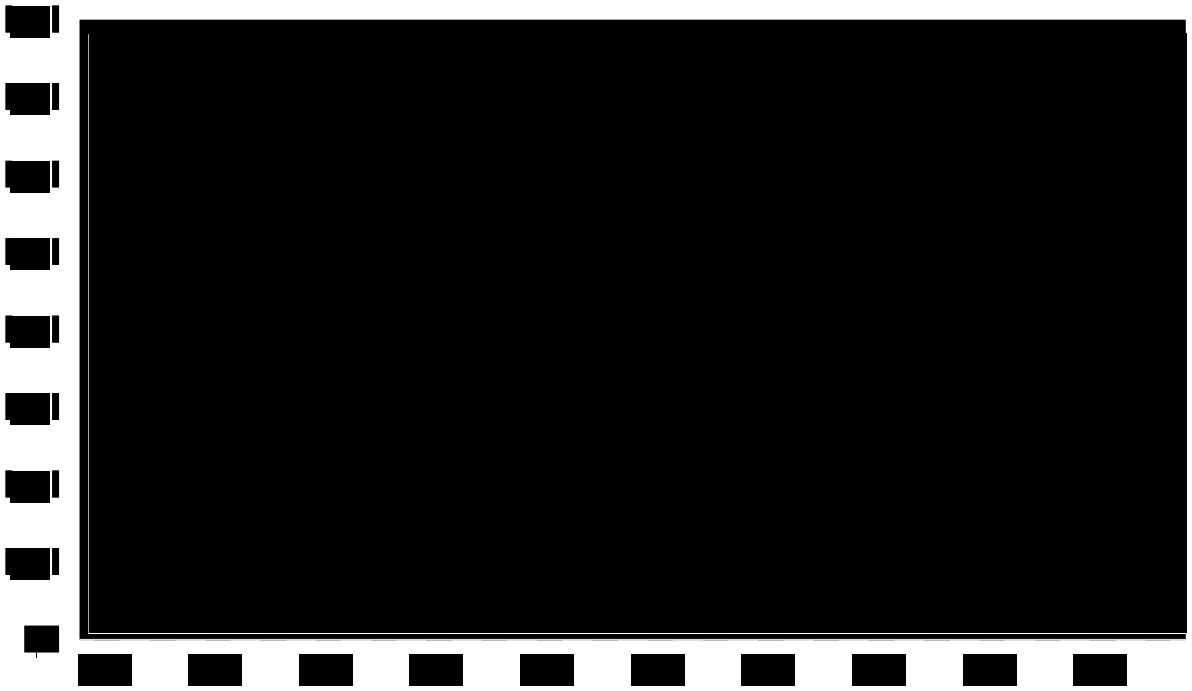
**Confidential in its Entirety**[9]

**Figure 7-19 - Preferred Plan Average Rate Change (Percent of Revenue)**



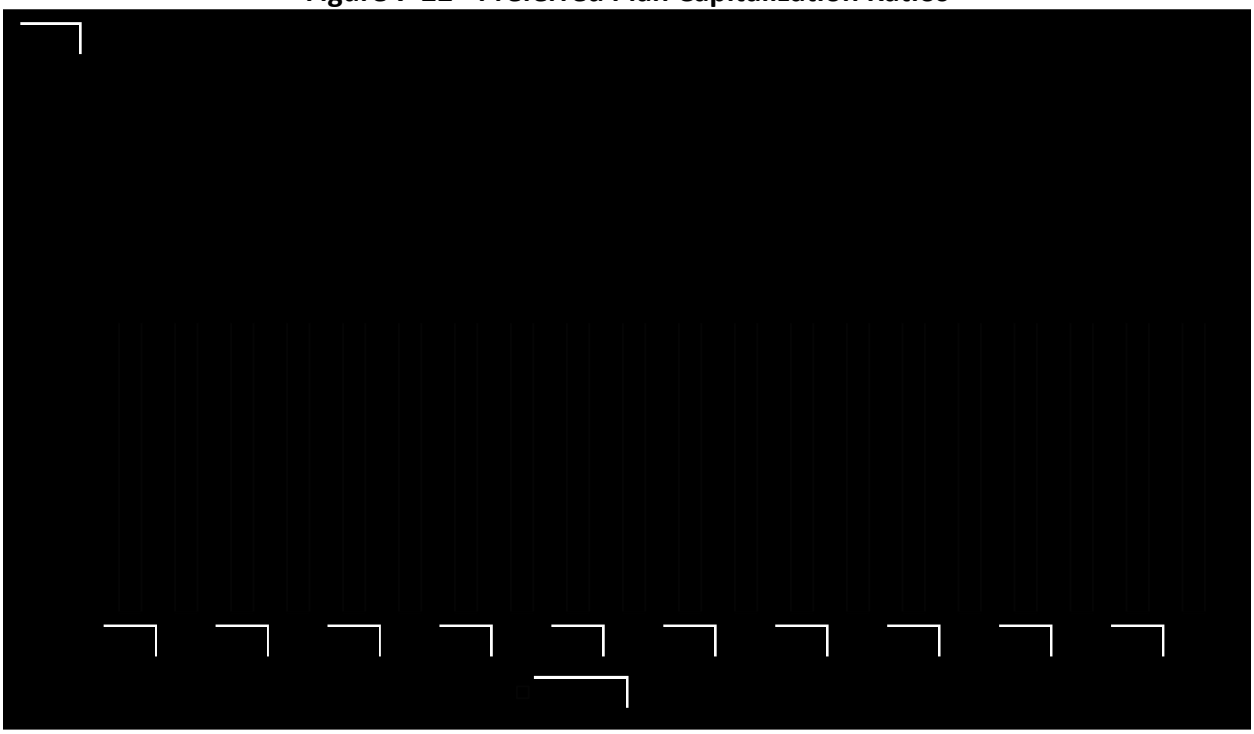
****Confidential in its Entirety**[10]**

**Figure 7-21 - Preferred Plan Capital Forecast ($ millions)**



****Confidential in its Entirety**[10]**

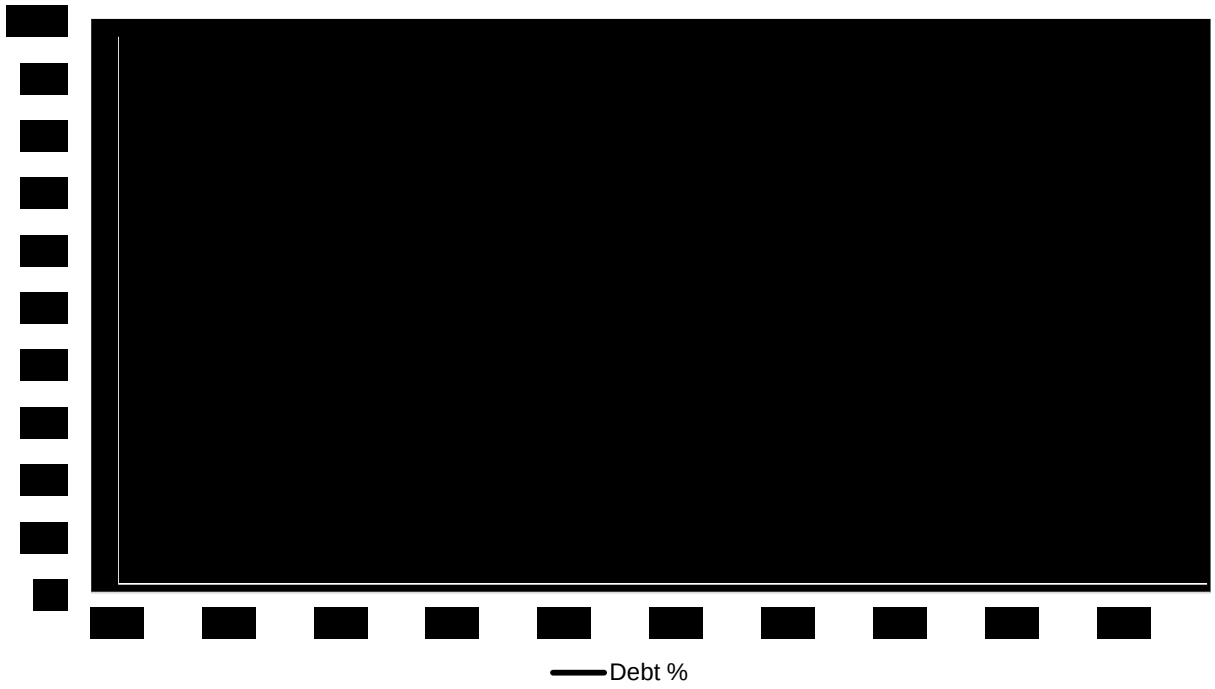
**Figure 7-22 - Preferred Plan Capitalization Ratios**



[10]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

****Confidential in its Entirety**[11]**

**Figure 7-23 - Preferred Plan Debt to Capital Ratio**




****Confidential in its Entirety**[11]**

**Figure 7-24 - Preferred Plan Pretax Interest Coverage Ratio**

[11]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating

****Confidential in its Entirety**[12]**

**Figure 7-25 - Preferred Plan Net Cash Flow to Capital Expenditures Ratio**

[12]4 CSR 240-2.135(2)(A) allows information to be marked as confidential when marketing analysis or other market-specific information relating to services offered in competition with others is used.

*(7) The utility shall develop, describe and document, officially adopt, and implement a resource acquisition strategy. This means that the utility's resource acquisition strategy shall be formally approved by an officer of the utility who has been duly delegated the authority to commit the utility to the course of action described in the resource acquisition strategy. The officially adopted resource acquisition strategy shall consist of the following components:*

Liberty-Empire's resource acquisition strategy has been formally approved. A signed commitment to the Preferred Plan and the resource acquisition strategy was included with the Company's letter of transmittal, and it can be found attached to this volume as Appendix 7A.

## 6.7 Preferred Resource Plan

*(A) A preferred resource plan selected pursuant to the requirements of section (1) of this rule;*

The Preferred Plan was described and documented in Section 1 above in response to rule 22.070 (1).

## 6.8 Implementation Plan

*(B) An implementation plan developed pursuant to the requirements of section (6) of this rule; and*

The Preferred Plan's implementation plan was described and documented in Section 6 above in response to rule 22.070 (6).

## 6.9 Contingency Resource Plans

*(C) A set of contingency resource plans developed pursuant to the requirements of section (4) of this rule and identification of the point at which the critical uncertain factors would trigger the utility to move to each contingency resource plan as the preferred resource plan.*

The contingency resource plans were described and their applicability was discussed in Section 4 above in response to rule 22.070 (4).

## SECTION 7 EVALUATION OF DEMAND-SIDE PROGRAMS AND DEMAND-SIDE RATES

*(8) Evaluation of Demand-Side Programs and Demand–Side Rates. The utility shall describe and document its evaluation plans for all demand-side programs and demand-side rates that are included in the preferred resource plan selected pursuant to 4 CSR 240-22.070(1). Evaluation plans required by this section are for planning purposes and are separate and distinct from the evaluation, measurement, and verification reports required by 4 CSR 240-3.163(7) and 4 CSR 240-20.093(7); nonetheless, the evaluation plan should, in addition to the requirements of this section, include the proposed evaluation schedule and the proposed approach to achieving the evaluation goals pursuant to 4 CSR 240-3.163(7) and 4 CSR 240-20.093(7). The evaluation plans for each program and rate shall be developed before the program or rate is implemented and shall be filed when the utility files for approval of demand-side programs or demand-side program plans with the tariff application for the program or rate as described in 4 CSR 240-20.094(3). The purpose of these evaluations shall be to develop the information necessary to evaluate the cost-effectiveness and improve the design of existing and future demand-side programs and demand-side rates, to improve the forecasts of customer energy consumption and responsiveness to demand-side programs and demand-side rates, and to gather data on the implementation costs and load impacts of demand-side programs and demand-side rates for use in future cost-effectiveness screening and integrated resource analysis.*

The evaluation plans and implementation plans for all candidate demand-side programs that were considered in the integration phase of this IRP are presented in Volume 050 – Demand-Side Resource Analysis. Additional information can be found in the appendices to Volume 5, specifically Appendix 5B – Energy Efficiency Program Design. Liberty-Empire's 2019 Preferred Plan includes the low and mid-cost bundle of RAP DSM.

APPENDIX 7A Commitment to the Preferred Plan Signed

**THE EMPIRE DISTRICT ELECTRIC COMPANY, A LIBERTY UTILITIES COMPANY (LIBERTY-EMPIRE)**

**2019 INTEGRATED RESOURCE PLAN**

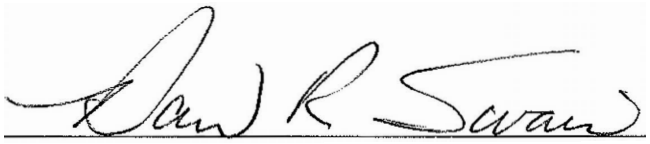
COMMITMENT TO THE

APPROVED PREFERRED RESOURCE PLAN

FILE NO. EO-2019-0049

In accordance with Missouri Public Service Commission Rule 4 CSR 240-22, The Empire District Electric Company, a Liberty-Utilities Company (Liberty-Empire) developed, described and documented, and now officially adopts for implementation the preferred resource plan and resource acquisition strategy contained in this filing.

As required, the adopted resource acquisition strategy consists of a preferred resource plan; an implementation plan; and a set of contingency resource plans. I hereby further commit to provide the notice called for by Commission Rule 4 CSR 240-22.080(12), if Empire should, between triennial compliance filings, decide to take actions materially inconsistent with the preferred resource plan.



David R. Swain

President, Central Region

6-27-19

Dated