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VOLUME 6

INTEGRATED RESOURCE PLAN AND RISK ANALYSIS

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

4 CSR 240-22.060

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Liberty Utilities
EMPIRE DISTRICT

****Denotes Confidential****

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INTEGRATED RESOURCE PLAN AND RISK ANALYSIS

4 CSR 240-22.0.060 Integrated Resource Plan and Risk Analysis

PURPOSE: This rule requires the utility to design alternative resource plans to meet the planning objectives identified in 4 CSR 240-22.010(2) and sets minimum standards for the scope and level of detail required in resource plan analysis and for the logically consistent and economically equivalent analysis of alternative resource plans. This rule also requires the utility to identify the critical uncertain factors that affect the performance of alternative resource plans and establishes minimum standards for the methods used to assess the risks associated with these uncertainties.

SECTION 1 RESOURCE PLANNING OBJECTIVES

(1) Resource Planning Objectives. The utility shall design alternative resource plans to satisfy at least the objectives and priorities identified in 4 CSR 240-22.010(2). The utility may identify additional planning objectives that alternative resource plans will be designed to meet. The utility shall describe and document its additional planning objectives and its guiding principles to design alternative resource plans that satisfy all of the planning objectives and priorities.

1.1 Resource Planning Objectives

As prescribed at 4 CSR 240-22.010(2), the fundamental objective of the electric utility resource planning process is to provide the public with 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. In developing this Integrated Resource Plan ("IRP"), Liberty-Empire considered and analyzed demand-side resources, renewable energy, and supply-side resources on an equivalent basis subject to compliance with legal mandates that may affect the selection of electric energy resources in the resource planning process.

The minimum present worth of long-run utility costs was the primary criterion for evaluating the comparative performance of the alternative resource plans, subject to certain constraints. In addition, Liberty-Empire identified and, where possible, quantitatively analyzed other considerations that were critical to meeting the fundamental resource planning objective, but that could constrain or limit the minimization of the present worth of expected costs. Within this filing, Liberty-Empire has documented the process and rationale used by its decision makers to assess such tradeoffs in determining the appropriate balance between minimization of expected costs and these other considerations in developing the resource acquisition strategy. These considerations included, but were not necessarily limited to, mitigation of:

1. Risks associated with critical uncertain factors that would affect the actual costs associated with alternative resource plans.
2. Risks associated with new or more stringent legal mandates that might be imposed at some point within the planning period.
3. Rate increases associated with alternative resource plans.

When taking into account the primary selection criterion (i.e. minimization of present worth of long run utility costs), and the careful and rigorous evaluation of other critical considerations, including evaluation of the risks identified above, Liberty-Empire is able to recommend a preferred resource plan from amongst the 16 alternative plans evaluated (see Volume 070).

1.2 Other Issues

Liberty-Empire is required under 393.1030 RSMo and 4 CSR 240-20.100 to comply with the state Renewable Energy Standard ("RES"), which is based on the total retail electric sales or the total retail electric usage that Liberty-Empire delivers each year to its Missouri retail customers. The Missouri RES requirements are summarized in Table 6-1. These values are based on a percentage of an electric utility's Missouri annual retail sales. Two percent of the RES requirement must be met with solar resources. Each eligible kWh of energy generated within the state of Missouri counts as 1.25 kWh. Additionally, some or all of the requirement may be satisfied by the purchase of Renewable Energy Credits ("RECs").

Table 6-1 - Missouri RES Requirements

Current Dates	Current RES Percentage (no less than)
2011-2013	2%
2014-2017	5%
2018-2020	10%
Beginning in 2021	15%

These annual renewable energy requirements can affect the present worth of long-run utility costs for respective resource plans. Liberty-Empire considered and quantitatively analyzed the cost impacts of RES requirements in this resource planning process.

1.3 Planning and Analysis

As specified in 4 CRS 240-22.010(2)(A), Liberty-Empire considered and analyzed demand-side resources, supply-side resources, renewable energy, and distributed energy resources all on an equivalent basis. More specifically, Liberty-Empire and its portfolio modeling consultant, CRA International ("CRA"), developed, considered, and analyzed the present worth of long-run utility costs for 16 alternative resource plans by calculating the present value revenue requirements ("PVRR") for each. Minimization of long run utility costs (as expressed in terms of PVRR) was the primary criterion for the determination of the financial rank of each plan. As noted above, other factors, including risk, rate impact minimization, diversity, and probable environmental costs, were used to select the Preferred Plan. Risks associated with critical uncertain factors that could affect actual long-run costs and the risks associated with changing market prices, carbon regulation, capital and financing costs, and load were also evaluated for their potential impacts on the alternative resource plans.

The details of Liberty-Empire's integrated resource plan evaluation and risk analysis are further explained in this volume. Table 6-2 summarizes the alternative resource plans (see Section 3).

SECTION 2 PERFORMANCE MEASURES

(2) Specification of Performance Measures. The utility shall specify, describe, and document a set of quantitative measures for assessing the performance of alternative resource plans with respect to resource planning objectives.

(A) These performance measures shall include at least the following:

2.1 Present Worth of Utility Revenue Requirements

1. Present worth of utility revenue requirements, with and without any rate of return or financial performance incentives for demand-side resources the utility is planning to request;

The annual revenue requirement includes the total cost of Liberty-Empire's electric operations and any costs for probable environmental compliance. The annual revenue requirement is the total of Liberty-Empire's annual expenses and its authorized return on rate base, less any revenues Liberty-Empire receives. Capital expenditures for investments in plant increase the rate base, while depreciation and amortization of assets reduce the rate base. In accordance with 4 CSR 240-22.060(2)(B), the net PVRR is calculated by taking the present value of the annual revenue requirements, discounted using Liberty-Empire's after-tax weighted average cost of capital ("WACC").

2.2 Present Worth of Probable Environmental Costs

2. Present worth of probable environmental costs;

The present worth of probable environmental costs was developed based on the expected risk levels for implementation of CO_2 regulations on generation. The following scenarios have been used in the Liberty-Empire evaluation:

- Base Environmental Scenario: No CO_2 price over the planning period. A 50% probability is assigned to this outcome.
- High Environmental Scenario: Carbon tax beginning in 2026 that aims towards a long-term power sector reduction target of 80% by 2050. A 50% probability is assigned to this outcome.

2.3 Present Worth of DSM Participant's Costs

3. Present worth of out-of-pocket costs to participants in demand-side programs and demand-side rates;

Demand-side management ("DSM") program costs were inputs to the integrated resource plan and risk analysis. The present value of these programs was calculated using the estimated future cost of the programs with the discount factor per 4 CSR 240-22.060(2)(B).

2.4 Levelized Annual Average Rates

4. Levelized annual average rates;

The levelized annual average rate is the simple average of the 20-year estimate of the annual rates. The annual average rate equals the total estimated annual revenue requirement divided by the forecasted total retail energy sales.

2.5 Maximum Single-Year Increase in Annual Average Rates

5. Maximum single-year increase in annual average rates;

For each alternative resource plan, each year-by-year percent change in the annual average rates was calculated and analyzed to determine the maximum single year increase.

2.6 Financial Ratios

6. Financial ratios (e.g., pretax interest coverage, ratio of total debt to total capital, ratio of net cash flow to capital expenditures) or other credit metrics indicative of the utility's ability to finance alternative resource plans; and

Liberty-Empire utilizes three financial ratios in its analyses of each alternative resource plan: pre-tax interest coverage; ratio of total debt to total capital; and ratio of net cash flow to capital expenditures.

2.7 Other Measures for Assessing Relative Performance Plans

7. Other measures that utility decision-makers believe are appropriate for assessing the performance of alternative resource plans relative to the planning objectives identified in 4 CSR 240-22.010(2).

Liberty-Empire did not utilize and does not propose any additional financial metrics for assessing the performance of alternative resource plans relative to the planning objectives identified in 4 CSR 240-22.010(2).

2.8 Utility Discount Rate

(B) All present worth and levelization calculations shall use the utility discount rate and all costs and benefits shall be expressed in nominal dollars.

Liberty-Empire utilized a discount rate of 6.71 percent for all analyses of alternative resource plans. All PVRR dollar amounts were discounted back to 2018 dollars. This figure represents Liberty-Empire's after-tax WACC.

SECTION 3 ALTERNATIVE RESOURCE PLANS

(3) Development of Alternative Resource Plans. The utility shall use appropriate combinations of demand-side resources and supply-side resources to develop a set of alternative resource plans, each of which is designed to achieve one (1) or more of the planning objectives identified in 4 CSR 240-22.010(2). Demand-side resources are the demand-side candidate resource options and portfolios developed in 4 CSR 240-22.050(6). Supply-side resources are the supply-side candidate resource options developed in 4 CSR 240-22.040(4). The goal is to develop a set of alternative plans based on substantively different mixes of supply-side resources and demand-side resources and variations in the timing of resource acquisition to assess their relative performance under expected future conditions as well as their robustness under a broad range of future conditions.

Liberty-Empire developed 16 alternative resource plans covering various combinations of supply-side resources, demand-side resources, renewables, and fueling options. Table 6-2 provides a summary of Liberty-Empire's alternative resource plans. Each plan is described in greater detail elsewhere in this Volume.

Table 6-2 - Summary of Alternative Resource Plans

Plan	Plan Description	Renewable vs. Gas	Utility Scale vs. Distrib-uted	Retirements	DSM Portfolio
0	Customer Savings Plan	Gas	Utility Scale	No Early Retirements	RAP
1	Asbury End of Life – Least Cost	Renewable	Utility Scale	No Early Retirements	RAP
2	Early Asbury Retire – Utility Scale Renewables	Renewable	Utility Scale	Asbury 2019	RAP
2B	Early Asbury Retire – Utility Scale Renewables - All 2023 Solar	Renewable	Utility Scale	Asbury 2019	RAP
2 - MAP	Early Asbury Retire – Utility Scale Renewables + MAP DSM	Renewable	Utility Scale	Asbury 2019	MAP
3	Early Asbury Retire – Utility Scale Thermal	Gas	Utility Scale	Asbury 2019	RAP
4	Early Asbury Retire – Distributed Renewable	Renewable	Distributed	Asbury 2019	RAP
5	Early Asbury Retire – Distributed Thermal	Gas	Distributed	Asbury 2019	RAP
6	Early Asbury Retire – Utility Scale Mix	Mix	Utility Scale	Asbury 2019	RAP
7	Early Asbury Retire – Distributed Mix	Mix	Distributed	Asbury 2019	RAP
8	Early Asbury, Peaker Re-tire - Utility Scale Re-newables	Renewable	Utility Scale	Asbury 2019; Energy Center Units 1&2 2021; Riv[1] Units 10&11 2025	RAP
9	Early Asbury, Peaker Re-tire - Utility Scale Ther-mal	Gas	Utility Scale	Asbury 2019; Energy Center Units 1&2 2021; Riv Units 10&11 2025	RAP
10	Early Asbury, Peaker Re-tire - Distributed Renew-able	Renewable	Distributed	Asbury 2019; Energy Center Units 1&2 2021; Riv Units 10&11 2025	RAP
11	Early Asbury, Peaker Re-tire - Distributed Ther-mal	Gas	Distributed	Asbury 2019; Energy Center Units 1&2 2021; Riv Units 10&11 2025	RAP
12	Early Asbury, Peaker Re-tire - Utility Scale Mix	Mix	Utility Scale	Asbury 2019; Energy Center Units 1&2 2021; Riv Units 10&11 2025	RAP
13	Early Asbury, Peaker Re-tire - Distributed Mix	Mix	Distributed	Asbury 2019; Energy Center Units 1&2 2021; Riv Units 10&11 2025	RAP

Notes:
DSM – Demand-side Management
RAP – Realistic Achievable Potential
MAP – Maximum Achievable Potential

[1] "Riv" denotes the Riverton power station.

3.1 Development of Alternative Resource Plans

(A) The utility shall develop, and describe and document, at least one (1) alternative resource plan, and as many as may be needed to assess the range of options for the choices and timing of resources, for each of the following cases. Each of the alternative resource plans for cases pursuant to paragraphs (3)(A)1.-(3)(A)5. shall provide resources to meet at least the projected load growth and resource retirements over the planning period in a manner specified by the case. The utility shall examine cases that—

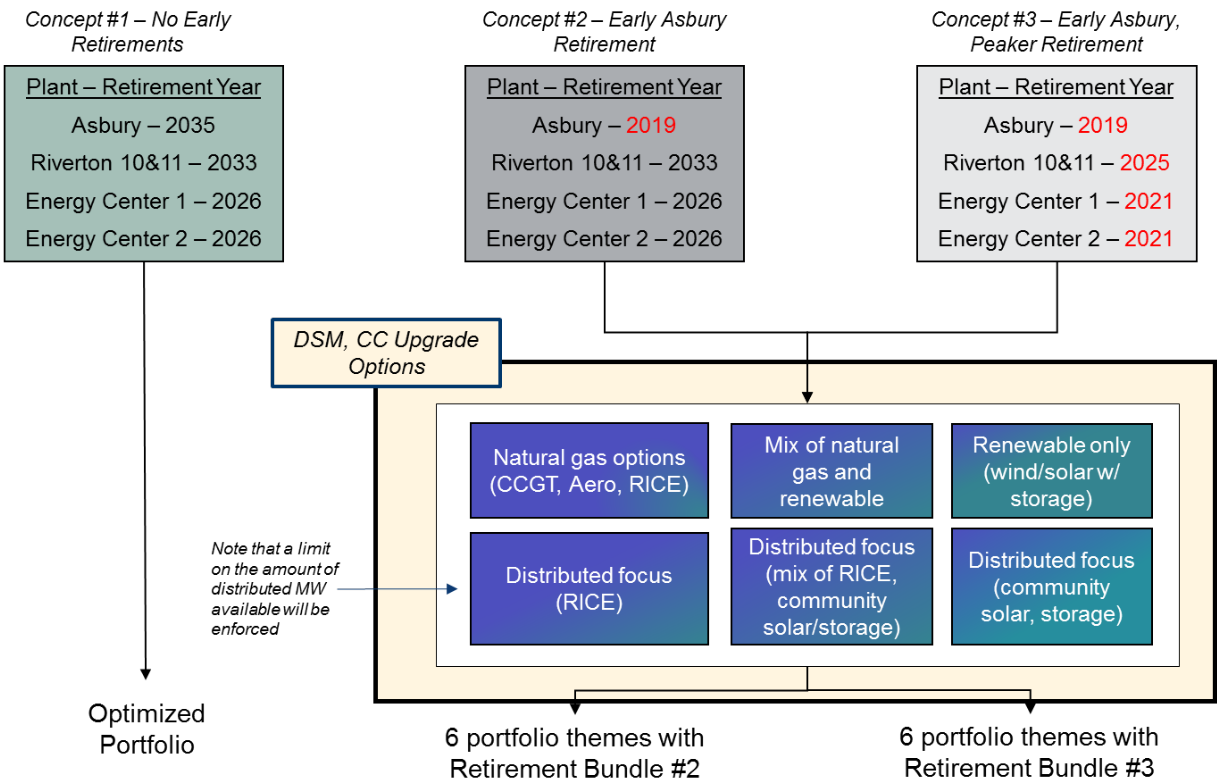
3.1.1 Rule Compliant Alternative Resource Plans

1. Minimally comply with legal mandates for demand-side resources, renewable energy resources, and other mandated energy resources. This constitutes the compliance benchmark resource plan for planning purposes;

Empire’s alternative resource plan development was centered broadly around three main planning considerations: (a) retirement options for Asbury and older peaking units (Energy Center 1&2, Riverton 10&11), (b) resource replacement technologies (renewable vs. thermal units), and (c) locational preferences (new utility scale vs. new distributed resources) for replacements. The retirement options include: (1) no early retirements, (2) retiring Asbury in 2019, and (3) retiring the peaking units early. Furthermore, each retirement option was linked to a set of replacement technologies, taking into account locational preferences.

Most of the 16 alternative resource plans included common elements: “low” and “mid” cost bundle for RAP DSM, the Stateline Combined Cycle power plant upgrade, and the addition of 600 MW of Liberty-Empire-owned wind (in conjunction with a tax equity partner) in 2020. Additionally, all of the 16 alternative resource plans comply with Missouri RES requirements. A plan utilizing MAP DSM was also evaluated. Finally, Liberty-Empire also included a Plan 0 as a bridge to Liberty-Empire’s previous Preferred Plan.

Figure 6-1 – Themes for Development of Alternative Resource Plans



3.1.2 All-Renewable Resource Plan

2. Utilize only renewable energy resources, up to the maximum potential capability of renewable resources in each year of the planning horizon, if that results in more renewable energy resources than the minimally-compliant plan. This constitutes the aggressive renewable energy resource plan for planning purposes;

Liberty-Empire has met this planning requirement in the development of several of the alternative resource plans. Specifically, alternative resource plans 1, 2, 2B, 2-MAP, 4, 8 and 10 utilize only renewable energy resources to meet capacity needs, subject to the constraint of "maximum potential capability." Liberty-Empire views Plan 2 as the most aggressive in achieving renewable energy resources for planning purposes.

3.1.3 All-Demand-Side Resource Plan

3. Utilize only demand-side resources, up to the maximum achievable potential of demand-side resources in each year of the planning horizon, if that results in more demand-side resources than the minimally-compliant plan. This constitutes the aggressive demand-side resource plan for planning purposes;

Alternative Resource Plan 2–MAP utilizes demand side resources, up to the maximum achievable potential, to meet capacity needs.

3.1.4 All Other Mandated Resources Plan

4. In the event that legal mandates identify energy resources other than renewable energy or demand-side resources, utilize only the other energy resources, up to the maximum capability of the other energy resources in each year of the planning horizon, if that results in more of the other energy resources than the compliance benchmark resource plan. For planning purposes, this constitutes the aggressive legally-mandated other energy resource plan;

Plan 2-MAP (only DSM can be used as a future resource up to the demand-side maximum achievable potential) and Plans 1, 2, 2B, 2-MAP, 4, 8, and 10 (only renewables can be used for future resource needs) are required by the IRP Rule.

3.1.5 Optimally Compliant DSM, Renewable, and Other Targeted Resource Plans

> *5. Optimally comply with legal mandates for demand-side resources, renewable energy resources, and other targeted energy resources. This constitutes the optimal compliance resource plan, where every legal mandate is at least minimally met, but some resources may be optimally utilized at levels greater than the mandated minimums;*

As discussed in Section 3.1.1, all of the plans presented by Liberty-Empire optimally comply with legal mandates for demand-side resources, renewable energy resources, and other targeted energy resources.

3.1.6 Special Contemporary Issue Plan

> *6. Any other plan specified by the commission as a special contemporary issue pursuant to 4 CSR 240-22.080(4);*

In File No. EO-2019-0066, the Commission issued an order on November 3, 2018 establishing twenty-three (23) special contemporary planning issues for Liberty-Empire to analyze and document in its 2019 triennial Integrated Resource Plan. These issues are addressed in Section 8.

3.1.7 Other Commission-Specified Plans

> *7. Any other plan specified by commission order; and*

No other plans were specified by Commission order.

3.1.8 Other Utility-Suggested Plans

8. Any additional alternative resource plans that the utility deems should be analyzed.

As discussed in sections 3.1.1 through 3.1.7, Liberty-Empire created, developed, and analyzed a variety of plans (16 altogether) that meet Commission-required guidelines and that test for the contributions from a variety of future resources. Moreover, each plan is subject to stress testing by analyzing Liberty-Empire's critical uncertain factors. Collectively, these 16 well-developed and analyzed alternative resource plans provide a reasonable basis of information for Commission and stakeholder review.

3.1.9 Load-Building Programs in Plans

(B) The alternative resource plans developed at this stage of the analysis shall not include load-building programs, which shall be analyzed as required by 4 CSR 240-22.070(5).

No load-building plans were included in any of Liberty-Empire's alternative resource plans.

3.1.10 Potential Retirement or Life Extension of Existing Generating Plants

(C) The utility shall include in its development of alternative resource plans the impact of—

1. The potential retirement or life extension of existing generation plants;

The alternative resource plans tested various retirement dates for Asbury, Energy Center 1 and 2, and Riverton 10 and 11. Table 6-2 summarizes the retirement assumptions for the alternative resource plans.

3.1.11 Additions of Environmental Equipment at Generating Plants

2. The addition of equipment and other retrofits on generation plants to meet environmental requirements; and

Based on current Coal Combustion Residuals ("CCR") regulations, the Asbury plant requires the construction of an ash landfill and the conversion of the boiler from the current wet system to a dry bottom ash handling system to continue operations past October 2020. No other major upgrades or additional environmental equipment are expected to be necessary at Liberty-Empire's existing supply-side resources during the planning period for this IRP. For additional information, please refer to Volume 4.

3.1.12 Conclusion of Any Currently-Implemented DSM Resources

3. The conclusion of any currently-implemented demand-side resources.

Previously, Liberty-Empire offered a demand-side portfolio in each of the four states served by Liberty-Empire (Missouri, Arkansas, Kansas, and Oklahoma). Currently, Liberty-Empire offers demand-side programs in Missouri and Arkansas only. By way of background, DSM customer programs began in Missouri in mid-2007 and in Arkansas in October 2007. Customer programs that began in Oklahoma in 2010 were discontinued on May 1, 2014 (Order No. 624718 in Oklahoma PUC Cause No. PUD 201300203), and the three-year Kansas pilot program that began in June 2010 concluded in June 2013.

The current Missouri and Arkansas programs are shown in Table 6-3 below. Currently, Liberty-Empire has an Energy Efficiency Cost Recovery rider in Arkansas that was designed to recover the full cost of implementing energy efficiency programs with a rate that is reconfigured annually. Liberty-Empire does not have such a mechanism in Missouri, but recovers amortized energy efficiency costs through an on-bill line item that can be adjusted as part of a general rate case.

Table 6-3 - Demand-Side Programs by State

Missouri	Arkansas
● High Efficiency Air Conditioner Rebate Program	● Residential Weatherization
● Multi-family Direct Install Program	● Commercial and Industrial Rebate Program
● Low-income Multi-family Direct Install Program	● High-efficiency Residential Lighting (LED)
● Low-Income Weatherization	● Online Audit and Energy Calculator
● Commercial and Industrial Rebate Program	● School-Based Energy Education

3.1.13 Description of Alternative Resource Plans

(D) The utility shall provide a description of each alternative resource plan including the type and size of each demand-side resource and supply-side resource addition and a listing of the sequence and schedule for the end of life of existing resources and for the acquisition of each new resource.

The following is a summary of the 16 alternative resource plans modeled by Liberty-Empire:

- Plan 0 ("Customer Savings Plan"): Plan 0 was modeled to act as a "bridge" to Liberty-Empire's previous Preferred Plan, which was updated in Liberty-Empire's Change in Preferred Plan filing in File No. EO-2019-0106. Liberty-Empire's previous Preferred Plan accelerates the timing of wind additions and changes the timing of some natural gas additions relative to Liberty-Empire's 2016 IRP Preferred Plan. In particular, it adds 600 MW of utility-owned wind at the end of 2020, which was discussed and analyzed in Liberty-Empire's Customer Savings Plan analysis. Liberty-Empire's previous Preferred Plan also retires Asbury in 2035 and replaces it with a 214 MW natural gas combustion turbine in the same year. Plan 0 in the 2019 IRP has some changes from Liberty-Empire's previous Preferred Plan: Energy Center 1 and 2 are both assumed to retire in 2026, and Liberty-Empire builds a 148 MW natural gas aeroderivative unit rather than a combustion turbine. Plan 0 also includes a 35 MW upgrade at the Stateline Combined Cycle facility, as well as the "low-bundle" and "mid-bundle" of RAP DSM.

- Plan 1 (Asbury End of Life – Least Cost): Plan 1 is used to compare the relative costs and benefits of retiring Asbury early, which is tested in a number of the alternative resource plans. Plan 1 is similar to Plan 0, but instead of replacing Asbury in 2035 with a natural gas aeroderivative unit, Plan 1 adds 100 MW of utility scale solar and 150 MW of utility scale solar + storage. Adding solar and solar + storage units was found to be the least-cost option when retaining Asbury through the end of its useful life. Plan 1 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 0.

- Plan 2 (Early Asbury Retire, Utility Scale Renewables): Plan 2 was developed to analyze the early retirement of Asbury and the costs and benefits of utility scale renewables. Plan 2 retires Asbury at the end of 2019. Due to the planned addition of 600 MW of utility scale wind in the plan, there is not an immediate capacity gap to fill. Plan 2 limits all capacity additions to utility scale renewables. Plan 2 builds 50 MW of solar in 2023, followed by another 50 MW of solar and 50 MW of solar + storage in 2027, 50 MW of solar in 2029, and 50 MW of solar + storage in 2034. Plan 2 was developed to analyze the effects of having both primarily utility scale resources and renewable resources under different possible future states of the world, including uncertainty around fuel prices, load, carbon prices, and capital costs. Plan 2 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 1.

- Plan 2B (Early Asbury Retire, 2023 Solar): Plan 2B was developed to test the effect of "over-building" utility scale solar in 2023 instead of the gradual buildup of solar in Plan 2. Overbuilding solar in 2023 can provide potential benefits since solar built by 2023 can qualify for 100% of the investment tax credit. Plan 2B builds 150 MW of utility scale solar in 2023, followed by 50 MW of utility scale solar + storage in 2027 and 50 MW of solar + storage in 2034. Plan 2B also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 2.

- Plan 2 - MAP (Early Asbury Retire, Central-Scale Renewables + MAP DSM): This plan was developed to test the effects of meeting future capacity needs with MAP DSM instead of RAP DSM. The "low-bundle" and "mid-bundle" of MAP DSM was selected in Plan 2 – MAP. This represents approximately 8 MW more of DSM capacity compared to RAP DSM by 2038. Plan 2 – MAP adds the same utility scale renewable resources as Plan 2. Plan 2 – MAP also adds the same Stateline Combined Cycle upgrade as Plan 2.

- Plan 3 (Early Asbury Retire, Utility Scale Thermal): Plan 3 was developed to analyze the early retirement of Asbury and the costs/benefit of owning utility scale thermal resources. During its screen of potential resource options, Liberty-Empire identified three main types of utility scale thermal units that were available as a potential resource option: natural gas combined cycle, a Wartsila natural gas peaking unit, and an aeroderivative natural gas peaking unit. Plan 3 selected natural gas aeroderivative units as the most economic utility scale thermal option. Plan 3 built two aeroderivative units, one in 2027 and one in 2034. Plan 3 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 2.

- Plan 4 (Early Asbury Retire, Distributed Renewable): Plan 4 was developed to analyze the value of building some level of renewables located at the distribution-level, instead of all new capacity additions being located at the utility scale level. Liberty-Empire developed estimates for potential distribution system projects that could be avoided if replaced with 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. Plan 4 adds 19.5 MW of distributed solar + storage in 2022 and 2028 and 13.5 MW of distributed solar + storage in 2032 and 2036. Plan 4 also adds 50 MW of utility scale solar in 2023 and 2034, as well as 50 MW of utility scale solar + storage in 2027. Plan 4 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 3.

- Plan 5 (Early Asbury Retire, Distributed Thermal): Plan 5 was developed to analyze the value of building some level of thermal units located at both the distribution level and the utility scale level. Liberty-Empire evaluated one distributed thermal resource option: a distribution-level Wartsila reciprocating unit. Plan 5 adds 7.4 MW of distributed Wartsila resource in 2022 and 2028, as well as 5 MW of distributed Wartsila in 2032 and 2036. Plan 5 also adds a 98 MW utility scale aeroderivative unit in 2027. Plan 5 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 4.

- Plan 6 (Early Asbury Retire, Central-Scale Mix): Plan 6 was developed to analyze the impacts of building both utility scale thermal and utility scale renewable resources. Plan 6 adds 50 MW of solar in 2023, 50 MW of solar + storage in 2027, a 49 MW aeroderivative in 2027, and 100 MW of solar in 2034. Plan 6 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 5.

- Plan 7 (Early Asbury Retire, Distributed Mix): Plan 7 was developed to analyze the impacts of building both distributed thermal and distributed renewable resources. Plan 7 adds 19.5 MW of distributed solar + storage in 2022, 50 MW of utility scale solar in 2023, a 49 MW aeroderivative in 2027, 7.5 MW of distributed gas in 2028, 13.5 MW of distributed solar + storage in 2032, 100 MW of utility scale solar in 2034, and 5 MW of distributed gas in 2036. Plan 7 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 6.

- Plan 8 (Early Asbury Retire, Peaker Retire, Utility Scale Renewables): Plan 8 was developed to analyze the early retirement of some of Liberty-Empire's existing natural gas peaking units, Energy Center 1 and 2 and Riverton 10 and 11. Plan 8 retires Energy Center 1 and 2 at the end of 2021 and retires Riverton 10 and 11 at the end of 2025. Due to the larger capacity gap created by the Energy Center 1 and 2 retirements, Plan 8 builds 100 MW of utility scale solar in 2022, 50 MW of utility scale solar + storage in 2022, 50 MW of utility scale solar in 2023, and 50 MW of utility scale solar + storage in 2029. Plan 8 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 7.

- Plan 9 (Early Asbury Retire, Peaker Retire, Utility Scale Thermal): Plan 9 was developed to analyze the early retirement of Liberty-Empire's existing natural gas peaking units and the effect of filling the capacity gap with utility scale thermal units. Plan 9 builds a 49 MW aeroderivative unit in 2022, a 49 MW aeroderivative unit in 2026, and a 49 MW aeroderivative unit in 2029. Plan 9 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 8.

- Plan 10 (Early Asbury Retire, Peaker Retire, Distributed Renewables): Plan 10 was developed to analyze the early retirement of Liberty-Empire's existing natural gas peaking units and the effect of filling the capacity gap with both distributed-scale and utility scale renewables. Plan 10 builds 19.5 MW of distributed solar + storage in 2022, 100 MW of utility scale solar in 2022, 50 MW of utility scale solar + storage in 2022, 19.5 MW of distributed solar + storage in 2028, 13.5 MW of distributed solar + storage, and 13.5 MW of distributed solar + storage in 2036. Plan 10 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 9.

- Plan 11 (Early Asbury Retire, Peaker Retire, Distributed Thermal): Plan 11 was developed to analyze the early retirement of Liberty-Empire's existing natural gas peaking units and the effect of filling the capacity gap with distributed thermal units along with utility scale thermal units. Plan 11 builds a 49 MW aeroderivative unit in 2022, a 7.5 MW distributed gas unit in 2022, a 49 MW aeroderivative unit in 2026, a 7.5 MW distributed gas unit, a 5 MW distributed gas unit in 2032, and a 5 MW distributed gas unit in 2036. Plan 11 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 10.

- Plan 12 (Early Asbury Retire, Peaker Retire, Utility Scale Mix): Plan 12 was developed to analyze the impacts of building both utility scale thermal and utility scale renewable resources. Plan 12 builds a 49 MW aeroderivative unit, 100 MW of utility scale solar in 2022, 50 MW of utility scale solar + storage in 2022, and 50 MW of utility scale solar in 2023. Plan 12 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 11.

- Plan 13 (Early Asbury Retire, Peaker Retire, Distributed Mix): Plan 13 was developed to analyze the impacts of building both distributed thermal and distributed renewable resources. Plan 13 builds a 49 MW aeroderivative unit in 2022, 100 MW of utility scale solar in 2022, 19.5 MW of distributed solar + storage in 2022, 50 MW of utility scale solar in 2023, 7.5 MW of distributed gas in 2028, 13.5 MW of distributed solar + storage in 2032, and 5 MW of distributed gas in 2036. Plan 13 also adds the same Stateline Combined Cycle upgrade and RAP DSM as Plan 12.

3.1.14 Schedule of Alternative Resource Plan Supply-Side Additions

Table 6-4 and Table 6-5 present the supply-side resource expansion components for each of Liberty-Empire's alternative resource plans.

Table 6-4 – Alternative Resource Plan Supply-Side Additions (Plan 0 to 5)

	Plan 0	Plan 1	Plan 2	Plan 2B	Plan 2 - MAP	Plan 3	Plan 4	Plan 5
2019								
2020								
2021								
2022							19.5 MW Distributed Solar + Storage	7.5 MW Distributed Gas
2023			50 MW Utility Solar	150 MW Utility Solar	50 MW Utility Solar		50 MW Utility Solar	
2024								
2025								
2026								
2027			50 MW Utility Solar; 50 MW Utility Solar + Storage	50 MW Utility Solar + Storage	50 MW Utility Solar; 50 MW Utility Solar + Storage	98 MW Aeroderivative	50 MW Utility Solar + Storage	98 MW Aeroderivative
2028							19.5 MW Distributed Solar + Storage	7.5 MW Distributed Gas
2029			50 MW Utility Solar		50 MW Utility Solar			
2030								
2031								
2032							13.5 MW Distributed Solar + Storage	5 MW Distributed Gas
2033								
2034			50 MW Utility Solar + Storage	50 MW Utility Solar + Storage	50 MW Utility Solar + Storage	49 MW Aeroderivative	50 MW Utility Solar	
2035								
2036	148 MW Aeroderivative	150 MW Utility Solar; 100 MW Utility Solar + Storage					13.5 MW Distributed Solar + Storage	5 MW Distributed Gas
2037								
2038								

Table 6-5 - Alternative Resource Plan Supply-Side Additions (Plan 6 to 13)

	Plan 6	Plan 7	Plan 8	Plan 9	Plan 10	Plan 11	Plan 12	Plan 13
2019								
2020								
2021								
2022		19.5 MW Distributed Solar + Storage	100 MW Utility Solar; 50 MW Utility Solar + Storage	49 MW Aeroderivative	100 MW Utility Solar; 50 MW Utility Solar + Storage; 19.5 MW Distributed Solar + Storage	49 MW Aeroderivative; 7.5 MW Distributed Gas	49 MW Aeroderivative ; 100 MW Utility Solar; 50 MW Utility Solar + Storage	49 MW Aeroderivative; 100 MW Utility Solar; 19.5 MW Distributed Solar + Storage
2023	50 MW Utility Solar	50 MW Utility Solar	50 MW Utility Solar				50 MW Utility Solar	50 MW Utility Solar
2024								
2025								
2026				49 MW Aeroderivative		49 MW Aeroderivative		
2027	49 MW Aeroderivative; 50 MW Utility Solar + Storage	49 MW Aeroderivative						
2028		7.5 MW Distributed Gas			19.5 MW Distributed Solar + Storage	7.5 MW Distributed Gas		7.5 MW Distributed Gas
2029			50 MW Utility Solar + Storage	49 MW Aeroderivative				
2030								
2031								
2032		13.5 MW Distributed Solar + Storage			13.5 MW Distributed Solar + Storage	5 MW Distributed Gas		13.5 MW Distributed Solar + Storage
2033								
2034	100 MW Utility Solar	100 MW Utility Solar						
2035								
2036		5 MW Distributed Gas			13.5 MW Distributed Solar + Storage	5 MW Distributed Gas		5 MW Distributed Gas
2037								
2038								

3.1.15 Schedule of Alternative Resource Plan Retirements

Table 6-6 presents the existing plant retirement assumptions for Liberty-Empire's alternative resource plans.

Table 6-6 - Alternative Resource Plan Retirement Assumptions

Plan	Asbury #1	Empire Energy Center #1	Empire Energy Center #2	Riverton #10	Riverton #11
Plan 0	2035	2026	2026	2033	2033
Plan 1	2035	2026	2026	2033	2033
Plan 2	2019	2026	2026	2033	2033
Plan 2B	2019	2026	2026	2033	2033
Plan 2 - MAP	2019	2026	2026	2033	2033
Plan 3	2019	2026	2026	2033	2033
Plan 4	2019	2026	2026	2033	2033
Plan 5	2019	2026	2026	2033	2033
Plan 6	2019	2026	2026	2033	2033
Plan 7	2019	2026	2026	2033	2033
Plan 8	2019	2021	2021	2025	2025
Plan 9	2019	2021	2021	2025	2025
Plan 10	2019	2021	2021	2025	2025
Plan 11	2019	2021	2021	2025	2025
Plan 12	2019	2021	2021	2025	2025
Plan 13	2019	2021	2021	2025	2025

3.1.16 Schedule of Expiration of Liberty-Empire Wind PPAs

Table 6-7 provides the sequence and schedule for the expiration of Liberty-Empire's wind purchased power agreement ("PPA") energy resources. The accredited capacity from these wind resources is determined by Southwest Power Pool ("SPP") criteria. These units can be re-rated periodically. The Elk River wind resource PPA is scheduled to expire late 2025. The Meridian Way wind resource PPA is scheduled to expire December 2028.

Table 6-7 - Liberty-Empire Renewable PPAs (ICAP)

	Elk River Contract (Wind WT)	Meridian Way Contract (Solar PV)	Total Nameplate Capacity	Total Accredited Capacity
2019	150	105	255	31
2020	150	105	255	31
2021	150	105	255	31
2022	150	105	255	31
2023	150	105	255	31
2024	150	105	255	31
2025	150	105	255	31
2026	0	105	105	9
2027	0	105	105	9
2028	0	105	105	9
2029	0	0	0	0
2030	0	0	0	0
2031	0	0	0	0
2032	0	0	0	0
2033	0	0	0	0
2034	0	0	0	0
2035	0	0	0	0
2036	0	0	0	0
2037	0	0	0	0
2038	0	0	0	0

3.1.17 Schedule of Wind and Community Solar Supply-Side Additions

Table 6-8 illustrates the sequence and schedule for Liberty-Empire's planned wind and community solar additions. Both the wind and the solar, though not online currently, are assumed to come online in every alternative resource plan. The addition of 600 MW of wind from Liberty-Empire's Customer Savings Plan is assumed to come online at the end of 2020, and 10 MW of Liberty-Empire-sited community solar is assumed to come online in 2021.

Table 6-8 - Liberty-Empire Renewable Intermittent Resources

	New CSP Wind (Wind WT)	Community Solar (Solar PV)	Total Nameplate Capacity	Total Accredited Capacity
2019	0	0	0	0
2020	0	0	0	0
2021	603	10	613	91
2022	603	10	613	91
2023	603	10	613	91
2024	603	10	613	91
2025	603	10	613	91
2026	603	10	613	91
2027	603	10	613	91
2028	603	10	613	91
2029	603	10	613	91
2030	603	10	613	91
2031	603	10	613	91
2032	603	10	613	91
2033	603	10	613	91
2034	603	10	613	91
2035	603	10	613	91
2036	603	10	613	91
2037	603	10	613	91
2038	603	10	613	91

3.1.18 DSM Utilized in Alternative Resource Plans

As part of the process of developing the 16 alternative resource plans, numerous demand-side resource candidates were considered in the screening process. The DSM programs that passed AEG's screening tests and that were analyzed by CRA are described in Table 6-9 below. The evaluation of the DSM programs is described in detail in Volume 5.

Table 6-9 – DSM Alternative Programs Considered

DSM Programs	Description	Online Year
Residential Lighting	Upstream incentives for LEDs at qualifying retailers	2020
Whole House Efficiency	The program is comprised of two program offerings: - Direct Install - free home energy audit and direct installation of energy conservation measures - Rebates - incentives for insulation, water heater, infiltration measures, and wi-fi thermostats	2020
Residential Behavioral	Behavior program utilizing customized energy reports sent periodically to households	2020
Low Income Whole House Efficiency	The program is comprised of two program offerings: - Direct Install - free home energy audit and direct installation of energy conservation measures - Rebates - incentives for insulation, water heater, infiltration measures, and wi-fi thermostats	2020
Low Income Behavioral	Behavior program utilizing customized energy reports sent periodically to households.	2020
Low Income Weatherization	Improve home efficiency for low income customers, install energy conservation measures and repair/replace heating	2020
Residential Time of Use	This rate provides a higher price during the designated peak period and lower prices during off-peak periods	2025
Residential Critical Peak Pricing	This rate higher rate for a particular block of hours that occurs on a critical peak event day	2025
Residential Inclining Block	An inclining block rate applies a rate(s) to a customer's bill if they exceed certain thresholds	2025
C&I Prescriptive & Custom Rebate	C&I customers may receive incentives for prescriptive or custom measures	2020
C&I Time of Use Rate	This rate provides a higher price during the designated peak period and lower prices during off-peak periods	2025
C&I CPP Rate	This rate higher rate for a particular block of hours that occurs on a critical peak event day	2025

C&I Real Time Pricing	This rate is a varied rate that is linked to the hourly market price for electricity. Typically targeted a large C&I customers	2025

3.1.18.1 DSM Screening Approach

Consistent with Chapter 22, Liberty-Empire calculates the benefits of its DSM programs based on the cost of avoided demand and the cost of avoided energy. Liberty-Empire's approach to calculating the avoided demand cost is based on a combination of sources that aim to develop a reasonable benchmark for the value of capacity. Because the SPP market does not have a capacity market, and because Liberty-Empire's own supply-demand balance dynamics are expected to evolve, it is necessary to consider a combination of fundamental SPP market drivers and Liberty-Empire-specific cost drivers in developing the estimate. The following section presents the rationale and drivers of Liberty-Empire's avoided demand cost projections for three distinct periods over time.

Years 2019-2024: The avoided demand cost projection for this time period is based on the mid-point between the levelized estimate of the Asbury plant's going-forward costs (fixed operations and maintenance costs and amortized new capital expenditures, less projected energy margins) and the fundamentally-derived ABB SPP capacity price forecast (which is close to zero today). The rationale for this approach is that while Liberty-Empire is currently long capacity, this situation is dependent on maintaining all capacity resources in the existing fleet. The Asbury plant currently has the highest going-forward costs and is thus the "marginal" retirement candidate. Thus, the plant's going-forward costs are representative of the costs needed for Liberty-Empire to avoid a capacity deficit.

While Liberty-Empire may have significant going-forward Asbury costs during this period, the SPP market is generally oversupplied, suggesting little fundamental value for capacity throughout SPP. With a surplus in SPP, Liberty-Empire could, in theory, retire Asbury and find a less expensive bilateral capacity opportunity in the market. The near-term avoided demand cost calculation splits the difference between the ABB capacity price and the Asbury going-forward cost.

Years 2025-2034: The avoided demand cost projection for this time period is based on a transition to the full Asbury going-forward costs, as ABB's fundamental analysis indicates a growing value for capacity in the broader SPP market. The rationale for this approach is that as the excess capacity situation in SPP extinguishes over time due to regional plant retirements and growing load, Liberty-Empire's avoided cost would be more closely based on the actual going-forward costs of Liberty-Empire's existing fleet without a low-cost market backstop price.

Years 2035+: The avoided demand cost projection for this time period is based on the cost of new entry ("CONE") for a new simple cycle combustion turbine ("CT"). The CT CONE includes capital costs, ongoing fixed operations and maintenance costs, and projects for transmission interconnection upgrade costs. In 2035 and beyond, Asbury will have reached its end of life and Liberty-Empire would need new capacity. The ABB fundamental forecast suggests similar dynamics in SPP, meaning that new entry pricing is a reasonable benchmark for avoided demand costs over the long-run throughout the whole market and specific to Liberty-Empire.

The avoided demand cost projection used by Liberty-Empire in the 2019 IRP is shown in Figure 6-2 in nominal $/kW-yr.

Figure 6-2 – Avoided Demand Cost (Nominal $/kW-year) Over 20-Year Horizon
****Confidential in Its Entirety**[2]**

[redacted]

Liberty-Empire's approach to determining the avoided energy costs is based on a fundamental market analysis of the SPP market. Since Liberty-Empire is a member of SPP and part of the SPP Integrated Marketplace ("SPP IM"), Liberty-Empire used market prices provided by ABB as the avoided energy cost. ABB created a forward view of the SPP-KSMO regional electricity market using its Fall 2018 Reference Case data set. The ABB Reference Case uses a combination of public data and proprietary forecasts to develop input assumptions for the key supply and demand drivers of power market outcomes. Supply includes a bottom-up analysis of generation resources, including parameters for fuel type, operations and performance of the resources (capacity, heat rates, planned outages, and forced outages), emissions costs, and expectations for the amount of additions and retirements over time. Demand includes the demand for electricity by zone at an annual, monthly, and hourly level.

Figure 6-3 illustrates Liberty-Empire's assumptions for the average avoided energy costs ($/MWh) for the ABB base case and two additional fundamental costs developed by ABB: a high and low natural gas price case. These prices represent the all-hours KSMO price forecast in nominal dollars per MWh.

[2] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Figure 6-3 – Average Forecasted Energy Prices (Nominal $/MWh) for Base, High and Low Case

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[redacted]

Liberty-Empire's base case avoided energy cost projections have been produced without any price on carbon, although they do include expectations for prices on NO_x and SO_2 emissions associated with current policy. To evaluate the potential risk associated with higher carbon prices in the future, Liberty-Empire developed a High CO_2 case which includes a price associated with CO_2 emissions starting in 2026. The rationale for this high case is that 2026 is a plausible starting date for a new federal regulation or policy, given the political change that would have to occur post-2020 and the time it would take to implement such regulations.

The CO_2 price trajectory is based on Synapse's latest public analysis on CO_2 emission reductions from the power sector under various CO_2 tax trajectories. The Synapse analysis found that an 80% reduction in CO_2 emissions by 2050 (consistent with the Paris Agreement goals) could be

[3] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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achieved with a price trajectory that moves towards $60/ton (real $) by 2050. This price trajectory has a CO_2 price of about $15/ton in real dollars (or $17/ton in nominal dollars) in 2026, growing to around $40/ton in real dollars (or $70/ton in nominal dollars) by 2040.

Liberty-Empire used these assumptions for CO_2 prices, combined with the previously described assumptions for avoided energy costs, to create Figure 6-4 and Figure 6-5, which describe Liberty-Empire's assumptions for avoided energy costs for each of the avoided probable environmental cost scenarios. Figure 6-5 illustrates Liberty-Empire's assumptions for the avoided energy costs ($/MWh) for the "No CO_2 avoided probable environmental cost" scenario.

Figure 6-4 – Liberty-Empire's Avoided Energy Cost Assumptions (No CO_2 Avoided Probable Environmental Cost Scenario)

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[redacted]

Liberty-Empire then commissioned ABB to analyze the SPP power market implications associated with this high CO_2 case within each of the three market scenarios (base, high, and low natural gas prices).

[4] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Figure 6-5 illustrates Liberty-Empire’s assumptions for the avoided energy costs ($/MWh) for the three scenarios with and without a carbon price. These prices represent the all-hours KSMO price forecast in nominal dollars per MWh.

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Figure 6-5 – Liberty-Empire's Avoided Energy Cost Assumptions ($/MWh)
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[redacted]

[5] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

SECTION 4 ANALYSIS OF RESOURCE PLAN

(4) Analysis of Alternative Resource Plans. The utility shall describe and document its assessment of the relative performance of the alternative resource plans by calculating for each plan the value of each performance measure specified pursuant to section (2). This calculation shall assume values for uncertain factors that are judged by utility decision-makers to be most likely. The analysis shall cover a planning horizon of at least twenty (20) years and shall be carried out on a year-by-year basis in order to assess the annual and cumulative impacts of alternative resource plans. The analysis shall be based on the assumption that rates will be adjusted annually, in a manner that is consistent with Missouri law. The analysis shall treat supply-side and demand-side resources on a logically-consistent and economically-equivalent basis, such that the same types or categories of costs, benefits, and risks shall be considered and such that these factors shall be quantified at a similar level of detail and precision for all resource types. The utility shall provide the following information:

4.1 Performance Measures of Resource Plans

(A) A summary tabulation that shows the performance of each alternative resource plan as measured by each of the measures specified in section (2) of this rule;

The performance of each of the 16 alternative resource plans with respect to the stated performance measures is provided in Table 6-10. Table 6-11 provides a legend to facilitate the referencing of each alternative resource plan.

Table 6-10 - 20 Year Performance of Alternative Resource Plans

****Confidential in its Entirety**[6]**

[redacted]

Table 6-11 - Plan Legend

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

[6] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

The deterministic PVRR for each of Liberty-Empire's 16 alternative resource plans over the twenty-year planning period is shown in Figure 6-6. The deterministic PVRR for each plan over the thirty-year period of 2019-2048, including end effects, is shown in Figure 6-7.

Figure 6-6 – Deterministic 20-Year PVRR of All Plans ($ millions)

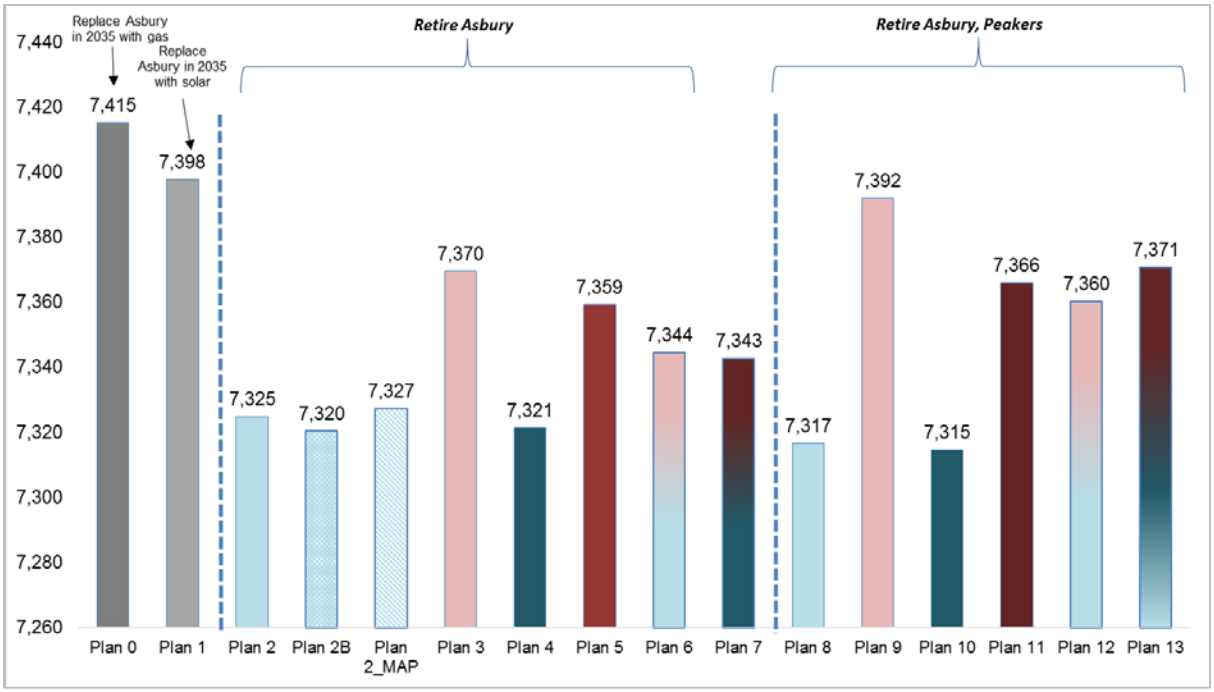
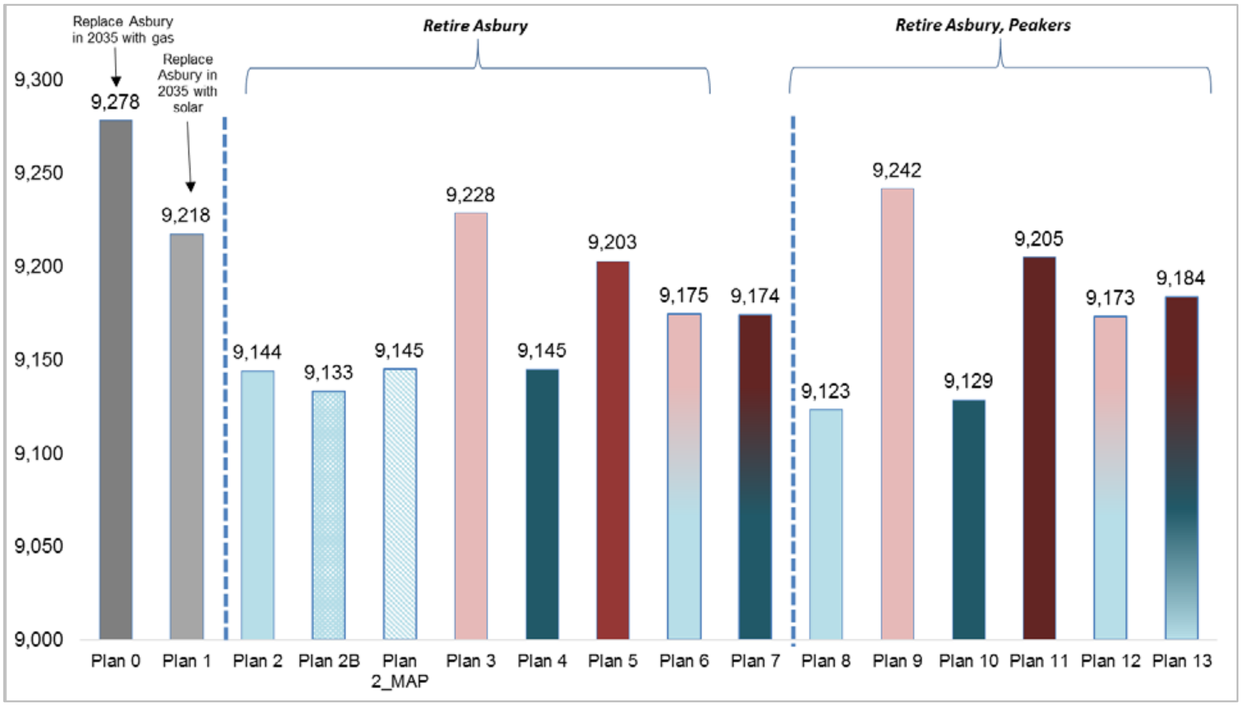


Figure 6-7 – Deterministic 30-Year PVRR of All Plans ($ millions)



As part of its revenue requirement calculations, Liberty-Empire ran a fundamental dispatch analysis for 20 years, calculating the cost of Liberty-Empire's generation fleet (as assumed under each alternative plan) in the SPP market. In order to properly compare plans that add significant amounts of capital and fixed costs, Liberty-Empire calculates 30-year PVRR figures using an "end-effects" approach. This modeling approach allows the model to continue calculating the fixed costs of capital expenditures, through depreciation and return on capital calculations, while growing variable costs like fuel, variable O&M, energy market purchases, and others at inflation.

The difference between the 20-year PVRR and 30-Year End Effects PVRR does not materially change the ordering of the plans, with a few exceptions. Plans that add distributed renewable resources (Plans 4 and 10) become relatively more expensive on a 30-year basis than on a 20-year basis, compared to their counterpart plans that do not add distributed renewables (Plans 2 and 8).

4.2 Graphic Analysis of Plans

(B) For each alternative resource plan, a plot of each of the following over the planning horizon:

4.2.1 DSM Impact on Peak Demand

1. The combined impact of all demand-side resources on the base-case forecast of summer and winter peak demands;

The combined impact of all demand-side resources on the base-case forecast of summer and winter peak demands for the resource plans is shown in Figure 6-8 and Figure 6-9 (RAP DSM and MAP DSM, respectively). Since all plans except for Plan 2 – MAP use the mid and low bundle of RAP DSM, this figure applies for 15 of the 16 plans. Plan 2 – MAP uses the mid and low bundle of MAP DSM.

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Figure 6-8 – RAP DSM Impact on Load - MW

(Applies to all plans but Plan 2 – MAP)

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[redacted]

Figure 6-9 – MAP DSM Impact on Load - MW

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

[redacted]

[7] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

4.2.2 DSM Program Composition of Plans

2. The composition, by program and demand-side rate, of the capacity provided by demand-side resources;

The composition by program and demand-side rate of the capacity provided by DSM resources for RAP and MAP is shown in Figure 6-10 and Figure 6-11. The corresponding tables of values for all these figures are provided in Appendix 6C.

Figure 6-10 - DSM Composition of Selected RAP DSM

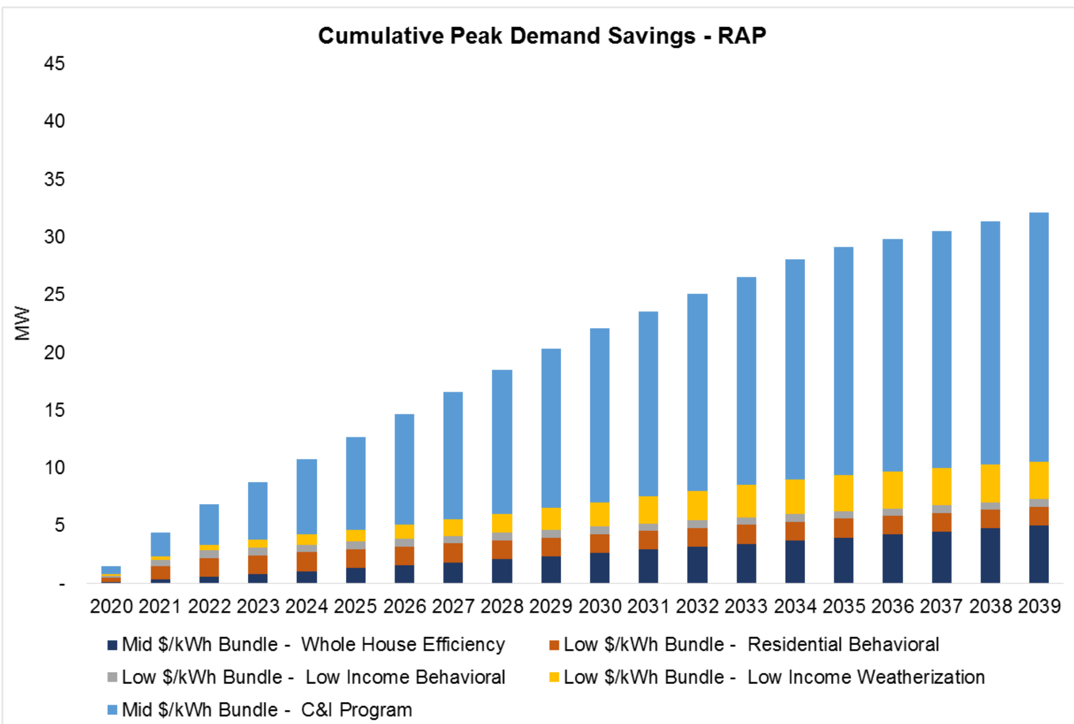
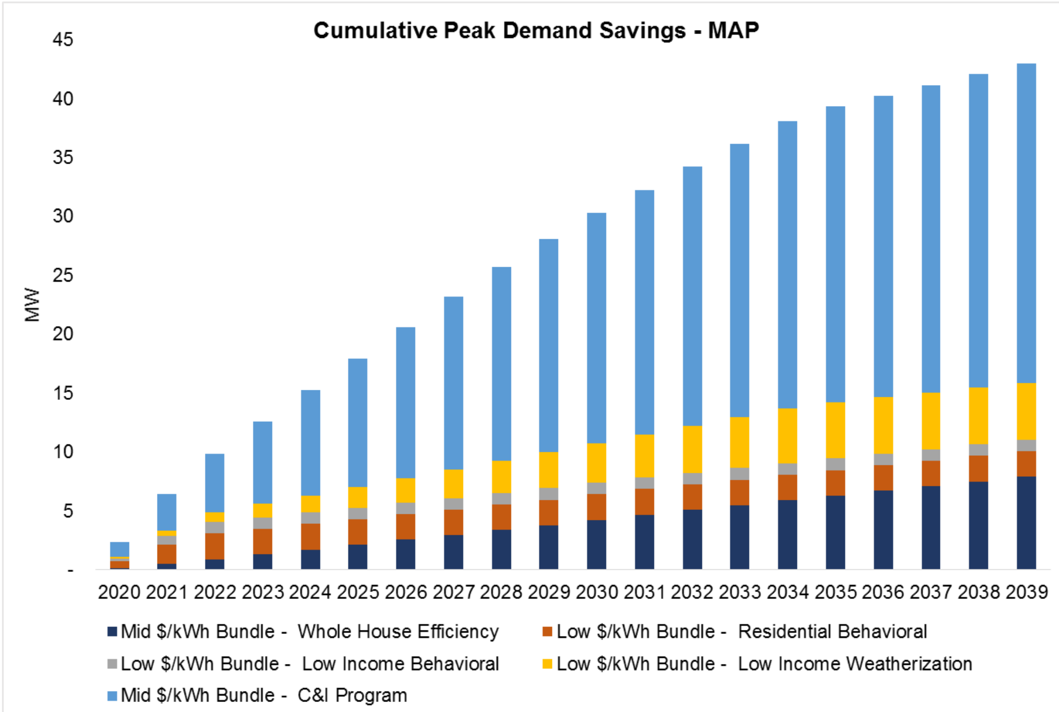


Figure 6-11 - DSM Composition of Selected MAP DSM



4.2.3 Supply-Side Composition of Plans

3. The composition, by supply-side resource, of the capacity supplied to the transmission grid provided by supply-side resources. Existing supply-side resources may be shown as a single resource;

The composition by supply-side resource of Liberty-Empire's capacity supplied by supply-side resources for each resource plan is shown in Figure 6-12 through Figure 6-27. The capacity figures below are provided in nameplate ICAP MW.

Figure 6-12 - Supply-Side Resource Composition of Plan 0

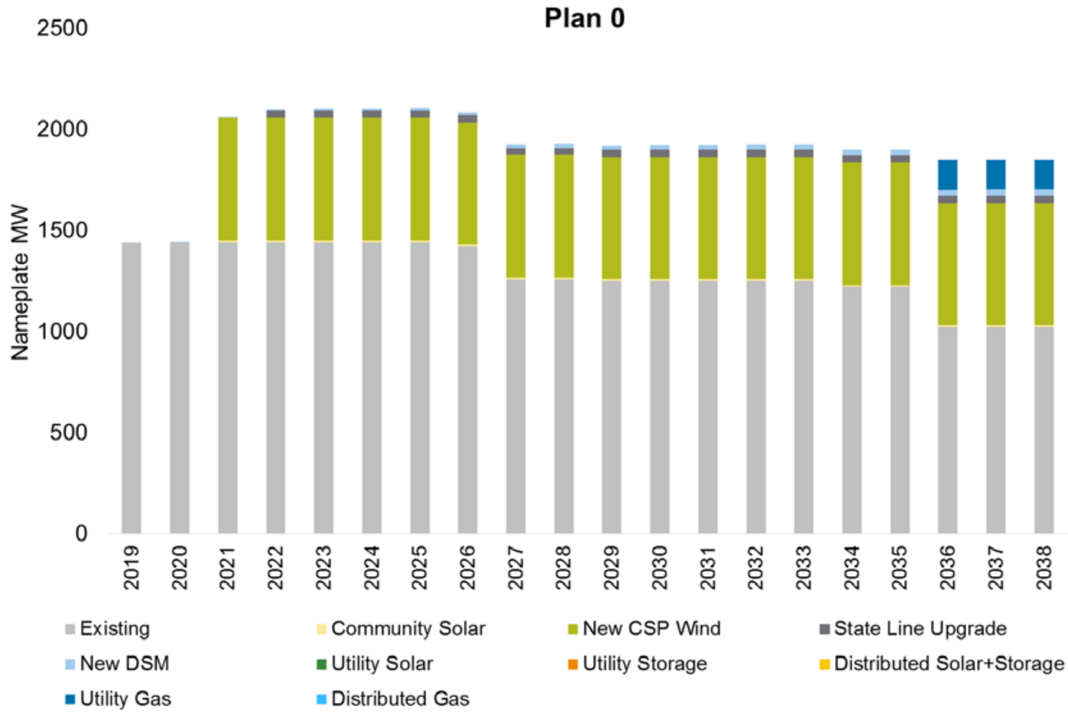


Figure 6-13 - Supply-Side Resource Composition of Plan 1

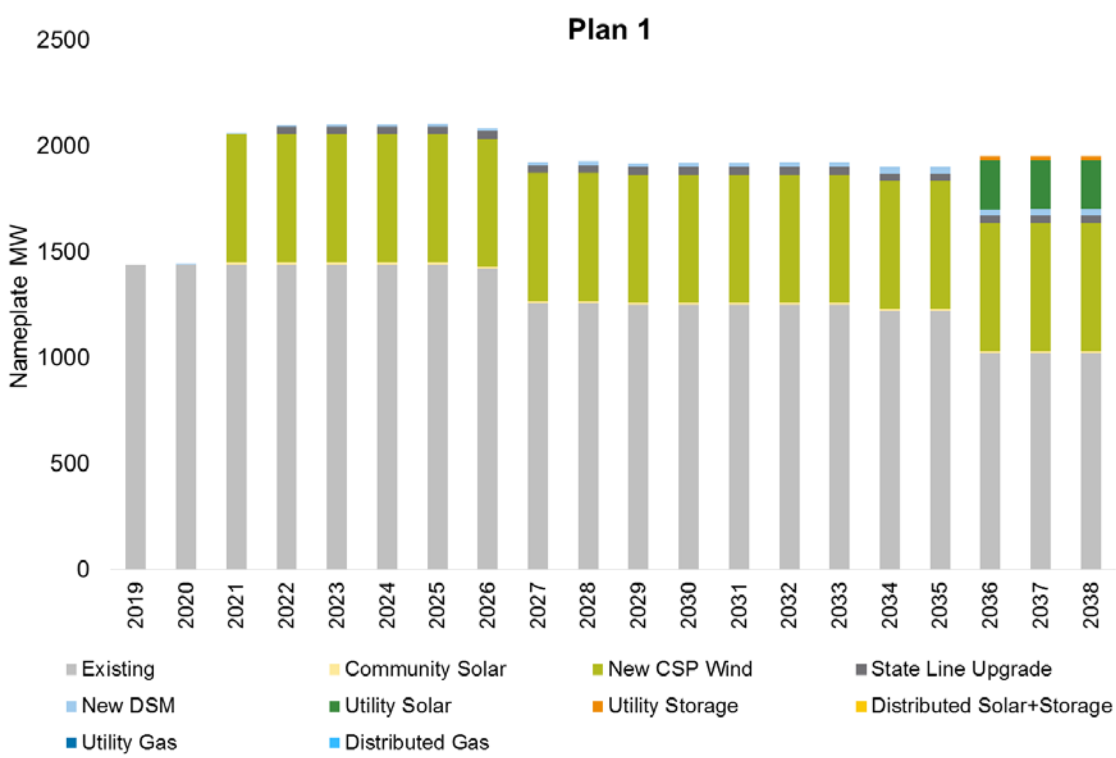


Figure 6-14 - Supply-Side Resource Composition of Plan 2

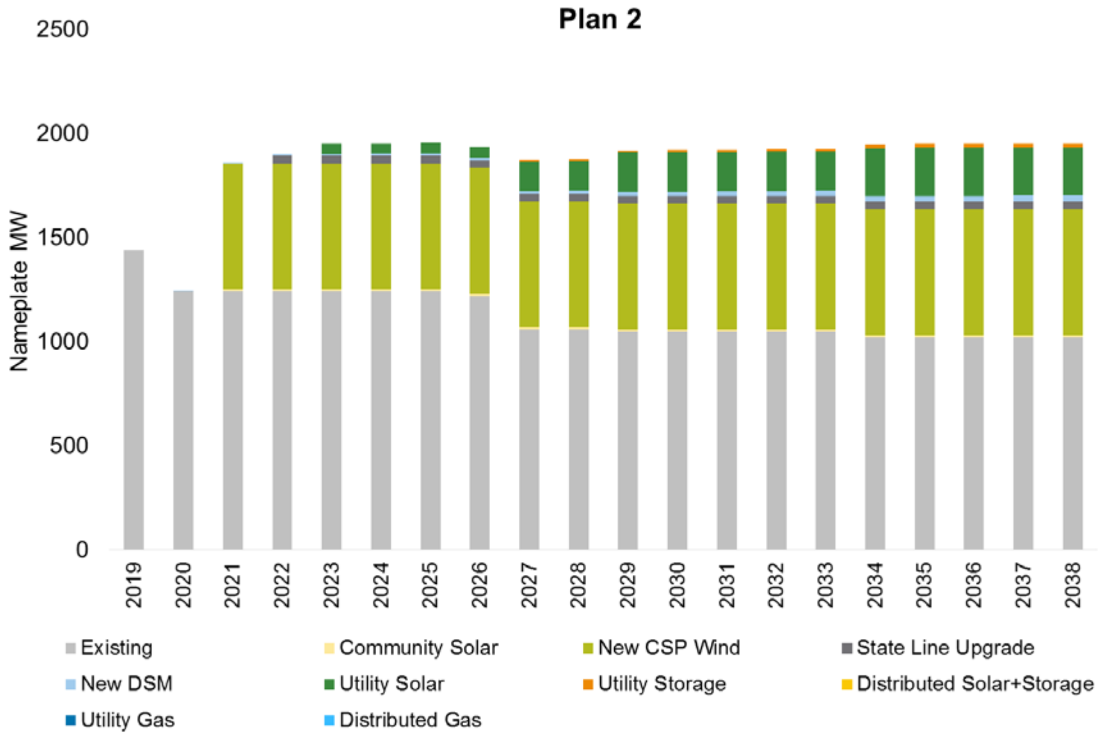


Figure 6-15 - Supply-Side Resource Composition of Plan 2B

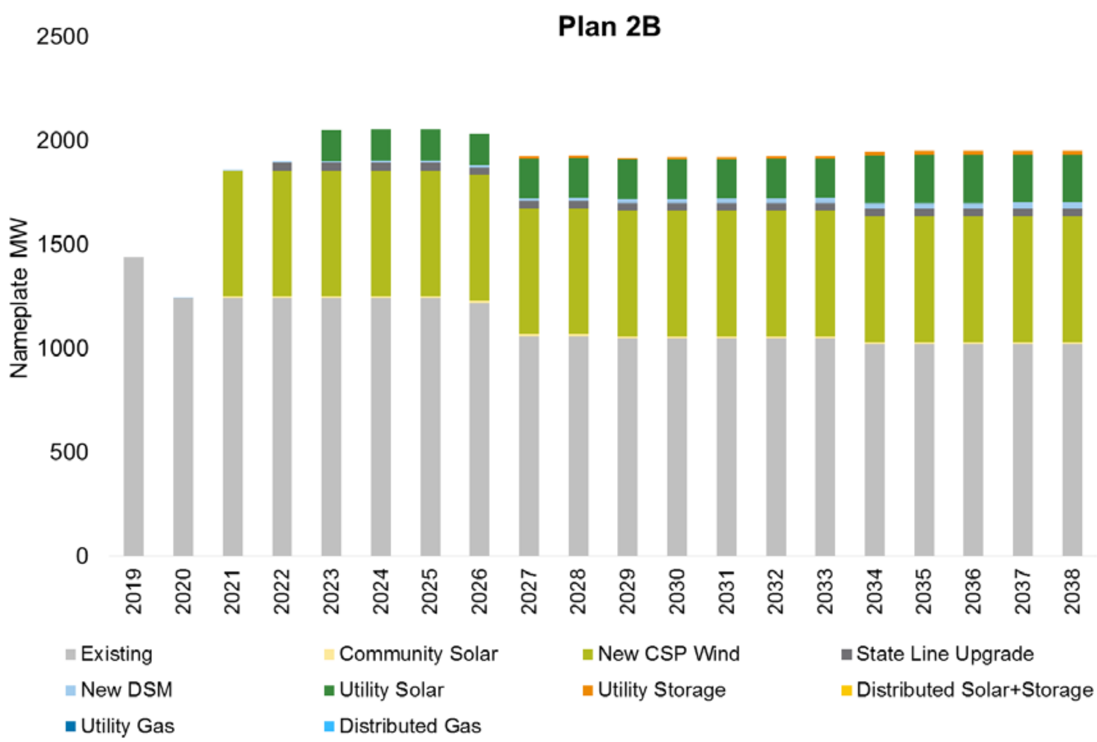


Figure 6-16 - Supply-Side Resource Composition of Plan 2 – MAP

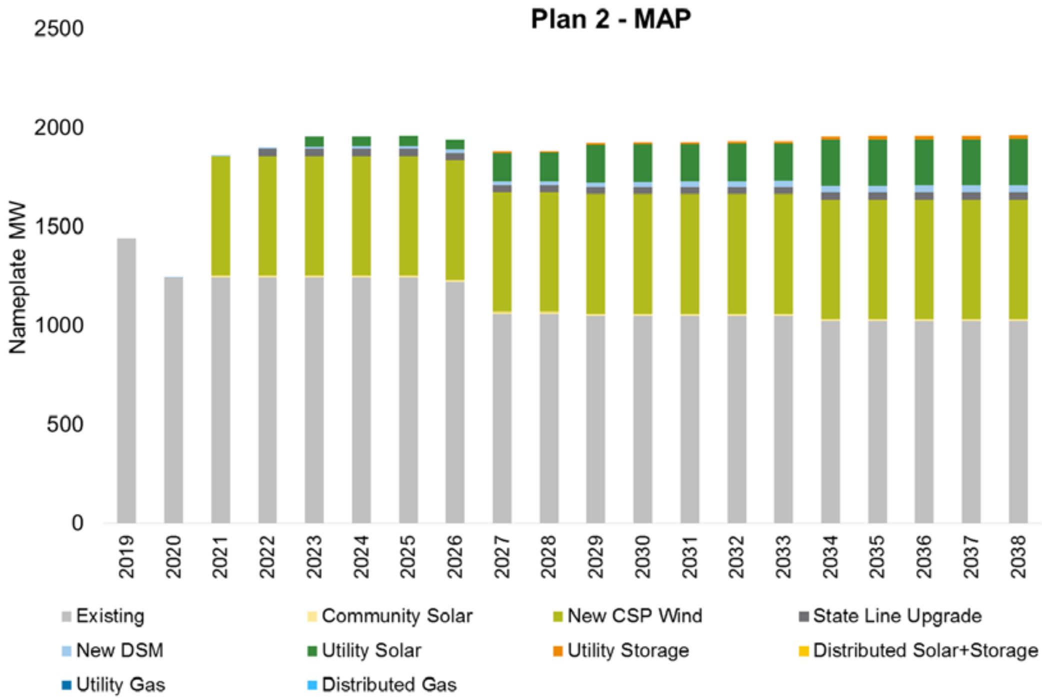


Figure 6-17 - Supply-Side Resource Composition of Plan 3

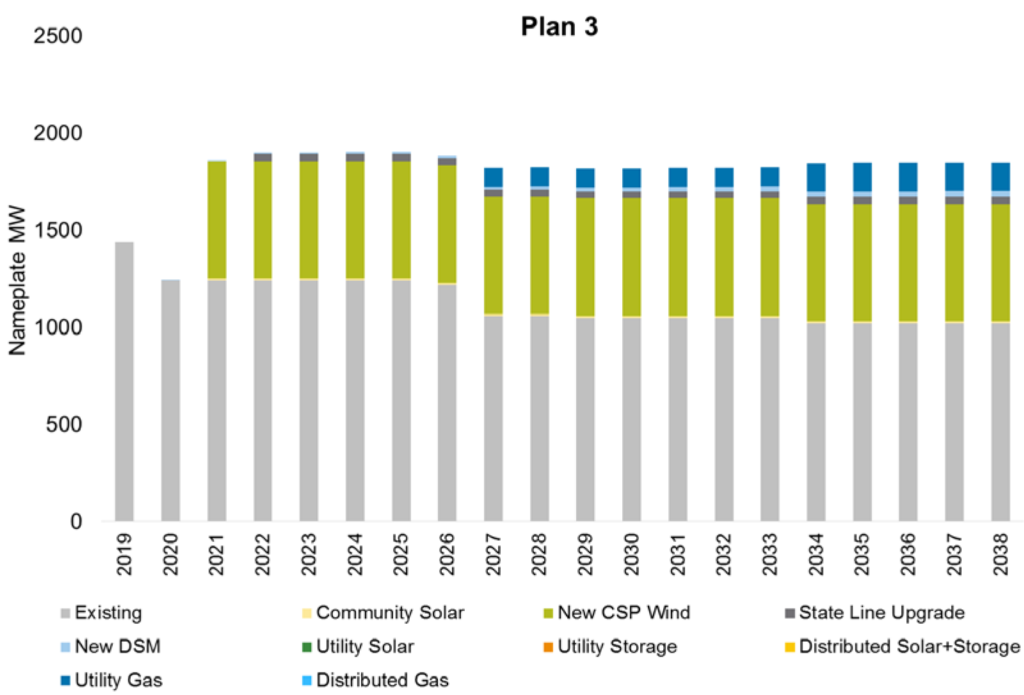


Figure 6-18 - Supply-Side Resource Composition of Plan 4

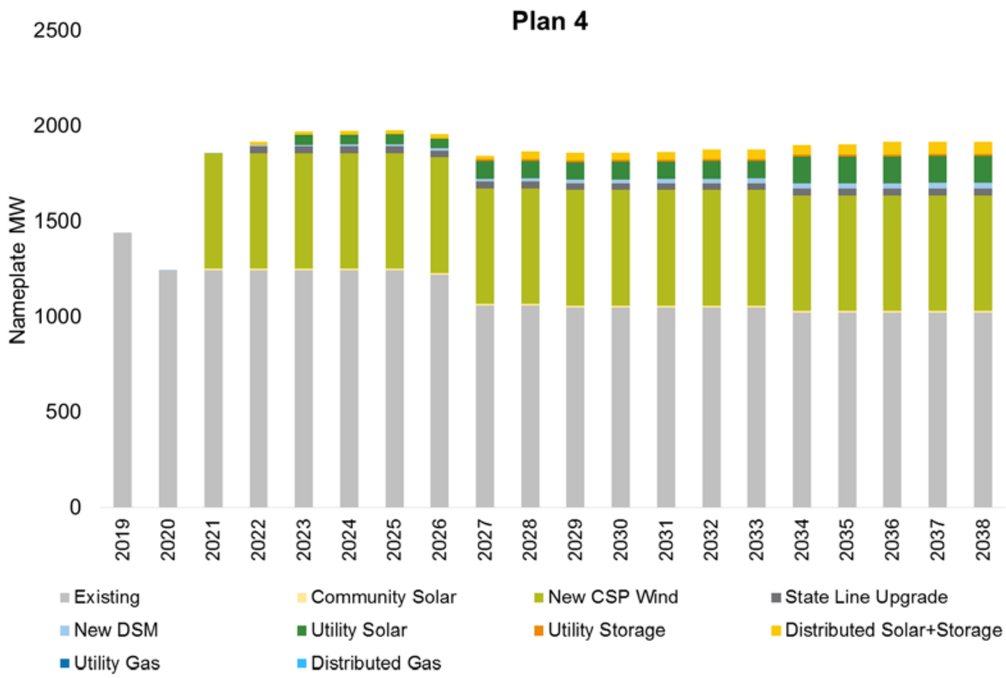


Figure 6-19 - Supply-Side Resource Composition of Plan 5

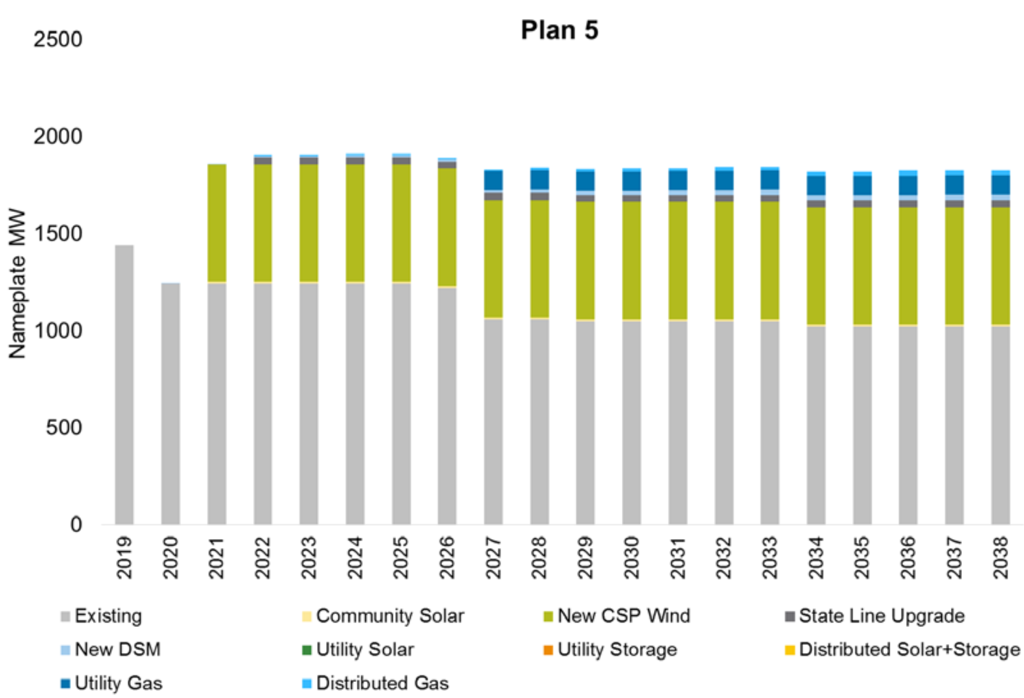


Figure 6-20 - Supply-Side Resource Composition of Plan 6

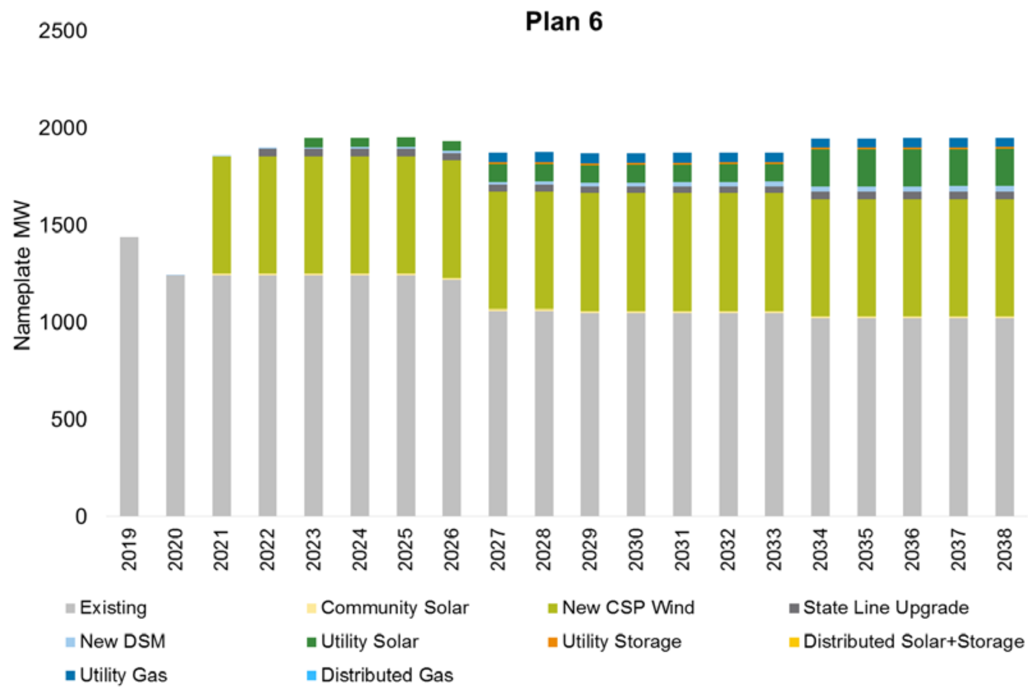


Figure 6-21 - Supply-Side Resource Composition of Plan 7

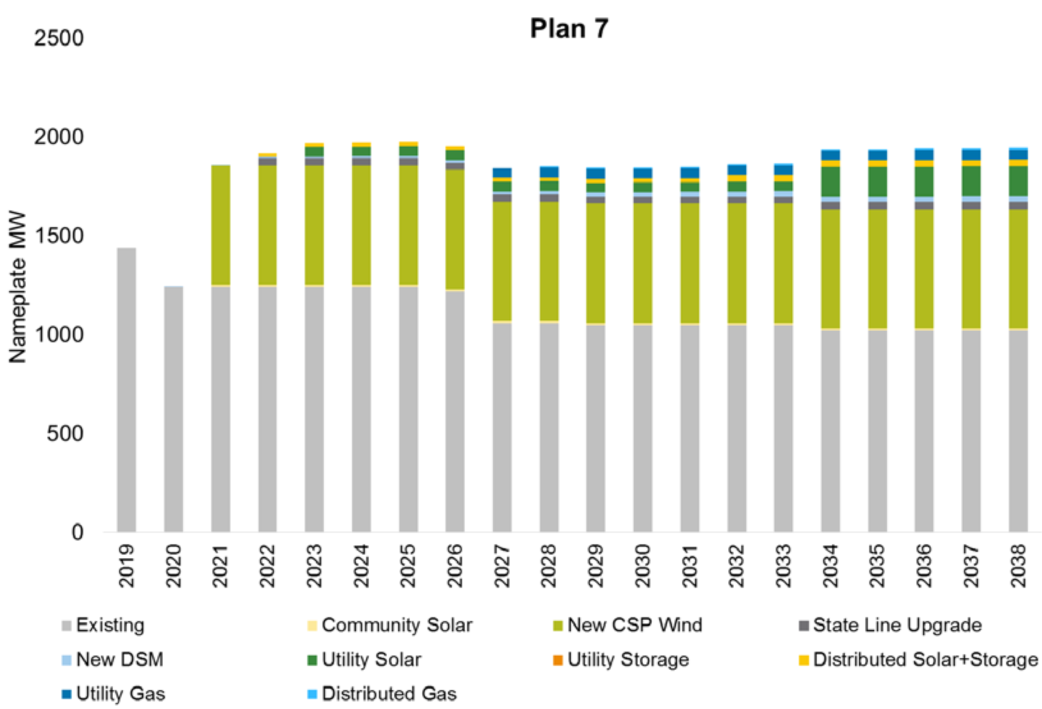


Figure 6-22 - Supply-Side Resource Composition of Plan 8

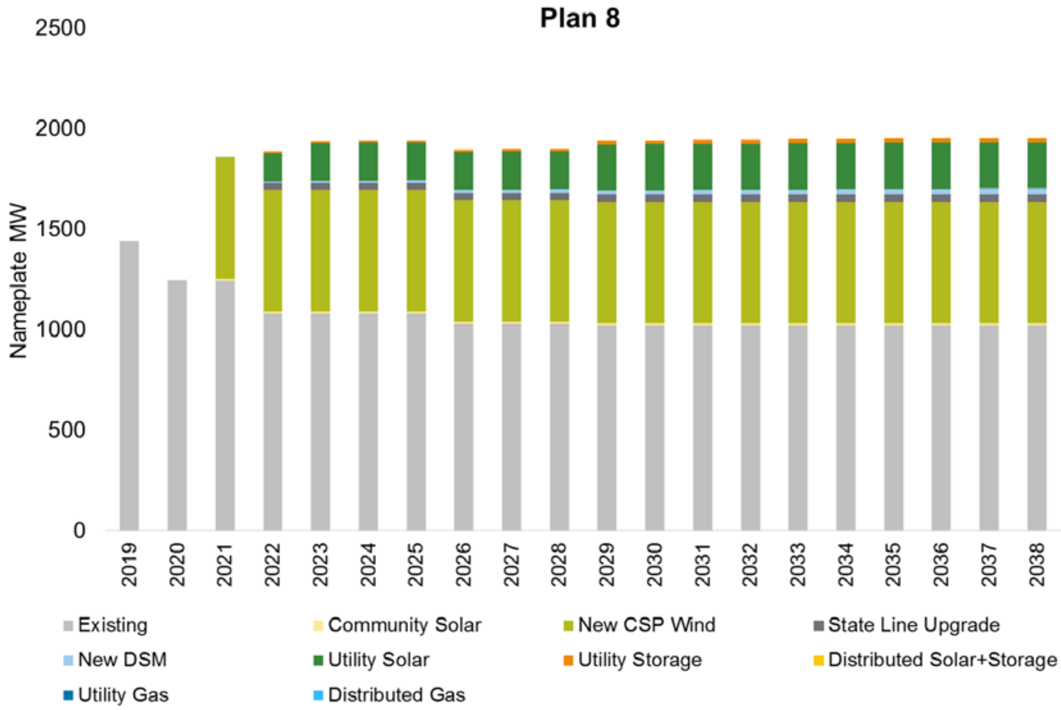


Figure 6-23 - Supply-Side Resource Composition of Plan 9

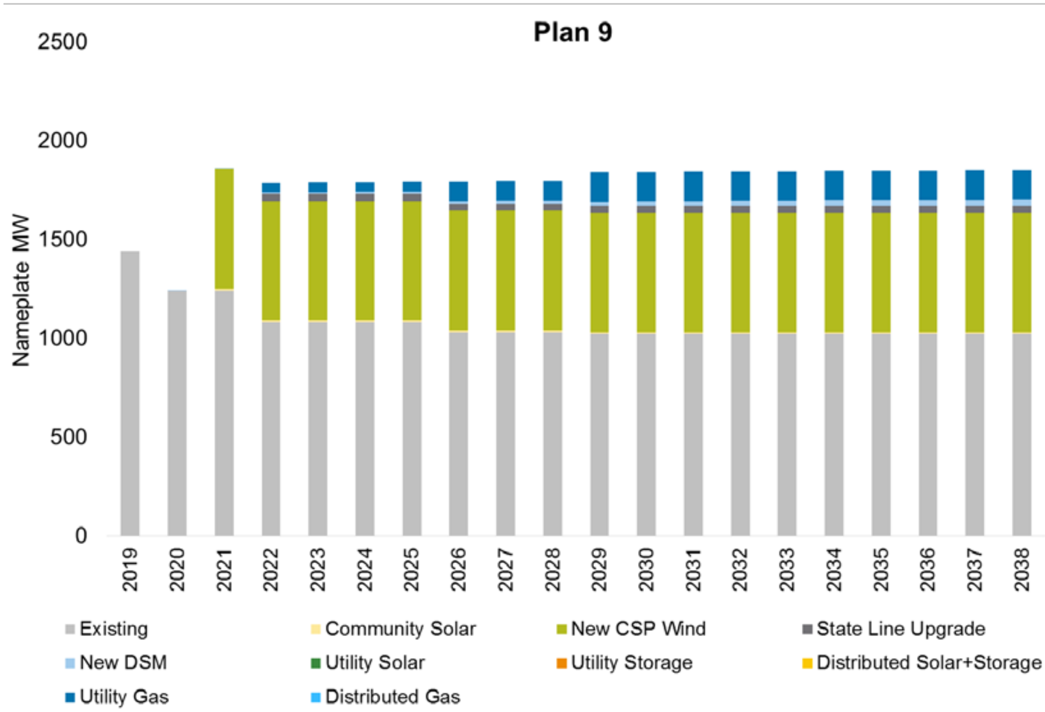


Figure 6-24 - Supply-Side Resource Composition of Plan 10

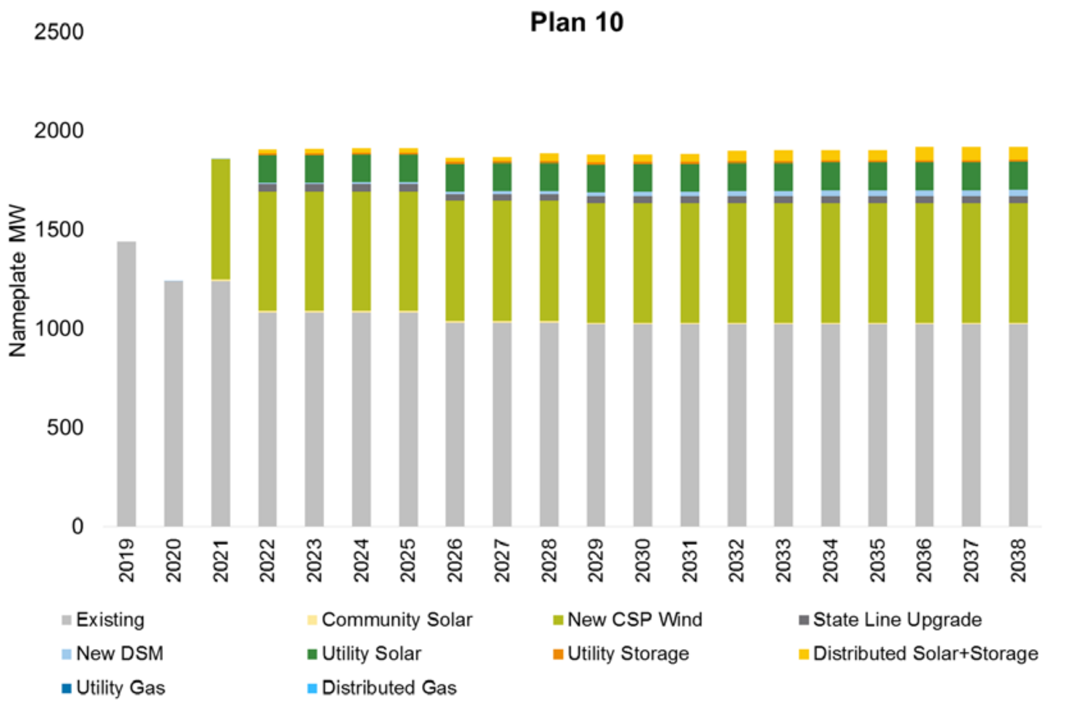


Figure 6-25 - Supply-Side Resource Composition of Plan 11

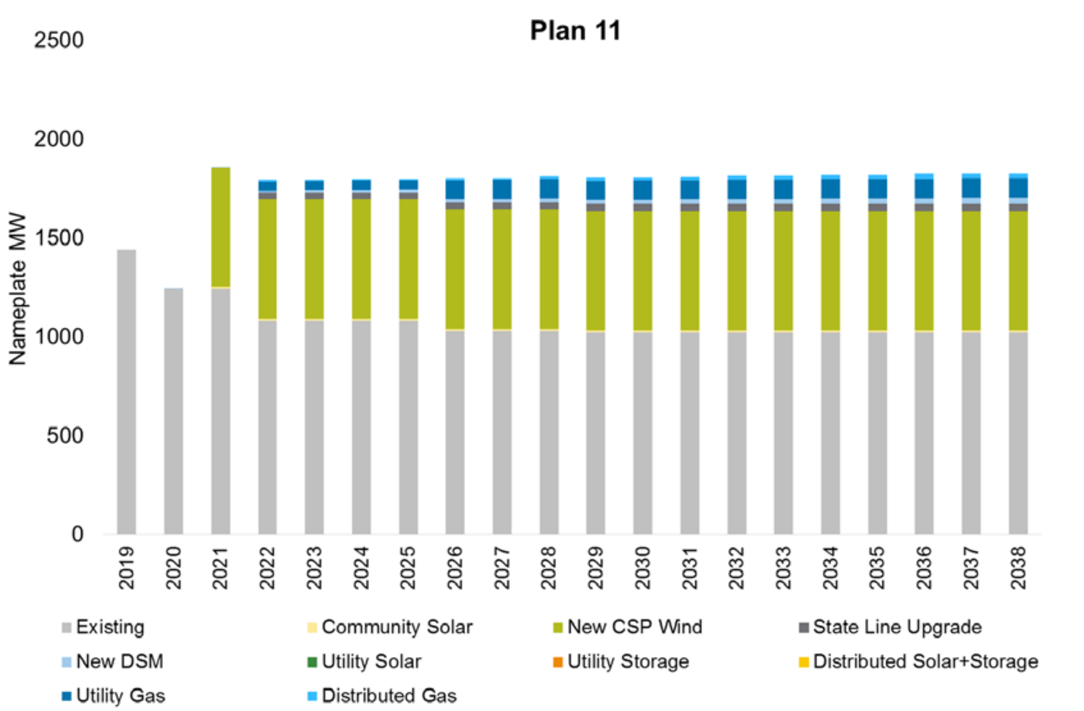


Figure 6-26 - Supply-Side Resource Composition of Plan 12

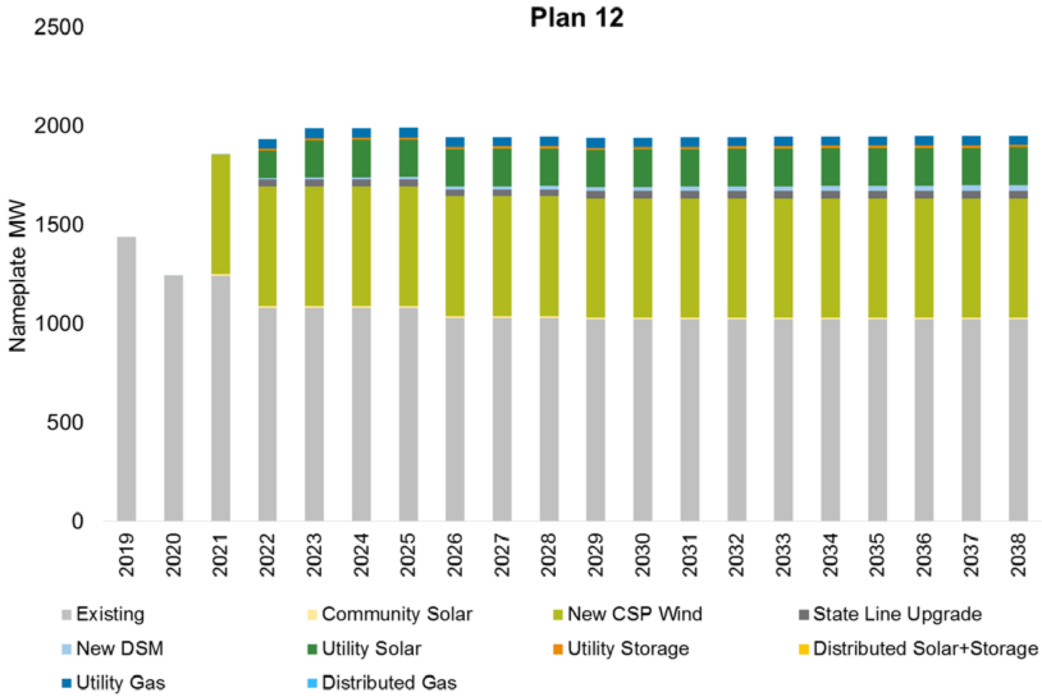
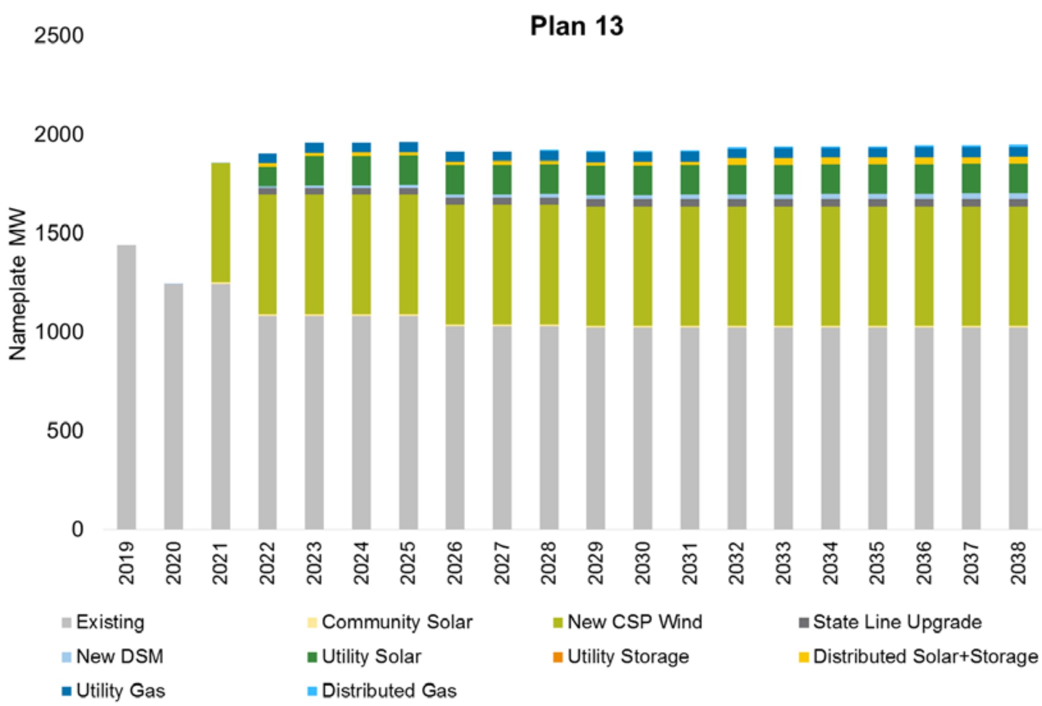


Figure 6-27 - Supply-Side Resource Composition of Plan 13



4.2.4 DSM Impacts on Annual Energy

4. The combined impact of all demand-side resources on the base-case forecast of annual energy requirements;

The combined impact of all demand-side resources on the base forecast of annual energy requirements for each alternative resource plan is shown in Figure 6-28 and Figure 6-29. Two figures are shown, one for RAP DSM and one for MAP DSM. Because all plans except for Plan 2 – MAP use the mid and low bundle of RAP DSM, this figure applies for 15 of the 16 plans.

Figure 6-28 - Impact of RAP DSM on Annual Energy Requirements - MWh
(Applies to every resource plan except Plan 2 – MAP)
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[redacted]

[8] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Figure 6-29 - Impact of MAP DSM on Annual Energy Requirements - MWh

****Confidential in its Entirety**[9]**

[redacted]

4.2.5 Composition of DSM to Annual Energy

5. The composition, by program and demand-side rate, of the annual energy provided by demand-side resources;

The composition by program and demand-side rate of the annual energy provided by demand-side resources for RAP and MAP DSM is shown in Figure 6-30 and Figure 6-31. The corresponding tables of values for all these figures are provided in Appendix 6F.

[9] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Figure 6-30 - Composition of DSM Energy of Selected RAP DSM

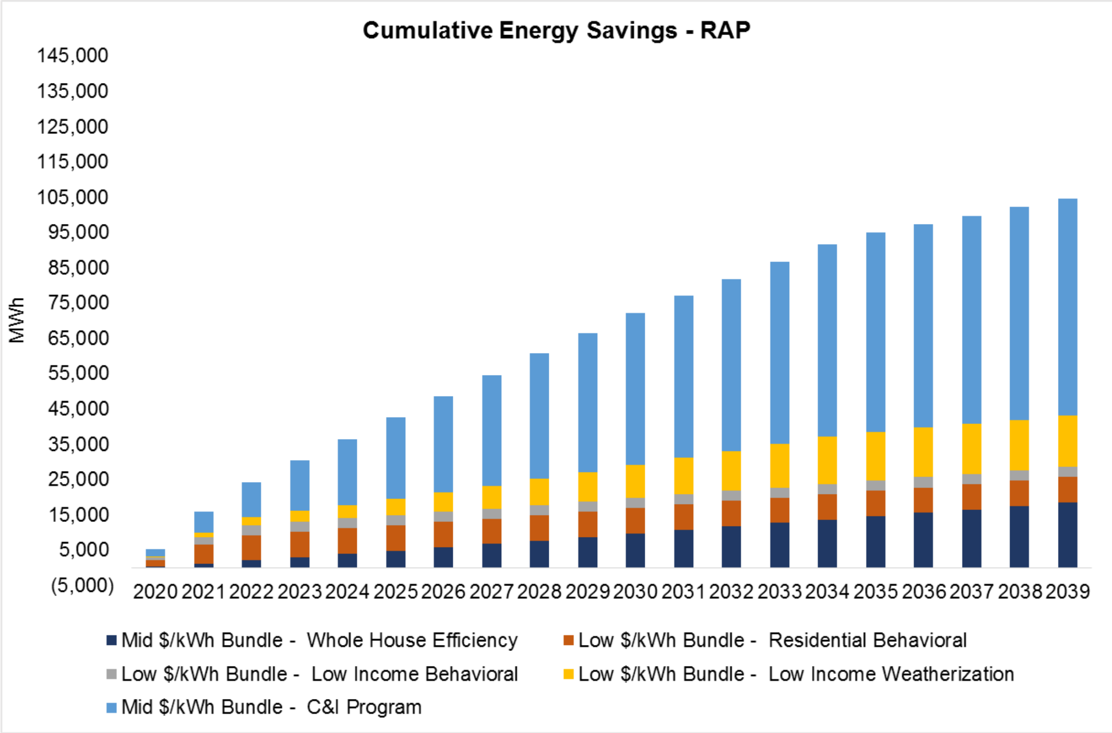
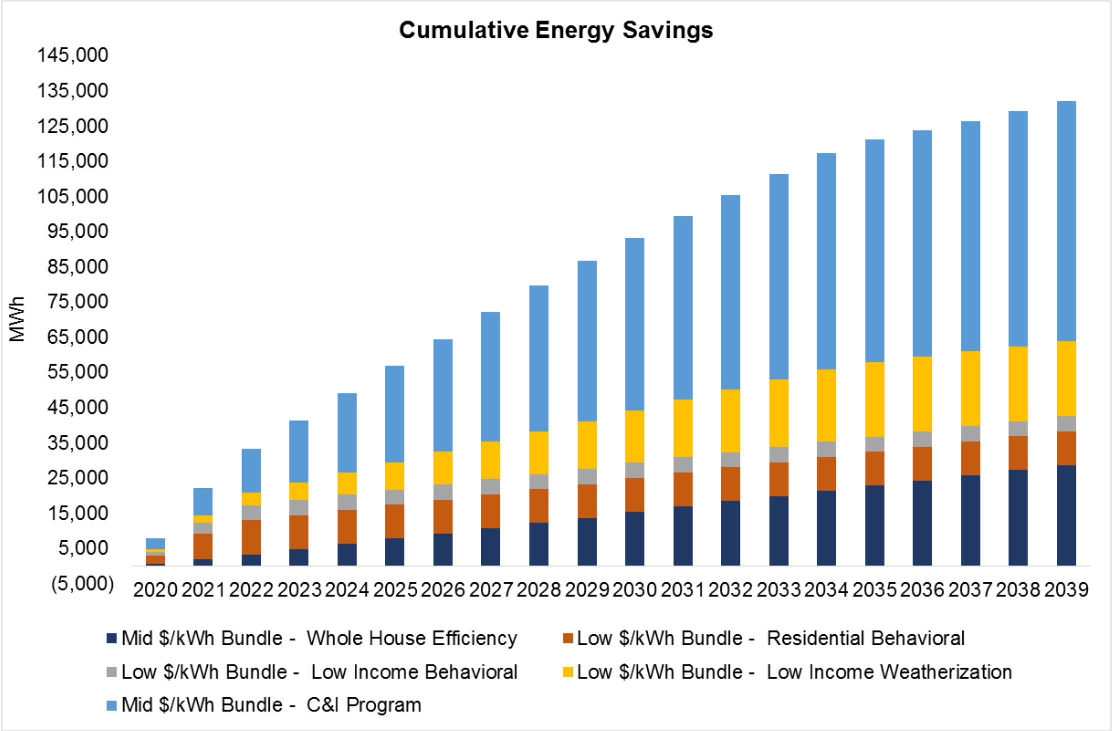


Figure 6-31- Composition of DSM Energy of Selected MAP DSM



4.2.6 Supply-Side Resource Contribution to Energy

6. The composition, by supply-side resource, of the annual energy supplied to the transmission grid, less losses, provided by supply-side resources. Existing supply-side resources may be shown as a single resource;

The composition by supply-side resources of the annual energy supplied to the transmission grid by supply-side resources is provided for each alternative resource plan in Figure 6-32 through Figure 6-47. Since it is not possible to determine the specific source of energy for losses, the losses are not shown.

Figure 6-32 - Composition of Supply-Side Energy for Plan 0

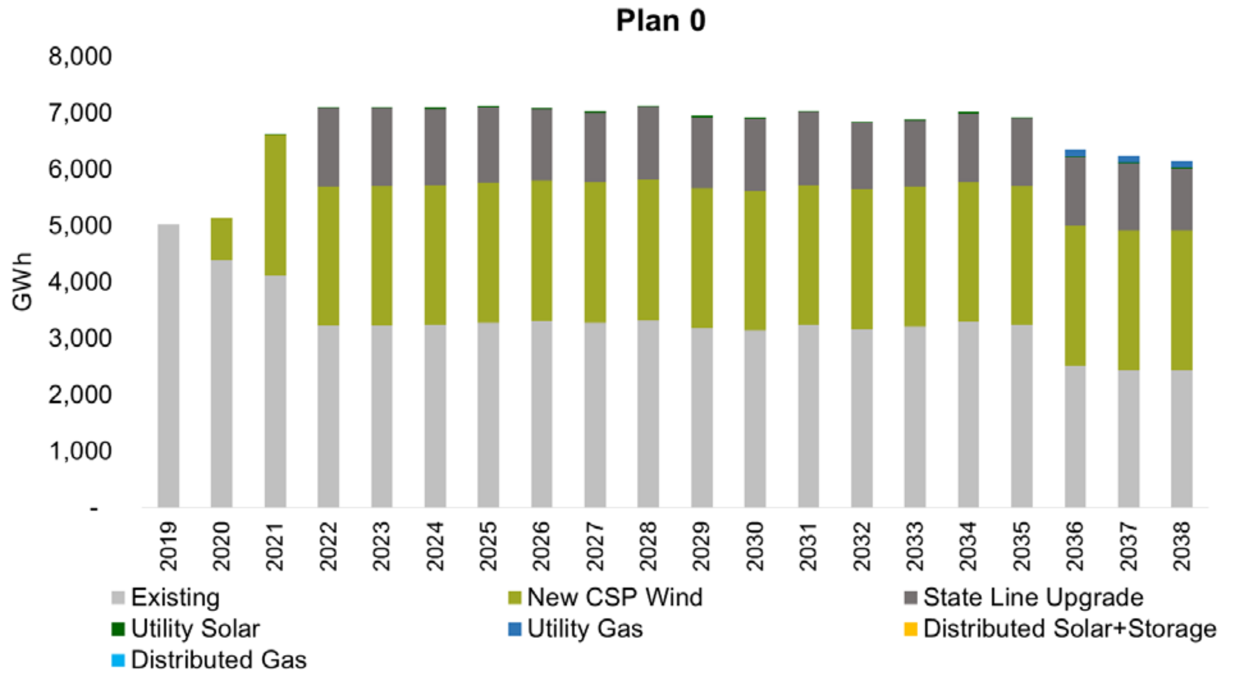


Figure 6-33 - Composition of Supply-Side Energy for Plan 1

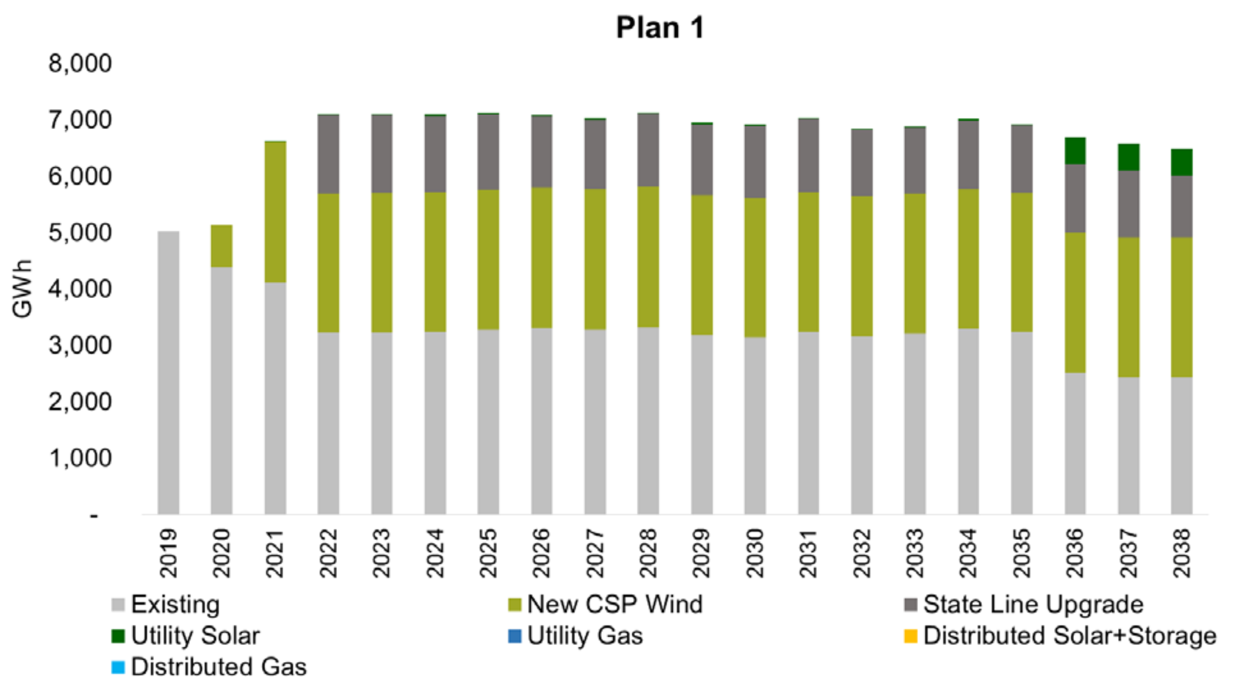


Figure 6-34 - Composition of Supply-Side Energy for Plan 2

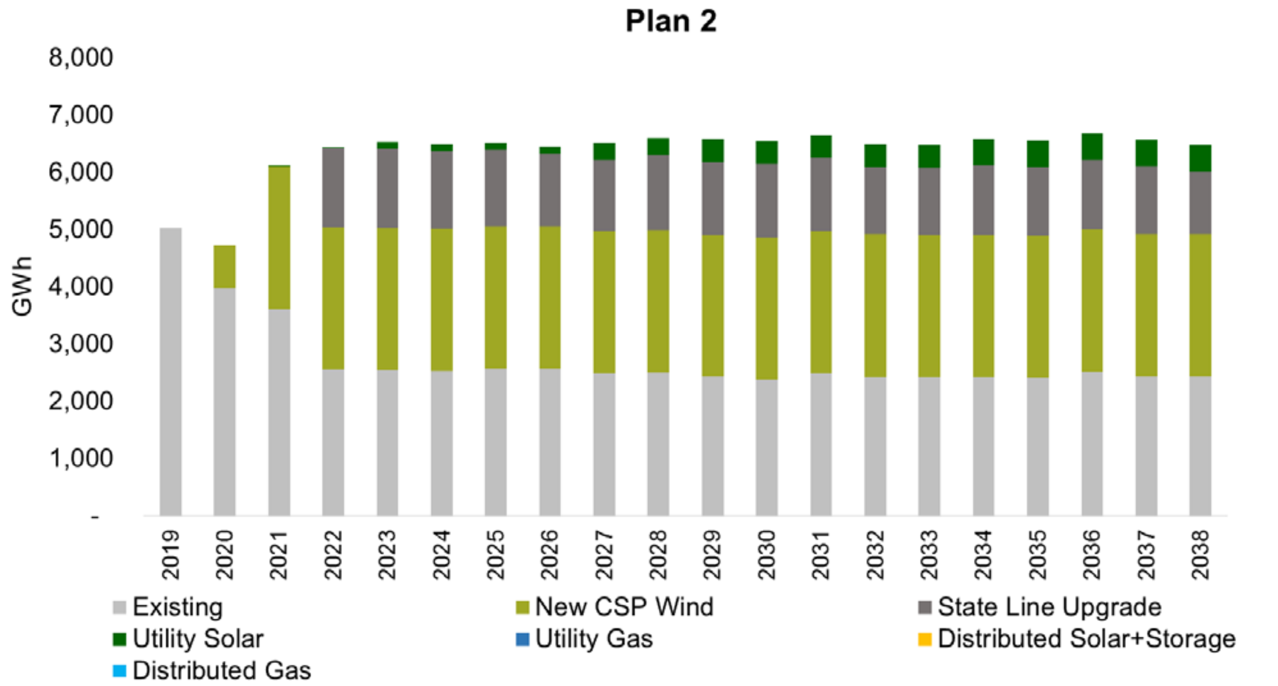


Figure 6-35 - Composition of Supply-Side Energy for Plan 2B

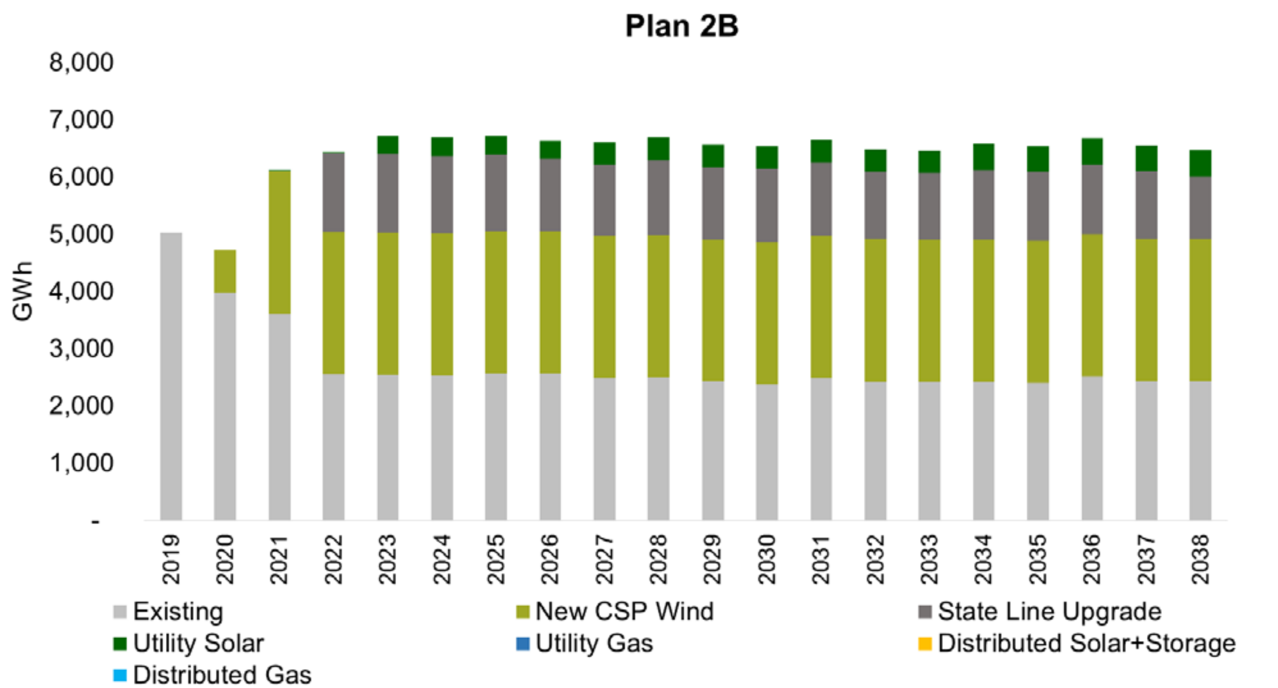


Figure 6-36 - Composition of Supply-Side Energy for Plan 2 – MAP

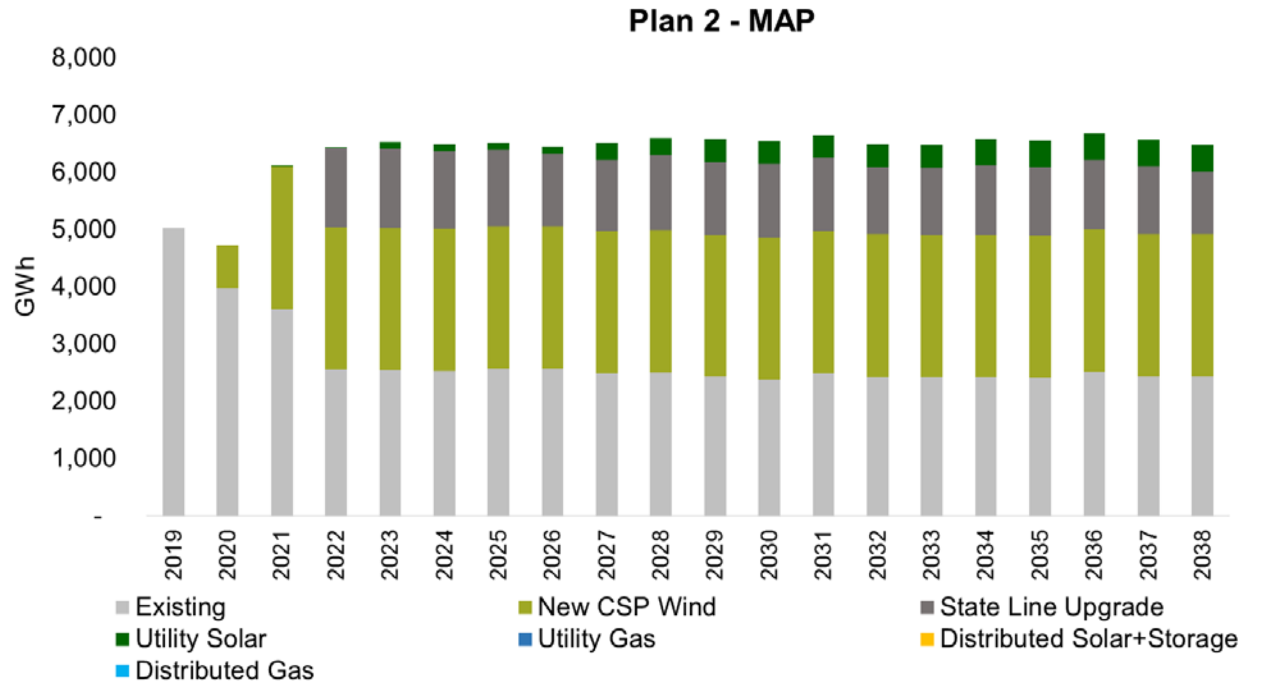


Figure 6-37 - Composition of Supply-Side Energy for Plan 3

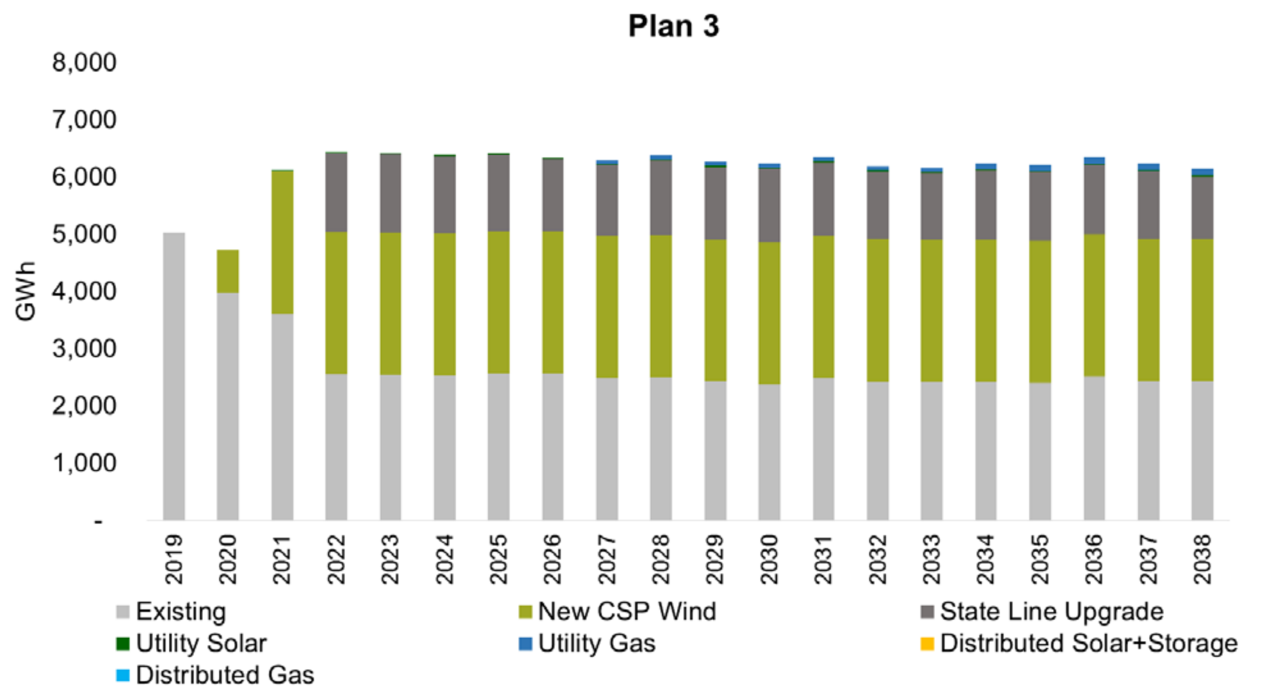


Figure 6-38 - Composition of Supply-Side Energy for Plan 4

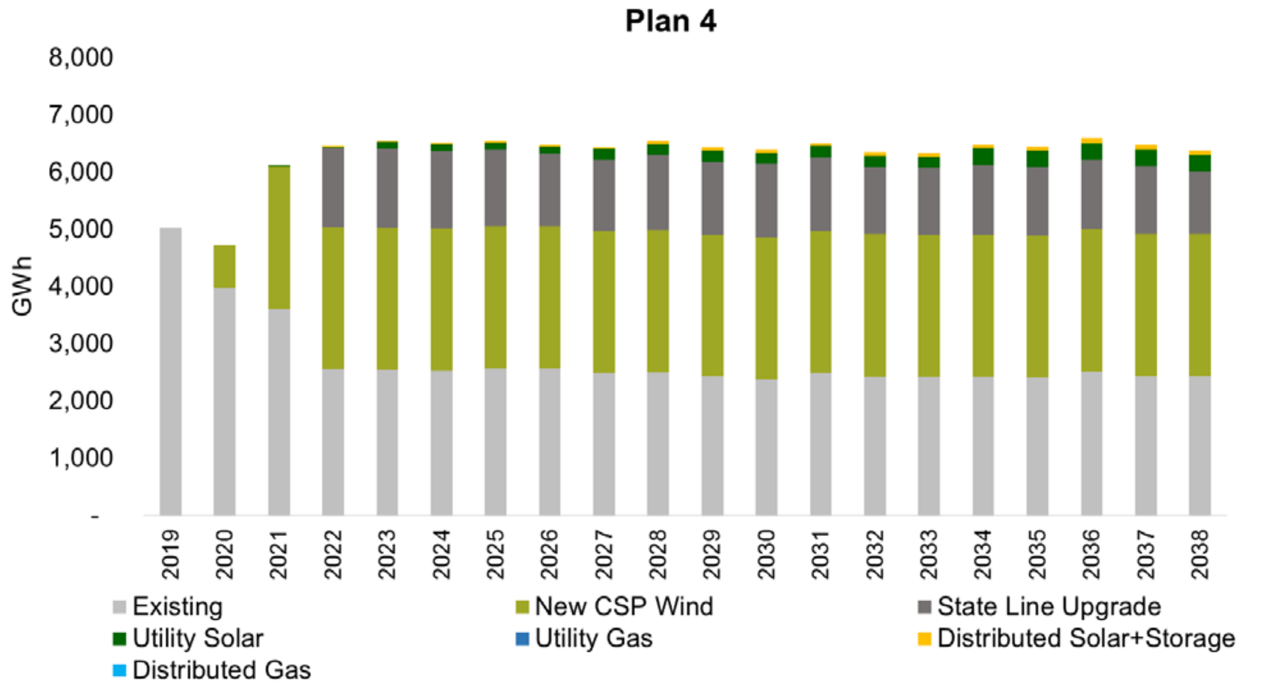


Figure 6-39 - Composition of Supply-Side Energy for Plan 5

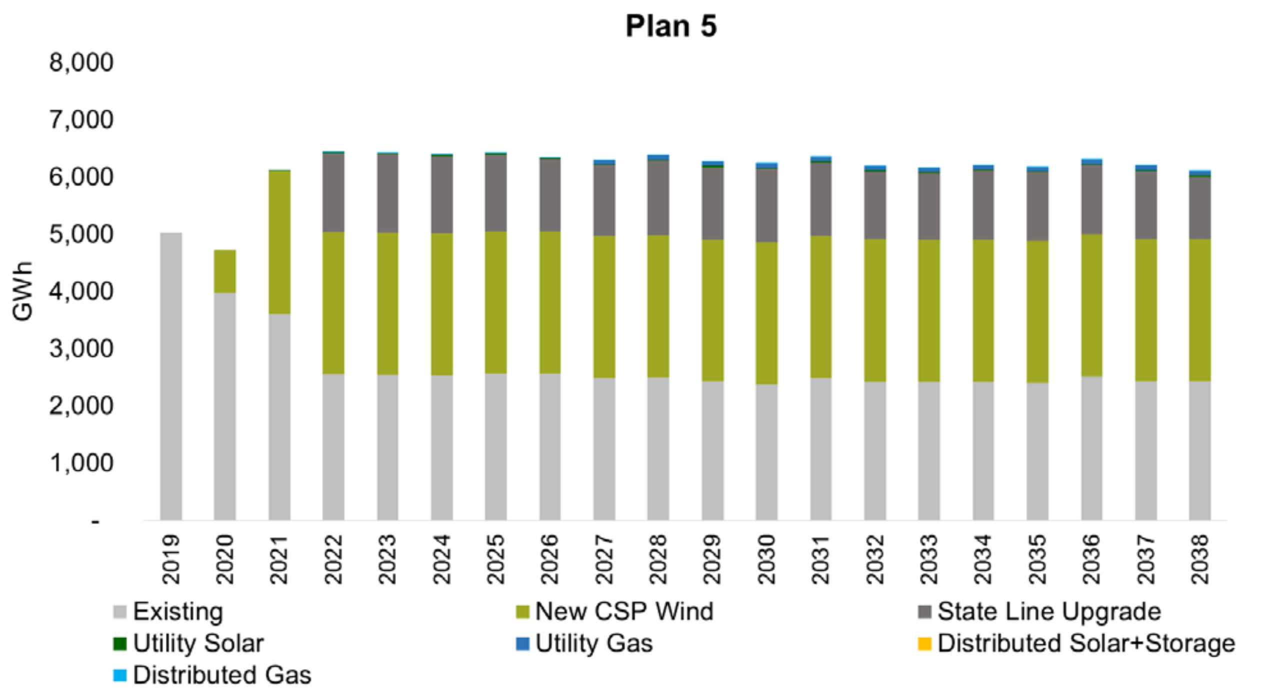


Figure 6-40 - Composition of Supply-Side Energy for Plan 6

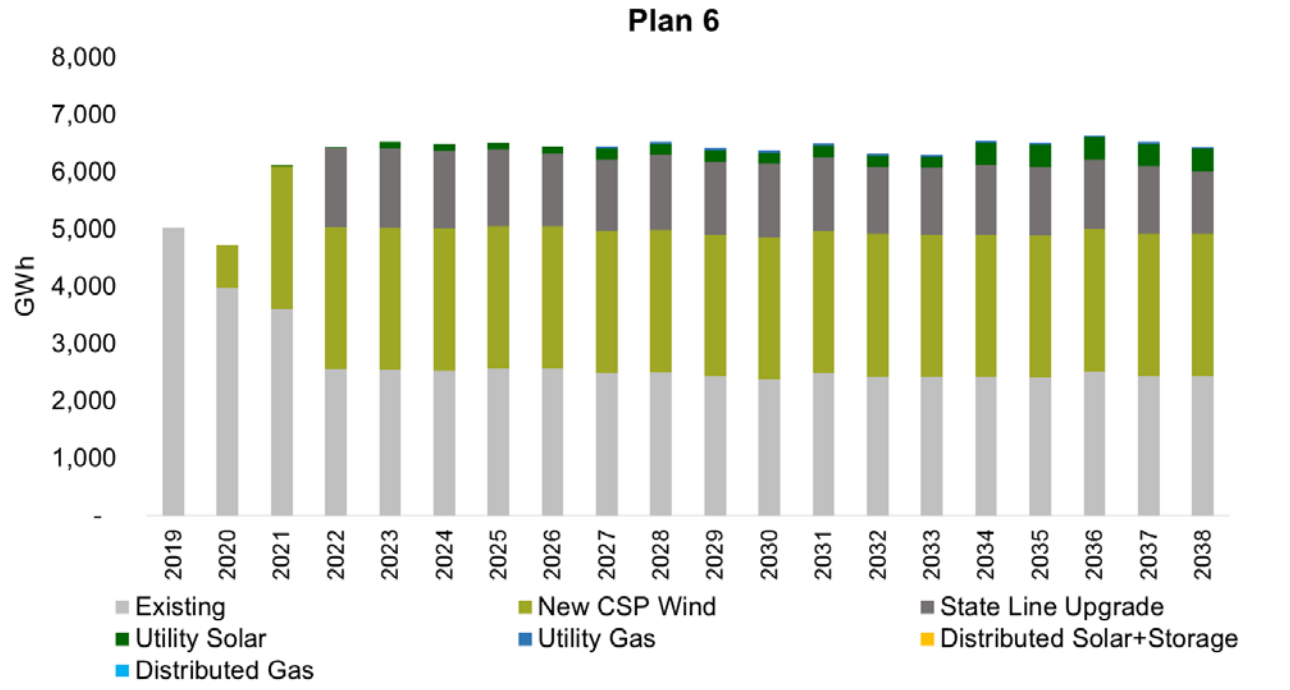


Figure 6-41 - Composition of Supply-Side Energy for Plan 7

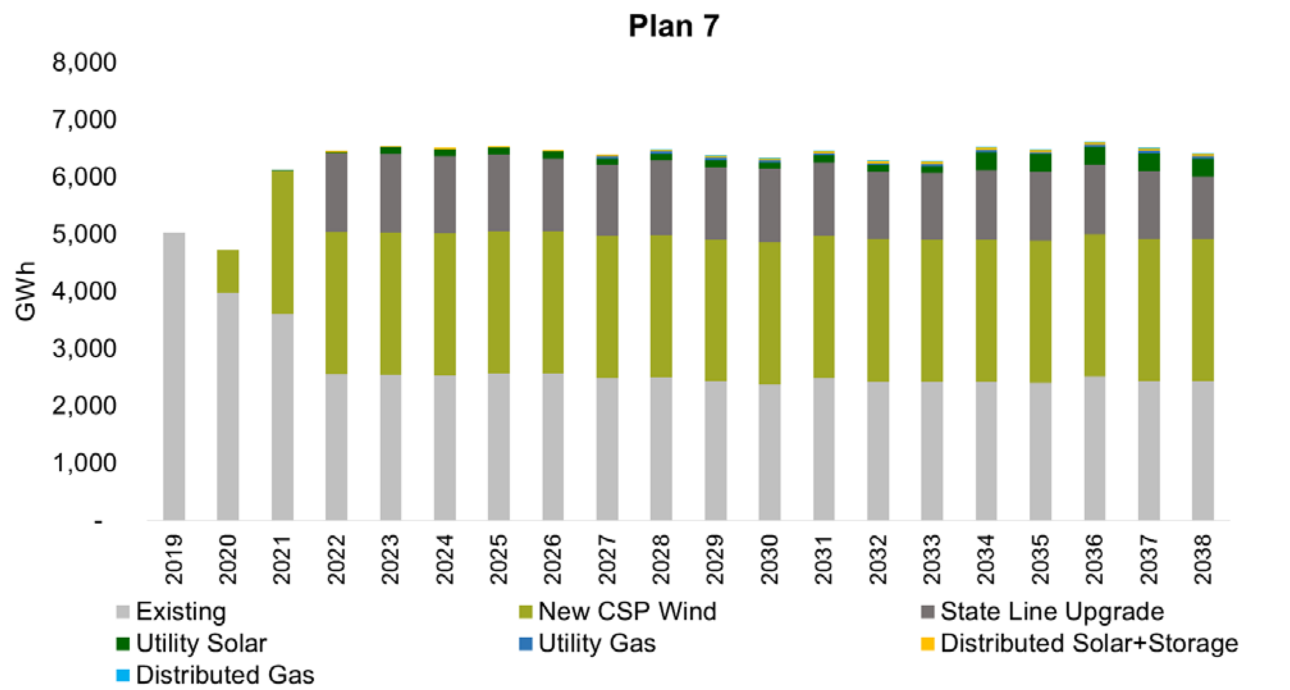


Figure 6-42 - Composition of Supply-Side Energy for Plan 8

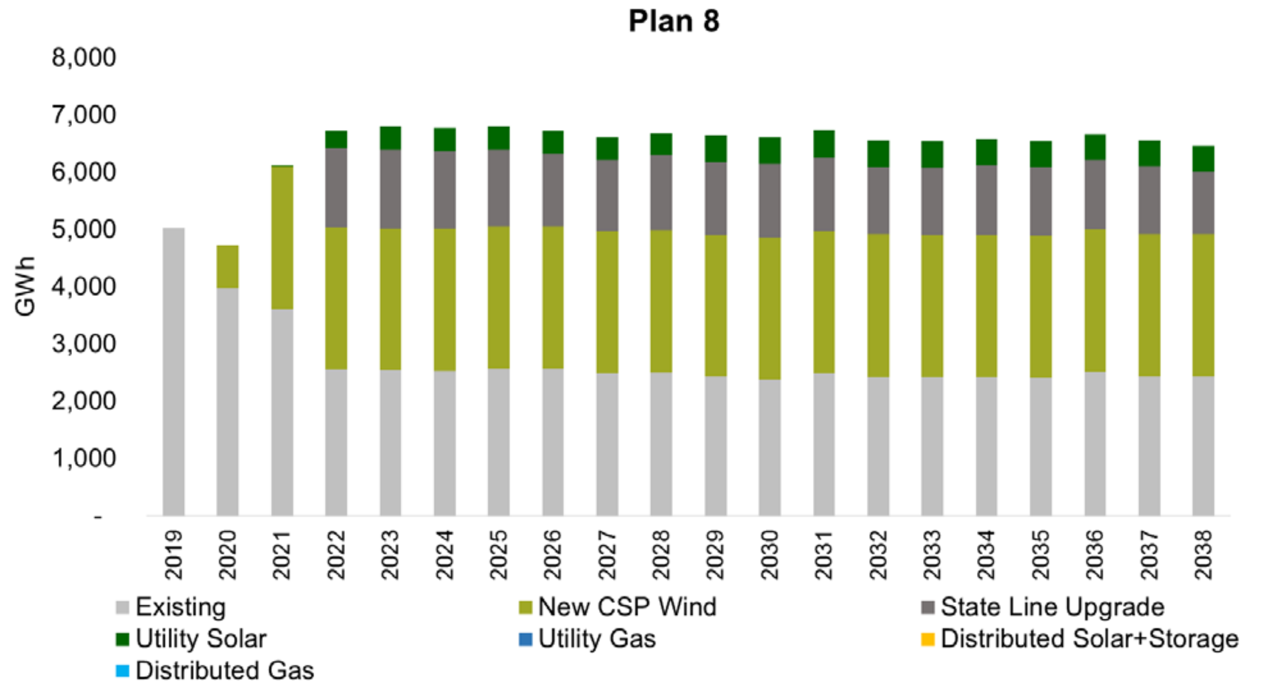


Figure 6-43 - Composition of Supply-Side Energy for Plan 9

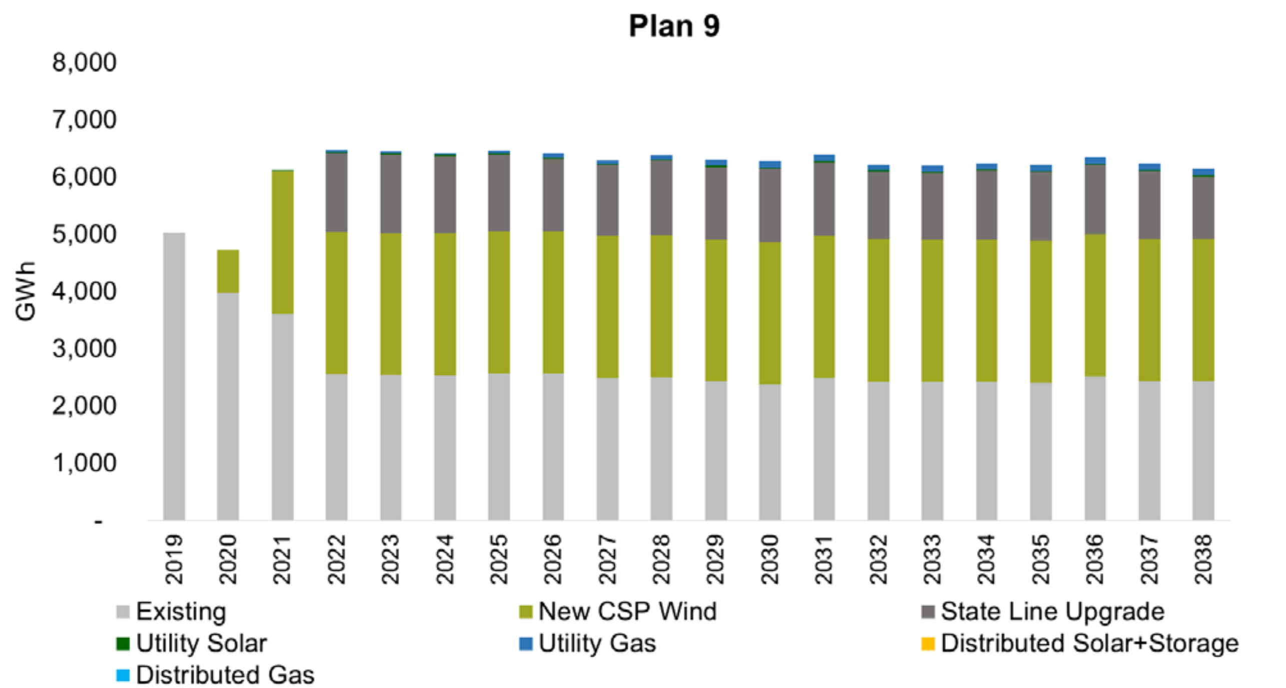


Figure 6-44 - Composition of Supply-Side Energy for Plan 10

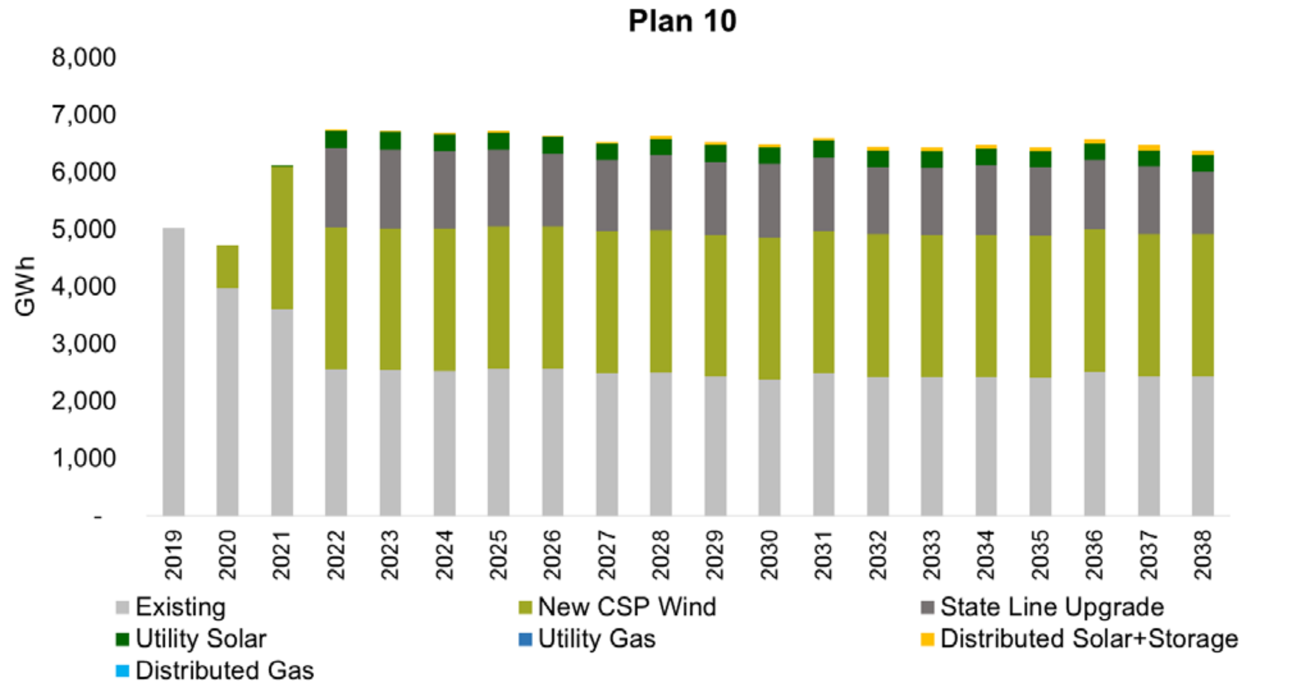


Figure 6-45 - Composition of Supply-Side Energy for Plan 11

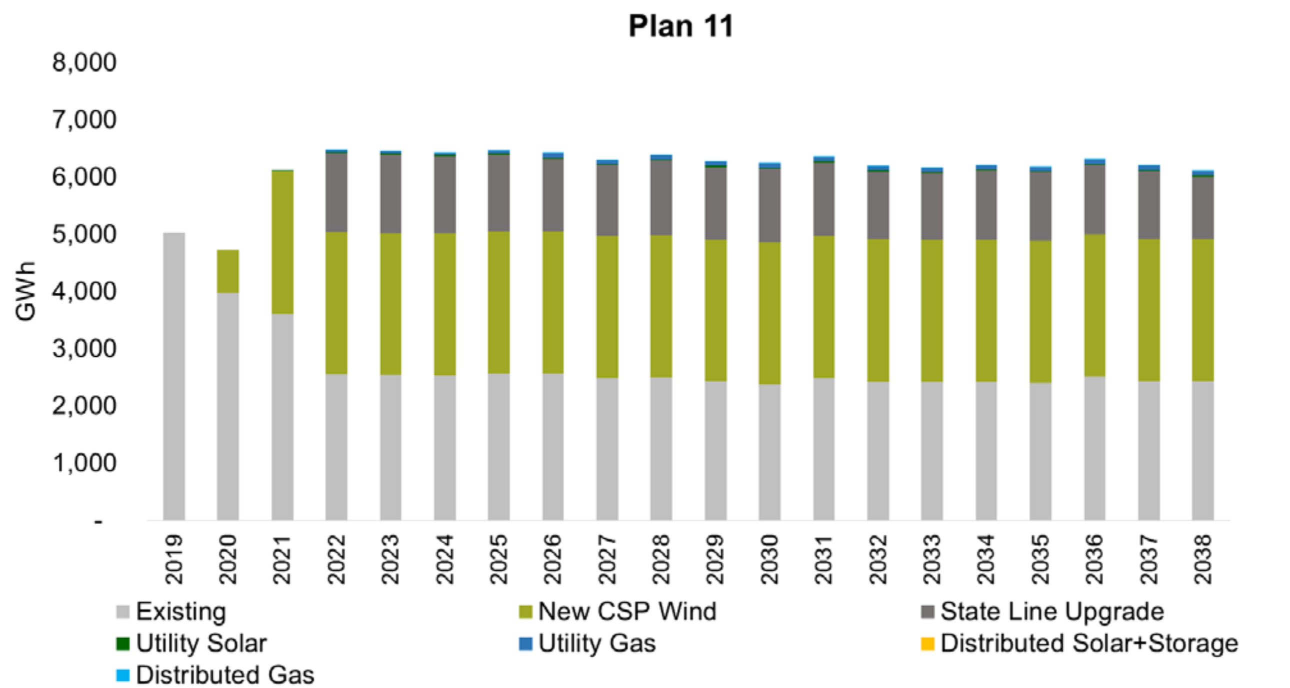


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Figure 6-46 - Composition of Supply-Side Energy for Plan 12

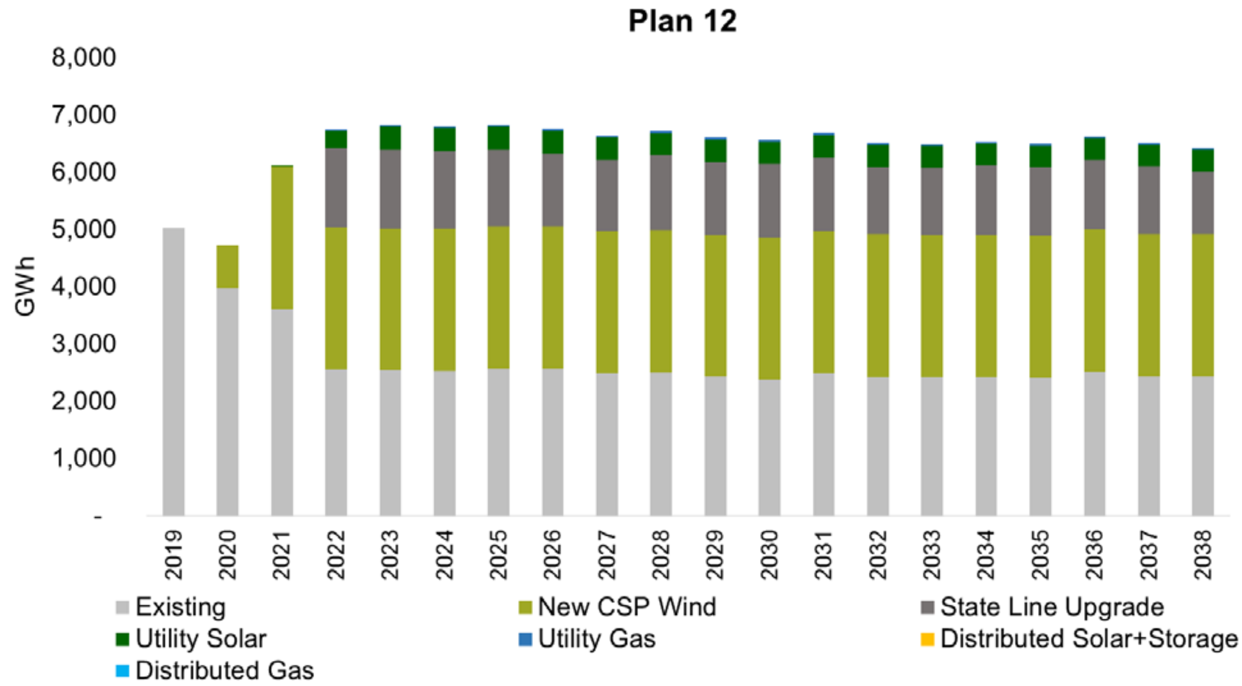
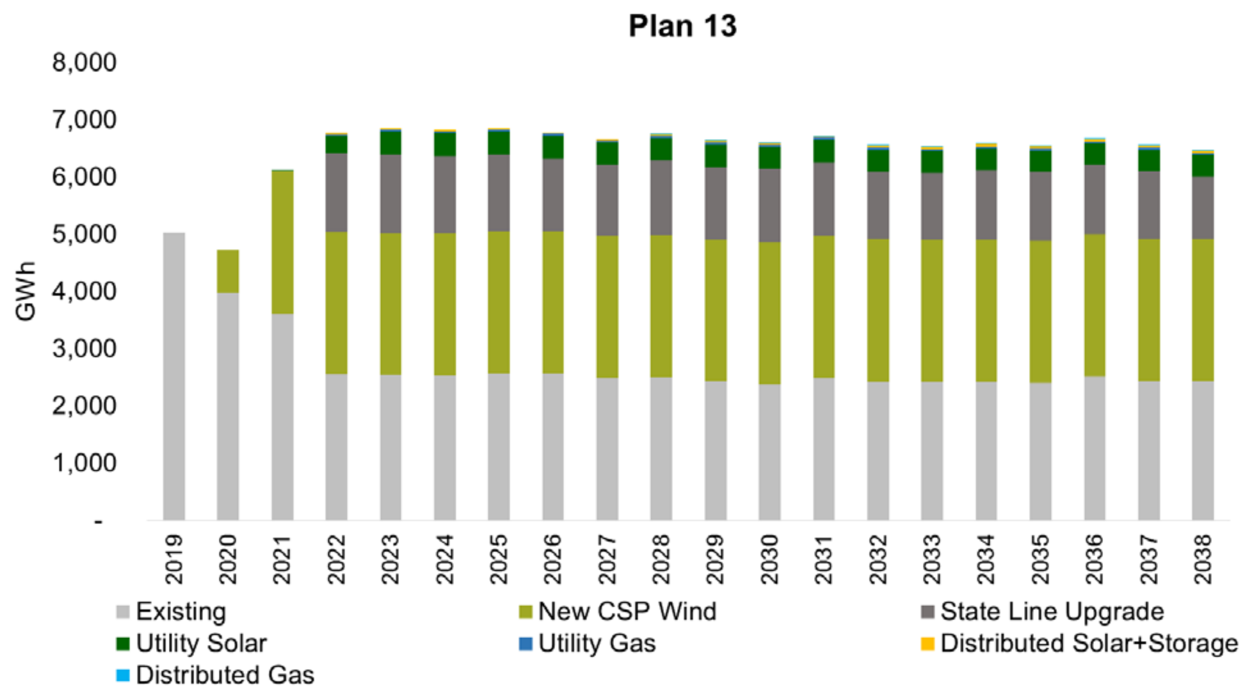


Figure 6-47 - Composition of Supply-Side Energy for Plan 13



4.2.7 Annual Emissions of Plans by Pollutant

7. Annual emissions of each environmental pollutant identified pursuant to 4 CSR 240-22.040(2)(B);

The annual emissions for NO_x, SO_2, and CO_2 for each alternative resource plan are provided on Figure 6-48 through Figure 6-63.

Figure 6-48 - Annual Emissions of Plan 0

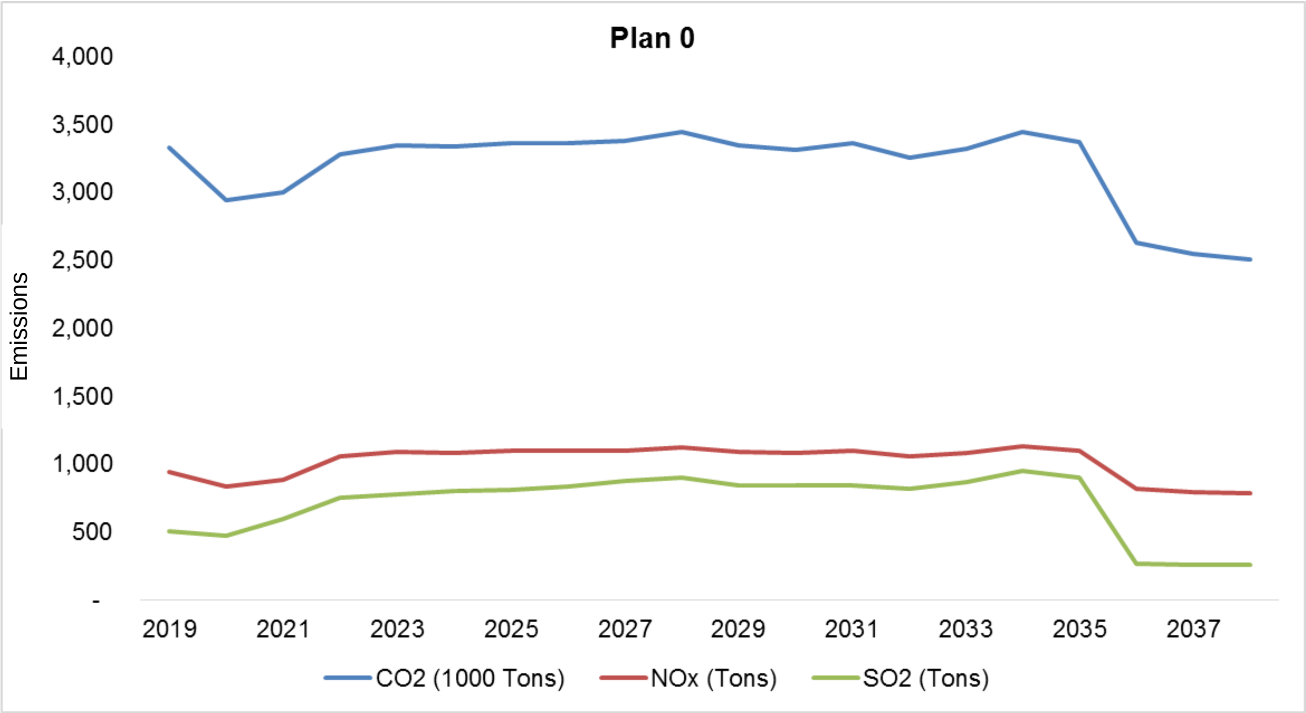


Figure 6-49 - Annual Emissions of Plan 1

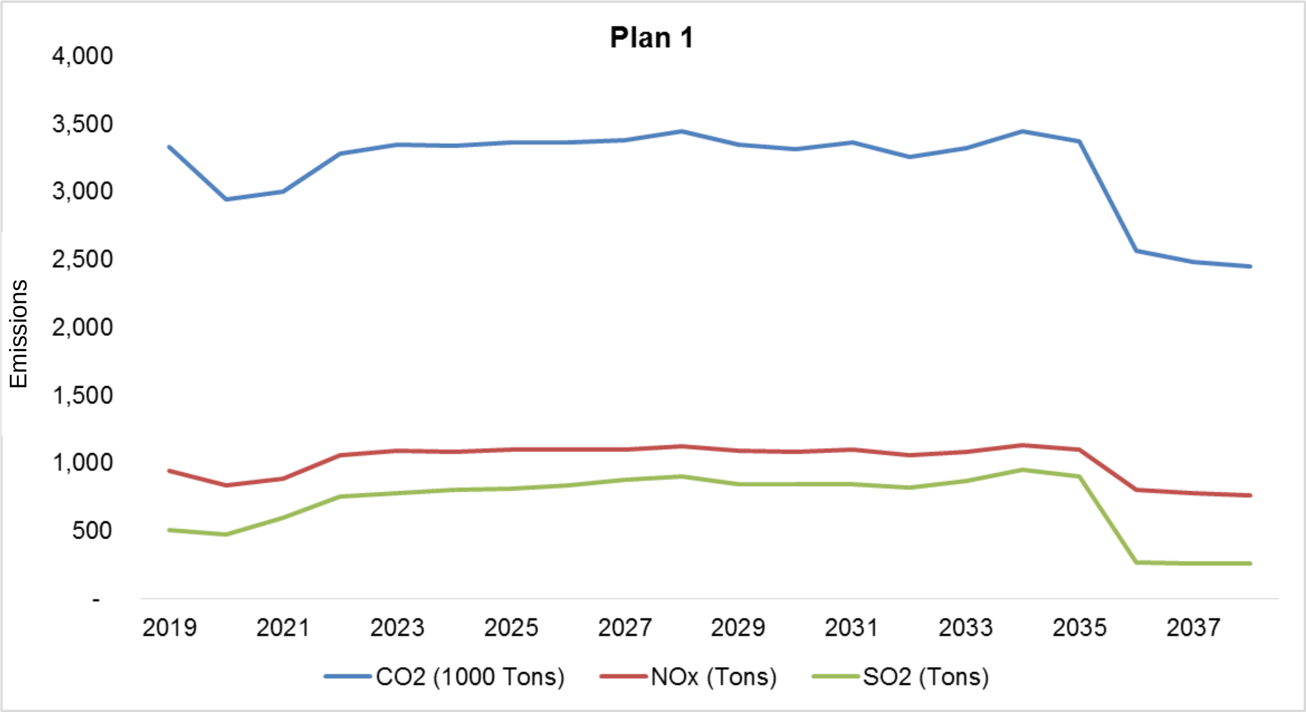


Figure 6-50 - Annual Emissions of Plan 2

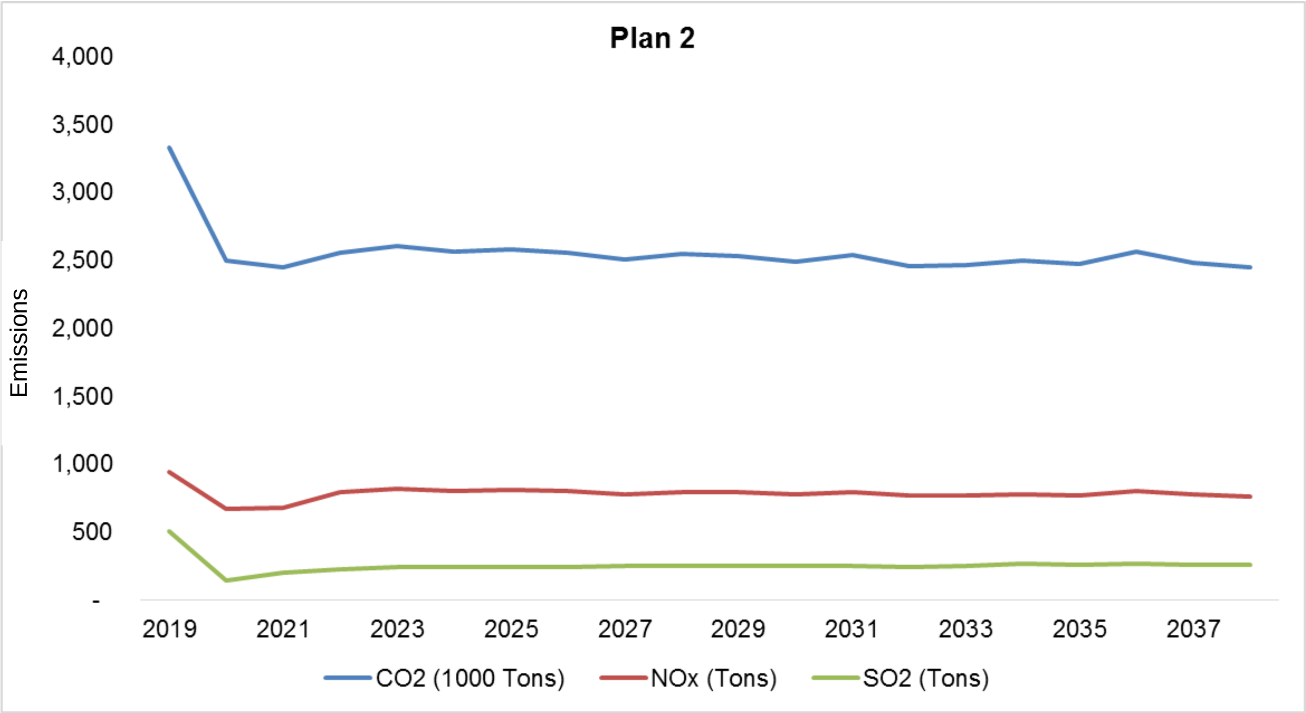


Figure 6-51 - Annual Emissions of Plan 2B

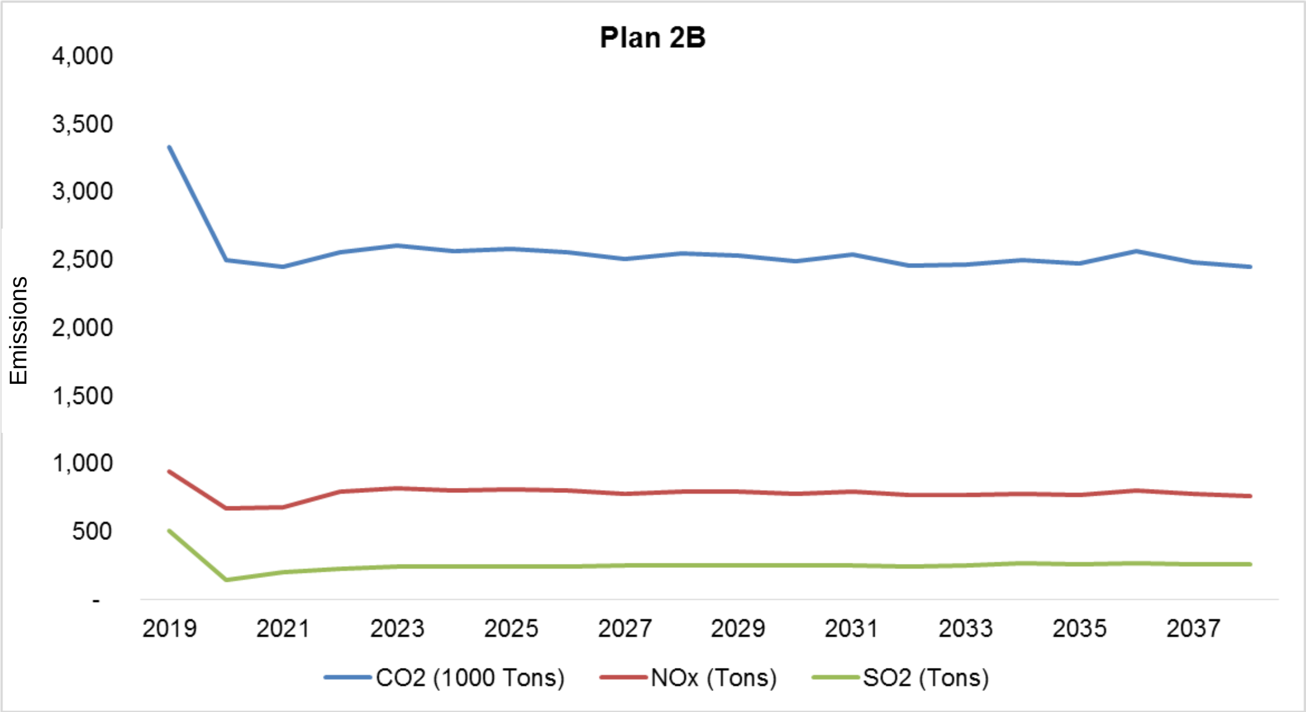


Figure 6-52 - Annual Emissions of Plan 2 – MAP

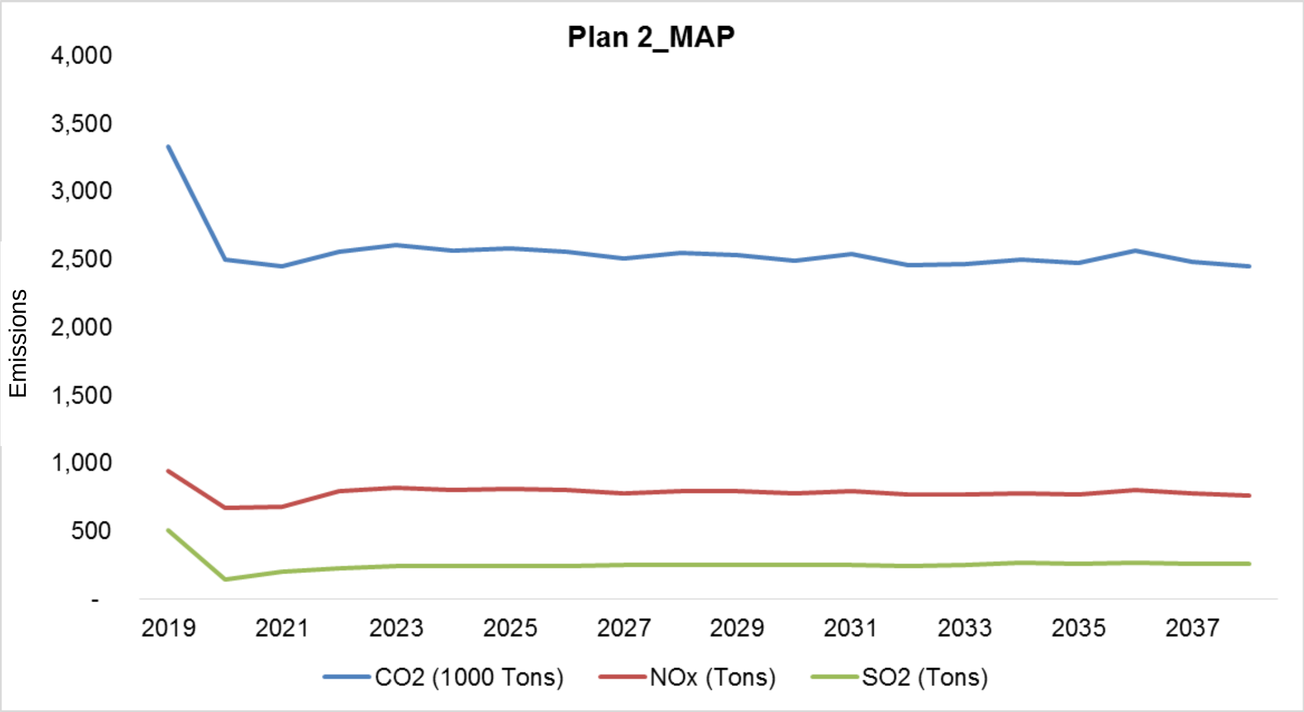


Figure 6-53 - Annual Emissions of Plan 3

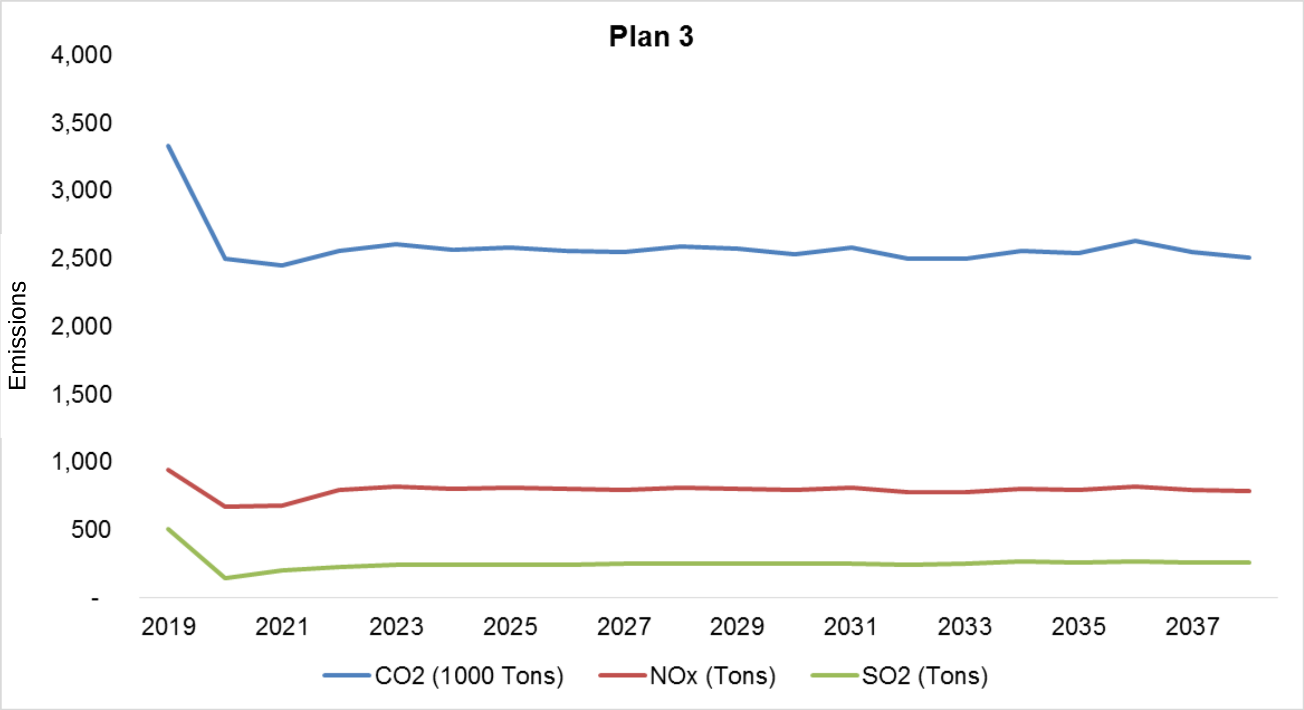


Figure 6-54 - Annual Emissions of Plan 4

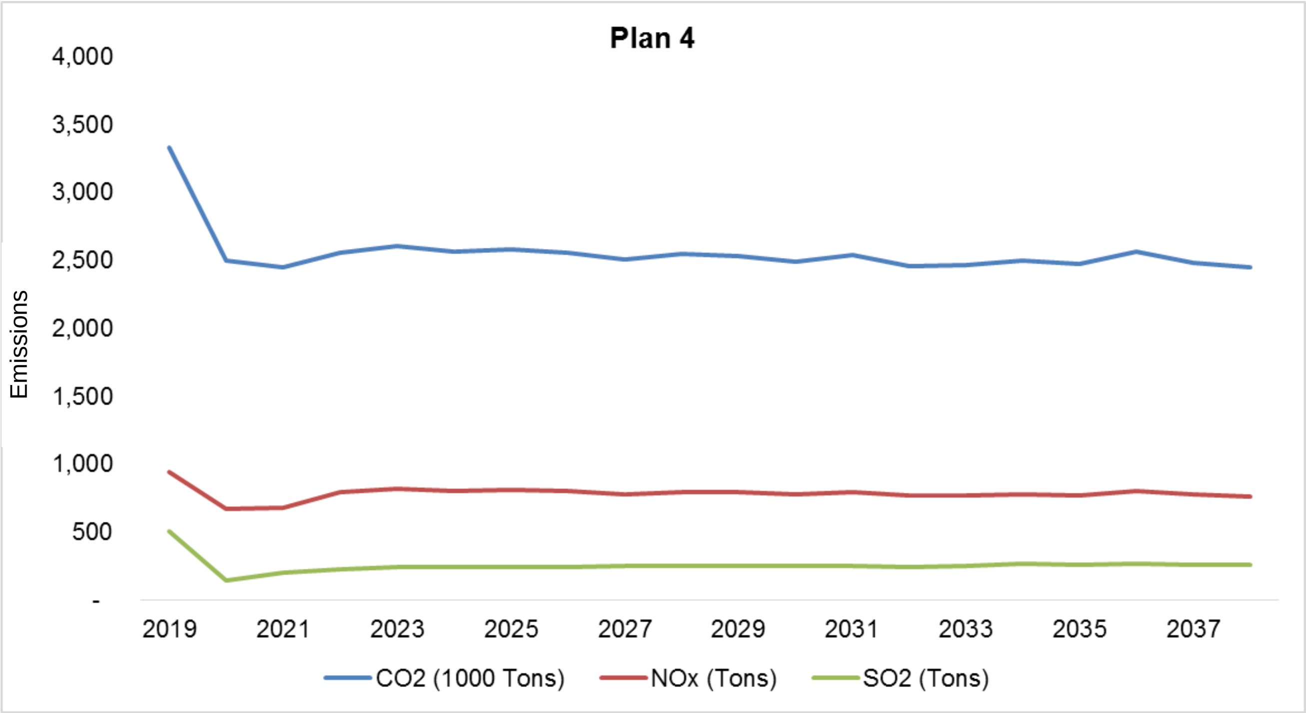
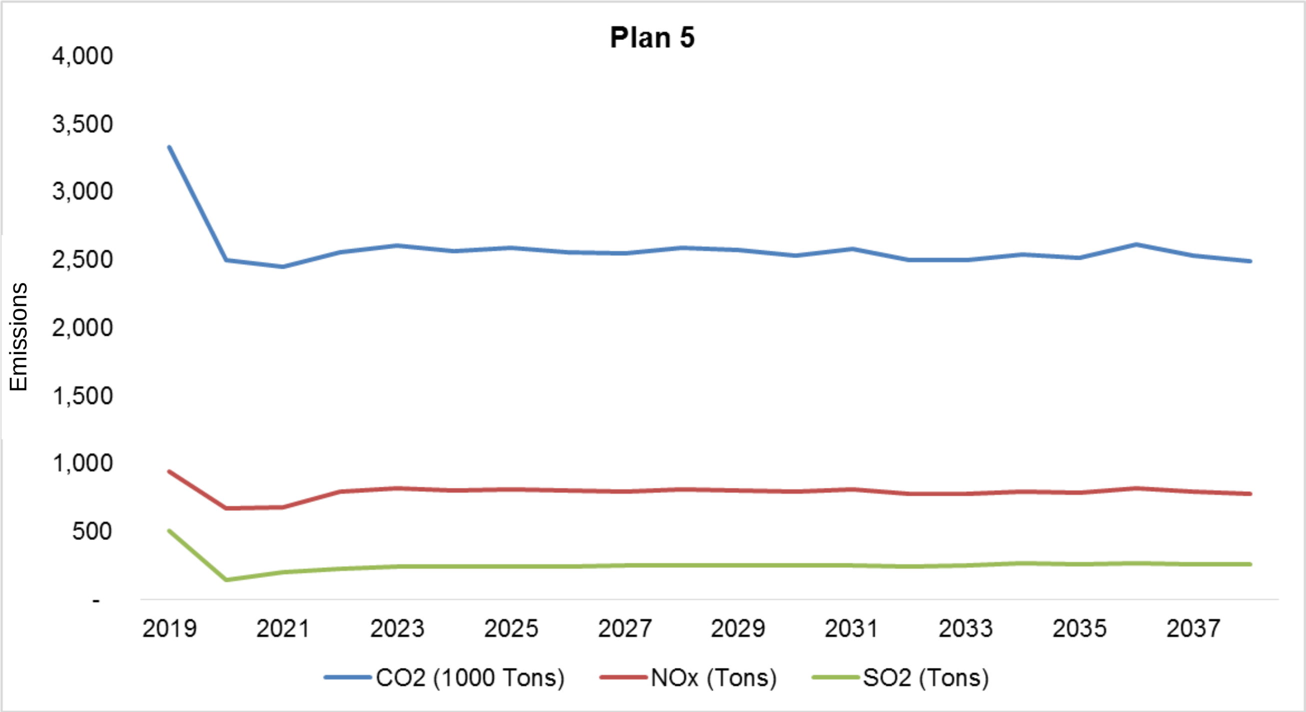


Figure 6-55 - Annual Emissions of Plan 5



NP

Figure 6-56 - Annual Emissions of Plan 6

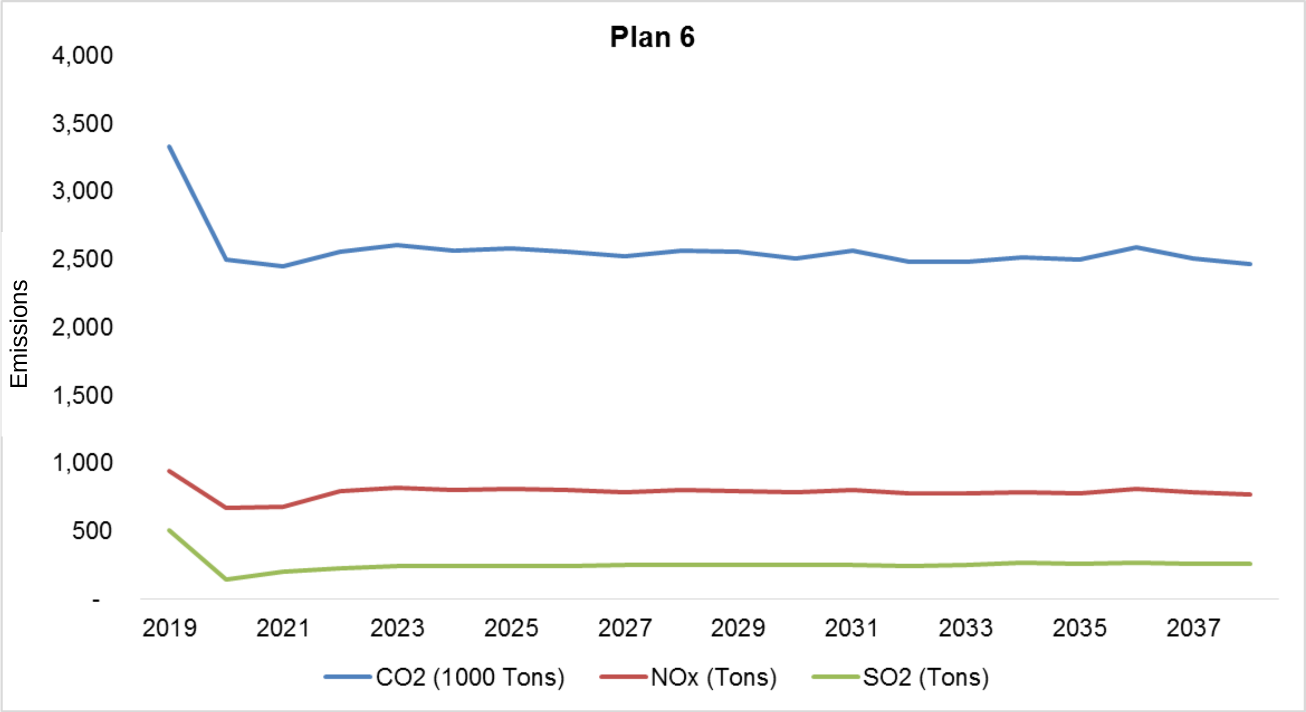


Figure 6-57 - Annual Emissions of Plan 7

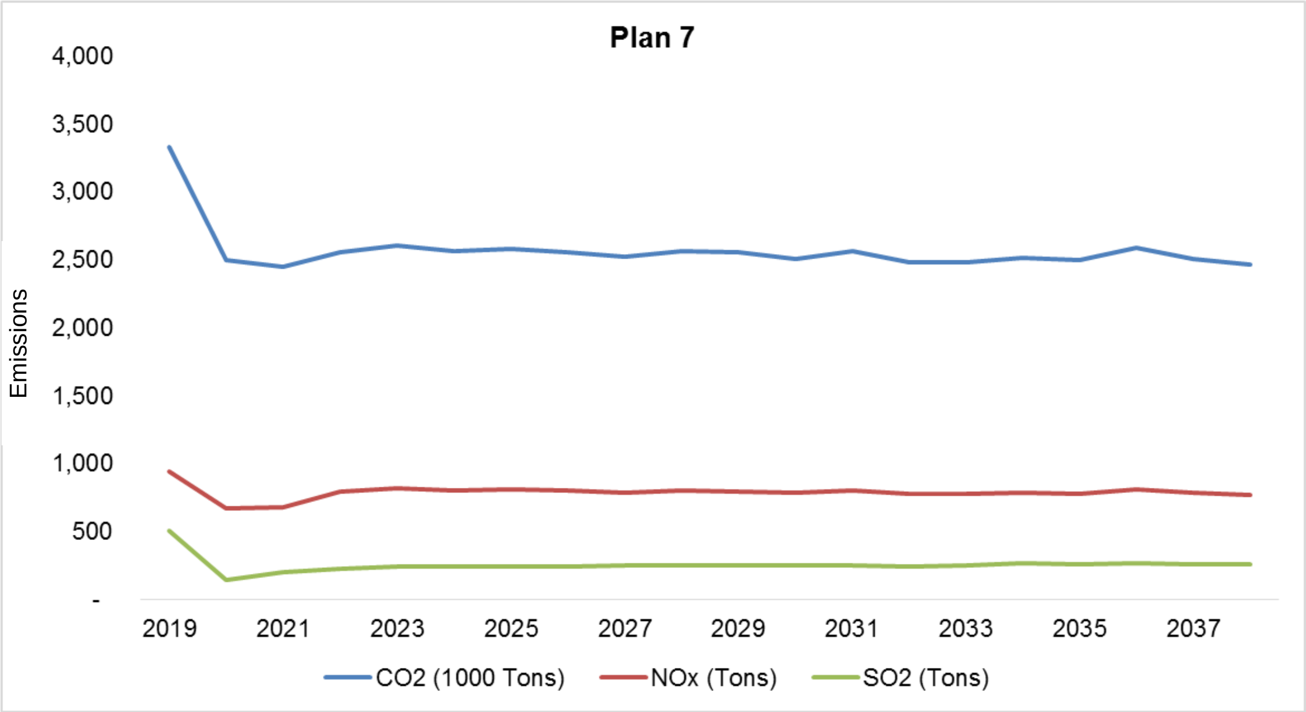


Figure 6-58 - Annual Emissions of Plan 8

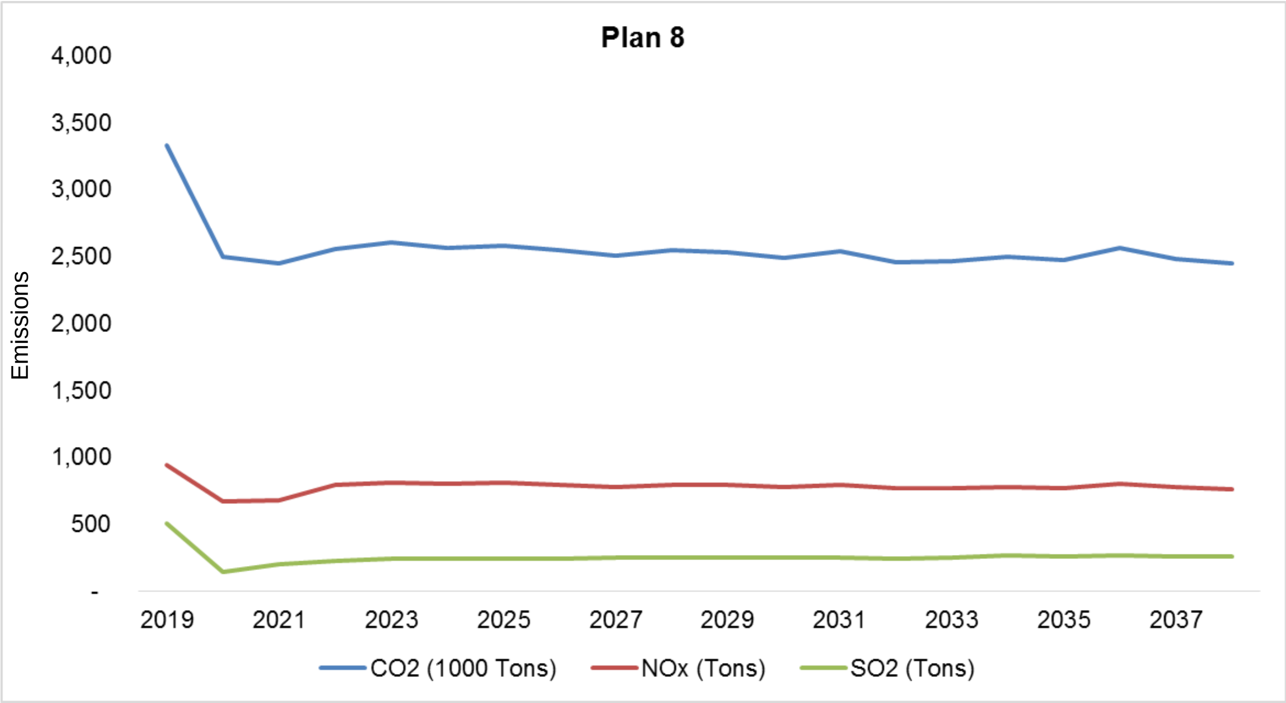


Figure 6-59 - Annual Emissions of Plan 9

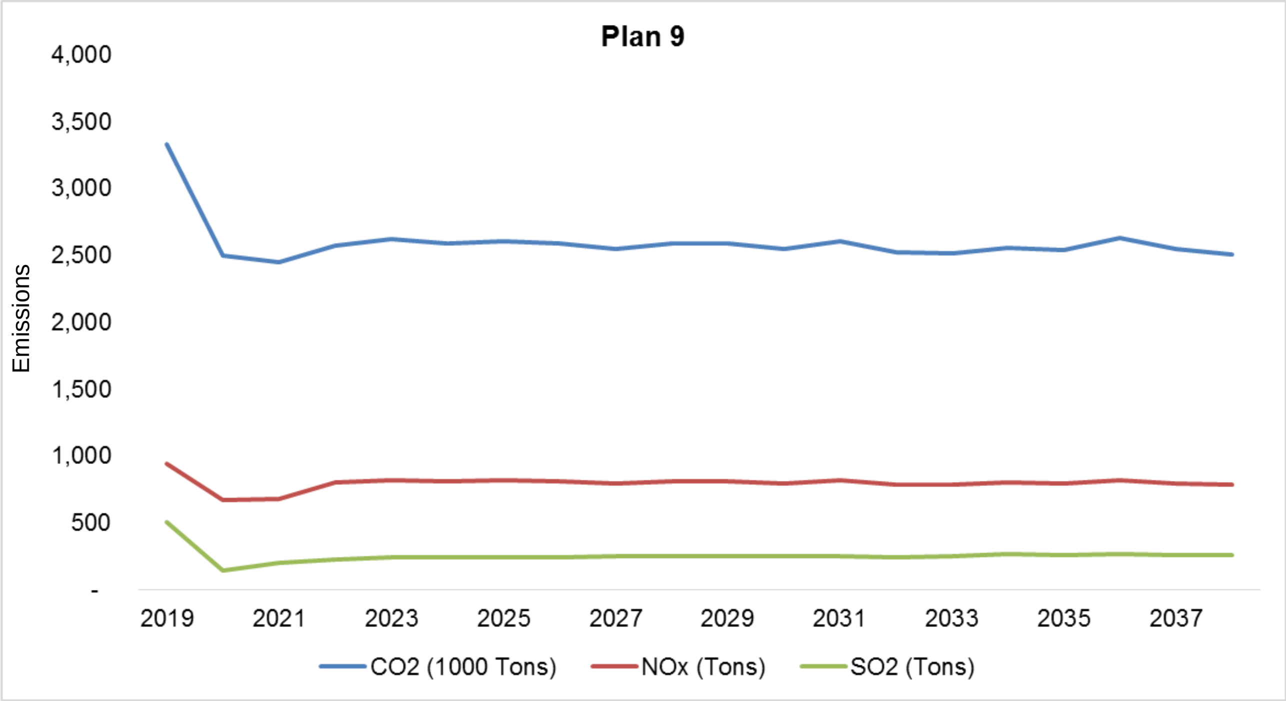


Figure 6-60 - Annual Emissions of Plan 10

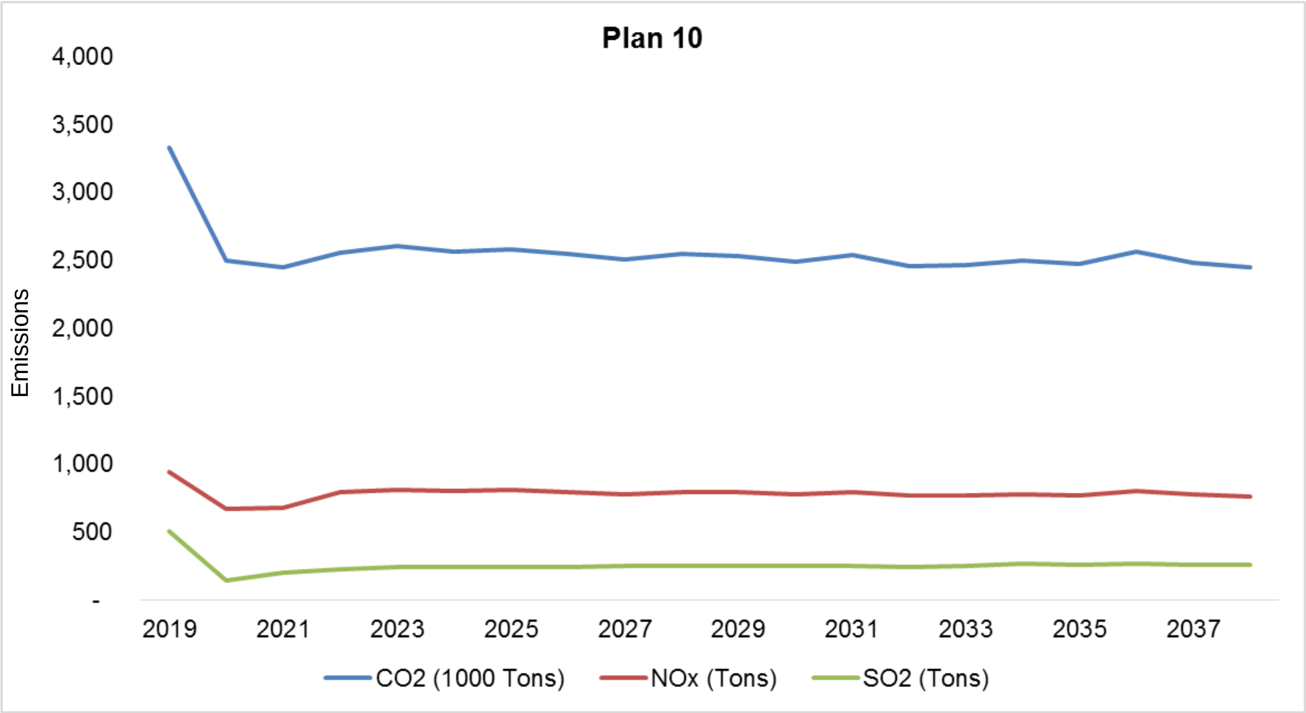


Figure 6-61 - Annual Emissions of Plan 11

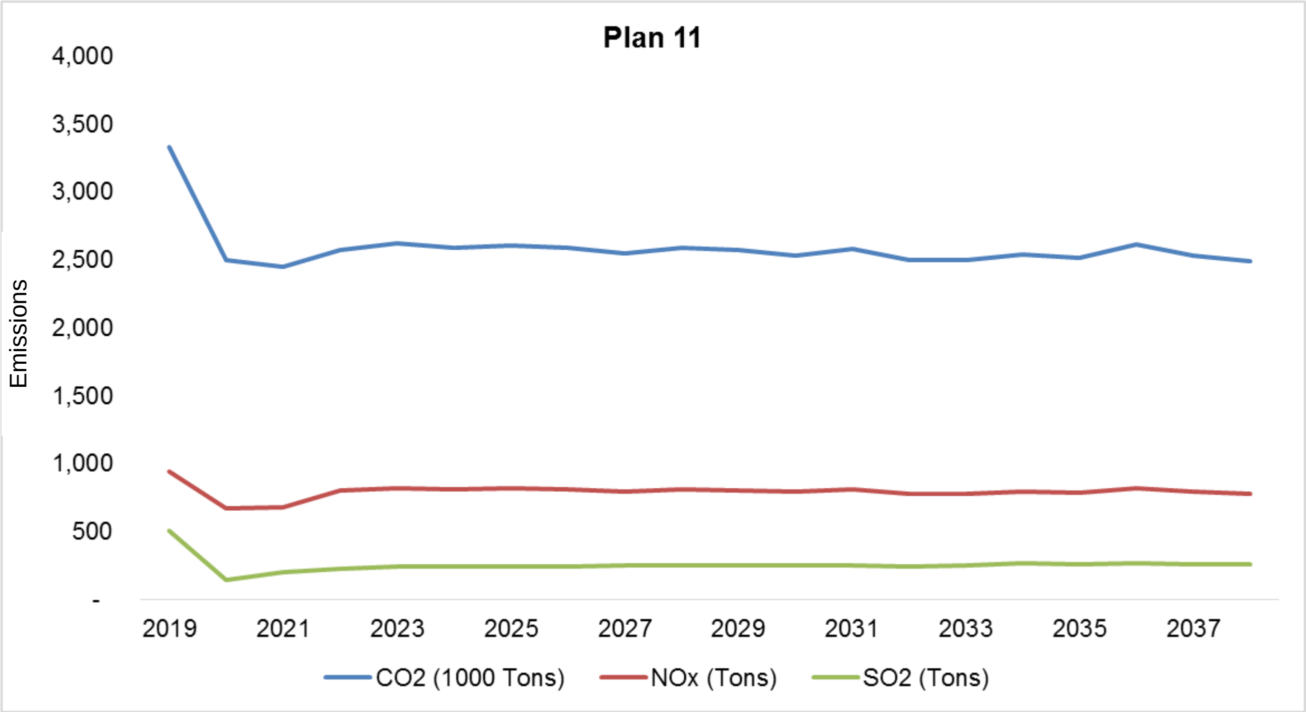


Figure 6-62 - Annual Emissions of Plan 12

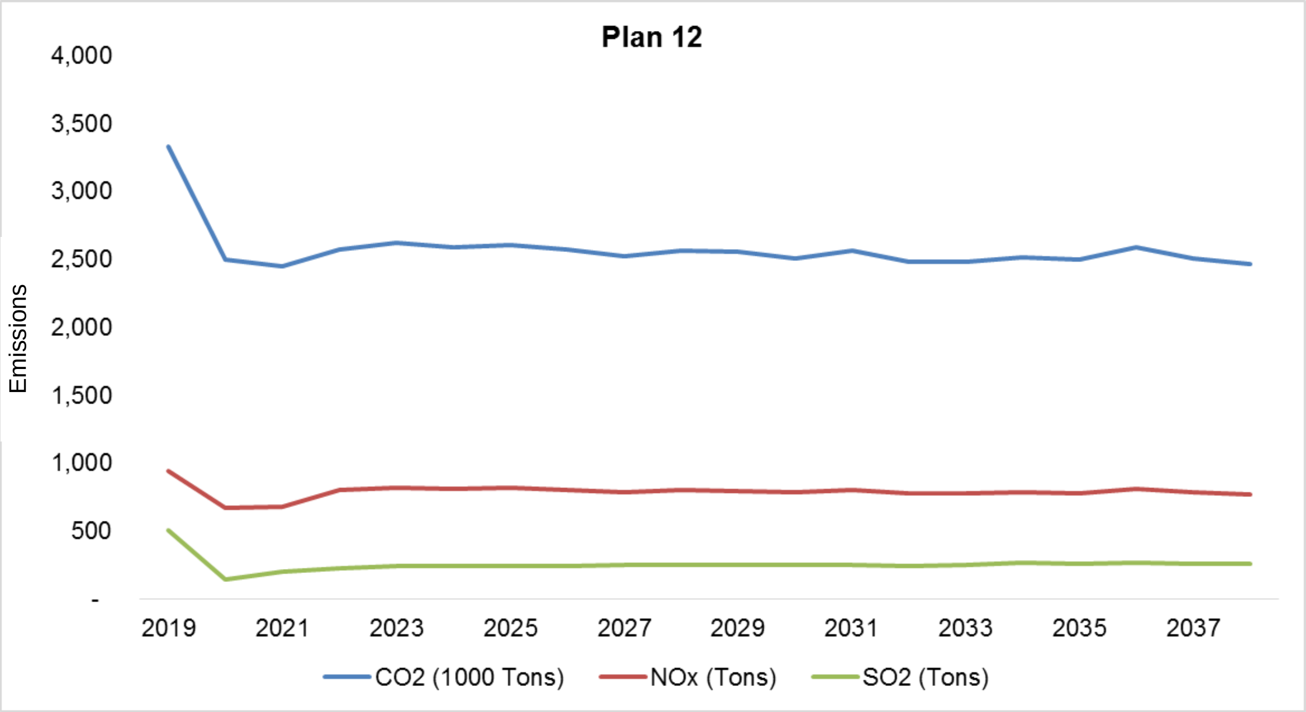
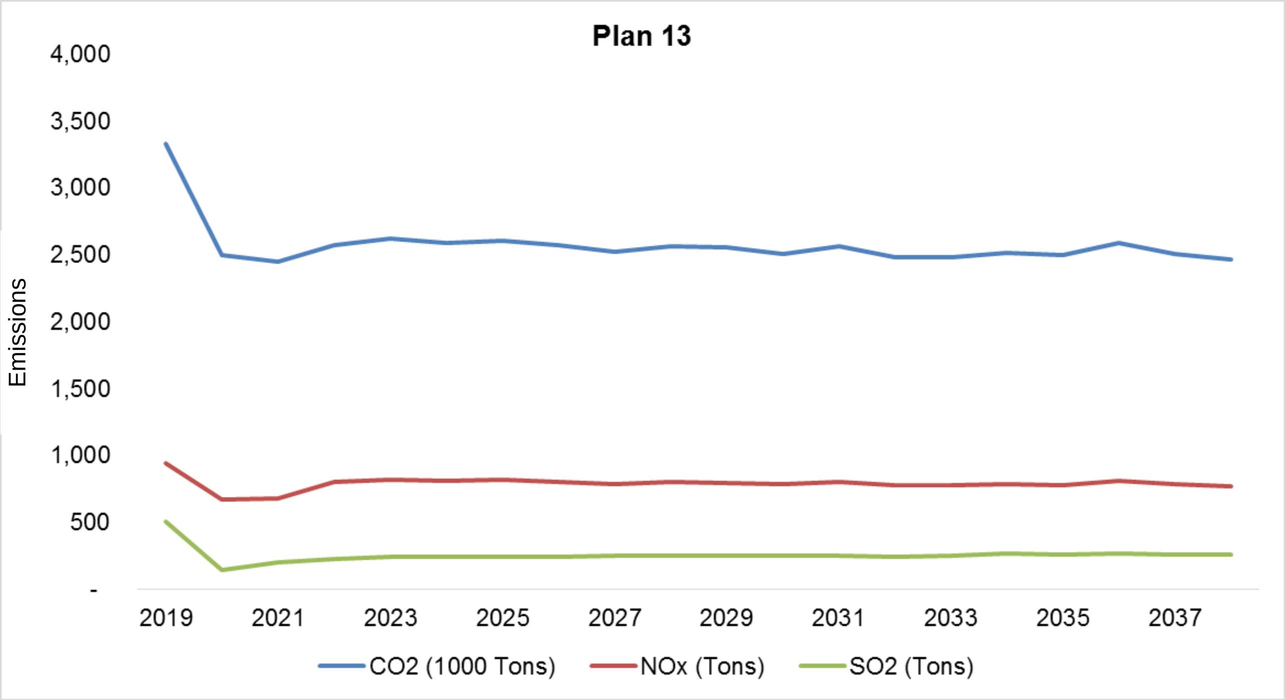


Figure 6-63 - Annual Emissions of Plan 13

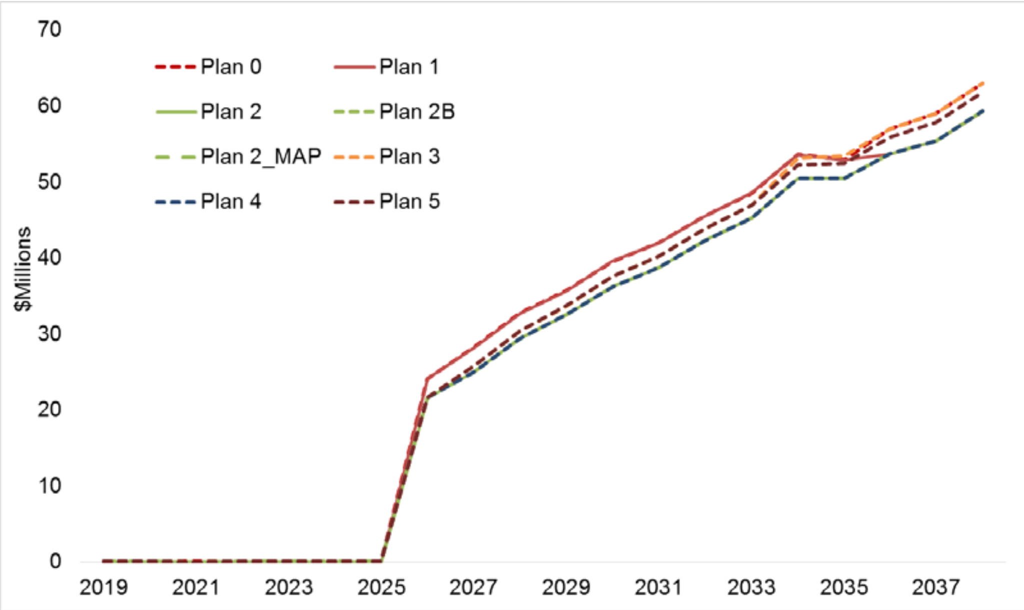


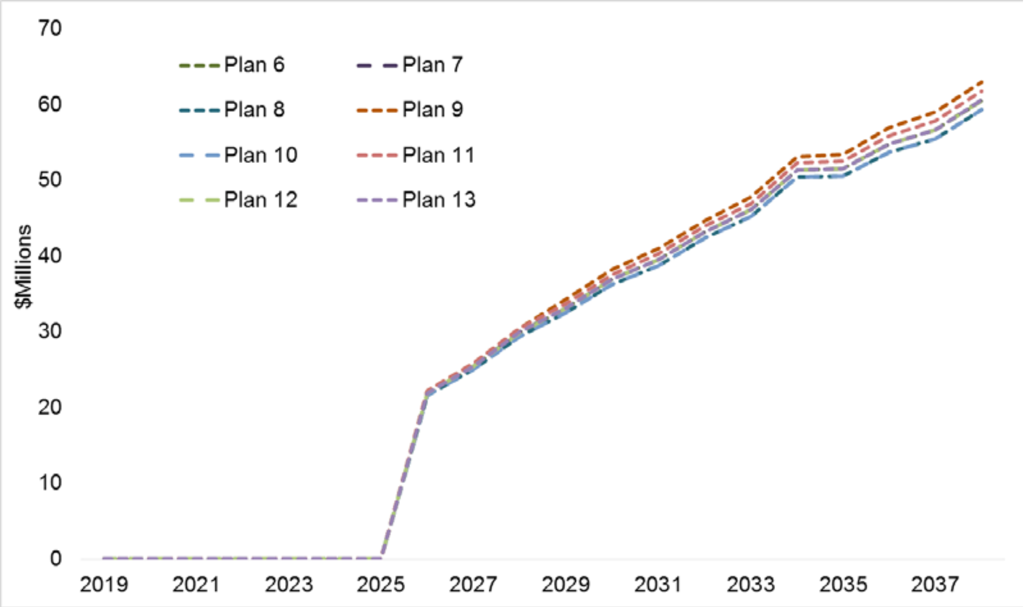
4.2.8 Annual Probable Environmental Cost for Each Plan

8. Annual probable environmental costs; and

The total annual probable environmental costs for each alternative resource plan are shown in Figure 6-64.

Figure 6-64 - Annual Probable Environmental Costs for Each Alternative Resource Plan





4.2.9 Forecast of Capacity Balance Tables

9. Public and highly-confidential forms of the capacity balance spreadsheets completed in the specified format;

(C) The analysis of economic impact of alternative resource plans, calculated with and without utility financial incentives for demand-side resources, shall provide comparative estimates for each year of the planning horizon—

The capacity balance forecast for each alternative resource plan for both summer and winter are provided in Table 6-12 through Table 6-43.

Table 6-12 – Summer Forecast of Capacity Balance for Plan 0
****Confidential In Its Entirety**[10]**

[redacted]

[10]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-13 – Winter Forecast of Capacity Balance for Plan 0
****Confidential In Its Entirety**[11]**

[redacted]

[11] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-14 – Summer Forecast of Capacity Balance for Plan 1
****Confidential In Its Entirety**[12]**

[redacted]

[12] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-15 – Winter Forecast of Capacity Balance for Plan 1
****Confidential In Its Entirety**[13]**

[redacted]

[13] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-16 – Summer Forecast of Capacity Balance for Plan 2
****Confidential In Its Entirety**[14]**

[redacted]

[14]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-17 – Winter Forecast of Capacity Balance for Plan 2
****Confidential In Its Entirety**[15]**

[redacted]

[15] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-18 – Summer Forecast of Capacity Balance for Plan 2B
Confidential In Its Entirety[16]

[redacted]

[16] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-19 – Winter Forecast of Capacity Balance for Plan 2B
****Confidential In Its Entirety**[17]**

[redacted]

[17] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-20 – Summer Forecast of Capacity Balance for Plan 2 – MAP
****Confidential In Its Entirety**[18]**

[redacted]

[18] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-21 – Winter Forecast of Capacity Balance for Plan 2 – MAP

Confidential In Its Entirety[19]

[redacted]

[19] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-22 – Summer Forecast of Capacity Balance for Plan 3
Confidential In Its Entirety[20]

[redacted]

[20] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-23 – Winter Forecast of Capacity Balance for Plan 3
****Confidential In Its Entirety**[21]**

[redacted]

[21] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-24 – Summer Forecast of Capacity Balance for Plan 4
Confidential In Its Entirety[22]

[redacted]

[22] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-25 – Winter Forecast of Capacity Balance for Plan 4
****Confidential In Its Entirety**[23]**

[redacted]

[23] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-26 – Summer Forecast of Capacity Balance for Plan 5
****Confidential In Its Entirety**[24]**

[redacted]

[24] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-27 – Winter Forecast of Capacity Balance for Plan 5
****Confidential In Its Entirety****[25]

[redacted]

[25] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-28 – Summer Forecast of Capacity Balance for Plan 6
****Confidential In Its Entirety**[26]**

[redacted]

[26] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-29 – Winter Forecast of Capacity Balance for Plan 6
****Confidential In Its Entirety**[27]**

[redacted]

[27]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-30 - Summer Forecast of Capacity Balance for Plan 7

Confidential In Its Entirety[28]

[redacted]

[28] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-31 – Summer Forecast of Capacity Balance for Plan 7
****Confidential In Its Entirety** [29]**

[redacted]

[29] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-32 - Summer Forecast of Capacity Balance for Plan 8
****Confidential In Its Entirety****[30]

[redacted]

[30]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-33 – Winter Forecast of Capacity Balance for Plan 8
****Confidential In Its Entirety**[31]**

[redacted]

[31] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-34 – Summer Forecast of Capacity Balance for Plan 9
****Confidential In Its Entirety**[32]**

[redacted]

[32] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-35 – Winter Forecast of Capacity Balance for Plan 9
****Confidential In Its Entirety**[33]**

[redacted]

[33]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-36 – Summer Forecast of Capacity Balance for Plan 10
Confidential In Its Entirety[34]

[redacted]

[34]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-37 – Winter Forecast of Capacity Balance for Plan 10

****Confidential In Its Entirety**[35]**

[redacted]

[35] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-38 – Summer Forecast of Capacity Balance for Plan 11
****Confidential In Its Entirety**[36]**

[redacted]

[36]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-39 – Winter Forecast of Capacity Balance for Plan 11
Confidential In Its Entirety[37]

[redacted]

[37]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-40 – Summer Forecast of Capacity Balance for Plan 12

Confidential In Its Entirety[38]

[redacted]

[38] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-41 – Winter Forecast of Capacity Balance for Plan 12
****Confidential In Its Entirety**[39]**

[redacted]

[39] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-42 – Summer Forecast of Capacity Balance for Plan 13
****Confidential In Its Entirety**[40]**

[redacted]

[40]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-43 – Winter Forecast of Capacity Balance for Plan 13
****Confidential In Its Entirety**[41]**

[redacted]

[41] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Economic Impact of Alternative Resource Plans

1. For the following performance measures for each year:

A. Estimated annual revenue requirement;

B. Estimated annual average rates and percentage increase in the average rate from the prior year; and

C. Estimated company financial ratios and credit metrics; and

Table 6-44 through Table 6-59 provide summaries of the performance of each alternative resource plan.

4.2.10 Performance Measure Results for Each Plan

Table 6-44 through Table 6-59 provide the performance measures of each alternative resource plan.

Table 6-44 - Plan 0 Performance
****Confidential in its Entirety**[42]**

[redacted]

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[42] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-45 - Plan 1 Performance
****Confidential in its Entirety**[43]**

[redacted]

[43] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-46 - Plan 2 Performance
****Confidential in its Entirety**[44]**

[redacted]

[44] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-47 - Plan 2B Performance
****Confidential in its Entirety**[45]**

[redacted]

Table 6-48 - Plan 2 – MAP Performance
****Confidential in its Entirety**[45]**

[redacted]

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[45] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-49 - Plan 3 Performance
****Confidential in its Entirety**[46]**

[redacted]

[46] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

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Table 6-50 - Plan 4 Performance
****Confidential in its Entirety** [47]**

[redacted]

Table 6-51 - Plan 5 Performance
****Confidential in its Entirety**[47]**

[redacted]

[47] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-52 - Plan 6 Performance
****Confidential in its Entirety**[48]**

[redacted]

Table 6-53 - Plan 7 Performance
****Confidential in its Entirety**[48]**

[redacted]

[48] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-54 - Plan 8 Performance
****Confidential in its Entirety**[49]**

[redacted]

Table 6-55 - Plan 9 Performance
****Confidential in its Entirety**[49]**

[redacted]

[49]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

NP

Table 6-56 - Plan 10 Performance
****Confidential in its Entirety**[50]**

[redacted]

Table 6-57 - Plan 11 Performance
****Confidential in its Entirety**[50]**

[redacted]

[50]4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-58 - Plan 12 Performance
****Confidential in its Entirety**[51]**

[redacted]

Table 6-59 - Plan 13 Performance
****Confidential in its Entirety**[51]**

[redacted]

[51] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

2. If the estimated company financial ratios in subparagraph (4)(C)1.C. 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 in subparagraphs (4)(C)1.A.-(4)(C)1.C. of the alternative resource plans that are associated with the necessary changes in legal mandates and cost recovery mechanisms.

Liberty-Empire does not anticipate below investment grade financial ratios based on the alternative plans presented.

4.2.11 Rate Change Modeling Methodology

(D) A discussion of how the impacts of rate changes on future electric loads were modeled and how the appropriate estimates of price elasticity were obtained;

A residential customer class price elasticity of -0.1 and a commercial customer class price elasticity of -0.15 were incorporated into the load forecast (addressed in Volume 3), which became the basis for all alternative plans.

4.2.12 Incremental Costs of Increasing Renewable Resources

(E) A discussion of the incremental costs of implementing more renewable energy resources than required to comply with renewable energy legal mandates;

Many of the alternative resource plans build renewable energy resources above what is required for Liberty-Empire to meet the Missouri RES standard. As demonstrated in its Customer Savings Plan, Liberty-Empire has found that adding low-cost wind to its portfolio provides significant cost savings for customers. Additionally, as demonstrated by the results of the alternative resource plan analysis, plans that add utility scale and distributed solar are lower-cost than plans that do not.

4.2.13 Incremental Costs of Increased DSM

(F) A discussion of the incremental costs of implementing more energy efficiency resources than required to comply with energy efficiency legal mandates;

There are no legal mandates at this time, of which Liberty-Empire is aware, that require Liberty-Empire to implement more energy efficiency or demand-side resources. As demonstrated in its alternative resource plan analysis, however, Liberty-Empire has found that adding some level of RAP DSM ("low" and "mid" bundle) is cost-effective for customers.

4.2.14 Incremental Costs of Implementing Excess Resources

(G) A discussion of the incremental costs of implementing more energy resources than required to comply with any other energy resource legal mandates; and

There are no legal mandates at this time, of which Liberty-Empire is aware, that require Liberty-Empire to implement more energy resources than required as part of this integrated resource plan. As demonstrated in its Customer Savings Plan, however, Liberty-Empire has found that adding additional low-cost wind resources is beneficial for customers and can generate significant cost savings.

4.2.15 IRP Analysis Software

(H) A description of the computer models used in the analysis of alternative resource plans.

The IRP used a combination of modeling tools to perform analysis of the energy markets, including SPP, and of Liberty-Empire's alternative resource plans. These models included:

- ABB's integrated energy market models, including PROMOD, which develop natural gas, coal, and electric power prices;

- CRA's suite of resource planning models, which perform dispatch analysis, portfolio cost analysis, and financial revenue requirement projections.

A description of these models follows.

ABB Market Models

Liberty-Empire relied on ABB's market models to develop inputs for natural gas, coal, and SPP power prices. ABB's models perform detailed, fundamental, "bottom-up" simulations of the energy markets, with analysis of the SPP power market most relevant to Liberty-Empire's IRP. Based on its proprietary PROMOD software, ABB simulates the operation of each region of North America.

PROMOD is recognized in the industry for its flexibility and breadth of technical capability, incorporating extensive details in generating unit operating characteristics and constraints, transmission constraints, generation analysis, unit commitment/operating conditions, and market system operations. The PROMOD model considers:

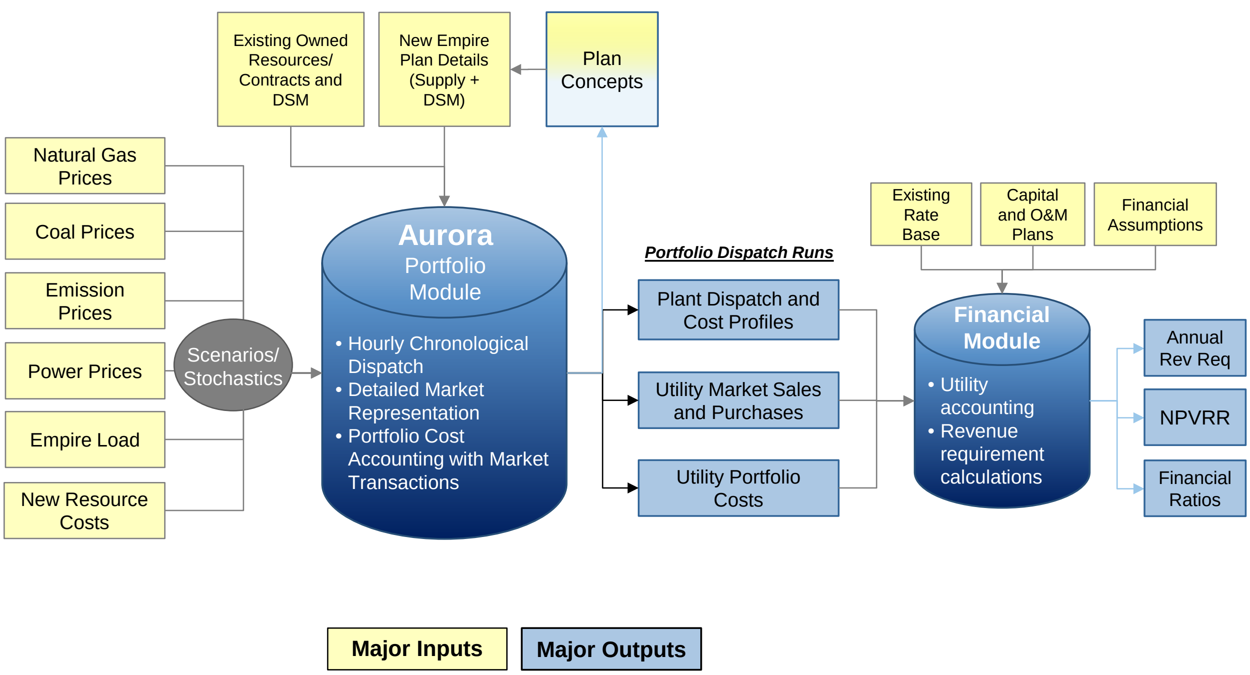
- Individual power plant characteristics, including heat rates, start-up costs, ramp rates, and other technical characteristics of plants;
- Transmission line interconnections, ratings, losses, and wheeling rates;
- Forecasts of resource additions and fuel costs over time;
- Forecasts of loads for each utility or load serving entity in the region; and
- The cost and availability of fuels that supply the plants.

The heart of PROMOD is an hourly chronological dispatch algorithm that minimizes costs (or bids) while simultaneously adhering to a wide variety of operating constraints, including generating unit characteristics, transmission limits, and customer demand. PROMOD performs an 8760-hour commitment and dispatch recognizing these constraints. PROMOD forecasts hourly energy prices, unit generation, revenues and fuel consumption, and transmission flows. For this IRP, market prices from the Fall 2018 Midwest Reference Case were used.

CRA Resource Planning Models

CRA's resource planning models include a combination of licensed and proprietary tools that evaluate portfolio options and calculate unit-specific generation and cost profiles, market purchases and sales in the SPP market, aggregate Liberty-Empire portfolio costs, and revenue requirements. An overview of the modeling process is provided in Figure 6-65, with additional detail on each component provided below.

Figure 6-65 – CRA Resource Planning Model Overview



CRA's resource planning tools comprise:

- The Aurora portfolio tool, which performs portfolio optimization and portfolio cost accounting, and

- CRA's proprietary financial module, which performs utility accounting and revenue requirement calculations.

Aurora

The Aurora[2] model was used in Liberty-Empire's IRP to develop and evaluate alternative resource plans. In both the development and evaluation process, Aurora requires inputs for key assumptions and drivers of the resource portfolio decision. As shown above in Figure 6-65, these inputs include natural gas prices, coal prices, emission prices, power prices, Liberty-Empire's load growth forecasts, and costs for new resource parameters, as described in detail in Volume 040. The model also requires information regarding Liberty-Empire's existing portfolio resources and contracts, such as capacity, operational characteristics, and costs.

After defining all of these input assumptions, portfolio optimization analysis was conducted with the Aurora model's portfolio optimization tool to develop least-cost portfolio concepts under a variety of themes and constraints. Themes defined which resource options were available, and constraints were included for minimum and maximum reserve margin and block size for candidate resources. Both supply-side and demand-side resources were evaluated in the portfolio optimization framework. The portfolio optimization algorithm in Aurora seeks to minimize the present value of revenue requirements through selection of candidate resource options to develop plans.

After the specific portfolio plans were constructed, each plan was evaluated through a full chronologic dispatch analysis for the base case and all stochastic input combinations in Aurora's portfolio module. This exercise performs an hourly, chronological dispatch of Liberty-Empire's portfolio within the SPP power market, accounting for all variable costs of operation, all contracts or PPAs, and all economic purchases and sales with the surrounding market. Aurora produces

[2] The Aurora model is licensed by Energy Exemplar. For more information, please see https://www.energyexemplar.com/

projections of asset-level dispatch and the total variable costs associated with serving load. It also produces estimates for other key metrics, such as carbon dioxide emissions over time and capacity and generation by fuel type, as summarized earlier in this volume.

Financial Module

The Aurora output is used by CRA's proprietary financial module to build a full annual revenue requirement, inclusive of capital investments, fixed operating and maintenance costs, and financial accounting of depreciation, taxes, and utility return on investment. The model requires a series of inputs, including book and tax values for existing generation assets, depreciation schedules, fixed operations and maintenance costs and major maintenance capital expenditures, debt and equity costs, tax rates, and a discount rate. The model produces annual and present value estimates of revenue requirements. The full set of portfolio modeling is undertaken for all portfolio options for the base case and all stochastic input combinations.

Additional Models

Due to the importance of additional revenue streams associated with storage resources (see Volume 040 for a discussion on storage resource value), Liberty-Empire also used CRA's Energy Storage Operations ("ESOP") model to evaluate real-time energy and ancillary services value for storage resources prior to inclusion in the portfolio optimization analysis. ESOP considers the operation of storage assets at five-minute granularity. Based on exogenously-specified energy and ancillary services prices, the model optimizes the dispatch of the storage resource to maximize revenue while taking into account detailed operational constraints such as efficiency, battery life cycle, maximum charge/discharge ratings, and storage capacity.

(5) The utility shall describe and document its selection of the uncertain factors that are critical to the performance of the alternative resource plans. The utility shall consider at least the following uncertain factors:

(A) The range of future load growth represented by the low-case and high-case load forecasts;

(B) Future interest rate levels and other credit market conditions that can affect the utility's cost of capital and access to capital;

(C) Future changes in legal mandates; (D) Relative real fuel prices;

(E) Siting and permitting costs and schedules for new generation and generation-related transmission facilities for the utility, for a regional transmission organization, and/or other transmission systems;

(F) Construction costs and schedules for new generation and generation-related transmission facilities for the utility, for a regional transmission organization, and/or other transmission systems;

(G) Purchased power availability, terms, cost, optionality, and other benefits;

(H) Price of emission allowances, including at a minimum sulfur dioxide, carbon dioxide, and nitrogen oxides;

(I) Fixed operation and maintenance costs for new and existing generation facilities;

(J) Equivalent or full- and partial-forced outage rates for new and existing generation facilities;

(K) Future load impacts of demand-side programs and demand-side rates;

(L) Utility marketing and delivery costs for demand-side programs and demand-side rates; and

(M) Any other uncertain factors that the utility determines may be critical to the performance of alternative resource plans.

Liberty-Empire compiled information concerning the uncertain factors listed in the rule from subject matter experts within the company and from its consultants. The base and variations above and below the base for each (e.g., low, mid, high) were also assigned a subjective probability by the subject matter experts. Some of the uncertain factors recommended in

Chapter 22 can also be grouped into a single uncertain factor for the purpose of this analysis. Table 6-60 contains the list of uncertain factors developed by Liberty-Empire and how they were grouped into single uncertain factors to facilitate the analysis.

Table 6-60 - Uncertain Factors

Uncertain Factor	Uncertain Factor Groupings
Load Growth	Load
Interest Rates Levels	Capital / Interest / Transmission
Siting and Permitting Costs for New Generation	Capital / Interest / Transmission
Construction Costs for New Generation	Capital / Interest / Transmission
Changes in Legal Mandates	RPS / Other Mandates
Fuel Price Forecasts	Natural Gas Price
Purchased Power Availability and Costs	Natural Gas Price / Carbon Price
Price of Emissions Allowances	Carbon Price
FOM for New and Existing Generation	FOM / Outage Rates
Forced Outage Rates for New and Existing Generation	FOM / Outage Rates
DSM and Demand-Side Rates Impact on Load	DSM
Utility Costs for DSM and Demand Side Rates	DSM

Liberty-Empire inspected the uncertain factors shown in Table 6-60 to determine which constitute the most important. Table 6-61 contains the uncertain factors that Liberty-Empire deemed to be critical. Uncertainty around DSM costs and potential is captured through the analysis for RAP and MAP portfolios during the portfolio optimization process. Liberty-Empire does not believe that any changes in RPS or any other foreseeable legal mandates would affect the alternative resource plans modeled.

Table 6-61 – Critical Uncertain Factors

Variable	Critical?	Comments
Capital / Interest Rates / Transmission	✓	Treated together as one; changes LCOE ordering of technologies
Natural Gas Price	✓	Integrated with consistent power prices; changes LCOE ordering of technologies
Carbon Price	✓	Integrated with consistent power prices; changes LCOE ordering of technologies
Load	✓	Changes capacity need
Asbury FOM / Outage	No	Changes LCOE of Asbury minimally, does not affect LCOE as much as other CUFs
Wind basis congestion	No	Minor LCOE change impact for MO wind options

For more discussion about uncertain factor ranges for natural gas prices, carbon prices, power prices, and capital costs, please see Volume 040 Section 5.

In addition to uncertainty around capital costs, Liberty-Empire combined uncertainty around future interest rates and transmission interconnection costs. For transmission interconnection cost uncertainty, Liberty-Empire assumed that transmission costs would be 50% higher in the high case and 50% lower in the low case. For interest rate uncertainty, Liberty-Empire assumed the following values:

- 4.33% for the base case;
- 3.55% for the low case;
- 8.46% for the high case.

SECTION 6 CRITICAL UNCERTAIN FACTORS ASSESSMENT

(6) The utility shall describe and document its assessment of the impacts and interrelationships of critical uncertain factors on the expected performance of each of the alternative resource plans developed pursuant to 4 CSR 240-22.060(3) and analyze the risks associated with alternative resource plans. This assessment shall explicitly describe and document the probabilities that utility decision-makers assign to each critical uncertain factor.

As provided in the response in Section 5, the uncertain factors determined to impact the expected performance of the alternative resource plans included: load growth, carbon prices, gas prices, power prices, and capital costs/interest rates/transmission costs. As demonstrated in the alternative resource plan analysis, these factors have the greatest potential influence on the resource plans. Thus, these factors were deemed to be the critical uncertain factors.

Market prices were developed for SPP-KSMO with the use of the various gas price forecasts developed by ABB's Power and Fuels Module. Load forecasts were developed by Liberty-Empire and Itron. Capital/transmission/interest costs were combined into a single factor for analysis. Capital cost uncertainty was considered for base, high and low probabilities.

To assess the risk in compliance with the requirements, each uncertain factor was evaluated for its impact on key plan results, illustrated by "tornado diagrams."[3] Tornado diagrams provide an effective means to depict the influence of these driving factors on the PVRR, thereby providing insight into where a risk aversion strategy should be focused. The major driver of PVRR uncertainty for all plans is capital cost uncertainty, followed by environmental cost uncertainty.

Figure 6-66 through Figure 6-81 illustrate the cumulative probability of the influence of critical uncertain factors on each of the alternative resource plans in terms of 20-year PVRR values.

[3] Tornado diagrams are useful for deterministic sensitivity analysis, comparing the relative importance of uncertain variables. Each variable considered is estimated for what the low, base, and high outcomes would be. The sensitive variable is modeled as an uncertain value while all other variables are held at baseline values.

Figure 6-66 – Plan 0 Tornado Diagram ($ millions)

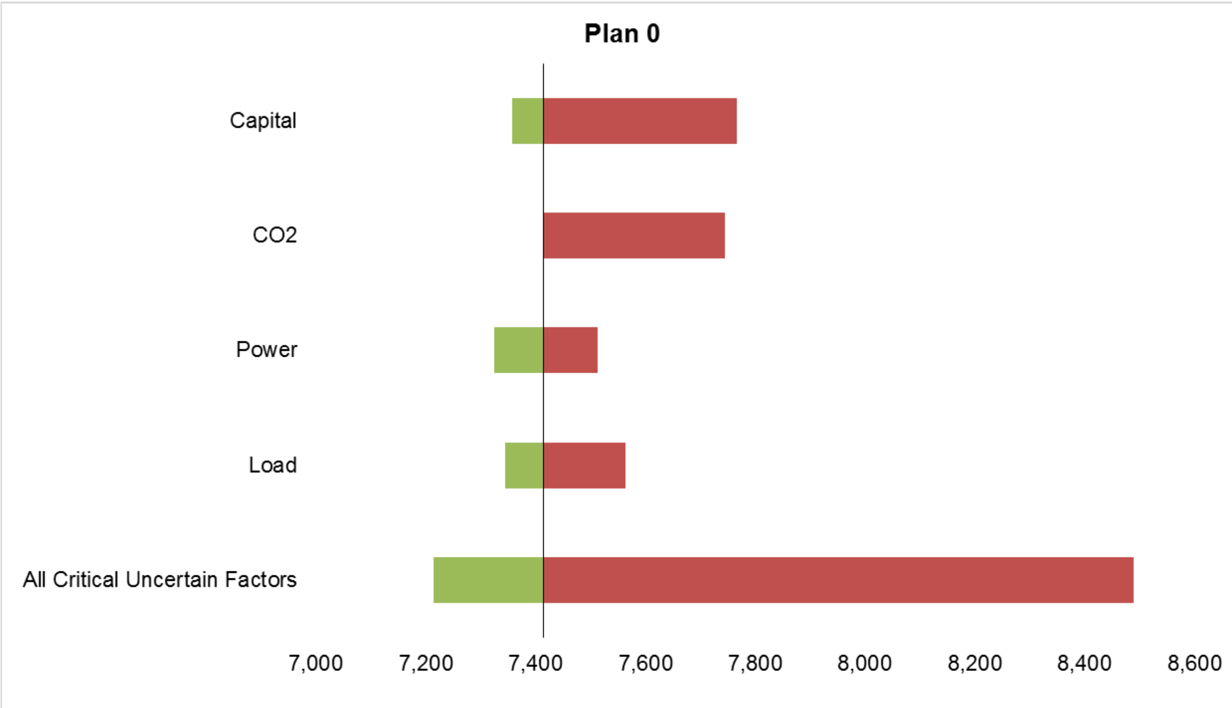


Figure 6-67 - Plan 1 Tornado Diagram ($ millions)

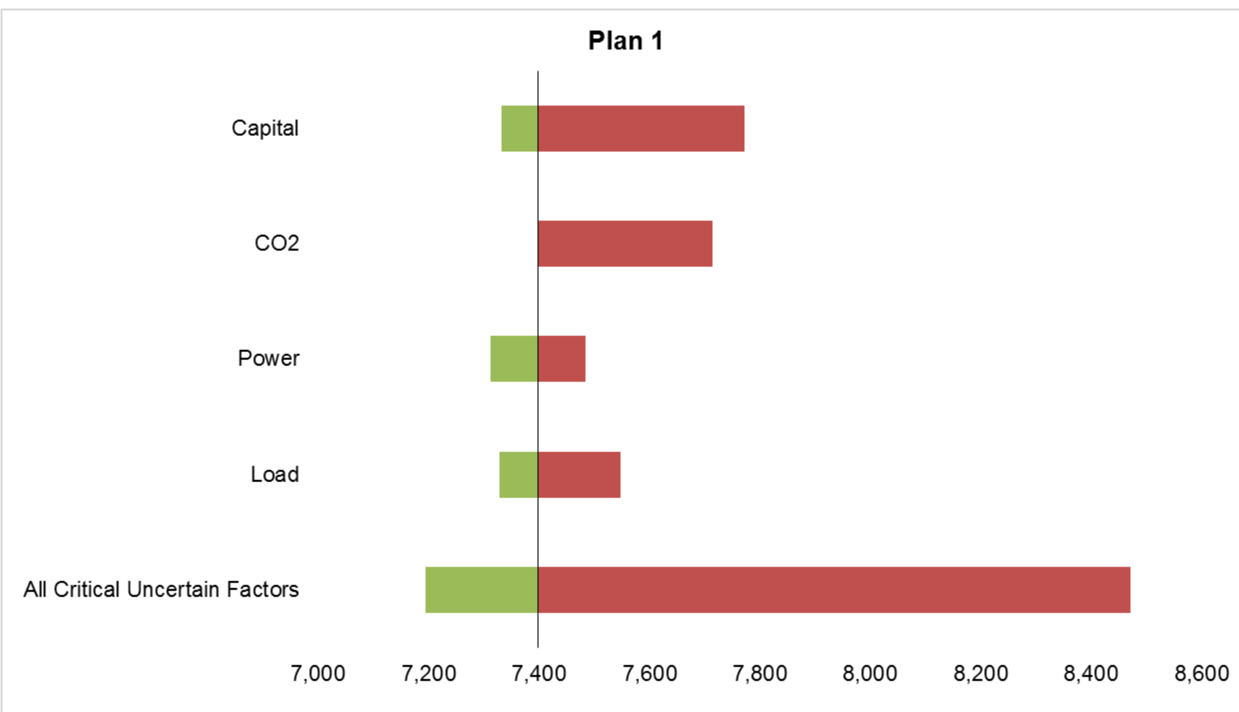


Figure 6-68 - Plan 2 Tornado Diagram ($ millions)

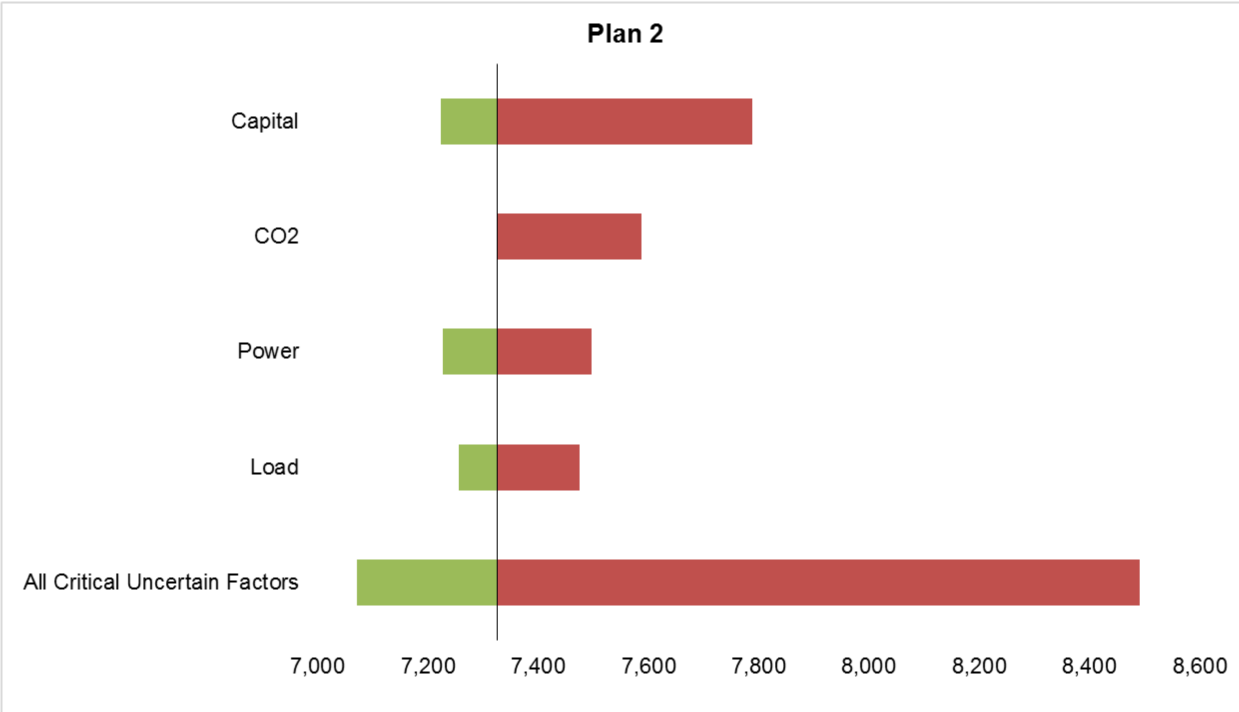


Figure 6-69 - Plan 2B Tornado Diagram ($ millions)

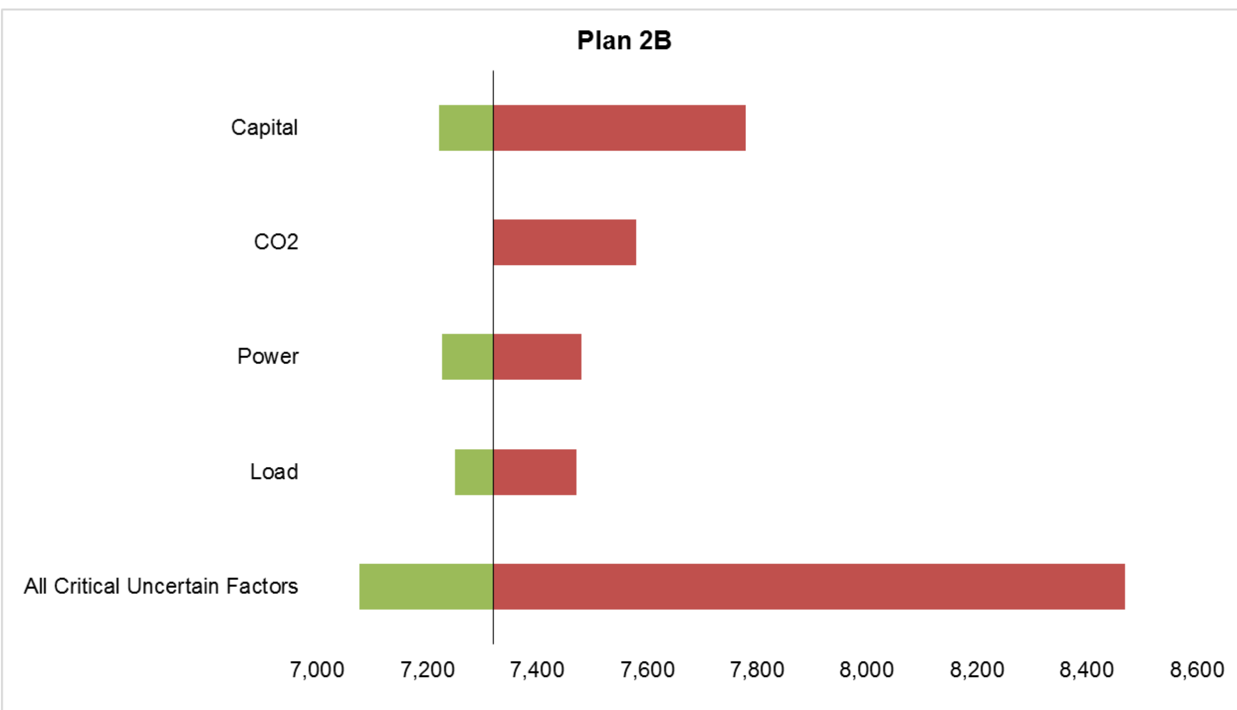


Figure 6-70 - Plan 2 – MAP Tornado Diagram ($ millions)

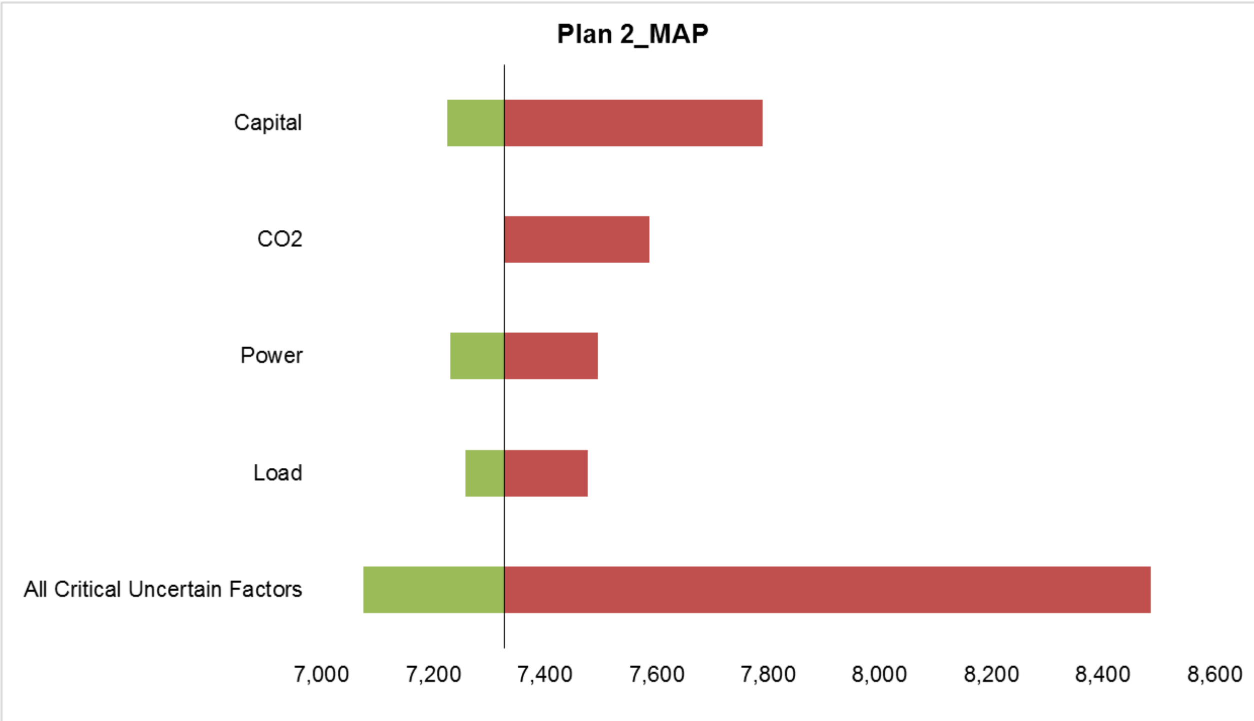


Figure 6-71 - Plan 3 Tornado Diagram ($ millions)

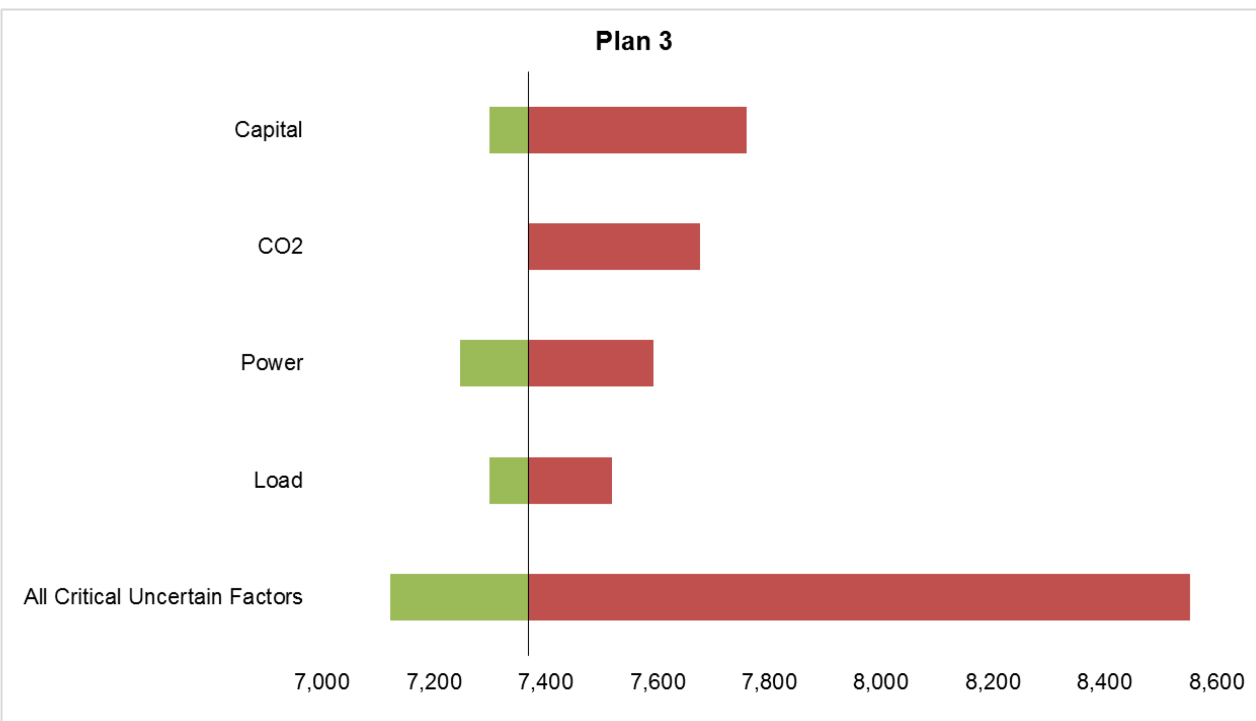


Figure 6-72 - Plan 4 Tornado Diagram ($ millions)

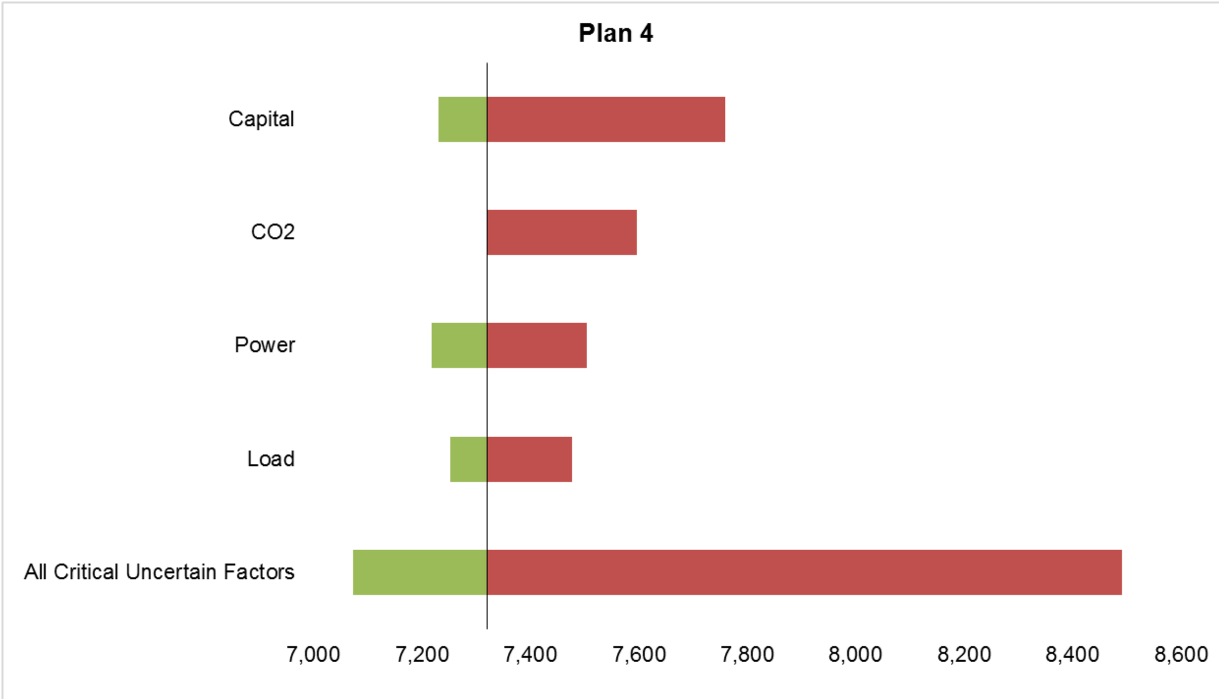


Figure 6-73 - Plan 5 Tornado Diagram ($ millions)

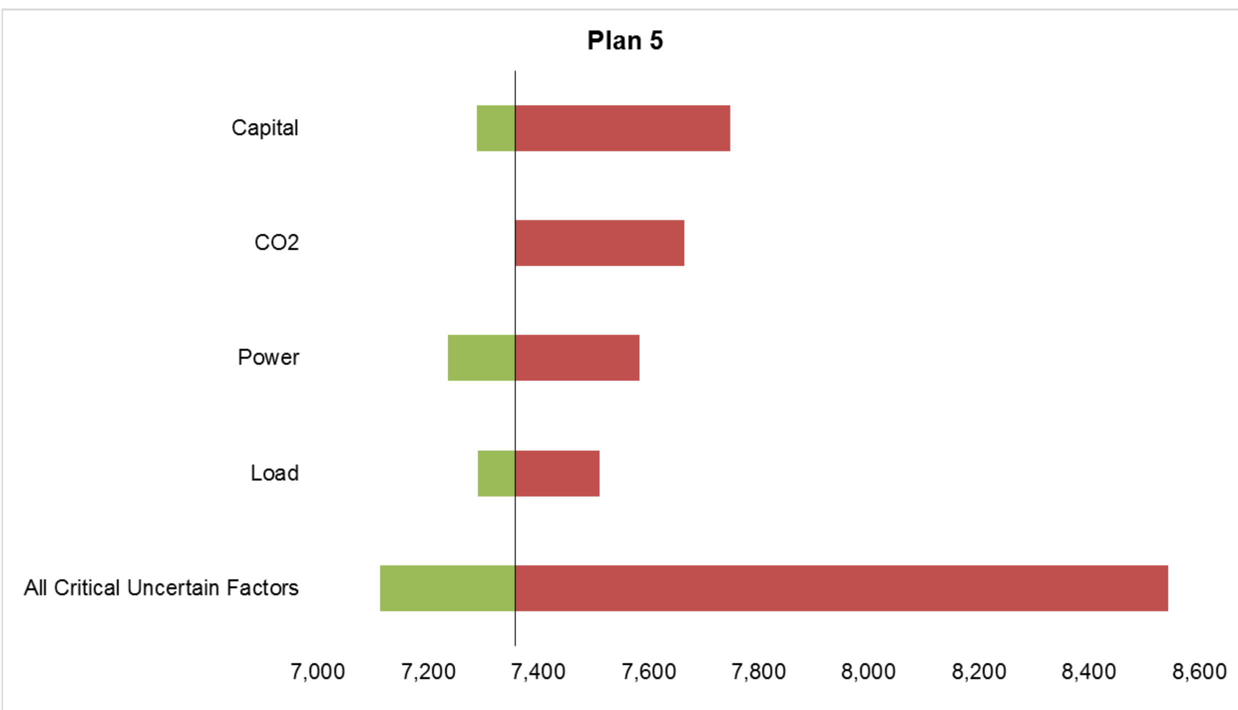


Figure 6-74 - Plan 6 Tornado Diagram ($ millions)

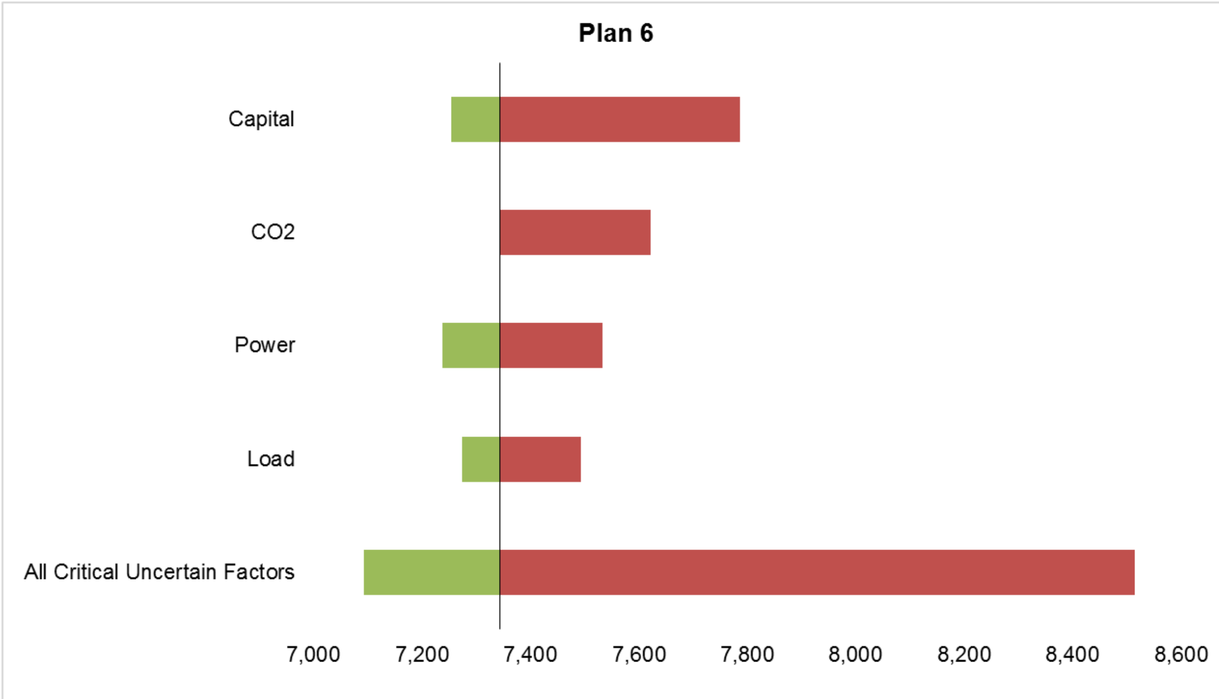


Figure 6-75 - Plan 7 Tornado Diagram ($ millions)

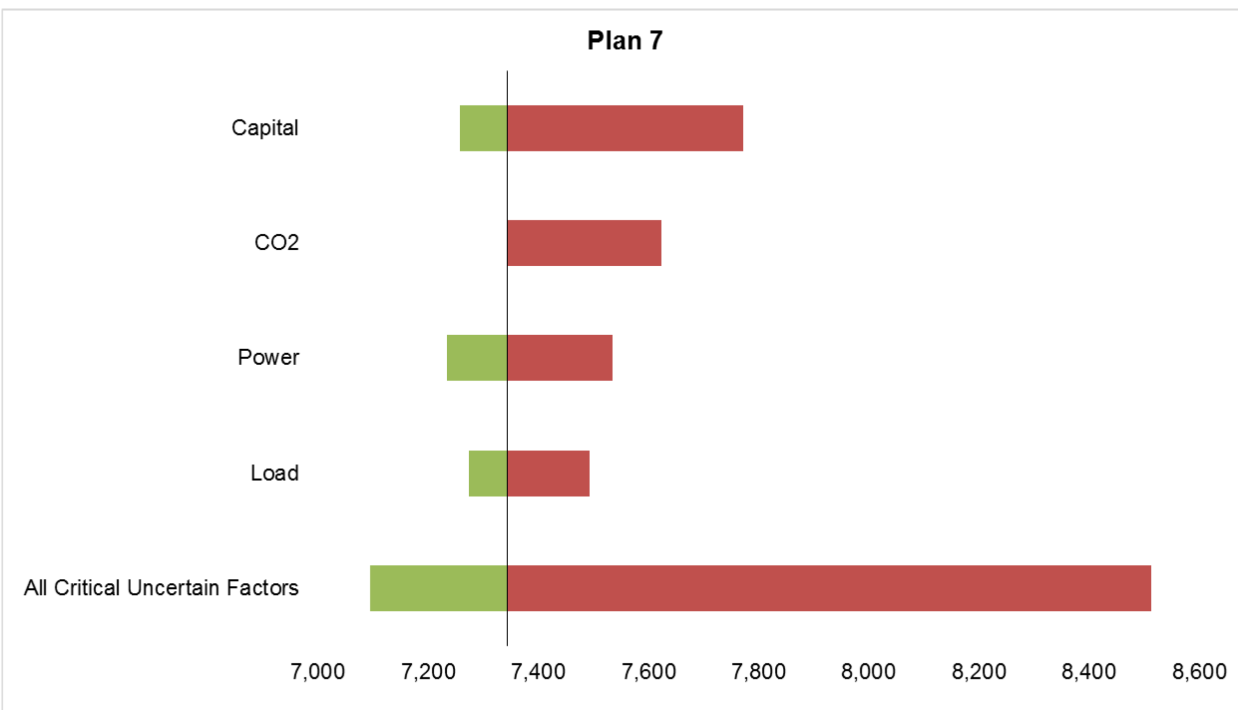


Figure 6-76 - Plan 8 Tornado Diagram ($ millions)

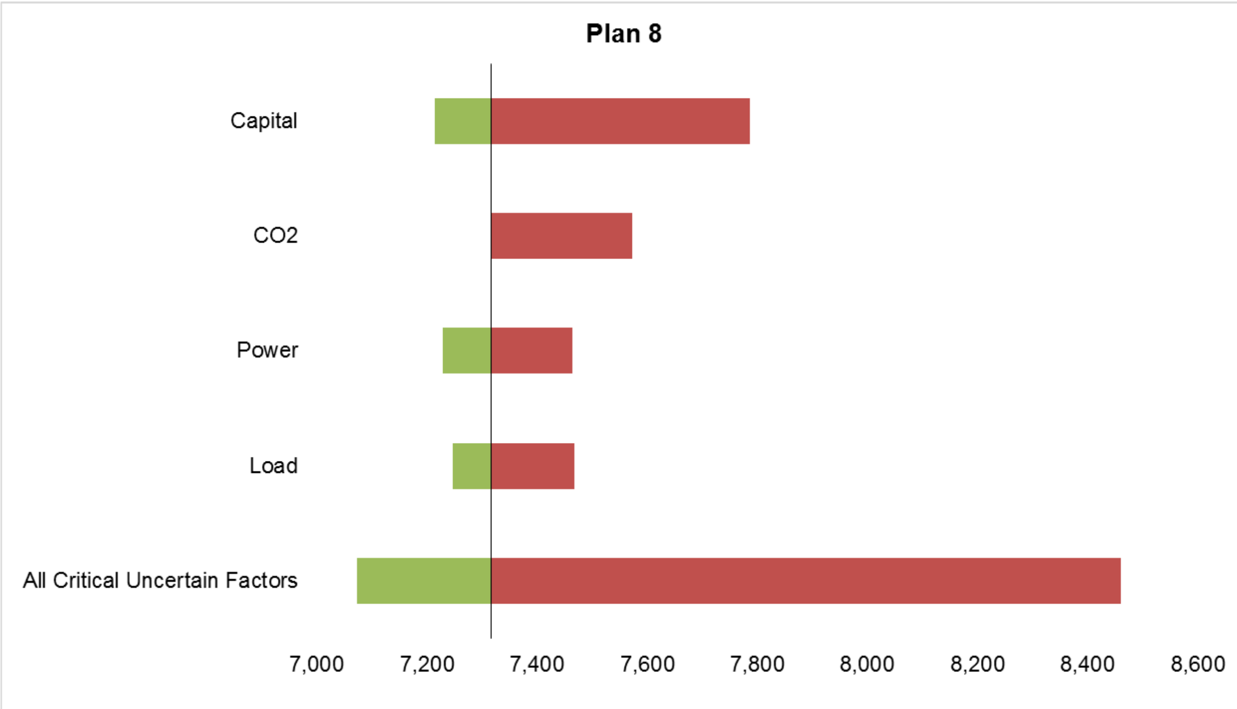


Figure 6-77 - Plan 9 Tornado Diagram ($ millions)

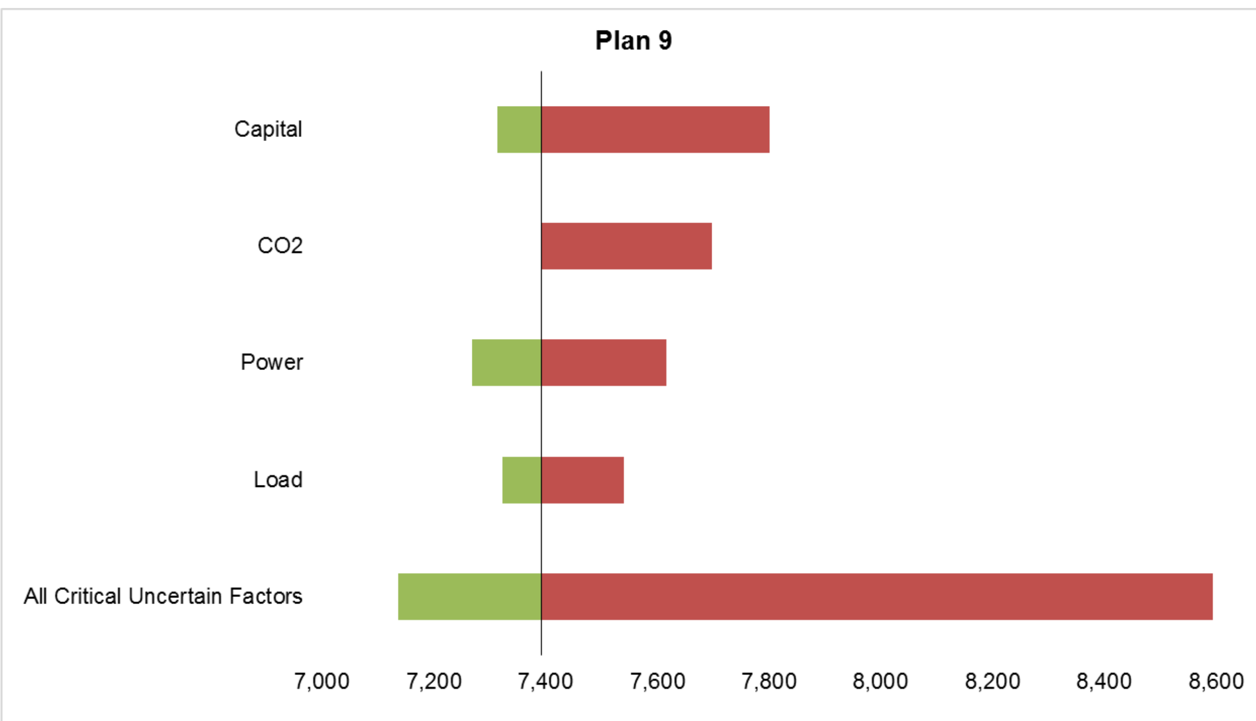


Figure 6-78 - Plan 10 Tornado Diagram ($ millions)

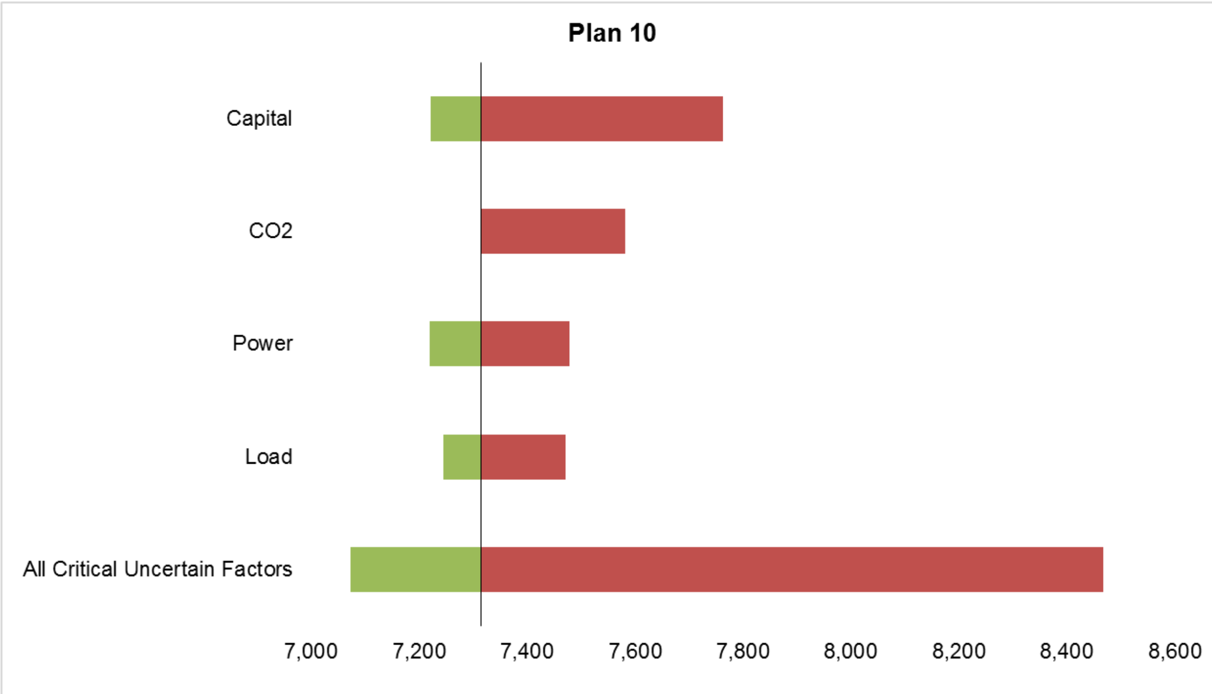


Figure 6-79 - Plan 11 Tornado Diagram ($ millions)

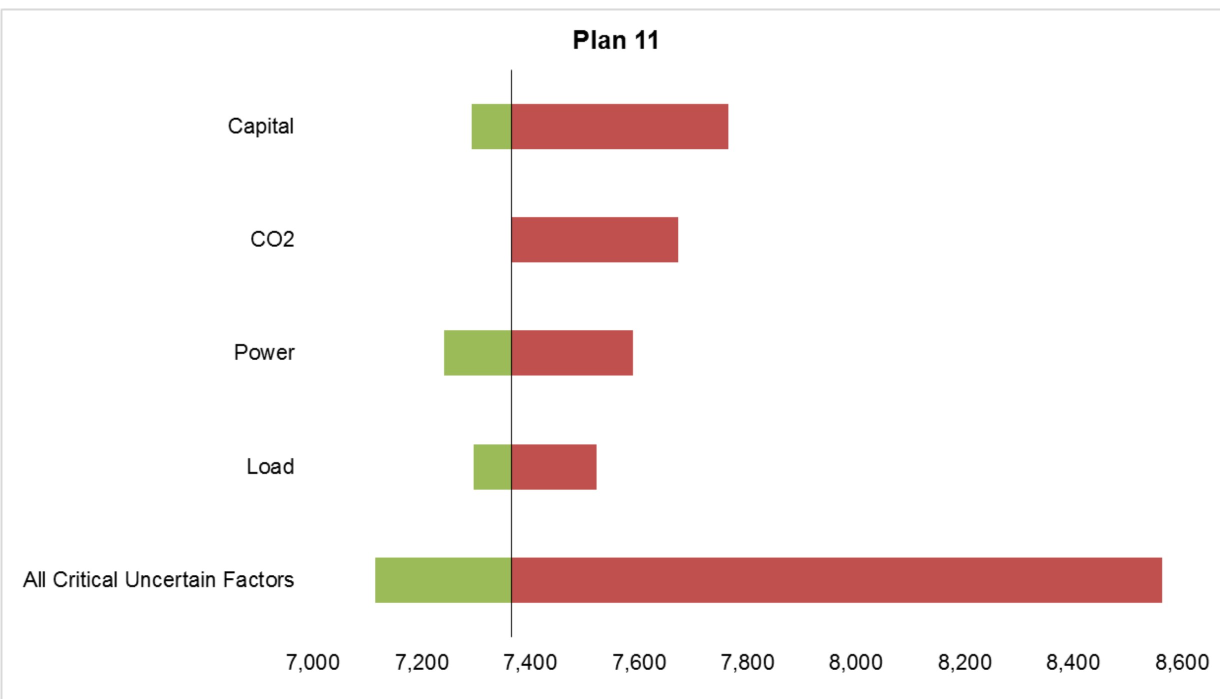


Figure 6-80 - Plan 12 Tornado Diagram ($ millions)

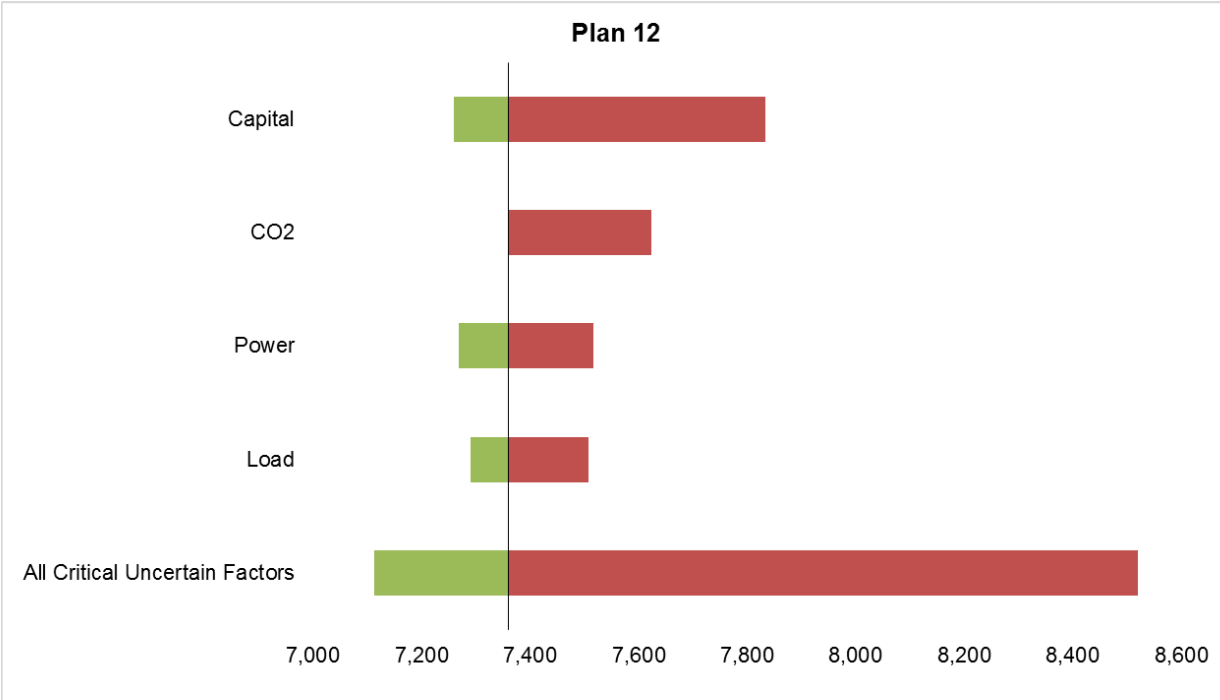


Figure 6-81 - Plan 13 Tornado Diagram ($ millions)

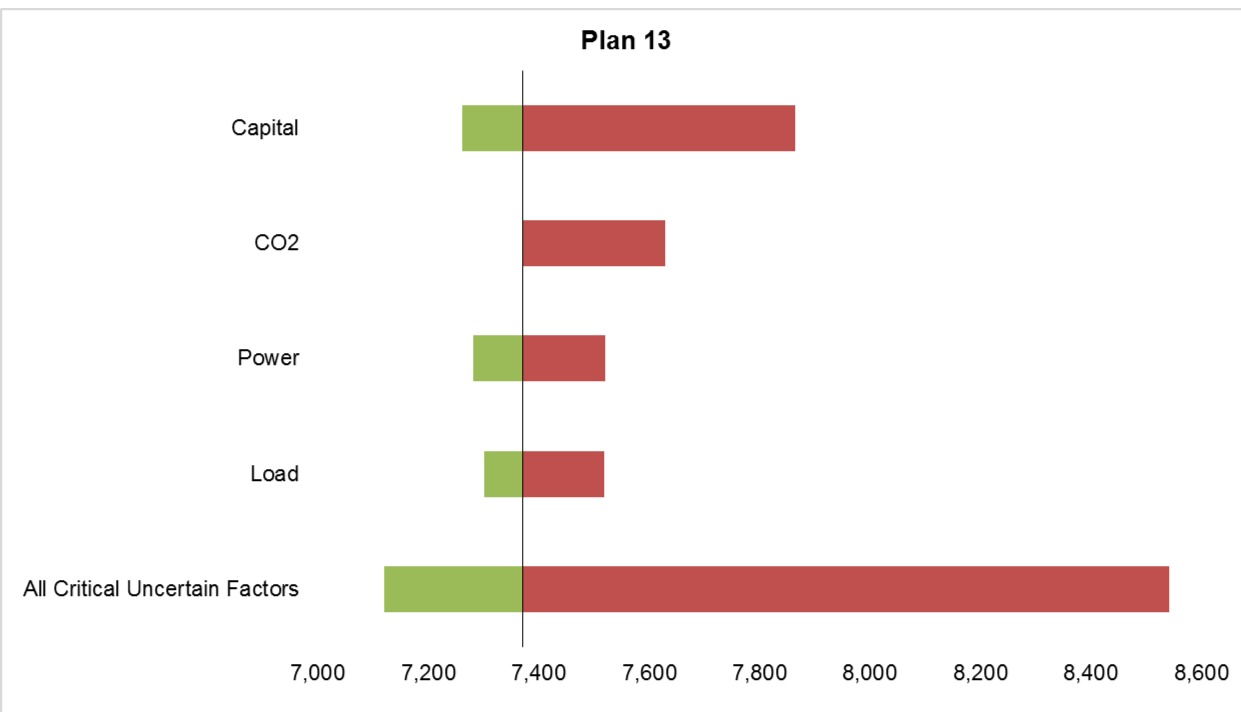


Figure 6-82 provides the stochastic risk values for each plan, added to the calculated (deterministic) PVRR, to provide an illustration of the total risk associated with each plan. The calculated PVRR is represented by the solid-filled bottom bars, while the risk values are represented by the grey-striped bars above the PVRR bars.

Figure 6-82 - PVRR with Risk Value for Alternative Resource Plans – 20 Year NPV ($ millions)

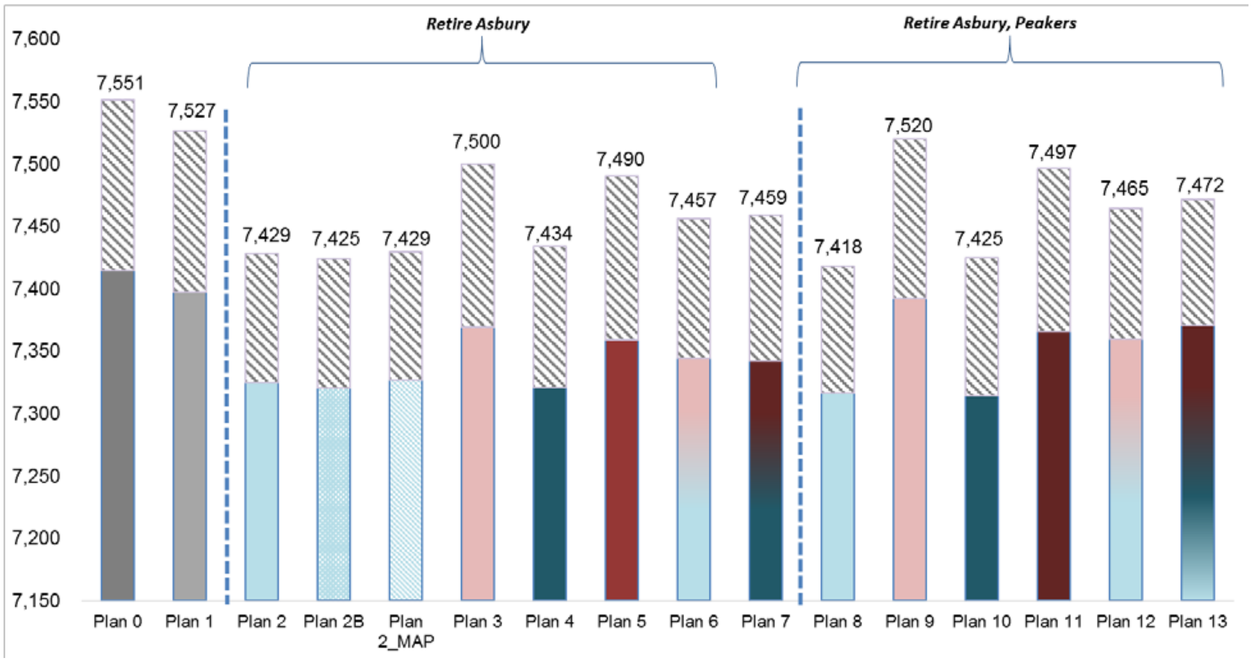
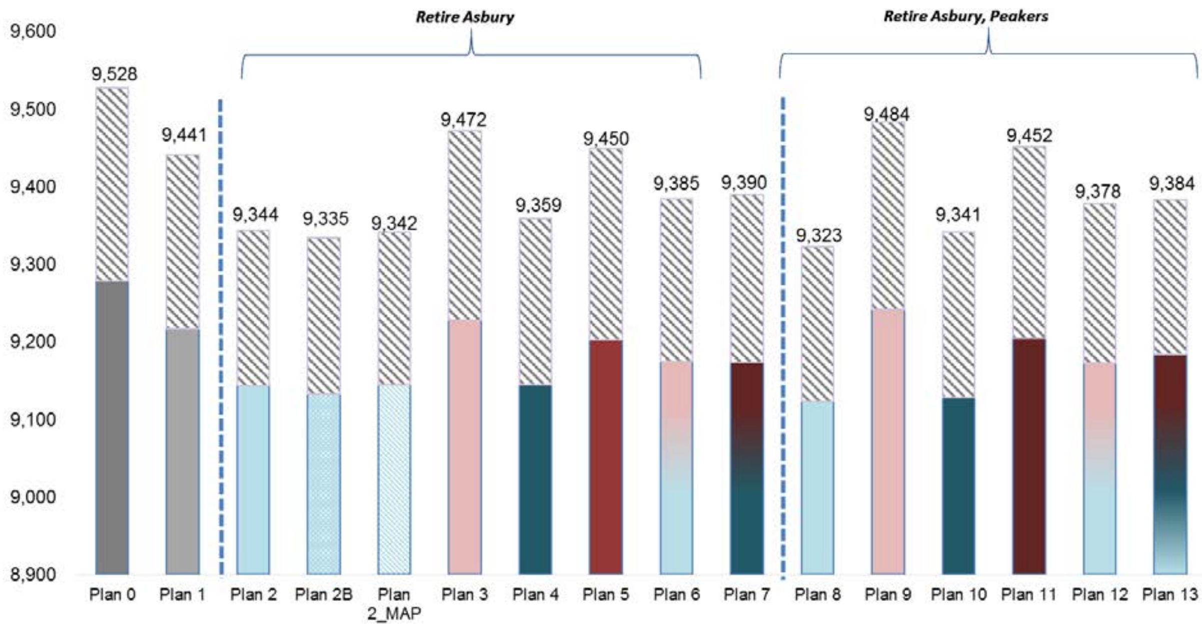


Figure 6-83 - PVRR with Risk Value for Alternative Resource Plans – 30 Year NPV ($ millions)

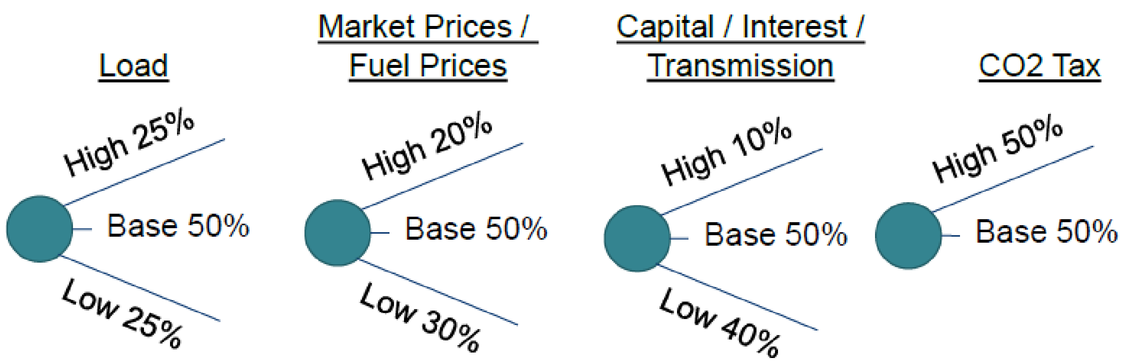


SECTION 7 CRITICAL UNCERTAIN FACTOR PROBABILITIES

(7) The utility decision-makers shall assign a probability pursuant to section (5) of this rule to each uncertain factor deemed critical by the utility. The utility shall compute the cumulative probability distribution of the values of each performance measure specified pursuant to 4 CSR 240-22.060(2). Both the expected performance and the risks of each alternative resource plan shall be quantified. The utility shall describe and document its risk assessment of each alternative resource plan.

The probabilities for the critical uncertain factors that were utilized to assess the alternative resource plans are provided in Figure 6-84.

Figure 6-84 - Uncertainty Tree



The uncertainty tree represents the uncertainties considered for each plan that resulted in a total of 54 endpoints per plan, or a total of 864 endpoints for all of the 16 alternative resource plans.

(A) The expected performance of each resource plan shall be measured by the statistical expectation of the value of each performance measure.

The expected value (deterministic) performance of each resource plan is provided in Table 6-62.

Table 6-62 - Expected Values of Alternative Plan Performance Measures
****Confidential in its Entirety**[52]**

[redacted]

(B) The risk associated with each resource plan shall be characterized by some measure of the dispersion of the probability distribution for each performance measure, such as the standard deviation or the values associated with specified percentiles of the distribution.

Table 6-65 presents the standard deviation of performance measures between iterations for each of the alternative resource plans. Certain performance measures are not influenced by risk and therefore have zero standard deviation values.

[52] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Table 6-63 - Standard Deviation of Alternative Plan Performance Measures

****Confidential in its Entirety**[53]**

[redacted]

Combining the uncertainty with the calculated PVRR for each plan provides a graphic comparison of the plans, as shown in Figure 6-82 and Figure 6-83.

(C) The utility shall provide—

1. A discussion of the method the utility used to determine the cumulative probability—

Liberty-Empire considered each of the critical uncertain factors to act independently. The uncertainty tree approach determined the cumulative probability of the uncertainties considered for each plan and resulted in a total of 54 combinations or endpoints for each plan.

7.1 Development of Uncertain Factors

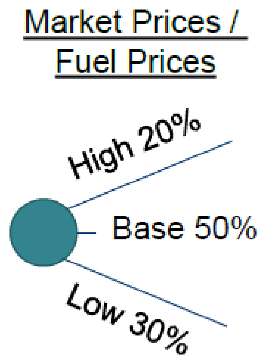
A. An explanation of how the critical uncertain factors were identified, how the ranges of potential outcomes for each uncertain factor were determined, and how the probabilities for each outcome were derived; and

[53] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when it is reports, work papers, or other documentation related to work produced by internal or external auditors or consultants.

Uncertain factors were identified in Section 5. Those factors that were considered critical were described in Section 6. Liberty-Empire used a levelized-cost of energy ("LCOE") approach when initially screening potential supply-side options, as discussed in Volume 040. Liberty-Empire used this same approach when identifying which uncertain factors could materially change the cost of alternative resource options. As discussed previously, gas/power prices, carbon prices, and capital costs were found to materially change the cost of supply-side resource. Load was added as a critical uncertain factor as it affects the potential build-out of any alternative resource plan. The identified changes and their drivers were discussed with Liberty-Empire's internal IRP team. Liberty-Empire presented these critical uncertain factors to the Missouri Stakeholder Group at the pre-integration meeting on February 6, 2019.

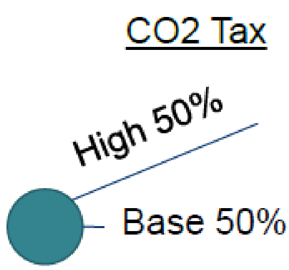
For each significant uncertain factor, Liberty-Empire identified a range of uncertainty. For market/fuel prices, Liberty-Empire used the ABB high/base/low pricing forecasts. The base was set at 50 percent and the probability of lower prices was believed to be greater (30 percent) than the probability of higher prices (20 percent). In Liberty-Empire's Customer Savings Plan, low gas and power prices were given a higher weighting than high prices. These weightings were deemed appropriate due to persistently low gas prices in recent years and the current forward curve being closer to the low case than to the base case fundamental market. Figure 6-85 illustrates the probabilities selected for the market and fuel prices uncertainty factor.

Figure 6-85 - Market Probabilities



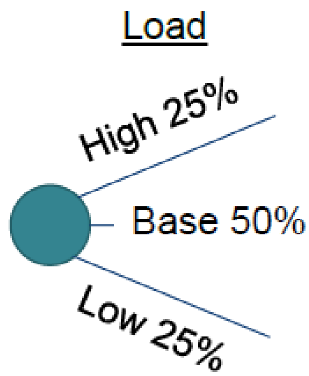
Empire's base carbon scenario assumes *no* carbon price. Liberty-Empire is also evaluating a case where a CO_2 price is enacted in 2026. The current federal government has moved away from any regulation of power sector CO_2 emissions. A future regulation or legislative action would require, at a minimum, majorities in Congress, a supportive Executive, and the ability to withstand legal challenges. Given existing activity in certain states and localities and generally growing political attention to the issue, there is a plausible case to be made for future regulation as early as 2026 that aims towards a long-term power sector reduction target of 80% by 2050, as contemplated in the high case. In summary, given the uncertainty around future carbon regulation, both the base case and high case were given a weighting of 50%.

Figure 6-86 - Environmental Cost Variable Probabilities



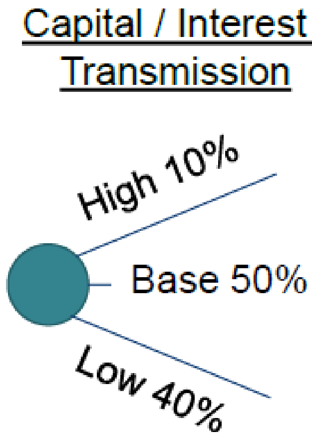
Load forecast uncertainties were discussed in Section 8 of Volume 3. Figure 6-87 illustrates this portion of the uncertainty tree used in the IRP analysis. The high and low scenarios are created in direct compliance with the Commission's rule to create two additional normal weather load forecasts. These two forecasts are created by adjusting the economic inputs in the forecast model capturing economic uncertainty. Long-term load growth is highly uncertain, and can be driven by a variety of factors, including macroeconomic trends, distributed solar installations, and electric vehicle penetration. Given wide uncertainty around other factors influencing load growth, which are fairly evenly distributed to the upside and downside, an equal weighting of 25% is given for the high and low cases.

Figure 6-87 - Load Probabilities



Capital/transmission/interest costs were combined into a single factor for analysis. Capital cost uncertainty was developed for high and low probabilities. Rapid improvement in costs for emerging technologies have resulted in cost declines that have been difficult for forecasters to keep up with. Liberty-Empire's base case projections represent Liberty-Empire's view of the most reasonable cost outlooks for supply-side resource options. The lower band includes lower starting values for capital costs for all technologies, but quicker declines in costs over time for technologies like solar and storage. Figure 6-88 illustrates this portion of the uncertainty tree.

Figure 6-88 - Capital/Transmission/Interest Probabilities



7.2 Analysis of Uncertain Factors

B. Analyses supporting the utility's choice of ranges and probabilities for the uncertain factors;

The support underlying Liberty-Empire's choice of ranges and probabilities for uncertain factors is provided in the commentary above.

2. Plots of the cumulative probability distribution of each distinct performance measure for each alternative resource plan;

Figure 6-89 through Figure 6-92 plot the cumulative probability distribution of each distinct performance measure for each alternative resource plan. These plots are sometimes referred to as risk profiles.

Figure 6-89 - Cumulative Probability of PVRR (20-Year) ($ millions)

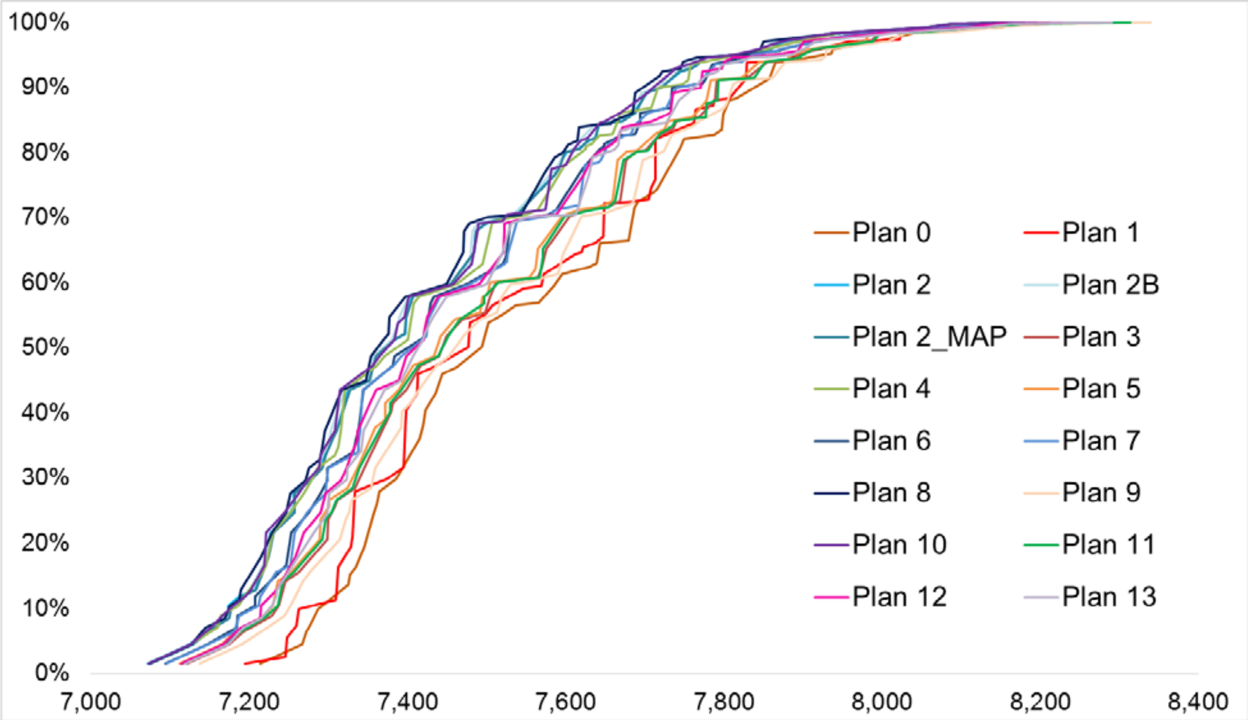


Figure 6-90 - Cumulative Probability of Probable Environmental Costs (NPV $ millions)

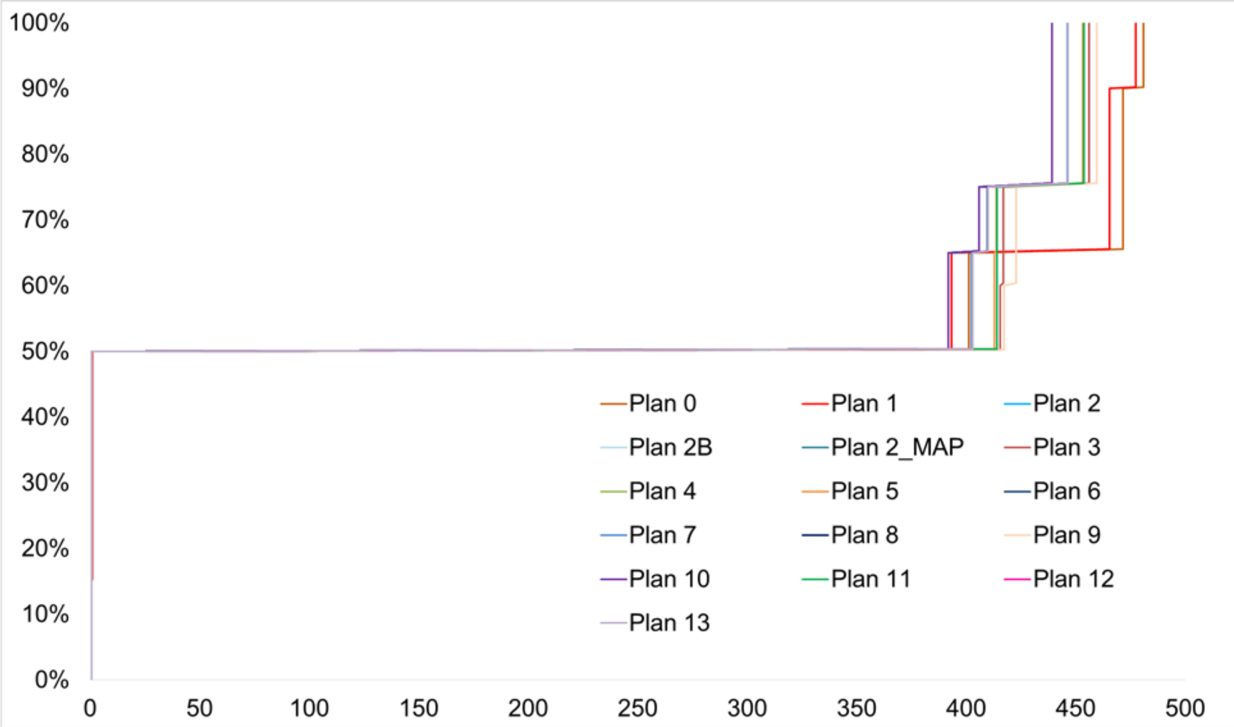


Figure 6-91 - Cumulative Probability of Levelized Average Rates (cents/kWh)

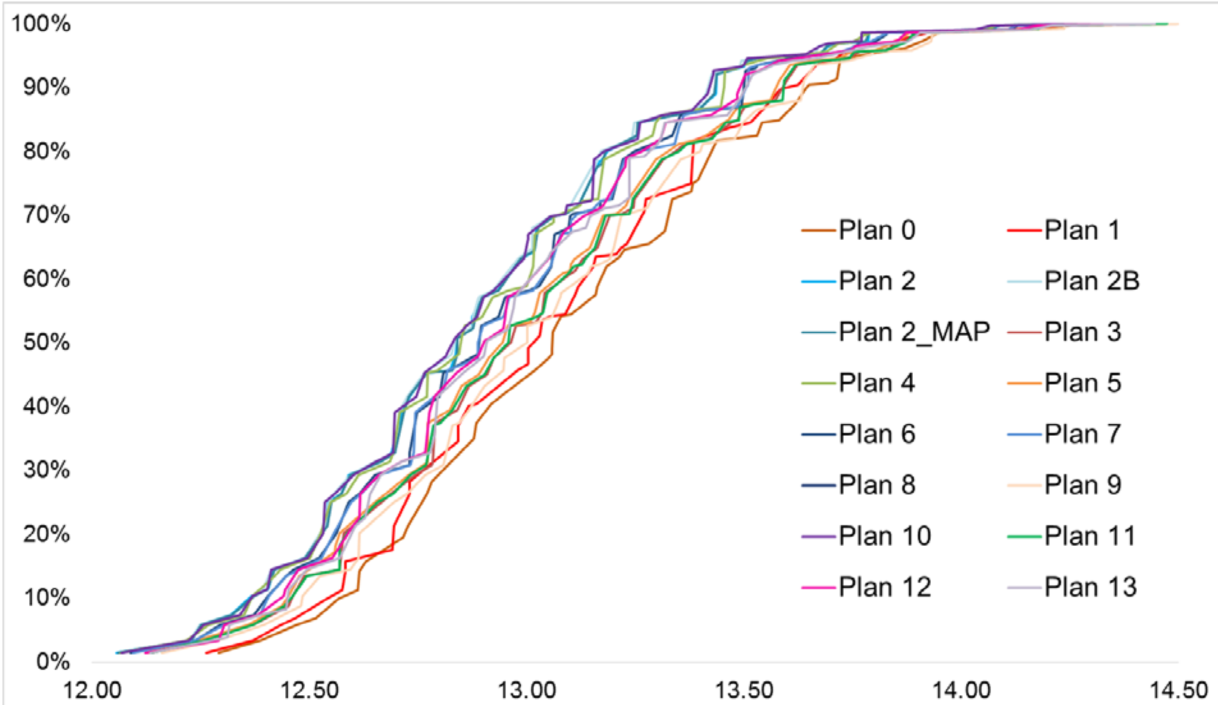
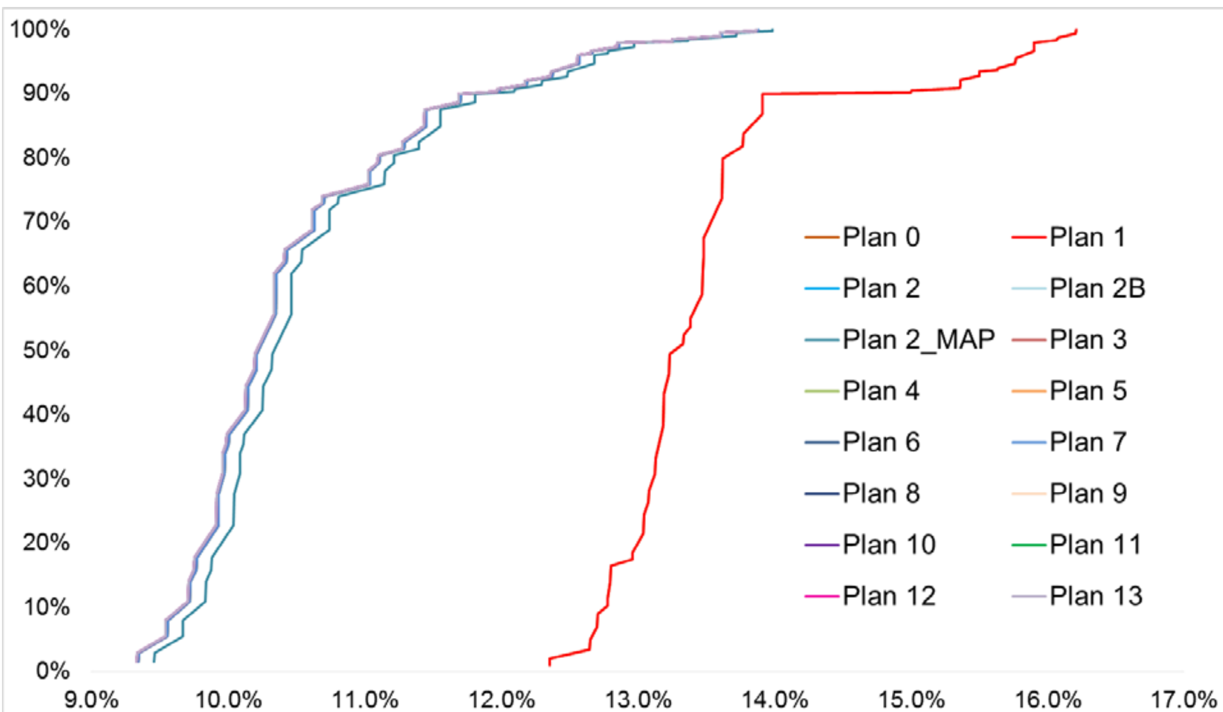


Figure 6-92 - Cumulative Probability of Rate Increases (%)



3. For each performance measure, a table that shows the expected value and the risk of each alternative resource plan; and

Table 6-62 provides the expected values of performance measures for each alternative resource plan. Table 6-63 indicates the risk as the standard deviation of performance measure values for each alternative resource plan.

7.3 Determination of Annual Unserved Hours in Plans

4. A plot of the expected level of annual unserved hours for each alternative resource plan over the planning horizon.

Empire's modeling does not include any unserved hours for any alternative resource plan.

SECTION 8 CONTEMPORARY ISSUES

4 CSR 240-22.080(4)(C) No later than November 1, an order containing a list of special contemporary issues shall be issued by the commission for each utility to analyze and document in its next triennial compliance filing or annual update report. The commission shall not be limited to only the filed suggested special contemporary issues. If the commission determines that there are no special contemporary issues for a utility to analyze, an order shall be issued by the commission stating that there are no special contemporary issues.

8.1 Special Contemporary Issues

Rule 4 CSR 240-22.080(4) requires Missouri utilities to consider and analyze special contemporary issues in their IRP triennial compliance filings or their annual IRP updates. Such special contemporary issues are contained in a Commission order with input from staff, public counsel, and interveners that are evolving new issues, which may not otherwise have been addressed by the utility or are continuations of unresolved issues from the preceding triennial compliance filing or annual update filing. In File No. EO-2019-0066, the Commission issued an order on October 24, 2018 establishing twenty-three (23) special contemporary planning issues for Liberty-Empire to analyze and document in its 2019 triennial Integrated Resource Plan. The responses to these 23 issues (a-w) are provided below.

8.1.1 AMI Meter Implementation

(a) Document Empire's most recent economic analysis for its system-wide implementation of AMI meters. Provide projected implementation dates and annual budget for AMI implementation.

One of Liberty-Empire's principal advanced distribution network technology initiatives is to implement an advanced metering infrastructure ("AMI") system covering its approximately

173,000 residential and commercial electric meter customers.[4] Liberty-Empire's AMI implementation planning is underway, in coordination with Liberty Utilities corporate-level support. Liberty-Empire will 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 to 15 months of network and meter deployment activity.

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.

AMI provides opportunities to Liberty-Empire to improve operational performance, reduce certain long-term capital expenditures related to meter purchases, and improve distribution system efficiencies. Long-term, it provides Liberty-Empire with strategically-minded tools that are needed in order to provide Liberty-Empire's customers with greater insights about their energy usage, and greater levels of choice about their energy products and consumption patterns. As Liberty-Empire's distribution system operations become more complex, AMI also provides Liberty-Empire system operators and engineers with valuable, if not essential, information that helps to improve the quality of Liberty-Empire's engineering operations and programs.[5]

Linkages to Other Liberty-Empire and Liberty Utility Initiatives

A key attribute of Liberty-Empire's AMI initiative is the leveraging of the considerable corporate-

[4] 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.

[5] There are several reasons why operating the system is becoming more complex. These reasons include the emergence of a variety of distributed energy resources (DER).

wide AMI investments and efforts of Liberty Utilities, including Liberty Utilities' 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; these in turn affect Liberty-Empire in both common and unique ways (in relation to Liberty Utilities). 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 Liberty Utilities' newly anticipated CIS system for billing and other customer care purposes. Table 6-64 below further describes some of these milestones in sequential terms.

Liberty-Empire's Advanced Transmission and Distribution Network Technologies Proposal

In addition to supporting customer care functions, AMI also plays an important role within Liberty-Empire's long-range plan to address and invest in advanced grid functionality. As such, it forms one cornerstone of Liberty-Empire's advanced transmission and distribution network technologies as part of its IRP compliance effort.[6]

In fact, AMI is an essential upgrade to the Liberty-Empire distribution grid. Other advanced grid functionality development and implementation activities involve: (a) expansion of advanced communications to substations, (b) installation of "self-healing" fault detection devices on circuits, (c) build out of distribution automation ("DA") functionality such as sophisticated voltage controls, and (d) efforts to develop an integrated distribution system planning operating model, one which improves Liberty-Empire's long-term ability to identify the right product for the right place on the Liberty-Empire transmission and distribution system. These other advanced grid functions and systems are described elsewhere within the IRP as part of Liberty-Empire's description of advanced transmission and distribution network technologies.

AMI Implementation Dates

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,[7] which in turn will allow

[6] Chapter 22, Section 45 of the Missouri Resources Code calls for consideration of utility planning and use of advanced transmission and distribution network technologies as part of Supply and Demand side resource planning. Liberty-Empire's AMI initiative is an important part of Liberty-Empire's compliance steps in meeting these requirements.

[7] Two-way advanced meters will communicate across a local utility mesh or similar radio communication system. Liberty-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 local Liberty-Empire staff.

Liberty-Empire to gradually decommission today's manual meter reading processes and to transition to automated meter reading. Once the cutover from manual meter reading is completed, network-based meter reads will be dispatched from the AMI system to the current Liberty-Empire billing system via a "flat file" transfer process. This process will also transition once the corporate MDM system is fully operational and integrated with the planned SAP customer care and billing system, after which the AMI and MDM systems will permit Liberty-Empire to collect, store and utilize sub-hourly metering information for billing and customer care purposes. For example, Liberty-Empire customer care representatives will 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.

Table 6-64 below provides a summary of key Liberty-Empire milestones for the Liberty-Empire AMI initiative.

Table 6-64 - Liberty-Empire AMI Initiative Summary Level Milestones and Activities

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. Liberty-Empire will staff internal project management and business process change management resources during this time as well.

Activity or Milestone	Timeframe	Description
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. Liberty-Empire will work closely with the meter installation contractor to train them to meet Liberty-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 Liberty-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 (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.

Activity or Milestone	Timeframe	Description
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.

Annual AMI Budgets

Liberty Utilities and local Liberty-Empire staff are working to hone capital implementation and on-going operations and maintenance ("O&M") expense estimates for the Liberty-Empire Missouri AMI rollout. In several expense categories, expenditures represent cost allocations based on either Liberty Utility's anticipated master contracts with its required AMI vendors or estimates of corporate support services such as IT. Once fully estimated and developed, a "pro rata" cost share can be accurately applied to Liberty-Empire for its specific capital and O&M budgeting purposes.[54] Liberty-Empire has reviewed preliminary estimates to validate reasonableness in meeting Liberty-Empire's specific requirements, but recognizes that some amount of uncertainty still exists in its program scope at this planning stage.

[54] Liberty-Empire Missouri represents ~ 25% of the residential and small commercial meter customer requirements of subsidiaries of Liberty Utilities Co. This type of factor will eventually may be applied to several cost categories to determine the 'pro rata' share for Liberty-Empire cost accounting purposes. This is offered as an example of the cost allocation process and analysis work that must unfold to properly and accurately finalize Liberty-Empire cost estimates.

At this time, Liberty-Empire estimates that AMI implementation will require a capital expenditure of $40 to $50 million. The components of this cost range estimate are shown in Table 6-65.[55] Before the consideration of ongoing O&M expense, and before accounting for numerous and extensive offsetting benefits, this implementation cost estimate represents an expenditure of $230 to $290 per Liberty-Empire customer, in simple terms (meaning the total estimated capital cost range provided above and dividing by Liberty-Empire's total meter count).[56] In part because Liberty Utilities and Liberty-Empire are able to leverage the advantages of a corporate-wide AMI and MDM system deployment, Liberty-Empire expects that its final AMI implementation will be cost-effective and reasonable when compared to other utility deployments of AMI systems.[57]

Table 6-65 - AMI Capital Implementation Cost Components (2020-2021 Timeframe)

(a)	AMI Meters (Residential, Commercial)[58]
(b)	AMI Field Network – Planning, Equipment, and Installation
Initial Software as a Service (SaaS) Charges and Fees for MDM, and Other Vendor Support Fees (in support of implementation)	
(c)	Meter Installation Fees
(d)	Liberty Utilities ("LU") / Liberty-Empire Project OH (PM, legal, consultants, etc.)
(e)	LU / Liberty-Empire staff costs (e.g., training, communications)
(f)	LU / Liberty-Empire AMI Team Costs
(g)	IT & Integration Costs
(h)	Customer Education and Marketing

Working in conjunction with the Liberty Utilities' corporate-wide AMI effort, Liberty-Empire is also working to carefully estimate Liberty-Empire's costs to operate and maintain the AMI

[55] There may be some additional O&M expense in support of the capital project, but Liberty-Empire does not believe this will be significant in comparison to the capital expense.
[56] Assuming a total meter installation quantity of 173,000 across residential and small commercial customers.
[57] Assuming a total meter installation quantity of 173,000 across residential and small commercial customers. bilities increase, prices shift and decline, and vendors consolidate, there may be advantages in waiting. Liberty-Empire believes the window for cost-effective AMI implementation is now available to it, comporting well with the 2020-2021 implementation timeframe schedule, and taking into account these industry dynamics.
[58] Liberty-Empire expects that the meter purchase cost, when accounting for warranty, shipping, testing and other needs, will represent around $20M of the cost estimate total. Additionally, meter installation is expected to range $5-7M, depending on scope.

system. These efforts are also preliminary. The cost categories associated with this estimation effort are shown in Table 6-66. As with the capital cost estimates, these costs do *not* account for operating cost reductions and other forms of savings and offsets that can be reasonably expected through the operation of the AMI system.

Table 6-66 - AMI Operations and Maintenance Cost Elements

(i)	Managed Services Fees: Network Monitoring and Maintenance
(j)	Recurring Fees for Software as a Service ("SaaS") for the Meter Data Management ("MDM") System
(k)	MDM Yearly Software Licensing Fees
(l)	AMI O&M Team Costs
(m)	LU IT On-going Support
(n)	On-going Customer Education and Marketing Expense
(o)	1% Meter Failure[59]

When taking into account an estimate for expected cost increases due to inflationary pressures, Liberty-Empire estimates that the total AMI system O&M costs over a 20-year planning period (2020 – 2034) will be approximately equal to the lower bound of the initial capital expenditure estimate.

8.1.2 Uncertain Factors

(b) When complying with 4 CSR 240-22.060(5)(M), include the following as uncertain factors that may be critical to the performance of alternative resource plans:

1. *Foreseeable demand response, including, but not limited to, aggregation and development of technologies such as integrated energy management control systems, linking smart thermostats, lighting controls, and other load-control technologies with smart end-use devices;*
2. *Foreseeable energy storage; and*

[59] This figure is technically a capital expenditure, but it is listed here for convenience. Liberty-Empire expects some periodic and small number of AMI meters will fail and will require replacement. The cost category covers Liberty-Empire's "back office" and field installation labor to replace failed meters, as these meters will be under a long-term warranty provided by the meter manufacturer.

3. *Foreseeable distributed energy resources, including, but not limited to, distributed solar generation, distributed wind generation, combined heat and power (CHP), and microgrid formation. Develop and provide a database of information on distributed generation (both utility owned and customer owned) and distributed energy storage (both utility owned and customer owned) for purposes of evaluating current penetration and planning for future increases in levels of distributed generation and energy storage.*

In compliance with this requirement, Liberty-Empire evaluated uncertainty around the development of demand response, energy storage, and distributed energy resources in a systematic and rigorous way, treating each as potential supply-side resource options available to Liberty-Empire for constructing its 16 alternative resource plans.

For example, through its robust DSM potential study (as presented in Volume 5), Liberty-Empire forecasted both RAP and MAP DSM levels, and incorporated these forecasts in its alternative resource plans.[60] For energy storage, several of the alternative resource plans presented in this volume include buildout assumptions of solar + storage units. Additionally, uncertainty of the future cost of storage resources is modeled through the capital cost uncertainty variable. An identical process was used for distributed energy resources ("DER").

In summary, each of the identified resources – demand response, energy storage, and DER – are evaluated systematically and rigorously as part of several of the alternative resource plans, and uncertainty on future costs are captured as part of the systematic and rigorous critical uncertain factor analysis.

Finally, Liberty-Empire plans to develop a comprehensive database for utility- and customer-owned DER, in a manner consistent with this special contemporary issue.

[60] The DSM estimates include demand response, in compliance with requirement (b)(1) noted above.

8.1.3 Electric Vehicles

(c) When complying with 4 CSR 240-22.060(5)(A), analyze and document the impact of electric vehicle usage for the 20-year planning period upon the low-case, base-case, and high-case load forecasts.

Various levels of electric vehicle load growth were incorporated into the development of the load forecast in Volume 3. Uncertainty around the load forecast itself captures the range of uncertainty affected by growing adoption of grid-connected electric vehicles.

8.1.4 Transmission Grid Changes from Coal Unit Retirements

(d) Analyze and document the cost of any transmission grid upgrades or additions needed to address transmission grid reliability, stability, or voltage support impacts that could result from likely future retirements of any existing Empire coal-fired generating unit in the time period established in the IRP process.

At present, no transmission upgrades have been identified as a direct result of the retirement of Liberty-Empire's owned and operated coal-fired generation on the Liberty-Empire owned and operated transmission system.

The only remaining coal-fired unit owned and operated by Liberty-Empire and directly connected to Liberty-Empire owned and operated transmission is Asbury Unit 1. The most recent stability studies conducted and coordinated at the RTO level, specifically the 2018 SPP TPL-001-4 Compliance Assessment Report, do not reveal issues with the retirement of this resource. In addition, contingency analyses conducted by Liberty-Empire have yet to exhibit any reliability issues on the Liberty-Empire owned and operated transmission system related to Asbury.

Furthermore, Liberty-Empire was an active participant in the development of the 2017 10-Year Integrated Transmission Plan ("ITP10") conducted by SPP. The study included a scenario in which several coal plants in the SPP region were retired as part of an assumption regarding implementation of the Clean Power Plan. As part of this work, Asbury was assumed to be retired in 2020. SPP did not identify any transmission issues or needs, in relation to Asbury's retirement in this timeframe. It should be noted that only 100 kV and above needs were considered for the 2017 ITP10 study.

Because the renewal of the ITP10 study is currently underway, Liberty-Empire will continue to work alongside SPP as coal unit retirements are studied across the RTO and as the respective impacts to the transmission system are clarified.

8.1.5 Impact of AMI implementation

(e) Provide the most recent analysis of the costs and benefits of Empire's system-wide implementation of AMI meters. Provide projected implementation dates and annual budget for AMI implementation and – if Empire is performing integrated resource analysis – include the capital and operating cost impacts in the integrated resource analysis. If an analysis of AMI costs and benefits does not exist, please provide a detailed explanation of why it does not exist.

As summarized in item (a) above, Liberty-Empire estimates that over a 20-year planning period, the AMI system will result in approximately $40 to $50 million in new capital costs and an equal level of new ongoing O&M expenditures. In contrast to these new costs, Liberty-Empire estimates that it will create substantial AMI-related cost savings and other benefits that will exceed these new incremental costs. In fact, Liberty-Empire estimates that the cost savings and other benefits will exceed new incremental costs by a factor of 1 to 2 over the same time period. Liberty-Empire is not prepared at this time to fine-tune this estimate, as more work is needed to scope the AMI program and work through many questions such as cost allocations with Liberty Utilities. However, Liberty-Empire expects that when taking into account all forms of benefits AMI will drive, Liberty-Empire will recoup the AMI-related costs over a reasonable time period.

Liberty-Empire's benefit categories are summarized in Table 6-67. Liberty-Empire is not prepared at this time to provide specific estimates of these benefits, but believes that the sum total of the benefits shown will exceed the long-term costs of AMI (both capital and O&M costs). Moreover, Table 6-67 itemizes the *principal* benefits that Liberty-Empire is working to estimate and quantify. In the table, these benefits are listed in order of expected decreasing contribution level.[61] The benefit type is also included. "OpEx" indicates operational cost savings. "CapEx" is indicates a reduction in estimated capital expenditure. "Pass thru" is used to capture several benefits which will accrue to customers due to their contributions to overall system efficiency. These benefits reflect energy savings that will ultimately benefit customers in the form of lower total energy charges.

The AMI initiative will drive many benefits, as described in this document. By leveraging the Liberty Utilities' corporate investments and activities, these benefits can be realized efficiently, economically, and at a reasonably low implementation risk.

[61] For example, Liberty-Empire expects that meter reading benefits will range between 35-40% of total cumulative benefits.

Table 6-67 - Liberty-Empire Principle AMI Benefits

Benefit	Benefit Type
Reduced Manual/Drive by Meter Reading Benefits	OpEx
Avoided Meter Replacement Costs	CapEx
kWh Reduction Program Benefits	Pass Thru
Reduced Distribution Network Losses Benefits	Pass Thru
Reduced Call Centre Billing Complaints	OpEx
Meter Visits and Disconnect Service Order Benefits	OpEx
Improved Meter Accuracy Benefits	Pass Thru
Meter Reading Benefits (Support Costs)	OpEx
Billing Department Reading Verification Benefits	OpEx
Reduced Meter Reading Equipment Benefits	OpEx
Outage Restoration Benefits (Reduced Overtime)	OpEx

Furthermore, Liberty-Empire expects that the top five to seven benefits will end up representing over 90% of the cumulative monetized benefit value. These benefits are described below:

- **Reduced Manual and/or drive by meter reading benefits** – Liberty-Empire will reduce its reliance on manual and drive-by metering systems once the AMI system is fully deployed. These expenses today are approximately $2 million and will grow over time due to inflationary and other cost pressures such as IT equipment support costs. These are mostly O&M expenditures. Additional savings will result from reduced support costs, such as those associated with vehicles and supervisors.
- **Avoided Meter Replacement Costs** – Liberty-Empire anticipates that it must upgrade its aging meter population regardless of its choice to pursue AMI. With AMI, an alternative required upgrade of its meters will be avoided. Liberty-Empire has assumed an orderly replacement of meters over the 20 years as an alternative to the AMI implementation time period, which is conservative. This is a form of capital cost savings.
- **kWh Reduction Program Benefits** – Liberty-Empire will use the AMI system to identify

additional customer energy saving opportunities. It estimates these benefits at approximately $500,000 per year. These are a form of "pass thru" benefit since they are not captured as part of Liberty-Empire's revenue requirements.

- **Reduced Distribution Network Losses** – AMI will help Liberty-Empire reduce distribution system network losses, thereby reducing customer charges for these losses.
- **Reduced Call Center Billing Complaints** – AMI enables Liberty-Empire's customer care representatives to gain quick access to a customer's detailed usage information. This can often be helpful in resolving customer billing complaints. By resolving complaints more easily, Liberty-Empire's costs within the billing department are reduced. Customer satisfaction also improves.
- **Meter Visits and Disconnect Service Order Benefits** – AMI meters include functionality that allows for the remote disconnect of meters. This will assist Liberty-Empire in facilitating timelier and less costly work associated with processing both meter connection requests (such as when a new tenant moves into a rental property) as well as service disconnection requests.
- **Improved Meter Accuracy** – The AMI meters are more accurate measuring devices. This means Liberty-Empire will more accurately measure the total energy being used by customers. This helps customers in their energy conservation goals. It also means lower non-technical system losses, a cost which is spread out over all customers.

The cumulative total of Liberty-Empire's operating and capital cost savings are yet to be fully developed and estimated, but Liberty-Empire expects that the total benefits over the 20-year planning period will exceed the capital and incremental O&M costs over the same period by a reasonable margin. Additionally, Liberty-Empire expects that the AMI system will deliver valuable customer "pass through" benefits that – while not internalized as part of Liberty-Empire's revenue requirements – are important opportunities to improve the overall distribution system efficiency and reduce Liberty-Empire's customers total energy charges. These also lead to environmental savings as energy is conserved.

8.1.6 AMI's Long Term and Strategic Value to Liberty-Empire

While Liberty-Empire has responded to the specific requirements of SCI items (a) and (e) of this document, there are many long-term and strategic benefits of AMI which are difficult to capture within the narrow and specific monetary analysis suggested as part of SCI items (a) and (e). Notwithstanding this limitation, these strategic benefits are important contributors to Liberty-Empire's overall case for implementing AMI. In fact, AMI is one cornerstone of Liberty-Empire's advanced distribution network technology initiative as reflected in this IRP.

First, AMI will improve Liberty-Empire's ability to assist its customers in better managing their energy choices. AMI will provide Liberty-Empire and its customers with granular information about the nature of customer energy use down to hourly and sub-hourly levels. Liberty-Empire anticipates making this information available to customers through a customer web portal so that customers can perform their own inspections of this information and learn more about how they are consuming their energy. This can lead to greater awareness and informed choices about their energy use. This contributes to conservation of energy.

Second, AMI is a foundation to any utility's ability to effectively implement and manage new pricing programs. There is significant innovation occurring in rate design throughout North America, and AMI (along with MDM and billing system improvements) is a central and essential technology to these efforts. Over time, Liberty-Empire may interact with Liberty-Empire customers through a variety of new rate programs that reflect unique customer needs, such as those created through the use of electric vehicle charging infrastructure, solar photovoltaic panels, or energy storage batteries. As these technology options expand, Liberty-Empire will facilitate customer choices by providing rate programs that allow customers to make prudent use of these capabilities.

Third, AMI provides the Liberty-Empire system operators and engineers with valuable information that helps improve the quality of Liberty-Empire's engineering operations and programs. One important example is how AMI information is used to better manage outage response activities in both limited, as well as widespread, storm-related wide outages. Another example is Liberty-Empire's long-term aspiration to implement a conservation voltage reduction ("CVR") program. AMI voltage and power consumption data, in fact, helps improve CVR program delivery and effectiveness by fine-tuning voltage conditions across feeder circuits. AMI also helps improve the quality of Liberty-Empire's engineering circuit models over time and helps identify and resolve safety problems in proactive ways. These benefits can help support Liberty-Empire's distribution automation goals related to self-healing grid management.

Liberty-Empire views improving operations in these ways, offering new rate designs to customers, and empowering customer choice through improved energy usage information as strategic, long term opportunities enabled in part by AMI.[62] Once Liberty-Empire implements the foundational AMI system and couples the AMI measurement capabilities with improved "back office" integrations and billing system improvements, Liberty-Empire will be well-positioned to drive and deliver AMI's strategic value proposition across many facets of its business.

8.1.7 Green Tariffs and Community Solar Mechanisms

(f) Analyze and assess the use of mechanisms such as green tariffs and community solar to increase the availability of distributed generation for large and small customers.

Community solar programs may increase the availability of *distributed* generation to the extent that these programs are able to remove or reduce barriers that limit distributed solar deployments. These barriers include high upfront costs, financing costs, the burden of handling installation logistics including vendor selection, and ongoing system maintenance costs and responsibilities. Moreover, customers who rent or lease their homes can enjoy the benefit of participation in a renewable energy service because the solar generation equipment is installed elsewhere.

[62] AMI is essential to these improvements but is also one of several needed improvements. The role of MDM and other systems have been noted.

Community solar programs can be customized to meet a wide range of customer preferences. The utility sponsoring the community solar program can build flexibility, for example, into the terms of the program in relation to subscription size, contract duration, and payment terms. This flexibility can be especially helpful in addressing customer "churn" as people and businesses relocate.

By offering a variety of choices through a community solar program, the customer can choose a subscription size that fits their energy need. By subscribing to the community solar program, subscribers can add to their green energy portfolio. Other utility customers – including non-subscribers – will also benefit from the increase in total renewable energy generated to meet total system load requirements.

8.1.8 Securitization

(g) Analyze and document the prospects for using securitization to advance the retirement of coal generation assets and channel the savings into more economical investments such as demand-side management, building wind and solar generation, and satisfying corporate renewable energy goals to attract new businesses to the service territory. (Securitization is essentially a lower cost, long-term loan that ratepayers take out and pledge to repay using a portion of their future electricity bills using a long-term, lower-cost bond that will save customers money, some of which can be used as new capital).

Currently, enabling legislation for securitization does not exist in any of the four jurisdictions (Missouri, Arkansas, Kansas, Oklahoma) served by Liberty-Empire. Identical legislation would need to be enacted in all four jurisdictions before Liberty-Empire could consider such a financing structure, which would require, among other things, the establishment of a special purpose entity to effectuate a securitization in each jurisdiction. This structure would need to be established in a manner that would be acceptable to rating agencies and that would ensure that the intangible property rights owned by the special purpose entities could not be impaired in any manner whatsoever by subsequent rulings of the Commission. Because of Liberty-Empire's four-state service territory, a separate securitization structure and transaction would be required in each jurisdiction. This adds to the already significant upfront and annual servicing costs required to implement and maintain a securitization structure that would remain in effect over the life of the dedicated utility rate bonds that would be issued pursuant to a securitization.

A key consideration around securitization is the fact that it provides guaranteed cash flow to security holders that cannot be undone by future commissions. However, securitization requires a significant investment of time and cost in order to structure a securitization acceptable to the credit rating agencies to ensure the highest possible ("AAA") credit rating. Without a AAA rating, the securitization might not generate sufficient interest cost savings, derived from the differential in credit spreads between AAA-rated credit and Liberty-Empire's BBB-rated credit, to offset the securitization structure's costs.

The costs to implement the structure include:

- Obtaining identical irrevocable Financing Orders from each of Liberty-Empire's four jurisdictions that meet very detailed requirements which must be acceptable to all participating parties in order for securitization to be successful;
- SEC registration on form SF-1 (similar to an initial public offering);
- Delivery of between 15 and 20 Legal Opinions (if not four times as many given the four jurisdictions) addressing: federal and state constitutional matters, bankruptcy / substantive non-consolidation matters, true-sale matters, security interest/UCC matters, state regulatory matters, tax matters, securities laws matters, and general corporate matters;
- A rating agency process to review the structure and rate the bonds; and
- Servicer set-up costs.

Securitization acts as a disincentive to public utilities to make investments to serve their customers, and fundamentally challenges the regulatory compact. Under the existing regulatory compact, utilities invest in capital projects to, among other things, maintain and enhance customer service and improve system reliability. In exchange for doing so, utilities are granted the right to recover their costs of service and earn a fair and just equity return on those investments. Securitizing assets removes that opportunity for the utility to earn an equity return. Any requirement to finance assets in this manner would reduce a utility's desire to invest in renewable projects in the future if it means losing out on the equity returns promised under the existing regulatory compact.

Using securitization to fund non-capital asset programs such as DSM is also a questionable policy goal and adds further complication to an already complex structure.

Thus, while the Company appreciates that there is interest among some parties to consider securitization, as demonstrated by the Customer Savings Plan, there are other means to achieve these very objectives of adding renewable generation to the fleet. Liberty-Empire and its indirect parent company, Liberty Utilities Co., already have very attractive costs of capital based on their BBB investment grade credit ratings. Additionally, Liberty Utilities Co.'s sister company, Algonquin Power Co., has issued green bonds related to its investment in renewable generation assets. One of the primary benefits of such green bond offerings is the growing list of investors who seek out these investment opportunities, which creates a highly competitive marketplace for these debt offerings and, in turn, a highly competitive cost of funding for these projects.

Green bond financings already provide the means for attracting competitive financing for renewable projects and at much lower up-front and annual costs. Additionally, Liberty-Empire's upcoming investment in its wind project will provide a means to attract businesses to its territory who are interested in or who require renewable generated power.

8.1.9 Retirement of Asbury

(h) Analyze, document, and screen the prompt retirement of the Asbury plant as a resource option.

The retirement of the Asbury plant is addressed in Volume 6 and 7.

8.1.10 Distributed Energy Resource, Grid Modernization, and DSM Investments

(i) Describe and document how utility investments in grid modernization, DSM, and distributed energy resources can improve customer energy service options and substitute for supply-side investments under the utility's contingency plan.

DER ("Distributed Energy Resources") Background

Liberty-Empire defines DER as resources interconnected to the Liberty-Empire distribution system, capable of serving customer load requirements, and below a nameplate rating threshold of 10 kW. Liberty-Empire differentiates DER from utility scale resources, which may interconnect at the transmission, sub-transmission, or distribution system level. Utility scale resources may have similar attributes as DER (depending on many circumstances). This distinction is important to appreciate Liberty-Empire's point of view in addressing these questions.

First, there is a diverse range of DERs becoming available to customers independent of the utility's involvement. These "behind the meter" resources provide a variety of energy services for customers. For example, they may provide backup power in the event of power outages and/or provide energy for day-to-day home and facility operations. Some DERs – such as battery-enabled EVs – require centralized supply to charge *and* offer potential injection of energy at the distribution level to serve load. Stand-alone batteries might also play a valuable role providing power quality to customers, extra capacity to trim peak electrical needs (which can be expensive resources under demand charges), and backup power for emergency contingency purposes.

DERs are also not exclusively renewable resources. For example, commercial and industrial facility owners throughout the country are deploying highly efficient natural gas turbines to provide a portion of a building's electrical load. Moreover, when the thermal energy from the turbine is captured and re-used for space heating, cooling, refrigeration, dehumidification, or other process purposes, this becomes a "combined heat power" or CHP installation. Additionally, micro-grids are attracting interest as a means to create self-contained or "islanded" energy systems. Micro-grids can be a source of backup power or even black-start capability in the event of system collapse.

It is also important to recognize that many favorable attributes of DER – such as those attributable to storage or solar – can also be obtained at large scale through utility scaled investments, often with more favorable project economics. For example, there is growing awareness of utility scale community solar programs as a way to provide customers with flexible access to renewable energy at a more favorable price point than what might be possible through separate, customer-owned, small rooftop solar installations.

Liberty-Empire Investments in DER as Substitute

Liberty-Empire believes that utility investments in DER can improve customer energy options and substitute for supply-side investments under the utility's contingency plan depending on the nature and location of the DER as well as available alternatives.

Any choice by Liberty-Empire to pursue the DER market by investing capital and expending O&M must be carefully evaluated with the goals of such an investment and the full range of utility options. For example, utility scale options could ostensibly deliver comparable renewable energy at a more favorable cost point to the consumer. This is not to suggest that independently supplied DER is not competitive. Rather, if Liberty-Empire seeks to invest capital and other resources, it must evaluate the DER options in a comprehensive fashion with alternatives that provide comparable services such as energy, capacity, and various forms of ancillary services.

Liberty-Empire also needs to consider interconnection costs for distributed resources, including costs to mitigate any impacts on local distribution circuits that might arise. For example, circuit overloads during peak times could arise with high levels of DER installation on certain circuits. There may also be costs required for smart inverters, and communications equipment to enable measurement and monitoring of the resource.

Liberty-Empire recognizes that DER may provide additional benefits depending on the nature of the DER and its point of interconnection. These additional benefits may include line loss benefits, benefits of deferring capital expense to address localized distribution grid capacity problems, power quality benefits (such as correcting for over- or under-voltage conditions), and potential additional reliability and resiliency benefits. To the extent that they can be quantified, Liberty-Empire accounts for such locational benefits as an offset to the installed cost of DER.

Grid Modernization Background

As outlined in Volume 045 Section 1.4.2, Liberty-Empire is pursuing various areas of grid modernization at the distribution level with several objectives:

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 metering, rate programs, and Liberty-Empire situational awareness of grid performance.

Liberty-Empire is also pursuing the technologies that support these improvements, such as SCADA-based communications, AMI, and various “back office” systems to control and manage distribution equipment and consolidate various customer care functions.

Grid modernization plays an important role in supporting the requirements and opportunities of both supply-side requirements and distributed resource alternatives.

First, AMI is required for the implementation of time-variant rates, which are essential for securing the benefits of many distributed resources. Time variant rates could also play an important role in integrating centrally supplied renewables in a cost-effective way, especially in combination with storage technologies.

Second, the improved information that AMI will generate will be captured within upgraded “back office” customer care systems, and in turn, Liberty-Empire customers will eventually gain routine access to this information. This will help Liberty-Empire’s customers learn more about their energy use patterns and gain better-informed basis to engage with new energy choices and options.

Third, to accommodate additional DER the utility requires the additional monitoring and communications across the distribution grid, as anticipated by Liberty-Empire in its grid modernization efforts. Therefore, Liberty-Empire’s long-term grid modernization efforts will lead to safer, more efficient, and more cost-effective grid access for new market participants and customer-deployed resources.

Fourth, sustaining reliability and providing the necessary system resilience is essential for the market to proceed with the most balanced and cost-effective integration of resources, whether from the centralized supply or distributed side of the resource spectrum. A less reliable and resilient grid diminishes opportunities for all resource options.

Liberty-Empire Investments in Grid Modernization as Substitute

With investments in grid modernization, Liberty-Empire acts as an enabler to support the requirements of cost-effective resource substitution by facilitating DER integration. Liberty-Empire's grid modernization investments also support the maintenance of adequate levels of core system reliability and resiliency, thus enabling better-informed long-term resource allocation decisions.

Liberty-Empire's Evaluation of DSM

Liberty-Empire has carefully evaluated demand side management ("DSM") options. The DSM options are presented in a comprehensive manner within Technical Volume 050 – Demand-side Resource Analysis. As part of this effort, as documented in Volume 050, Liberty-Empire engaged AEG to conduct a DSM Potential Study. AEG analyzed potential demand-side resources for all major end uses as identified by the Residential Customer Energy Survey and secondary sources. The major end uses considered include:

- Residential sector: cooling, space heating, water heating, interior lighting, exterior lighting, appliances, electronics, and miscellaneous.
- Commercial and Industrial sector: space heating, space cooling, ventilation, water heating, refrigeration, interior and exterior lighting, office equipment, food preparation, motors, process, and miscellaneous.[63]

Furthermore, AEG developed nine program design scenarios, and used these to assess the *optimal* demand-side programs to propose for implementation. The recommended demand-side

[63] CHP is analyzed as a supply-side resource.

management programs for 2017-2019 include:

- Residential Lighting
- Whole House Efficiency
- Residential Behavioral
- Low Income Whole House Efficiency
- Low Income Weatherization
- Commercial & Industrial Rebate

Additional programs were added to these and placed in the DSM portfolio after 2019 as measures and programs become cost-effective. These include:

- Low Income Behavior
- Strategic Energy Management
- C&I Retro-commissioning
- Residential Demand Load Control
- Curtailment Agreement

Taking into account technology trends, and informed by market research, Liberty-Empire and AEG further determined the potential range of effects of these programs based on technical and economic feasibility considerations. Through these estimation means, both a final Realistic Achievable Potential ("RAP") result and a final Maximum Achievable Potential ("MAP") result were determined. The RAP and MAP are then used in conjunction with other resources as part of the process to develop and analyze the 16 alternative resource plans presented in Volume 6.

Liberty-Empire Investments in DSM as Substitute

As highlighted above, Liberty-Empire has carefully evaluated DSM options. To the extent that they are economically viable, they have been included within the Liberty-Empire preferred portfolio and help offset supply resources. In Volume 045, Liberty-Empire also describes the specific technology requirements (such as AMI) needed to support the various DSM options.

Liberty-Empire believes that DSM provides customers with additional sets of choices about how to fulfill their energy requirements, playing a unique role in questions regarding facility upgrades and other energy reduction opportunities. Over time, Liberty-Empire's AMI effort will provide Liberty-Empire and its customers with additional information about load patterns, creating more insights into DSM potential effects and opportunities. DSM-related rate programs and new DSM-related technologies may also play a role in the future, as they may create new directions for DSM programs to create value.

8.1.11 Energy Storage and Conservation Voltage Reductions

> *(j) Describe and document the roles which energy storage and conservation voltage reductions could play in the utility's system planning, particularly with regards to extreme weather situations, DSM, and distributed energy resources.*

Liberty-Empire is evaluating the potential for distributed battery storage in a variety of beneficial ways. It is also evaluating how costs and benefits compare to utility scale alternatives. Potential benefits being considered for energy storage include energy, capacity, ancillary services such as ramping or frequency regulation, and black-start capability. Given the growing importance of battery technology, Liberty-Empire is actively evaluating the promise and role that batteries may play in improving the performance of the grid. Some roles that batteries might play on the Liberty-Empire grid include:

- Backup power for customers, to carry over brief outage events and periods, lasting up to several hours. This application could be important to a facility such as a police station needing to keep communication systems up and running during a power outage.
- Support roles for micro-grids, such as providing black-start capabilities and power quality functions.

- Influencing an individual customer's load duration curve. Enough storage on the system could influence Liberty-Empire's load serving requirements by time of day. This may have beneficial effects for the system if it re-apportions load requirements to less expensive periods for wholesale market purchases.
- Providing local distribution system support to help correct under- and over-voltage problems that could arise due to net metering customers.
- In a sophisticated deployment arrangement, playing a role in arbitraging energy in highly dynamic ways, such as electing to charge and discharge when the market is providing the appropriate price signals.

Batteries may be an important contributor to power system reliability and cost-efficiency across a range of market services, but it is not known today whether the utility might be better served promoting these uses at scale or through broad distribution to many customers. Therefore, specific market and power system functions must be carefully addressed; specific battery technologies, types and performance must be investigated; and the full range of costs and benefits over potential life cycles and programs must be determined. For most battery deployments, new rate programs that align incentives and costs must also be put in place.

As an example, Liberty Utilities' program in New Hampshire to own and install 1,000 PowerWalls from Tesla bring many of these points together. Liberty-Empire, as part of the Liberty Utilities family of companies, is closely monitoring and learning from this effort. In this case, Liberty Utilities is coupling the storage device with a residential time-of-use rate. Customers will either pay a monthly fee or an upfront sum. The utility, in this instance, takes control of the batteries when it predicts a period of peak demand for the upcoming day. Working in concert, the batteries can help lower certain transmission charges that the system otherwise incurs, and which the utility passes onto customers. As potentially beneficial as this program may turn out to be, the utility also recognizes that other companies may also want to provide these services, and so the utility has to carefully evaluate all of the costs and benefits, and ultimately offer a superior service: one that secures the estimated benefits.

Conservation Voltage Reduction ("CVR")

Conservation Voltage Reduction ("CVR") is a well-established technique for reducing peak power demand and energy conservation. Many utilities have conducted pilots and demonstrations attesting to these facts. However, CVR is challenging and potentially expensive to implement across an entire utility distribution service territory. Moreover, the energy savings and peak demand savings achieved on a small number of test circuits may not be replicated across an entire system or may not persist for a number of reasons. As a result, care is needed when extrapolating from small-scale CVR experiences to apply CVR's promise at scale.

The underlying effect that contributes to energy savings is flattening and compressing the voltage band that fluctuates around 120 volts. In fact, the ANSI standard voltage band is between 114 and 126 volts. Across a distribution circuit, some customers may receive a higher voltage and others a lower voltage. Typically, the voltage drops the farther from the source. Through various means of voltage regulation, it is possible to flatten voltage levels to the lower half (114-120), and in doing so, to achieve energy savings (and/or peak shaving) at no particular inconvenience to customers. Most customer loads operate at the lower end of the band without noticeable effect.

The "CVR factor" is often used to express the potential of CVR to achieve energy reductions. It is the ratio of energy load consumption to voltage regulation change. For example, a 2% drop in voltage combined with a 1% change in energy consumption yields a CVR factor of 0.5. It is often common for readers to learn about successful pilots and demonstrations and conclude that these conditions (and results) may apply system wide. This would be in error. Voltage conditions vary across the distribution system. Load conditions, feeders and substations are unique and uniquely configured, and there are CVR factors for each portion of the system. Second, the nature of the load served has a significant bearing on the CVR factor. One laboratory, in a 2010 study, offers a two-part classification of loads to help explain CVR: those with and without thermal cycles. Many loads consume energy as a function of voltage when the appliance is operating. Other devices (e.g., thermal loads such as an electric water heater) will vary the duty cycle depending on supply voltage.[64]

An additional factor that makes CVR difficult to estimate and to build is that load behaviors are changing due to customer choices and technology. LED lighting, for example, has different effects with voltage changes than do other devices due to the fact that LED lights are less responsive in terms of energy use to voltage change. In addition to changes due to technology and changes in use patterns, loads also change due to seasonality and weather.

Determining what specific level of voltage reduction is possible, practical, or warranted – and what effect this has on energy consumption – on any individual circuit is challenging. The load behaviors require modeling over an extended period to ensure that seasonal and weather effects are taken into account. Additionally, choices are needed about the establishment and verification of baseline conditions (without regulation), so as to have a basis of conclusion about the measured voltage effects (with regulation). This either requires more study time and complexity (working with one circuit, for example, and evaluating before and after) or working with control and study circuits.

There are many approaches to implementing CVR. One approach is to first determine voltage levels across the circuit subject to regulation, then obtain the voltage. If the system will be used to achieve peak reductions, voltage signals are needed on a frequent basis in order to adjust circuit voltage levels at the time of the peak condition. AMI is one approach for achieving "end of line" voltage readings. Another approach is to bring back voltage from field distribution automation devices, such as reclosers or smart fuses. These devices must be communicating in a two-way mode for this to be effective. There are also additional choices about the CVR system design. It is possible to manipulate voltage levels through installing voltage regulators and

[64] Discussion taken from Costs and Benefits of Conservation Voltage Reduction. CVR Warrants Careful Examination. NRECA-DOE Smart Grid Demonstration Project. Final Report. May 31, 2014.

capacitor banks out along the circuits, or to install regulators within the distribution substation. A central measurement and control system is also required to manage any widely distributed voltage regulation system. Some voltage regulation equipment may not be capable of working within a CVR system. If the device needs to be connected to a two-way communicating network, for instance, the operator must be able to adjust equipment settings.

Liberty-Empire plans to be better equipped to consider the role of CVR over time. First, AMI may provide a cost-effective means to acquire voltage signals. Second, the planned implementation of ADMS will provide the measurement and control logic system that can be used to drive CVR. Third, Liberty-Empire's continued efforts to push communications and automation out into the distribution system will gradually increase its ability to more actively manage voltage levels across the distribution system over time.

CVR has three potential benefits. First, if Liberty-Empire can reduce load serving requirements due to CVR, this will also lower line losses from the central generating stations. Second, CVR can be driven in a way that reduces energy use throughout the year and during most system conditions. Third, CVR can be used to reduce peak demand requirements at times of highest system stresses. Assuming that the specific substations and circuits are outfitted with CVR controls and communication, this peak shaving effect can be obtained on individual circuits, or it can be achieved more widely under coincident demand conditions.

As Liberty-Empire installs more of the necessary infrastructure that it needs in order to drive CVR (and in particular, ADMS), Liberty-Empire will evaluate how CVR might play a role in helping to reduce load requirements. As noted, however, load conditions and behaviors are also changing. Electric vehicles and rooftop solar also affect voltage levels and shift the load patterns of distribution circuits. In fact, Liberty-Empire's timing in installing its grid modernization infrastructure (DA, AMI, ADMS) will coincide with gaining the needed information about how its distribution circuit load patterns may be changing due to LED lighting and due to other changes such as EV and solar. This will give Liberty-Empire more insights into the potential role CVR might play in achieving additional energy conservation. Regardless, Liberty-Empire will need to carefully study, evaluate, and conduct a comprehensive cost/benefit evaluation based on a specific form of CVR implementation to estimate the long-term effects of a CVR implementation.

CVR and Extreme Weather, DSM, and DER

In some locations and circumstances, CVR is an effective technology to help conserve energy or lower peak demand on localized distribution system elements. However, extreme weather may pose a threat to the benefits of CVR by, for example, destroying distribution system equipment such as capacitor banks on poles. If the CVR system relies on these equipment sets, then the weather condition impairs the CVR system from operating in that location.

Additionally, in most instances of extreme weather, the distribution system operator will be mainly concerned with the resilience of the grid and the threats to safety posed by the storm to members of the public and to utility workers. By itself, CVR is unlikely to contribute to improved safety during these weather conditions where there are chances of significant outages.

To the extent that CVR may help Liberty-Empire reduce total energy consumption or reduce peak loads, CVR can be viewed as complementary to DSM measures. Because CVR is a technology and system implemented by the utility, however, Liberty-Empire views CVR as separate from DSM measures.

Finally, Liberty-Empire's ability to manage and control voltage levels across its distribution system may play a valuable role as more DER is connected to the Liberty-Empire system. However, the role of voltage regulation goes beyond that of achieving energy conservation, which is the focus of CVR.

Potential Demand and Energy Load – Electric Vehicles

(k) Evaluate the potential demand and energy load associated with electric vehicles

within the utility's service territory, discuss how the preferred plan addresses the additional demand and energy load requirements, and evaluate potential means for shifting the additional demand and energy load to off-peak periods. Describe all current and planned electric vehicle initiatives undertaken by the utility, including how such initiatives have been affected by the Western District Court of Appeals' ruling in WD80911.

Various levels of electric vehicle load growth were incorporated into the development of the load forecast in Volume 3. Uncertainty analysis performed on the load forecast captures the range of uncertainty affected by growing adoption of grid-connected electric vehicles.

8.1.12 Utility Plant Cost Reductions

(l) Describe and document the extent to which federal investment, production, and other tax credits reduce the costs for utility plant.

Technical Volume 4 Section 2.2 discusses how tax credits affect the relative economics of renewable resources.

8.1.13 Generating Assets – RTO and ISO

(m) Describe and document the extent to which each of the utility's generating assets is or is not competitive within the utility's applicable Regional Transmission Organization or Independent System Operator.

Table 6-68 below shows the capacity factor and energy margin (in $/MWh) for Liberty-Empire's major fossil units under base case assumptions. For the purposes of this table, Liberty-Empire excluded its gas peaking units because the relative competitiveness of a gas peaking unit is not directly related to its revenue in the energy market. Liberty-Empire also excluded its renewable resources from this table, as the dispatch of renewable resources is fixed and unrelated to energy market prices.

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Table 6-68 - Capacity Factor and Energy Margins for Liberty-Empire's Major Fossil Fuel Units **Confidential in its Entirety[65]**

[redacted]

8.1.13.1 Senate Bill 564

(n) Describe and document the utility's plans regarding the authorities and requirements contained in Senate Bill 564 (2018), including, but not limited to, the following sections of the legislation:

(1) Section 393.1610, RSM0. (Investments in Small Scale and Pilot Projects); and

(2) Section 393.1665, RSMo. (Utility-Owned Solar Facilities).

With the passage of Senate Bill 564 in August 2018, section 393.1610 allows the Commission to approve small scale or pilot project investments for innovative technology, including but not limited to renewable generation, microgrids, and/or energy storage, provided that the

[65] 4 CSR 240-2.135(2)(A)1 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.

investments are designed to advance the utility's operational knowledge of deploying the technology, such as by gaining operational efficiencies resulting in customer savings and benefits. Furthermore, section 393.1665 requires Liberty-Empire to invest $3.5 million by the end of 2023 in utility scale solar facilities.

Liberty-Empire is currently working on its proposed tariff for a Community Solar Pilot Program, which will provide customers the opportunity to voluntarily subscribe to the generation output of solar facilities owned and operated by the Company within its Missouri service territory. The solar facilities will be connected to Liberty-Empire's distribution system, and the generation output will provide an offset for energy used by participating customers. Liberty-Empire plans to offer one 5 MW solar facility in its initial offering, with the potential to add five additional 5 MW solar facilities based on customer commitments. Customers will be required to enroll in the solar program in advance and each facility will be built when 90 percent of the proposed solar resource is committed through signed Participant Agreements.

In addition, Liberty-Empire is in the early stages of researching and developing a battery storage pilot program. Liberty-Empire believes a battery storage program will provide many benefits to both the Company and customers. As a non-wires alternative ("NWA"), Liberty-Empire believes that the addition of batteries may reduce peak loads on feeders near their capacity rating, increase circuit and substation reliability, and allow customers to utilize the benefits of backup power (thereby improving overall system reliability during outages). Furthermore, a battery storage pilot program will allow Liberty-Empire to better understand customer needs around time-of-use ("TOU") rates, which may provide incentives for customers to reduce their load.

8.1.13.2 Purchasing Goals for Increased Access to Renewable Energy and Distributed Generation Resources

(o) Describe and document the utility's efforts to address the corporate social responsibility and/or renewable energy purchasing goals of commercial, industrial, institu-

tional, and public-sector customers for increased access to renewable energy and distributed generation resources.

Liberty-Empire began to develop its wind renewable energy portfolio on December 10, 2004, when it entered into a 20-year contract with Elk River Windfarm, LLC (owned by Avangrid Renewables, LLC) to purchase all of the energy generated at the 150 MW Elk River Windfarm located in Butler County, Kansas.

On June 19, 2007, Liberty-Empire enhanced its renewable energy portfolio when it entered into a 20-year purchased power agreement with Cloud County Wind Farm, LLC. EDP Renewables North America LLC is an indirect parent company of Cloud County Wind Farm, LLC. Pursuant to the terms of the agreement, Liberty-Empire purchases all of the output from the 105 MW Phase 1 Meridian Way Wind Farm located in Cloud County, Kansas.

In addition, the Ozark Beach Hydroelectric Project, owned by Liberty-Empire, has produced renewable hydropower for many years.

Effective May 16, 2015, Liberty-Empire began offering rebates for Missouri customers for qualifying solar installations in accordance with the Missouri Renewable Energy Standard ("RES") and Liberty-Empire's Solar Rebate Rider approved by the Commission. This program remains in effect. Additionally, for compliance with the Missouri RES, Liberty-Empire currently retires sufficient renewable energy credits ("RECs") to provide the equivalent of 5% of its retail electric sales. This number escalates to no less than 15% of its retail electric sales beginning in 2021. Generation from Liberty-Empire's Ozark Beach Hydroelectric Project and the PPA with Elk River Windfarm supplies the RECs, which are retired for compliance (although Meridian Way is eligible as well).

The Missouri RES contains a requirement that at least 2% of the Liberty-Empire RES portfolio shall be derived from solar energy. Solar RECs ("SRECs") from customer–generated sources are retired to meet the 2% solar compliance requirement.

Liberty-Empire filed its proposed Customer Savings Plan with the Commission on October 31, 2017, and per the Commission's Report and Order issued July 11, 2018, announced its plan to build up to 600 MW of additional wind in or near its service territory. On June 19, 2019, Liberty-Empire received an Order approving Liberty-Empire's proposed Certificates of Convenience and Necessity ("CCN") for three wind projects totaling 600 MWs, located in southwest Missouri and southeast Kansas. These projects are expected to be completed by the end of 2020. Liberty-Empire expects to take ownership of these facilities on January 4, 2021. These projects are expected to save customers approximately $169 million over the next 20 years. As Liberty-Empire's existing wind PPAs with Elk River and Meridian Way expire in 2025 and 2028, respectively, these new additions to Liberty-Empire's generation portfolio will also be used for compliance with the Missouri RES.

Liberty-Empire has seen significant adoption of the community solar energy program that has been offered to its customers. In addition, the Company has begun exploring opportunities to expand the solutions to allow for greater adoption of renewable energy resource, distributed generation, and battery storage. To date, specifics of the solutions are being developed with a goal of defining a slate of products and services that would meet the needs of all customers, including those with corporate social responsibility goals.

8.1.14 EPA's Proposed Affordable Clean Energy Rule

(p) Describe and document the potential impacts on the utility of the EPA's proposed federal Affordable Clean Energy rule, including, but not limited to, the following aspects of the rule:

(1) The use of on-site efficiency upgrades as the best system of emission reduction for reducing carbon dioxide emissions;

On December 2017, the EPA issued an advance notice of proposed rulemaking ("ANPRM") in which the agency proposed emission guidelines to limit greenhouse gas ("GHG") emissions from existing electric generating units ("EGUs"). The ANPRM also solicited information on the proper respective roles of the federal and state governments in that process, as well as information on systems of emission reduction that are applicable at or to an existing EGU, information on compliance measures, and information on state planning requirements under the Clean Air Act ("CAA"). This ANPRM did not propose any regulatory requirements.

As a result of this ANPRM, on August 21, 2018, the EPA proposed the Affordable Clean Energy ("ACE") rule, which would establish emission guidelines for states to develop plans to address greenhouse gas emissions from existing coal-fired power plants. The ACE rule replaces the 2015 Clean Power Plan, which the EPA has proposed to repeal because it was determined through court challenge to have exceeded EPA's authority under the Clean Air Act. The Clean Power Plan was stayed by the U.S. Supreme Court and has never gone into effect.

Until the litigation and rulemaking regarding the CPP and ACE is resolved, it is difficult to determine the impact of the proposed ACE rule, but it could mean the addition of new emission reduction technologies, reduced generation, alternate generation, or implementation mandates for demand reduction technologies.

(2) Changes to the New Source Review permitting program; and

Currently, New Source Review ("NSR") is triggered if a project is expected to cause a significant net increase in a facility's actual annual emissions. This approach has historically discouraged utilities from investing in beneficial efficiency improvements. Under the proposed ACE rule, states will be called upon to develop plans to establish standards of performance for existing coal-fired power plants that are based on the application of a range of efficiency improvement projects.

The EPA is proposing to amend the NSR regulations to include an hourly emission increase test for modifications of EGUs. The proposed NSR change(s) could be one tool that states use to help ensure the efficient and effective implementation of their 111(d) plans. States would have the option to adopt the hourly test ultimately promulgated as part of the NSR provisions in their state implementation plans ("SIPs").

> *Changes to the implementation of Section 111(d) of the Clean Air Act regarding the EPA's emission guideline issuance and state plan development and submission.*

The proposed ACE rule aligns CAA section 111(d) general implementing regulations to give states adequate time and flexibility to develop their state plans. The proposed rule would provide states three years to develop state plans and the EPA twelve months to act on a complete state plan submittal. In addition, the proposed rule would provide adjustments to the existing variance provisions to provide expanded flexibility to states.

8.1.15 Electric Vehicle Charging Infrastructure

> *(q) Analyze and screen electric vehicle charging infrastructure as a candidate resource option in light of the Court of Appeals Western District's decision in KCP&L v. PSC, No. WD80911 (Aug. 7, 2018), that such an investment may be recoverable in rate base.*

Electric vehicle charging infrastructure was screened out as a potential resource option. Refer to Technical Volume 4 Section 1.7.1 for details.

8.1.16 Renewable Energy and Battery Storage

> *(r) Analyze, document, and screen renewable energy + battery storage as an alternative to existing coal-fired generation, comparable to Xcel Energy's proposed Colorado Clean Energy Plan in Colorado PUC Docket No. 16A-0396E.*

Renewable energy and battery storage combinations were included as resource options in the portfolio optimization analysis. Some of those resources were selected for alternative resource plans. Refer to Technical Volume 4 Section 2.3 and Technical Volume 6 Section 3.1.14 for details.

8.1.17 Environmental Standards

(s) Analyze and document the future capital and operating costs faced by each Empire coal-fired generating unit in order to comply with all existing, pending, or potential environmental standards, including:

(1) Clean Air Act New Source Review provisions

(2) 1-Hour Sulfur-Dioxide National Ambient Air Quality Standard

(3) National Ambient Air Quality Standards for ozone and fine particulate matter;

(4) Cross-State Air Pollution Rule, including the anticipated 2016 update to the rule to incorporate interstate transport requirements for the 2008 ozone National Ambient Air Quality Standard;

(5) Mercury and Air Toxics Standards;

(6) Clean Water Act Section 316(b) Cooling Water Intake Standards;

(7) Clean Water Act Steam Electric Effluent Limitation Guidelines;

(8) Coal Combustion Waste rules;

(9) Clean Air Section 111(d) Greenhouse Gas standards for existing sources; and

(10) Clean Air Act Regional Haze requirements

In December 2014, Liberty-Empire completed an environmental retrofit at the Asbury plant. The retrofit project included the installation of a pulse-jet fabric filter (baghouse), circulating dry scrubber, and powder activated carbon injection system. This new equipment enables Liberty-Empire to comply with the Mercury and Air Toxics Standard (“MATS”). The final cost of the project was $112.1 million, excluding AFUDC.

Liberty-Empire has and will continue to incur capital and operating costs at its coal-fired generating facilities to comply with existing and future environmental regulations. At Asbury, for instance, project operating costs with AQCS are estimated at $2.3 million annually. This is in addition to the approximately $1.3 million that will be spent to operate and maintain the selective catalytic reduction ("SCR") system previously installed.

Liberty-Empire has also published a Closure Plan for the Asbury Plant CCR Impoundment. The plan schedule assumes a closure initiation in November 2020 with completion of the closure by October 2025. If Liberty-Empire is unable to implement the Closure Plan for the Asbury Plant CCR Impoundment by this time, it will need to construct at least one cell of a new landfill and complete the conversion of the existing bottom ash handling from a wet to a dry system to comply with both the CCR and ELG rules (see Volume 4). Final closure of the existing ash impoundment, for which an asset retirement obligation of $15.5 million has been recorded, is anticipated after the new landfill is operational. In lieu of the expected impoundment closure, the new cell construction and the conversion of the existing ash handling system are expected to cost up to $3 million and $17 million, respectively.

Riverton Unit 7 was retired from service in June 2014, and Units 8 and 9 were retired from service in July 2015. Those units were decommissioned and dismantled in 2017. Costs associated with the retirement of Riverton Units 7, 8 and 9 include $1.43 million that was spent to close the existing ash landfill and $5.9 million for the environmental remediation and demolition of the units. Operating costs for the landfill post-closure are forecast to be approximately $25,000 per year.

On Liberty-Empire's 7.52% ownership share of Plum Point, annual costs for operating the air pollution control equipment and the fly ash landfill were approximately $458,000 in 2018. There is also the infrequent need to construct a new landfill cell. The last cell constructed cost approximately $290,000.

On Liberty-Empire's 12% ownership share of the two units at the Iatan Station, Liberty-Empire will need to construct additional landfill cells in the future and ash conversion projects to comply with the ELG and CCR rules, costing Liberty-Empire approximately $9 million. Ongoing capital projects needed for compliance for the CWA 316(a) rules have an estimated cost to Liberty-Empire of $19 million dollars.

8.1.17.1 Utility Scale Wind and Solar Resources

(t) Analyze and document cost and performance information sufficient to fairly analyze and compare utility scale wind and solar resources, including distributed generation, to other supply side alternatives.

Utility scale wind and solar generation, as well as distributed solar, are included as resource options in the portfolio optimization analysis. Refer to Technical Volume 4 Section 2 for details.

8.1.17.2 Emerging Energy Efficiency Technologies

(u) Analyze the impact of emerging energy efficiency technologies throughout the planning period.

Liberty-Empire assessed several different “improved” or “emerging” technologies that are either available in the market (but restricted by current market barriers due to high cost or low supply) or not currently available (but come on market at various times throughout the planning period). The reason for including these technologies was to capture the effects of advancements in technology and potential reduction in technology costs. The assumptions for these technologies were based on currently available secondary research. The list below contains the measures that Liberty-Empire classified as emerging technology options.

Table 6-69 - List of Emerging Technologies Options

Sector	End Use	Technology	Measure Label
Residential	Cooling	Central AC	SEER 21.0
Residential	Cooling	Central AC	SEER 24.0 Ductless, Var.Ref.Flow
Residential	Cooling / Heating	Air-Source Heat Pump	SEER 23.0

Sector	End Use	Technology	Measure Label
Residential	Cooling / Heating	Geothermal Heat Pump	EER 30.0 / COP 5.0
Residential	Cooling / Heating	Geothermal Heat Pump	EER 36.0 / COP 4.9
Residential	Water Heating	Water Heater (<= 55 Gal)	NEEA Tier 1 EF 2.35
Residential	Water Heating	Water Heater (<= 55 Gal)	NEEA Tier 2 EF 2.50
Residential	Water Heating	Water Heater (> 55 Gal)	NEEA Tier 3 EF 2.35
Residential	Water Heating	Water Heater (> 55 Gal)	NEEA Tier 4 EF 2.50
Residential	Interior Lighting	General Service Screw-In	LED 2019/2020 (97 lm/W)
Residential	Interior Lighting	General Service Screw-In	LED 2025 (111 lm/W)
Residential	Interior Lighting	General Service Screw-In	LED 2030 (123 lm/W)
Residential	Interior Lighting	Linear Lighting	LED 2019/2020 (123 lm/W system)
Residential	Interior Lighting	Linear Lighting	LED 2025 (142 lm/W sys-tem)
Residential	Interior Lighting	Linear Lighting	LED 2030 (158 lm/W sys-tem)
Residential	Interior Lighting	Exempted Screw-In	LED 2019/2020 (89 lm/W)
Residential	Interior Lighting	Exempted Screw-In	LED 2025 (108 lm/W)
Residential	Interior Lighting	Exempted Screw-In	LED 2030 (122 lm/W)
Residential	Exterior Lighting	Screw-in	LED 2019/2020 (89 lm/W)
Residential	Exterior Lighting	Screw-in	LED 2025 (104 lm/W)
Residential	Exterior Lighting	Screw-in	LED 2030 (117 lm/W)
Residential	Appliances	Refrigerator	Advanced Refrigerator with Vacuum Insulation
Residential	Appliances	Clothes Washer	High Efficiency (MEF 2.89)
Residential	Appliances	Clothes Dryer	High 2020 (EF 4.51)
Residential	Appliances	Clothes Dryer	Heat Pump Dryer (CEF 4.35)
Residential	Appliances	Clothes Dryer	Heat Pump Dryer (CEF 6.65)
Residential	Appliances	Dishwasher	Proposed ENERGY STAR (270 kWh)
Residential	Water Heating	Water Heater	Drainwater Heat Recovery
Residential	Water Heating	Water Heater	Water Heater - Desuper-heater
Residential	All	All	ENERGY STAR Home Design
Residential	All	All	Connected Home Energy Management System
Non-Residential	Cooling	Air-Cooled Chiller	COP 4.45 (EER 15.2)
Non-Residential	Cooling	Water-Cooled Chiller	COP 11.72 (0.30 kW/ton)
Non-Residential	Cooling	Water-Cooled Chiller	COP 12.13 (0.29 kW/ton)
Non-Residential	Cooling	Water-Cooled Chiller	COP 13.03 (0.27 kW/ton)
Non-Residential	Cooling/Heating	Geothermal Heat Pump	EER 35.5 (COP 4.76)
Non-Residential	Interior Lighting	Exempted Lighting	LED 2019/2020 (97 lm/W)
Non-Residential	Interior Lighting	Exempted Lighting	LED 2025 (111 lm/W)
Non-Residential	Interior Lighting	Exempted Lighting	LED 2030 (123 lm/W)
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2019/2020 (121 lm/W)
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2025 (138 lm/W)

Sector	End Use	Technology	Measure Label
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2030 (152 lm/W)
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2019/2020 (121 lm/W) w/ Controls
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2025 (138 lm/W) w/ Controls
Non-Residential	Interior Lighting	High-Bay Lighting	LED 2030 (152 lm/W) w/ Controls
Non-Residential	Interior Lighting	Linear Lighting	LED 2019/2020 (123 lm/W system)
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2025 (142 lm/W system)
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2030 (158 lm/W system)
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2019/2020 (123 lm/W system) w/ Controls
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2025 (142 lm/W system) w/ Controls
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2030 (158 lm/W system) w/ Controls
Non-Residential	Int./Ext. Lighting	Linear Lighting	LED 2019/2020 (123 lm/W system)
Non-Residential	Exterior Lighting	General Service Lighting	LED 2019/2020 (97 lm/W)
Non-Residential	Exterior Lighting	General Service Lighting	LED 2025 (111 lm/W)
Non-Residential	Exterior Lighting	General Service Lighting	LED 2030 (123 lm/W)
Non-Residential	Exterior Lighting	Area Lighting	LED 2019/2020 (105 lm/W)
Non-Residential	Exterior Lighting	Area Lighting	LED 2025 (120 lm/W)
Non-Residential	Exterior Lighting	Area Lighting	LED 2030 (132 lm/W)
Non-Residential	Exterior Lighting	Area Lighting	LED 2019/2020 (105 lm/W) w/ Controls
Non-Residential	Exterior Lighting	Area Lighting	LED 2025 (120 lm/W) w/ Controls
Non-Residential	Exterior Lighting	Area Lighting	LED 2030 (132 lm/W) w/ Controls
Non-Residential	Heating	All	Space Heating - Heat Recovery Ventilator
Non-Residential	Cooling	RTU	RTU - Advanced Controls
Non-Residential	Water Heating	Water Heater	Water Heater - Drainwater Heat Recovery
Non-Residential	Water Heating	Water Heater	Water Heater - Solar System
Non-Residential	Water Heating	Water Heater	Commercial Laundry - Ozone Treatment
Non-Residential	Ventilation	Ventilation	Ventilation - Demand Controlled
Non-Residential	Cooling	All	Data Center - Server Virtualization

8.1.18 Missouri Energy Efficiency Investment Act (MEEIA) Program potential

(v) Analyze whether it would be appropriate for Empire to develop and implement a Missouri Energy efficiency Investment Act (MEEIA) program.

Liberty-Empire has expressed its intent to work with its stakeholders to pursue a MEEIA portfolio or comparable demand-side investment mechanism upon resolution of its 2019 Integrated Resource Plan, provided that such a portfolio is supported by the results of the Demand-side Potential Study and the integrated analysis. Liberty-Empire would, of course, prefer to pursue a more comprehensive cost-recovery mechanism, thus reducing or eliminating the disincentive to offering such programs.

There are items in two separate cases in which Liberty-Empire has addressed its intent to explore the potential of making a MEEIA filing subsequent to the resolution of its 2019 Triennial Integrated Resource Plan filing. The first of those two items was filed as part of the Joint Filing[66] in Liberty-Empire's 2016 Triennial Integrated Resource Plan filing. In it, Liberty-Empire commits to the following:

Empire will analyze, describe and document the economic impact of alternative resource plans, calculated with and without utility financial incentives or lost earnings opportunities for demand-side resources, and comparative estimates for each year of the planning horizon within its 2019 triennial compliance filing.

As directed, Liberty-Empire has done this analysis as part of its 2019 Triennial Integrated Resource Plan filing. This information will be helpful as a supplement to the analysis that would support a future MEEIA filing, or a comparable demand-side investment mechanism. Liberty-Empire intends to work with stakeholders to pursue this in 2019 and 2020.

[66] Missouri Public Service Commission File No. EO-2019-0049. *Joint Filing*, Item 14. Filed October 25, 2016.

The second of these two items was filed as part of the Stipulation and Agreement in EM-2016-0213, [67] which finalized Liberty's acquisition of Liberty-Empire.

> *Empire will work with DE, the Staff of the Commission ("Staff"), the Office of the Public Counsel ("OPC") and other parties through the existing DSM Advisory Group to review and consider the viability of adopting additional energy efficiency programs for its customers. Within one year of the Commission's finding of substantial compliance of the Empire Integrated Resource Plan that follows Commission approval of a Statewide Technical Reference Manual (TRM), Empire will develop and submit an application for approval of a portfolio of DSM programs under the Missouri Energy Efficiency Investment Act (MEEIA), so long as any such portfolio is a part of Empire's adopted preferred resource plan in its Integrated Resource Plan, or has been analyzed through the integration process required by 4 CSR 240-22.060, and the portfolio and any DSIM submitted in the application is fully compliant with the MEEIA statute and applicable regulations.*

Liberty-Empire actively participated in the development of the Statewide TRM, which has been finalized and filed. The document has yet to be approved by the Missouri Public Service Commission, meaning the preceding language does not obligate Liberty-Empire to make a MEEIA filing within one year subsequent to its 2019 Integrated Resource Plan filing. However, Liberty-Empire does still intend to use the recommendations of the Demand-side Potential Study filed as part of its 2019 Integrated Resource Plan as the basis for a subsequent MEEIA, or the pursuit of approval of a comparable demand-side investment mechanism.

8.1.19 Scenarios of Projected Off-System Sales Revenue

> *(w) Analyze and document low, base, and high scenarios of projected off-system sales revenues under a range of assumed natural gas prices, CO_2 prices and coal prices.*

[67] Missouri Public Service Commission File No. EO-2019-0049. *Joint Filing*, Item 14. Filed October 25, 2016. *i*, Item 1. Filed August 23, 2016.

The projected off-system sales under a variety of assumptions for the Preferred Plan are illustrated below.

Figure 6-93- Off-System Sales Under Different Assumptions
****Confidential in its Entirety**[68]**

[redacted]

[redacted]

[68]4 CSR 240-2.135(2)(A)1 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.

Appendix 6A	Avoided Energy Cost and Plan Tables
Appendix 6B	DSM Impact on Plan Loads Tables
Appendix 6C	DSM Composition Tables
Appendix 6D	Supply-Side Resource Composition Tables
Appendix 6E	Impact of DSM on Annual Energy Requirements Tables
Appendix 6F	Composition of DSM Energy Provided Tables
Appendix 6G	Composition of Supply-Side Energy Tables
Appendix 6H	Annual Emissions Tables
Appendix 6I	Plan Tornado Diagrams Tables
Appendix 6J	PVRR with Risk Value for Alternative Resource Plans Table
Appendix 6K	Cumulative Probability Tables

Appendix 6A **Avoided Energy Cost and Plan Tables**

Table 6A-1 - Avoided Energy and Capacity Costs ($ Nominal) **Confidential in its Entirety**[69]

[redacted]

Table 6A-2 - PVRR (20 Years) For All Plans

Plan	Plan Description	20 Year NPVRR ($M)
Plan 0	Customer Savings Plan	7,415
Plan 1	Asbury End of Life - Least Cost	7,398
Plan 2	Early Asbury Retire - Central Scale Renewables	7,325
Plan 2B	Early Asbury Retire - Central Scale Renewables - All 2023 Solar	7,320
Plan 2_MAP	Early Asbury Retire - Central Scale Renewables + MAP DSM	7,327
Plan 3	Early Asbury Retire - Central Scale Thermal	7,370
Plan 4	Early Asbury Retire - Distributed Renewable	7,321
Plan 5	Early Asbury Retire - Distributed Thermal	7,359
Plan 6	Early Asbury Retire - Central Scale Mix	7,344
Plan 7	Early Asbury Retire - Distributed Mix	7,343
Plan 8	Early Asbury, Peaker Retire - Central Scale Renewables	7,317
Plan 9	Early Asbury, Peaker Retire - Central Scale Thermal	7,392
Plan 10	Early Asbury, Peaker Retire - Distributed Renewable	7,315
Plan 11	Early Asbury, Peaker Retire - Distributed Thermal	7,366
Plan 12	Early Asbury, Peaker Retire - Central Scale Mix	7,360
Plan 13	Early Asbury, Peaker Retire - Distributed Mix	7,371

[69] 4 CSR 240-2.135(2)(A)1 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 6A-3 - Annual Rate Increases for All Plans ($ in Millions)
****Confidential in its Entirety**[70]**

[redacted]

Table 6A-4 – Average Rate Revenue of All Plans
****Confidential in its Entirety**[70]**

[redacted]

[70] 4 CSR 240-2.135(2)(A)1 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.

Appendix 6B **DSM Impact on Plan Loads Tables**

Table 6B-1 – RAP DSM Impact on Load
****Confidential in its Entirety**[71]**

[redacted]

Table 6B-2 - MAP DSM Impact on Load
****Confidential in its Entirety**[71]**

[redacted]

[71] 4 CSR 240-2.135(2)(A)1 allows information to be marked as confidential when reports, work papers, or other documentation related to work produced by internal or external auditors or consultants is used.

Appendix 6C DSM Composition Tables

Table 6C-1 - DSM Composition of RAP DSM (MW)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Whole House Efficiency	0.10	0.31	0.56	0.81	1.07	1.32	1.58	1.83	2.08	2.34	2.64	2.92	3.18	3.44	3.70	3.97	4.23	4.49	4.75	5.02
C&I Program	0.72	2.12	3.51	5.03	6.54	8.03	9.53	11.01	12.43	13.83	15.04	16.05	17.06	18.04	19.06	19.77	20.16	20.57	21.08	21.58
Residential Behavioral	0.41	1.22	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
Low Income Behavioral	0.16	0.49	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Low Income Weatherization	0.10	0.29	0.48	0.67	0.87	1.06	1.25	1.44	1.67	1.89	2.12	2.34	2.56	2.79	3.01	3.14	3.17	3.21	3.24	3.27

Table 6C-2 - DSM Composition of MAP DSM (MW)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Whole House Efficiency	0.17	0.51	0.92	1.33	1.74	2.14	2.55	2.96	3.37	3.78	4.25	4.68	5.09	5.49	5.89	6.30	6.71	7.11	7.52	7.92
C&I Program	1.22	3.07	5.01	7.01	8.97	10.89	12.79	14.69	16.50	18.11	19.53	20.76	22.02	23.23	24.44	25.14	25.59	26.07	26.61	27.14
Residential Behavioral	0.54	1.63	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17	2.17
Low Income Behavioral	0.24	0.73	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Low Income Weatherization	0.16	0.48	0.80	1.12	1.44	1.76	2.08	2.40	2.72	3.05	3.37	3.69	4.01	4.33	4.65	4.81	4.81	4.81	4.81	4.81

Table 6D-1 - Supply-Side Resource Composition of Plan 0

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1442	0	0	0	2	0	0	0	0	0
2021	1442	10	605	0	4	0	0	0	0	0
2022	1442	10	605	35	7	0	0	0	0	0
2023	1442	10	605	35	9	0	0	0	0	0
2024	1442	10	605	35	11	0	0	0	0	0
2025	1442	10	605	35	13	0	0	0	0	0
2026	1420	10	605	35	15	0	0	0	0	0
2027	1258	10	605	35	16	0	0	0	0	0
2028	1258	10	605	35	18	0	0	0	0	0
2029	1249	10	605	35	20	0	0	0	0	0
2030	1249	10	605	35	22	0	0	0	0	0
2031	1249	10	605	35	23	0	0	0	0	0
2032	1249	10	605	35	25	0	0	0	0	0
2033	1249	10	605	35	26	0	0	0	0	0
2034	1221	10	605	35	28	0	0	0	0	0
2035	1221	10	605	35	29	0	0	0	0	0
2036	1021	10	605	35	30	0	0	0	148	0
2037	1021	10	605	35	31	0	0	0	148	0
2038	1021	10	605	35	31	0	0	0	148	0

Table 6D-2 - Supply-Side Resource Composition of Plan 1

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1442	0	0	0	2	0	0	0	0	0
2021	1442	10	605	0	4	0	0	0	0	0
2022	1442	10	605	35	7	0	0	0	0	0
2023	1442	10	605	35	9	0	0	0	0	0
2024	1442	10	605	35	11	0	0	0	0	0
2025	1442	10	605	35	13	0	0	0	0	0
2026	1420	10	605	35	15	0	0	0	0	0
2027	1258	10	605	35	16	0	0	0	0	0
2028	1258	10	605	35	18	0	0	0	0	0
2029	1249	10	605	35	20	0	0	0	0	0
2030	1249	10	605	35	22	0	0	0	0	0
2031	1249	10	605	35	23	0	0	0	0	0
2032	1249	10	605	35	25	0	0	0	0	0
2033	1249	10	605	35	26	0	0	0	0	0
2034	1221	10	605	35	28	0	0	0	0	0
2035	1221	10	605	35	29	0	0	0	0	0
2036	1021	10	605	35	30	230	20	0	0	0
2037	1021	10	605	35	31	230	20	0	0	0
2038	1021	10	605	35	31	230	20	0	0	0

Table 6D-3 - Supply-Side Resource Composition of Plan 2

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	0	0	0
2023	1242	10	605	35	9	50	0	0	0	0
2024	1242	10	605	35	11	50	0	0	0	0
2025	1242	10	605	35	13	50	0	0	0	0
2026	1220	10	605	35	15	50	0	0	0	0
2027	1058	10	605	35	16	140	10	0	0	0
2028	1058	10	605	35	18	140	10	0	0	0
2029	1049	10	605	35	20	190	10	0	0	0
2030	1049	10	605	35	22	190	10	0	0	0
2031	1049	10	605	35	23	190	10	0	0	0
2032	1049	10	605	35	25	190	10	0	0	0
2033	1049	10	605	35	26	190	10	0	0	0
2034	1021	10	605	35	28	230	20	0	0	0
2035	1021	10	605	35	29	230	20	0	0	0
2036	1021	10	605	35	30	230	20	0	0	0
2037	1021	10	605	35	31	230	20	0	0	0
2038	1021	10	605	35	31	230	20	0	0	0

Table 6D-4 - Supply-Side Resource Composition of Plan 2B

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	0	0	0
2023	1242	10	605	35	9	150	0	0	0	0
2024	1242	10	605	35	11	150	0	0	0	0
2025	1242	10	605	35	13	150	0	0	0	0
2026	1220	10	605	35	15	150	0	0	0	0
2027	1058	10	605	35	16	190	10	0	0	0
2028	1058	10	605	35	18	190	10	0	0	0
2029	1049	10	605	35	20	190	10	0	0	0
2030	1049	10	605	35	22	190	10	0	0	0
2031	1049	10	605	35	23	190	10	0	0	0
2032	1049	10	605	35	25	190	10	0	0	0
2033	1049	10	605	35	26	190	10	0	0	0
2034	1021	10	605	35	28	230	20	0	0	0
2035	1021	10	605	35	29	230	20	0	0	0
2036	1021	10	605	35	30	230	20	0	0	0
2037	1021	10	605	35	31	230	20	0	0	0
2038	1021	10	605	35	31	230	20	0	0	0

Table 6D-5 - Supply-Side Resource Composition of Plan 2 - MAP

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	6	0	0	0	0	0
2022	1242	10	605	35	9	0	0	0	0	0
2023	1242	10	605	35	12	50	0	0	0	0
2024	1242	10	605	35	14	50	0	0	0	0
2025	1242	10	605	35	17	50	0	0	0	0
2026	1220	10	605	35	19	50	0	0	0	0
2027	1058	10	605	35	21	140	10	0	0	0
2028	1058	10	605	35	24	140	10	0	0	0
2029	1049	10	605	35	26	190	10	0	0	0
2030	1049	10	605	35	28	190	10	0	0	0
2031	1049	10	605	35	30	190	10	0	0	0
2032	1049	10	605	35	32	190	10	0	0	0
2033	1049	10	605	35	34	190	10	0	0	0
2034	1021	10	605	35	35	230	20	0	0	0
2035	1021	10	605	35	37	230	20	0	0	0
2036	1021	10	605	35	37	230	20	0	0	0
2037	1021	10	605	35	38	230	20	0	0	0
2038	1021	10	605	35	39	230	20	0	0	0

Table 6D-6 - Supply-Side Resource Composition of Plan 3

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	0	0	0
2023	1242	10	605	35	9	0	0	0	0	0
2024	1242	10	605	35	11	0	0	0	0	0
2025	1242	10	605	35	13	0	0	0	0	0
2026	1220	10	605	35	15	0	0	0	0	0
2027	1058	10	605	35	16	0	0	0	98	0
2028	1058	10	605	35	18	0	0	0	98	0
2029	1049	10	605	35	20	0	0	0	98	0
2030	1049	10	605	35	22	0	0	0	98	0
2031	1049	10	605	35	23	0	0	0	98	0
2032	1049	10	605	35	25	0	0	0	98	0
2033	1049	10	605	35	26	0	0	0	98	0
2034	1021	10	605	35	28	0	0	0	148	0
2035	1021	10	605	35	29	0	0	0	148	0
2036	1021	10	605	35	30	0	0	0	148	0
2037	1021	10	605	35	31	0	0	0	148	0
2038	1021	10	605	35	31	0	0	0	148	0

Table 6D-7 - Supply-Side Resource Composition of Plan 4

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	20	0	0
2023	1242	10	605	35	9	50	0	20	0	0
2024	1242	10	605	35	11	50	0	20	0	0
2025	1242	10	605	35	13	50	0	20	0	0
2026	1220	10	605	35	15	50	0	20	0	0
2027	1058	10	605	35	16	90	10	20	0	0
2028	1058	10	605	35	18	90	10	39	0	0
2029	1049	10	605	35	20	90	10	39	0	0
2030	1049	10	605	35	22	90	10	39	0	0
2031	1049	10	605	35	23	90	10	39	0	0
2032	1049	10	605	35	25	90	10	53	0	0
2033	1049	10	605	35	26	90	10	53	0	0
2034	1021	10	605	35	28	140	10	53	0	0
2035	1021	10	605	35	29	140	10	53	0	0
2036	1021	10	605	35	30	140	10	66	0	0
2037	1021	10	605	35	31	140	10	66	0	0
2038	1021	10	605	35	31	140	10	66	0	0

Table 6D-8 - Supply-Side Resource Composition of Plan 5

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	0	0	7
2023	1242	10	605	35	9	0	0	0	0	7
2024	1242	10	605	35	11	0	0	0	0	7
2025	1242	10	605	35	13	0	0	0	0	7
2026	1220	10	605	35	15	0	0	0	0	7
2027	1058	10	605	35	16	0	0	0	98	7
2028	1058	10	605	35	18	0	0	0	98	15
2029	1049	10	605	35	20	0	0	0	98	15
2030	1049	10	605	35	22	0	0	0	98	15
2031	1049	10	605	35	23	0	0	0	98	15
2032	1049	10	605	35	25	0	0	0	98	20
2033	1049	10	605	35	26	0	0	0	98	20
2034	1021	10	605	35	28	0	0	0	98	20
2035	1021	10	605	35	29	0	0	0	98	20
2036	1021	10	605	35	30	0	0	0	98	25
2037	1021	10	605	35	31	0	0	0	98	25
2038	1021	10	605	35	31	0	0	0	98	25

Table 6D-9 - Supply-Side Resource Composition of Plan 6

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	0	0	0
2023	1242	10	605	35	9	50	0	0	0	0
2024	1242	10	605	35	11	50	0	0	0	0
2025	1242	10	605	35	13	50	0	0	0	0
2026	1220	10	605	35	15	50	0	0	0	0
2027	1058	10	605	35	16	90	10	0	49	0
2028	1058	10	605	35	18	90	10	0	49	0
2029	1049	10	605	35	20	90	10	0	49	0
2030	1049	10	605	35	22	90	10	0	49	0
2031	1049	10	605	35	23	90	10	0	49	0
2032	1049	10	605	35	25	90	10	0	49	0
2033	1049	10	605	35	26	90	10	0	49	0
2034	1021	10	605	35	28	190	10	0	49	0
2035	1021	10	605	35	29	190	10	0	49	0
2036	1021	10	605	35	30	190	10	0	49	0
2037	1021	10	605	35	31	190	10	0	49	0
2038	1021	10	605	35	31	190	10	0	49	0

Table 6D-10 - Supply-Side Resource Composition of Plan 7

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1242	10	605	35	7	0	0	20	0	0
2023	1242	10	605	35	9	50	0	20	0	0
2024	1242	10	605	35	11	50	0	20	0	0
2025	1242	10	605	35	13	50	0	20	0	0
2026	1220	10	605	35	15	50	0	20	0	0
2027	1058	10	605	35	16	50	0	20	49	0
2028	1058	10	605	35	18	50	0	20	49	7
2029	1049	10	605	35	20	50	0	20	49	7
2030	1049	10	605	35	22	50	0	20	49	7
2031	1049	10	605	35	23	50	0	20	49	7
2032	1049	10	605	35	25	50	0	33	49	7
2033	1049	10	605	35	26	50	0	33	49	7
2034	1021	10	605	35	28	150	0	33	49	7
2035	1021	10	605	35	29	150	0	33	49	7
2036	1021	10	605	35	30	150	0	33	49	12
2037	1021	10	605	35	31	150	0	33	49	12
2038	1021	10	605	35	31	150	0	33	49	12

Table 6D-11 - Supply-Side Resource Composition of Plan 8

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	140	10	0	0	0
2023	1080	10	605	35	9	190	10	0	0	0
2024	1080	10	605	35	11	190	10	0	0	0
2025	1080	10	605	35	13	190	10	0	0	0
2026	1030	10	605	35	15	190	10	0	0	0
2027	1030	10	605	35	16	190	10	0	0	0
2028	1030	10	605	35	18	190	10	0	0	0
2029	1021	10	605	35	20	230	20	0	0	0
2030	1021	10	605	35	22	230	20	0	0	0
2031	1021	10	605	35	23	230	20	0	0	0
2032	1021	10	605	35	25	230	20	0	0	0
2033	1021	10	605	35	26	230	20	0	0	0
2034	1021	10	605	35	28	230	20	0	0	0
2035	1021	10	605	35	29	230	20	0	0	0
2036	1021	10	605	35	30	230	20	0	0	0
2037	1021	10	605	35	31	230	20	0	0	0
2038	1021	10	605	35	31	230	20	0	0	0

Table 6D-12 - Supply-Side Resource Composition of Plan 9

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	0	0	0	49	0
2023	1080	10	605	35	9	0	0	0	49	0
2024	1080	10	605	35	11	0	0	0	49	0
2025	1080	10	605	35	13	0	0	0	49	0
2026	1030	10	605	35	15	0	0	0	99	0
2027	1030	10	605	35	16	0	0	0	99	0
2028	1030	10	605	35	18	0	0	0	99	0
2029	1021	10	605	35	20	0	0	0	148	0
2030	1021	10	605	35	22	0	0	0	148	0
2031	1021	10	605	35	23	0	0	0	148	0
2032	1021	10	605	35	25	0	0	0	148	0
2033	1021	10	605	35	26	0	0	0	148	0
2034	1021	10	605	35	28	0	0	0	148	0
2035	1021	10	605	35	29	0	0	0	148	0
2036	1021	10	605	35	30	0	0	0	148	0
2037	1021	10	605	35	31	0	0	0	148	0
2038	1021	10	605	35	31	0	0	0	148	0

Table 6D-13 - Supply-Side Resource Composition of Plan 10

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	140	10	20	0	0
2023	1080	10	605	35	9	140	10	20	0	0
2024	1080	10	605	35	11	140	10	20	0	0
2025	1080	10	605	35	13	140	10	20	0	0
2026	1030	10	605	35	15	140	10	20	0	0
2027	1030	10	605	35	16	140	10	20	0	0
2028	1030	10	605	35	18	140	10	39	0	0
2029	1021	10	605	35	20	140	10	39	0	0
2030	1021	10	605	35	22	140	10	39	0	0
2031	1021	10	605	35	23	140	10	39	0	0
2032	1021	10	605	35	25	140	10	53	0	0
2033	1021	10	605	35	26	140	10	53	0	0
2034	1021	10	605	35	28	140	10	53	0	0
2035	1021	10	605	35	29	140	10	53	0	0
2036	1021	10	605	35	30	140	10	66	0	0
2037	1021	10	605	35	31	140	10	66	0	0
2038	1021	10	605	35	31	140	10	66	0	0

Table 6D-14 - Supply-Side Resource Composition of Plan 11

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	0	0	0	49	7
2023	1080	10	605	35	9	0	0	0	49	7
2024	1080	10	605	35	11	0	0	0	49	7
2025	1080	10	605	35	13	0	0	0	49	7
2026	1030	10	605	35	15	0	0	0	98	7
2027	1030	10	605	35	16	0	0	0	98	7
2028	1030	10	605	35	18	0	0	0	98	15
2029	1021	10	605	35	20	0	0	0	98	15
2030	1021	10	605	35	22	0	0	0	98	15
2031	1021	10	605	35	23	0	0	0	98	15
2032	1021	10	605	35	25	0	0	0	98	20
2033	1021	10	605	35	26	0	0	0	98	20
2034	1021	10	605	35	28	0	0	0	98	20
2035	1021	10	605	35	29	0	0	0	98	20
2036	1021	10	605	35	30	0	0	0	98	25
2037	1021	10	605	35	31	0	0	0	98	25
2038	1021	10	605	35	31	0	0	0	98	25

Table 6D-15 - Supply-Side Resource Composition of Plan 12

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	140	10	0	49	0
2023	1080	10	605	35	9	190	10	0	49	0
2024	1080	10	605	35	11	190	10	0	49	0
2025	1080	10	605	35	13	190	10	0	49	0
2026	1030	10	605	35	15	190	10	0	49	0
2027	1030	10	605	35	16	190	10	0	49	0
2028	1030	10	605	35	18	190	10	0	49	0
2029	1021	10	605	35	20	190	10	0	49	0
2030	1021	10	605	35	22	190	10	0	49	0
2031	1021	10	605	35	23	190	10	0	49	0
2032	1021	10	605	35	25	190	10	0	49	0
2033	1021	10	605	35	26	190	10	0	49	0
2034	1021	10	605	35	28	190	10	0	49	0
2035	1021	10	605	35	29	190	10	0	49	0
2036	1021	10	605	35	30	190	10	0	49	0
2037	1021	10	605	35	31	190	10	0	49	0

Table 6D-16 - Supply-Side Resource Composition of Plan 13

	Existing	Community Solar	New CSP Wind	State Line Upgrade	New DSM	Utility Solar	Utility Storage	Distributed Solar+Storage	Utility Gas	Distributed Gas
2019	1442	0	0	0	0	0	0	0	0	0
2020	1242	0	0	0	2	0	0	0	0	0
2021	1242	10	605	0	4	0	0	0	0	0
2022	1080	10	605	35	7	100	0	20	49	0
2023	1080	10	605	35	9	150	0	20	49	0
2024	1080	10	605	35	11	150	0	20	49	0
2025	1080	10	605	35	13	150	0	20	49	0
2026	1030	10	605	35	15	150	0	20	49	0
2027	1030	10	605	35	16	150	0	20	49	0
2028	1030	10	605	35	18	150	0	20	49	7
2029	1021	10	605	35	20	150	0	20	49	7
2030	1021	10	605	35	22	150	0	20	49	7
2031	1021	10	605	35	23	150	0	20	49	7
2032	1021	10	605	35	25	150	0	33	49	7
2033	1021	10	605	35	26	150	0	33	49	7
2034	1021	10	605	35	28	150	0	33	49	7
2035	1021	10	605	35	29	150	0	33	49	7
2036	1021	10	605	35	30	150	0	33	49	12
2037	1021	10	605	35	31	150	0	33	49	12
2038	1021	10	605	35	31	150	0	33	49	12

Appendix 6E Impact of DSM on Annual Energy Requirements Tables

Table 6E-1 - Impact of DSM on Annual Energy Requirements RAP DSM
****Confidential in its Entirety**[72]**

[redacted]

[72] 4 CSR 240-2.135(2)(A) allows information to be marked as confidential when reports, work papers, or other documentation related to work produced by internal or external auditors or consultants is used.

****Table 6E-2 - Impact of DSM on Annual Energy Requirements MAP DSM****
****Confidential in its Entirety**[73]**

[redacted]

[73] 4 CSR 240-2.135(2)(A) allows information to be marked as confidential when reports, work papers, or other documentation related to work produced by internal or external auditors or consultants is used.

Appendix 6F Composition of DSM Energy Provided Tables

Table 6F-1 - Composition of DSM Energy Provided in RAP DSM (MWh)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Whole House Efficiency	375	1,129	2,070	3,004	3,936	4,871	5,809	6,747	7,685	8,620	9,731	10,758	11,727	12,686	13,654	14,622	15,591	16,559	17,527	18,492
C&I Program	2,061	6,060	10,038	14,369	18,684	22,956	27,230	31,474	35,534	39,517	42,975	45,856	48,760	51,565	54,464	56,492	57,619	58,778	60,243	61,663
Residential Behavioral	1,800	5,400	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200
Low Income Behavioral	720	2,160	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880	2,880
Low Income Weatherization	425	1,276	2,126	2,977	3,827	4,678	5,528	6,379	7,371	8,363	9,356	10,348	11,340	12,332	13,325	13,892	14,033	14,175	14,317	14,459

Table 6F-2 - Composition of DSM Energy Provided in MAP DSM (MWh)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Whole House Efficiency	628	1,855	3,343	4,822	6,298	7,777	9,261	10,746	12,231	13,709	15,426	16,983	18,452	19,917	21,379	22,854	24,328	25,801	27,274	28,741
C&I Program	3,054	7,717	12,580	17,607	22,546	27,374	32,142	36,924	41,470	45,517	49,081	52,159	55,324	58,381	61,425	63,162	64,299	65,504	66,873	68,208
Residential Behavioral	2,400	7,200	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
Low Income Behavioral	1,080	3,240	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320	4,320
Low Income Weatherizati	709	2,126	3,544	4,961	6,379	7,796	9,214	10,631	12,049	13,466	14,884	16,301	17,719	19,137	20,554	21,263	21,263	21,263	21,263	21,263

Appendix 6G Composition of Supply-Side Energy Tables

Table 6G-1 - Composition of Supply-Side Energy for Plan 0

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	4,380,026	751,481	-	-	-	-	-
2021	4,117,111	2,486,758	-	20,232	-	-	-
2022	3,222,199	2,478,552	1,381,442	20,131	-	-	-
2023	3,225,893	2,477,777	1,377,666	20,031	-	-	-
2024	3,238,776	2,483,236	1,353,833	19,967	-	-	-
2025	3,275,627	2,483,523	1,347,208	19,831	-	-	-
2026	3,314,438	2,484,350	1,270,162	19,732	-	-	-
2027	3,284,043	2,486,758	1,236,726	19,633	-	-	-
2028	3,325,913	2,487,404	1,299,077	19,570	-	-	-
2029	3,182,283	2,479,383	1,267,693	19,437	-	-	-
2030	3,141,002	2,476,802	1,283,395	19,340	-	-	-
2031	3,244,717	2,483,523	1,287,080	19,243	-	-	-
2032	3,156,694	2,495,882	1,172,295	19,182	-	-	-
2033	3,212,671	2,478,552	1,172,273	19,051	-	-	-
2034	3,297,041	2,477,777	1,218,802	18,956	-	-	-
2035	3,233,298	2,479,383	1,196,121	18,861	-	-	-
2036	2,511,780	2,490,535	1,211,450	18,801	111,419	-	-
2037	2,430,507	2,484,350	1,188,481	18,673	114,260	-	-
2038	2,432,707	2,486,758	1,092,799	18,580	111,031	-	-

Table 6G-2 - Composition of Supply-Side Energy for Plan 1

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	4,380,026	751,481	-	-	-	-	-
2021	4,117,111	2,486,758	-	20,232	-	-	-
2022	3,222,199	2,478,552	1,381,442	20,131	-	-	-
2023	3,225,893	2,477,777	1,377,666	20,031	-	-	-
2024	3,238,776	2,483,236	1,353,833	19,967	-	-	-
2025	3,275,627	2,483,523	1,347,208	19,831	-	-	-
2026	3,314,438	2,484,350	1,270,162	19,732	-	-	-
2027	3,284,043	2,486,758	1,236,726	19,633	-	-	-
2028	3,325,913	2,487,404	1,299,077	19,570	-	-	-
2029	3,182,283	2,479,383	1,267,693	19,437	-	-	-
2030	3,141,002	2,476,802	1,283,395	19,340	-	-	-
2031	3,244,717	2,483,523	1,287,080	19,243	-	-	-
2032	3,156,694	2,495,882	1,172,295	19,182	-	-	-
2033	3,212,671	2,478,552	1,172,273	19,051	-	-	-
2034	3,297,041	2,477,777	1,218,802	18,956	-	-	-
2035	3,233,298	2,479,383	1,196,121	18,861	-	-	-
2036	2,511,780	2,490,535	1,211,450	484,325	-	-	-
2037	2,430,507	2,484,350	1,188,481	481,002	-	-	-
2038	2,432,707	2,486,758	1,092,799	478,604	-	-	-

Table 6G-3 - Composition of Supply-Side Energy for Plan 2

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	-
2023	2,544,816	2,477,777	1,377,666	121,192	-	-	-
2024	2,532,352	2,483,236	1,353,833	120,806	-	-	-
2025	2,564,802	2,483,523	1,347,208	119,983	-	-	-
2026	2,567,823	2,484,350	1,270,162	119,383	-	-	-
2027	2,485,058	2,486,758	1,236,726	300,529	-	-	-
2028	2,503,429	2,487,404	1,299,077	299,573	-	-	-
2029	2,431,639	2,479,383	1,267,693	398,690	-	-	-
2030	2,384,569	2,476,802	1,283,395	396,704	-	-	-
2031	2,490,220	2,483,523	1,287,080	394,726	-	-	-
2032	2,425,416	2,495,882	1,172,295	393,464	-	-	-
2033	2,424,916	2,478,552	1,172,273	390,762	-	-	-
2034	2,421,963	2,477,777	1,218,802	469,445	-	-	-
2035	2,409,640	2,479,383	1,196,121	467,040	-	-	-
2036	2,511,780	2,490,535	1,211,450	465,582	-	-	-
2037	2,430,507	2,484,350	1,188,481	462,387	-	-	-
2038	2,432,707	2,486,758	1,092,799	460,081	-	-	-

Table 6G-4 - Composition of Supply-Side Energy for Plan 2B

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	-
2023	2,544,816	2,477,777	1,377,666	323,515	-	-	-
2024	2,532,352	2,483,236	1,353,833	322,486	-	-	-
2025	2,564,802	2,483,523	1,347,208	320,288	-	-	-
2026	2,567,823	2,484,350	1,270,162	318,687	-	-	-
2027	2,485,058	2,486,758	1,236,726	397,674	-	-	-
2028	2,503,429	2,487,404	1,299,077	396,409	-	-	-
2029	2,431,639	2,479,383	1,267,693	393,704	-	-	-
2030	2,384,569	2,476,802	1,283,395	391,744	-	-	-
2031	2,490,220	2,483,523	1,287,080	389,790	-	-	-
2032	2,425,416	2,495,882	1,172,295	388,544	-	-	-
2033	2,424,916	2,478,552	1,172,273	385,875	-	-	-
2034	2,421,963	2,477,777	1,218,802	464,583	-	-	-
2035	2,409,640	2,479,383	1,196,121	462,202	-	-	-
2036	2,511,780	2,490,535	1,211,450	460,760	-	-	-
2037	2,430,507	2,484,350	1,188,481	457,597	-	-	-
2038	2,432,707	2,486,758	1,092,799	455,316	-	-	-

Table 6G-5 - Composition of Supply-Side Energy for Plan 2-MAP

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	-
2023	2,544,816	2,477,777	1,377,666	121,192	-	-	-
2024	2,532,352	2,483,236	1,353,833	120,806	-	-	-
2025	2,564,802	2,483,523	1,347,208	119,983	-	-	-
2026	2,567,823	2,484,350	1,270,162	119,383	-	-	-
2027	2,485,058	2,486,758	1,236,726	300,529	-	-	-
2028	2,503,429	2,487,404	1,299,077	299,573	-	-	-
2029	2,431,639	2,479,383	1,267,693	398,690	-	-	-
2030	2,384,569	2,476,802	1,283,395	396,704	-	-	-
2031	2,490,220	2,483,523	1,287,080	394,726	-	-	-
2032	2,425,416	2,495,882	1,172,295	393,464	-	-	-
2033	2,424,916	2,478,552	1,172,273	390,762	-	-	-
2034	2,421,963	2,477,777	1,218,802	469,445	-	-	-
2035	2,409,640	2,479,383	1,196,121	467,040	-	-	-
2036	2,511,780	2,490,535	1,211,450	465,582	-	-	-
2037	2,430,507	2,484,350	1,188,481	462,387	-	-	-
2038	2,432,707	2,486,758	1,092,799	460,081	-	-	-

Table 6G-6 - Composition of Supply-Side Energy for Plan 3

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	-
2023	2,544,816	2,477,777	1,377,666	20,031	-	-	-
2024	2,532,352	2,483,236	1,353,833	19,967	-	-	-
2025	2,564,802	2,483,523	1,347,208	19,831	-	-	-
2026	2,567,823	2,484,350	1,270,162	19,732	-	-	-
2027	2,485,058	2,486,758	1,236,726	19,633	71,066	-	-
2028	2,503,429	2,487,404	1,299,077	19,570	68,773	-	-
2029	2,431,639	2,479,383	1,267,693	19,437	72,395	-	-
2030	2,384,569	2,476,802	1,283,395	19,340	75,493	-	-
2031	2,490,220	2,483,523	1,287,080	19,243	75,493	-	-
2032	2,425,416	2,495,882	1,172,295	19,182	71,318	-	-
2033	2,424,916	2,478,552	1,172,273	19,051	66,506	-	-
2034	2,421,963	2,477,777	1,218,802	18,956	104,565	-	-
2035	2,409,640	2,479,383	1,196,121	18,861	109,181	-	-
2036	2,511,780	2,490,535	1,211,450	18,801	111,419	-	-
2037	2,430,507	2,484,350	1,188,481	18,673	114,260	-	-
2038	2,432,707	2,486,758	1,092,799	18,580	111,031	-	-

Table 6G-7 - Composition of Supply-Side Energy for Plan 4

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	25,880	-
2023	2,544,816	2,477,777	1,377,666	121,192	-	25,751	-
2024	2,532,352	2,483,236	1,353,833	120,806	-	25,666	-
2025	2,564,802	2,483,523	1,347,208	119,983	-	25,494	-
2026	2,567,823	2,484,350	1,270,162	119,383	-	25,366	-
2027	2,485,058	2,486,758	1,236,726	199,367	-	25,240	-
2028	2,503,429	2,487,404	1,299,077	198,733	-	51,081	-
2029	2,431,639	2,479,383	1,267,693	197,376	-	50,738	-
2030	2,384,569	2,476,802	1,283,395	196,396	-	50,485	-
2031	2,490,220	2,483,523	1,287,080	195,420	-	50,232	-
2032	2,425,416	2,495,882	1,172,295	194,792	-	68,015	-
2033	2,424,916	2,478,552	1,172,273	193,444	-	67,559	-
2034	2,421,963	2,477,777	1,218,802	293,669	-	67,221	-
2035	2,409,640	2,479,383	1,196,121	292,172	-	66,885	-
2036	2,511,780	2,490,535	1,211,450	291,256	-	84,613	-
2037	2,430,507	2,484,350	1,188,481	289,260	-	84,045	-
2038	2,432,707	2,486,758	1,092,799	287,817	-	83,625	-

Table 6G-8 - Composition of Supply-Side Energy for Plan 5

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	115
2023	2,544,816	2,477,777	1,377,666	20,031	-	-	224
2024	2,532,352	2,483,236	1,353,833	19,967	-	-	225
2025	2,564,802	2,483,523	1,347,208	19,831	-	-	169
2026	2,567,823	2,484,350	1,270,162	19,732	-	-	172
2027	2,485,058	2,486,758	1,236,726	19,633	71,066	-	311
2028	2,503,429	2,487,404	1,299,077	19,570	68,773	-	661
2029	2,431,639	2,479,383	1,267,693	19,437	72,395	-	915
2030	2,384,569	2,476,802	1,283,395	19,340	75,493	-	414
2031	2,490,220	2,483,523	1,287,080	19,243	75,493	-	631
2032	2,425,416	2,495,882	1,172,295	19,182	71,318	-	1,179
2033	2,424,916	2,478,552	1,172,273	19,051	66,506	-	1,752
2034	2,421,963	2,477,777	1,218,802	18,956	69,710	-	1,600
2035	2,409,640	2,479,383	1,196,121	18,861	72,787	-	1,973
2036	2,511,780	2,490,535	1,211,450	18,801	74,279	-	1,727
2037	2,430,507	2,484,350	1,188,481	18,673	76,173	-	2,486
2038	2,432,707	2,486,758	1,092,799	18,580	74,021	-	3,028

Table 6G-9 - Composition of Supply-Side Energy for Plan 6

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	-	-
2023	2,544,816	2,477,777	1,377,666	121,192	-	-	-
2024	2,532,352	2,483,236	1,353,833	120,806	-	-	-
2025	2,564,802	2,483,523	1,347,208	119,983	-	-	-
2026	2,567,823	2,484,350	1,270,162	119,383	-	-	-
2027	2,485,058	2,486,758	1,236,726	199,367	35,533	-	-
2028	2,503,429	2,487,404	1,299,077	198,733	34,386	-	-
2029	2,431,639	2,479,383	1,267,693	197,376	36,198	-	-
2030	2,384,569	2,476,802	1,283,395	196,396	37,747	-	-
2031	2,490,220	2,483,523	1,287,080	195,420	37,747	-	-
2032	2,425,416	2,495,882	1,172,295	194,792	35,659	-	-
2033	2,424,916	2,478,552	1,172,273	193,444	33,253	-	-
2034	2,421,963	2,477,777	1,218,802	394,830	34,855	-	-
2035	2,409,640	2,479,383	1,196,121	392,827	36,394	-	-
2036	2,511,780	2,490,535	1,211,450	391,591	37,140	-	-
2037	2,430,507	2,484,350	1,188,481	388,912	38,087	-	-
2038	2,432,707	2,486,758	1,092,799	386,970	37,010	-	-

Table 6G-10 - Composition of Supply-Side Energy for Plan 7

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	-	25,880	-
2023	2,544,816	2,477,777	1,377,666	121,192	-	25,751	-
2024	2,532,352	2,483,236	1,353,833	120,806	-	25,666	-
2025	2,564,802	2,483,523	1,347,208	119,983	-	25,494	-
2026	2,567,823	2,484,350	1,270,162	119,383	-	25,366	-
2027	2,485,058	2,486,758	1,236,726	118,786	35,533	25,240	-
2028	2,503,429	2,487,404	1,299,077	118,408	34,386	25,157	330
2029	2,431,639	2,479,383	1,267,693	117,601	36,198	24,988	458
2030	2,384,569	2,476,802	1,283,395	117,013	37,747	24,863	207
2031	2,490,220	2,483,523	1,287,080	116,428	37,747	24,738	316
2032	2,425,416	2,495,882	1,172,295	116,058	35,659	42,605	330
2033	2,424,916	2,478,552	1,172,273	115,267	33,253	42,319	564
2034	2,421,963	2,477,777	1,218,802	317,014	34,855	42,108	508
2035	2,409,640	2,479,383	1,196,121	315,429	36,394	41,897	634
2036	2,511,780	2,490,535	1,211,450	314,425	37,140	41,759	864
2037	2,430,507	2,484,350	1,188,481	312,282	38,087	41,479	1,247
2038	2,432,707	2,486,758	1,092,799	310,721	37,010	41,272	1,517

Table 6G-11 - Composition of Supply-Side Energy for Plan 8

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	303,004	-	-	-
2023	2,542,406	2,477,777	1,377,666	402,666	-	-	-
2024	2,530,387	2,483,236	1,353,833	401,385	-	-	-
2025	2,564,802	2,483,523	1,347,208	398,655	-	-	-
2026	2,566,110	2,484,350	1,270,162	396,670	-	-	-
2027	2,485,058	2,486,758	1,236,726	394,680	-	-	-
2028	2,503,429	2,487,404	1,299,077	393,424	-	-	-
2029	2,431,639	2,479,383	1,267,693	471,321	-	-	-
2030	2,384,569	2,476,802	1,283,395	468,980	-	-	-
2031	2,490,220	2,483,523	1,287,080	466,646	-	-	-
2032	2,425,416	2,495,882	1,172,295	465,149	-	-	-
2033	2,424,916	2,478,552	1,172,273	461,938	-	-	-
2034	2,421,963	2,477,777	1,218,802	459,689	-	-	-
2035	2,409,640	2,479,383	1,196,121	457,333	-	-	-
2036	2,511,780	2,490,535	1,211,450	455,906	-	-	-
2037	2,430,507	2,484,350	1,188,481	452,776	-	-	-
2038	2,432,707	2,486,758	1,092,799	450,519	-	-	-

Table 6G-12 - Composition of Supply-Side Energy for Plan 9

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	30,958	-	-
2023	2,542,406	2,477,777	1,377,666	20,031	33,993	-	-
2024	2,530,387	2,483,236	1,353,833	19,967	37,567	-	-
2025	2,564,802	2,483,523	1,347,208	19,831	38,499	-	-
2026	2,566,110	2,484,350	1,270,162	19,732	74,362	-	-
2027	2,485,058	2,486,758	1,236,726	19,633	71,066	-	-
2028	2,503,429	2,487,404	1,299,077	19,570	68,773	-	-
2029	2,431,639	2,479,383	1,267,693	19,437	108,593	-	-
2030	2,384,569	2,476,802	1,283,395	19,340	113,240	-	-
2031	2,490,220	2,483,523	1,287,080	19,243	113,240	-	-
2032	2,425,416	2,495,882	1,172,295	19,182	106,977	-	-
2033	2,424,916	2,478,552	1,172,273	19,051	99,759	-	-
2034	2,421,963	2,477,777	1,218,802	18,956	104,565	-	-
2035	2,409,640	2,479,383	1,196,121	18,861	109,181	-	-
2036	2,511,780	2,490,535	1,211,450	18,801	111,419	-	-
2037	2,430,507	2,484,350	1,188,481	18,673	114,260	-	-
2038	2,432,707	2,486,758	1,092,799	18,580	111,031	-	-

Table 6G-13 - Composition of Supply-Side Energy for Plan 10

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	303,004	-	25,880	-
2023	2,542,406	2,477,777	1,377,666	301,505	-	25,751	-
2024	2,530,387	2,483,236	1,353,833	300,546	-	25,666	-
2025	2,564,802	2,483,523	1,347,208	298,502	-	25,494	-
2026	2,566,110	2,484,350	1,270,162	297,018	-	25,366	-
2027	2,485,058	2,486,758	1,236,726	295,526	-	25,240	-
2028	2,503,429	2,487,404	1,299,077	294,586	-	51,081	-
2029	2,431,639	2,479,383	1,267,693	292,575	-	50,738	-
2030	2,384,569	2,476,802	1,283,395	291,120	-	50,485	-
2031	2,490,220	2,483,523	1,287,080	289,670	-	50,232	-
2032	2,425,416	2,495,882	1,172,295	288,742	-	68,015	-
2033	2,424,916	2,478,552	1,172,273	286,754	-	67,559	-
2034	2,421,963	2,477,777	1,218,802	285,351	-	67,221	-
2035	2,409,640	2,479,383	1,196,121	283,895	-	66,885	-
2036	2,511,780	2,490,535	1,211,450	283,006	-	84,613	-
2037	2,430,507	2,484,350	1,188,481	281,066	-	84,045	-
2038	2,432,707	2,486,758	1,092,799	279,664	-	83,625	-

Table 6G-14 - Composition of Supply-Side Energy for Plan 11

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	20,131	30,958	-	115
2023	2,542,406	2,477,777	1,377,666	20,031	33,993	-	224
2024	2,530,387	2,483,236	1,353,833	19,967	37,567	-	225
2025	2,564,802	2,483,523	1,347,208	19,831	38,499	-	169
2026	2,566,110	2,484,350	1,270,162	19,732	74,362	-	172
2027	2,485,058	2,486,758	1,236,726	19,633	71,066	-	311
2028	2,503,429	2,487,404	1,299,077	19,570	68,773	-	661
2029	2,431,639	2,479,383	1,267,693	19,437	72,395	-	915
2030	2,384,569	2,476,802	1,283,395	19,340	75,493	-	414
2031	2,490,220	2,483,523	1,287,080	19,243	75,493	-	631
2032	2,425,416	2,495,882	1,172,295	19,182	71,318	-	1,179
2033	2,424,916	2,478,552	1,172,273	19,051	66,506	-	1,752
2034	2,421,963	2,477,777	1,218,802	18,956	69,710	-	1,600
2035	2,409,640	2,479,383	1,196,121	18,861	72,787	-	1,973
2036	2,511,780	2,490,535	1,211,450	18,801	74,279	-	1,727
2037	2,430,507	2,484,350	1,188,481	18,673	76,173	-	2,486
2038	2,432,707	2,486,758	1,092,799	18,580	74,021	-	3,028

Table 6G-15 - Composition of Supply-Side Energy for Plan 12

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	303,004	30,958	-	-
2023	2,542,406	2,477,777	1,377,666	402,666	33,993	-	-
2024	2,530,387	2,483,236	1,353,833	401,385	37,567	-	-
2025	2,564,802	2,483,523	1,347,208	398,655	38,499	-	-
2026	2,566,110	2,484,350	1,270,162	396,670	37,181	-	-
2027	2,485,058	2,486,758	1,236,726	394,680	35,533	-	-
2028	2,503,429	2,487,404	1,299,077	393,424	34,386	-	-
2029	2,431,639	2,479,383	1,267,693	390,740	36,198	-	-
2030	2,384,569	2,476,802	1,283,395	388,794	37,747	-	-
2031	2,490,220	2,483,523	1,287,080	386,855	37,747	-	-
2032	2,425,416	2,495,882	1,172,295	385,618	35,659	-	-
2033	2,424,916	2,478,552	1,172,273	382,970	33,253	-	-
2034	2,421,963	2,477,777	1,218,802	381,085	34,855	-	-
2035	2,409,640	2,479,383	1,196,121	379,151	36,394	-	-
2036	2,511,780	2,490,535	1,211,450	377,959	37,140	-	-
2037	2,430,507	2,484,350	1,188,481	375,372	38,087	-	-
2038	2,432,707	2,486,758	1,092,799	373,498	37,010	-	-

Table 6G-16 - Composition of Supply-Side Energy for Plan 13

	Existing	New CSP Wind	State Line Upgrade	Utility Solar	Utility Gas	Distributed Solar+Storage	Distributed Gas
2019	5,030,584	-	-	-	-	-	-
2020	3,971,832	751,481	-	-	-	-	-
2021	3,614,710	2,486,758	-	20,232	-	-	-
2022	2,556,934	2,478,552	1,381,442	303,004	30,958	25,880	-
2023	2,542,406	2,477,777	1,377,666	402,666	33,993	25,751	-
2024	2,530,387	2,483,236	1,353,833	401,385	37,567	25,666	-
2025	2,564,802	2,483,523	1,347,208	398,655	38,499	25,494	-
2026	2,566,110	2,484,350	1,270,162	396,670	37,181	25,366	-
2027	2,485,058	2,486,758	1,236,726	394,680	35,533	25,240	-
2028	2,503,429	2,487,404	1,299,077	393,424	34,386	25,157	330
2029	2,431,639	2,479,383	1,267,693	390,740	36,198	24,988	458
2030	2,384,569	2,476,802	1,283,395	388,794	37,747	24,863	207
2031	2,490,220	2,483,523	1,287,080	386,855	37,747	24,738	316
2032	2,425,416	2,495,882	1,172,295	385,618	35,659	42,605	330
2033	2,424,916	2,478,552	1,172,273	382,970	33,253	42,319	564
2034	2,421,963	2,477,777	1,218,802	381,085	34,855	42,108	508
2035	2,409,640	2,479,383	1,196,121	379,151	36,394	41,897	634
2036	2,511,780	2,490,535	1,211,450	377,959	37,140	41,759	864
2037	2,430,507	2,484,350	1,188,481	375,372	38,087	41,479	1,247
2038	2,432,707	2,486,758	1,092,799	373,498	37,010	41,272	1,517

Appendix 6H Annual Emissions Tables

Table 6H-1 - Annual Emissions of Plan 0

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,947	3,001	3,281	3,351	3,338	3,361	3,369	3,379	3,445	3,352	3,316	3,362	3,259	3,321	3,450	3,374	2,631	2,550	2,511
NOx (Tons)	945	839	884	1,063	1,091	1,088	1,097	1,100	1,103	1,126	1,094	1,081	1,098	1,062	1,085	1,131	1,104	825	800	786
SO2 (Tons)	508	473	601	756	780	803	809	835	880	902	845	849	846	821	871	955	908	268	263	265

Table 6H-2 - Annual Emissions of Plan 1

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,947	3,001	3,281	3,351	3,338	3,361	3,369	3,379	3,445	3,352	3,316	3,362	3,259	3,321	3,450	3,374	2,570	2,488	2,450
NOx (Tons)	945	839	884	1,063	1,091	1,088	1,097	1,100	1,103	1,126	1,094	1,081	1,098	1,062	1,085	1,131	1,104	805	780	766
SO2 (Tons)	508	473	601	756	780	803	809	835	880	902	845	849	846	821	871	955	908	268	263	264

Table 6H-3 - Annual Emissions of Plan 2

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	819	806	813	801	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-4 - Annual Emissions of Plan 2B

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	819	806	813	801	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-5 - Annual Emissions of Plan 2-MAP

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	819	806	813	801	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-6 - Annual Emissions of Plan 3

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,548	2,587	2,574	2,533	2,583	2,502	2,501	2,557	2,539	2,631	2,550	2,511
NOx (Tons)	945	676	683	797	819	806	813	801	796	810	807	793	811	783	782	801	796	825	800	786
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	254	253	253	245	251	267	261	268	263	265

Table 6H-7 - Annual Emissions of Plan 4

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	819	806	813	801	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-8 - Annual Emissions of Plan 5

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,609	2,569	2,587	2,555	2,548	2,587	2,574	2,533	2,583	2,503	2,502	2,539	2,521	2,612	2,531	2,493
NOx (Tons)	945	676	683	797	819	806	813	801	797	810	807	793	811	783	783	795	789	819	794	780
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	254	253	253	245	251	267	261	268	263	264

Table 6H-9 - Annual Emissions of Plan 6

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,528	2,568	2,554	2,512	2,562	2,483	2,483	2,518	2,500	2,591	2,509	2,471
NOx (Tons)	945	676	683	797	819	806	813	801	790	804	801	786	804	776	776	789	783	812	786	773
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	253	253	245	251	267	260	268	263	264

Table 6H-10 - Annual Emissions of Plan 7

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,608	2,568	2,587	2,555	2,528	2,568	2,554	2,512	2,562	2,483	2,483	2,519	2,500	2,591	2,509	2,472
NOx (Tons)	945	676	683	797	819	806	813	801	790	804	801	786	804	776	777	789	783	812	787	773
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	253	253	245	251	267	260	268	263	264

Table 6H-11 - Annual Emissions of Plan 8

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,607	2,567	2,587	2,554	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	816	804	813	800	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-12 - Annual Emissions of Plan 9

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,572	2,625	2,587	2,608	2,594	2,548	2,587	2,594	2,554	2,604	2,522	2,519	2,557	2,539	2,631	2,550	2,511
NOx (Tons)	945	676	683	803	823	811	820	813	796	810	814	800	818	789	788	801	796	825	800	786
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	254	253	253	245	251	267	261	268	263	265

Table 6H-13 - Annual Emissions of Plan 10

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,555	2,607	2,567	2,587	2,554	2,509	2,549	2,534	2,492	2,542	2,463	2,464	2,499	2,480	2,570	2,488	2,450
NOx (Tons)	945	676	683	797	816	804	813	800	784	798	794	779	797	770	770	782	776	805	780	766
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	252	252	245	251	267	260	268	263	264

Table 6H-14 - Annual Emissions of Plan 11

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,572	2,625	2,588	2,608	2,594	2,548	2,587	2,574	2,533	2,583	2,503	2,502	2,539	2,521	2,612	2,531	2,493
NOx (Tons)	945	676	683	803	823	811	820	813	797	810	807	793	811	783	783	795	789	819	794	780
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	254	253	253	245	251	267	261	268	263	264

Table 6H-15 - Annual Emissions of Plan 12

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,572	2,625	2,587	2,608	2,574	2,528	2,568	2,554	2,512	2,562	2,483	2,483	2,518	2,500	2,591	2,509	2,471
NOx (Tons)	945	676	683	803	823	811	820	806	790	804	801	786	804	776	776	789	783	812	786	773
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	253	253	245	251	267	260	268	263	264

Table 6H-16 - Annual Emissions of Plan 13

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
CO2 (1000 Tons)	3,329	2,501	2,453	2,572	2,625	2,587	2,608	2,574	2,528	2,568	2,554	2,512	2,562	2,483	2,483	2,519	2,500	2,591	2,509	2,472
NOx (Tons)	945	676	683	803	823	811	820	806	790	804	801	786	804	776	777	789	783	812	787	773
SO2 (Tons)	508	150	204	231	242	246	249	247	250	253	253	253	253	245	251	267	260	268	263	264

Appendix 6I Plan Tornado Diagrams Tables

Table 6I-1 - Plan 0 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,213	8,288	7,415
Load	7,346	7,494	7,415
Power	7,325	7,423	7,415
CO2	7,415	7,745	7,415
Capital	7,357	7,709	7,415

Table 6I-2 - Plan 1 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,195	8,268	7,398
Load	7,328	7,477	7,398
Power	7,313	7,399	7,398
CO2	7,398	7,713	7,398
Capital	7,333	7,707	7,398

Table 6I-3 - Plan 2 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,071	8,238	7,325
Load	7,255	7,406	7,325
Power	7,227	7,398	7,325
CO2	7,325	7,587	7,325
Capital	7,222	7,686	7,325

Table 6I-4 - Plan 2B Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,076	8,225	7,320
Load	7,251	7,402	7,320
Power	7,228	7,387	7,320
CO2	7,320	7,580	7,320
Capital	7,222	7,681	7,320

Table 6I-5 - Plan 2-MAP Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,075	8,234	7,327
Load	7,258	7,407	7,327
Power	7,231	7,399	7,327
CO2	7,327	7,587	7,327
Capital	7,225	7,688	7,327

Table 6I-6 - Plan 3 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,122	8,305	7,370
Load	7,300	7,450	7,370
Power	7,246	7,470	7,370
CO2	7,370	7,676	7,370
Capital	7,299	7,689	7,370

Table 6I-7 - Plan 4 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,072	8,242	7,321
Load	7,252	7,408	7,321
Power	7,217	7,400	7,321
CO2	7,321	7,596	7,321
Capital	7,230	7,669	7,321

Table 6I-8 - Plan 5 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,112	8,297	7,359
Load	7,290	7,442	7,359
Power	7,236	7,459	7,359
CO2	7,359	7,666	7,359
Capital	7,289	7,678	7,359

Table 6I-9 - Plan 6 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,094	8,265	7,344
Load	7,275	7,423	7,344
Power	7,238	7,426	7,344
CO2	7,344	7,621	7,344
Capital	7,253	7,695	7,344

Table 6I-10 - Plan 7 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,095	8,266	7,343
Load	7,273	7,424	7,343
Power	7,234	7,426	7,343
CO2	7,343	7,624	7,343
Capital	7,257	7,687	7,343

Table 6I-11 - Plan 8 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,073	8,218	7,317
Load	7,247	7,398	7,317
Power	7,229	7,377	7,317
CO2	7,317	7,572	7,317
Capital	7,214	7,684	7,317

Table 6I-12 - Plan 9 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,137	8,339	7,392
Load	7,322	7,471	7,392
Power	7,268	7,492	7,392
CO2	7,392	7,698	7,392
Capital	7,314	7,724	7,392

Table 6I-13 - Plan 10 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,073	8,227	7,315
Load	7,245	7,402	7,315
Power	7,219	7,383	7,315
CO2	7,315	7,582	7,315
Capital	7,221	7,669	7,315

Table 6I-14 - Plan 11 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,115	8,313	7,366
Load	7,296	7,452	7,366
Power	7,242	7,466	7,366
CO2	7,366	7,673	7,366
Capital	7,292	7,691	7,366

Table 6I-15 - Plan 12 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,114	8,274	7,360
Load	7,291	7,438	7,360
Power	7,268	7,425	7,360
CO2	7,360	7,623	7,360
Capital	7,259	7,733	7,360

Table 6I-16 - Plan 13 Tornado Diagram ($ in Millions)

	Low	High	Base
All Critical Uncertain Factors	7,120	8,291	7,371
Load	7,301	7,450	7,371
Power	7,282	7,432	7,371
CO2	7,371	7,629	7,371
Capital	7,262	7,755	7,371

Appendix 6J PVRR with Risk Value for Alternative Resource Plans Table

Table 6J-1 - PVRR with Risk Value for Alternative Resource Plans ($ in Millions)

	Plan 0	Plan 1	Plan 2	Plan 2B	Plan 2_MAP	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8	Plan 9	Plan 10	Plan 11	Plan 12	Plan 13
Expected Value	7,551	7,527	7,429	7,425	7,429	7,500	7,434	7,490	7,457	7,459	7,418	7,520	7,425	7,497	7,465	7,472
Base Value	7,415	7,398	7,325	7,320	7,327	7,370	7,321	7,359	7,344	7,343	7,317	7,392	7,315	7,366	7,360	7,371
Stochastic Adder	136	129	104	104	102	130	113	131	112	116	102	128	110	131	104	101

Appendix 6K Cumulative Probability Tables

Table 6K-1 - Cumulative Probability Plans 0, 1, 2, 2B and 2-MAP ($ in Millions)

Plan 0 NPV	Plan 0 Cumulative Prob	Plan 1 NPV	Plan 1 Cumulative Prob	Plan 2 NPV	Plan 2 Cumulative Prob	Plan 2B NPV	Plan 2B Cumulative Prob	Plan 2_MAP NPV	Plan 2_MAP Cumulative Prob
7,213	1.50%	7,195	1.50%	7,071	1.50%	7,076	1.50%	7,075	1.50%
7,267	4.50%	7,246	2.50%	7,124	4.50%	7,129	4.50%	7,128	4.50%
7,272	6.38%	7,248	5.50%	7,153	7.00%	7,152	7.00%	7,155	7.00%
7,276	7.38%	7,260	7.38%	7,173	8.50%	7,174	8.88%	7,175	8.50%
7,287	9.88%	7,263	9.88%	7,174	10.38%	7,175	10.38%	7,178	10.38%
7,325	13.63%	7,309	11.38%	7,188	11.88%	7,192	11.88%	7,190	11.88%
7,327	15.13%	7,311	12.63%	7,208	12.88%	7,201	12.88%	7,208	12.88%
7,335	16.38%	7,313	16.38%	7,222	17.88%	7,222	17.88%	7,225	17.88%
7,346	19.50%	7,328	19.50%	7,227	21.63%	7,228	21.63%	7,231	21.63%
7,357	24.50%	7,331	21.00%	7,255	24.75%	7,251	24.75%	7,258	24.75%
7,362	26.00%	7,333	26.00%	7,256	27.75%	7,258	27.75%	7,258	27.75%
7,364	28.00%	7,334	28.00%	7,276	29.63%	7,274	29.63%	7,277	29.63%
7,385	29.88%	7,374	29.88%	7,290	31.50%	7,289	31.63%	7,293	31.50%
7,415	36.13%	7,396	31.75%	7,296	33.50%	7,291	33.50%	7,296	33.50%
7,420	38.00%	7,398	38.00%	7,304	36.00%	7,299	34.75%	7,305	36.00%
7,423	40.50%	7,399	40.50%	7,310	37.25%	7,303	37.25%	7,311	37.25%
7,435	43.00%	7,412	43.00%	7,325	43.50%	7,320	43.50%	7,327	43.50%
7,444	46.00%	7,414	46.00%	7,352	45.00%	7,354	45.00%	7,352	45.00%
7,462	47.00%	7,433	47.00%	7,359	48.75%	7,357	48.75%	7,360	48.75%
7,494	50.13%	7,477	50.13%	7,384	51.25%	7,381	51.25%	7,383	51.25%
7,503	53.88%	7,479	53.88%	7,397	52.25%	7,387	53.75%	7,396	52.25%
7,521	55.13%	7,498	55.13%	7,398	54.75%	7,390	54.75%	7,399	54.75%
7,537	56.63%	7,508	56.63%	7,406	57.88%	7,402	57.88%	7,407	57.88%
7,566	57.00%	7,547	59.13%	7,454	59.75%	7,452	59.75%	7,454	59.75%
7,585	59.50%	7,569	59.50%	7,485	64.75%	7,479	62.88%	7,485	64.75%
7,596	61.38%	7,573	61.38%	7,486	67.88%	7,482	67.88%	7,486	67.88%
7,619	62.13%	7,612	64.50%	7,499	69.13%	7,488	69.13%	7,498	69.13%
7,629	62.38%	7,620	64.75%	7,527	70.13%	7,518	70.13%	7,525	70.13%
7,640	63.00%	7,622	65.50%	7,534	70.50%	7,535	70.50%	7,538	70.50%
7,644	66.13%	7,637	66.13%	7,587	76.75%	7,580	76.75%	7,587	76.75%
7,679	66.50%	7,648	67.13%	7,588	77.50%	7,588	77.50%	7,592	77.50%
7,686	71.50%	7,648	72.13%	7,601	80.00%	7,598	80.00%	7,599	80.00%
7,691	72.50%	7,683	72.50%	7,616	80.63%	7,611	80.63%	7,618	80.63%
7,709	73.75%	7,705	72.88%	7,629	81.88%	7,617	81.88%	7,628	81.88%
7,714	74.13%	7,707	74.13%	7,637	82.25%	7,634	83.88%	7,638	82.25%
7,717	74.63%	7,708	74.63%	7,643	84.25%	7,634	84.25%	7,641	84.25%
7,745	80.88%	7,713	75.88%	7,651	84.63%	7,651	84.63%	7,653	84.63%
7,749	82.13%	7,713	82.13%	7,671	84.88%	7,660	84.88%	7,672	84.88%
7,788	82.75%	7,762	84.63%	7,686	86.13%	7,681	86.13%	7,688	86.13%
7,797	83.50%	7,764	86.63%	7,703	89.25%	7,696	89.25%	7,701	89.25%
7,799	86.00%	7,786	87.25%	7,719	90.00%	7,717	90.00%	7,721	90.00%
7,807	88.00%	7,788	88.00%	7,745	92.50%	7,732	92.50%	7,743	92.50%
7,815	88.25%	7,807	88.25%	7,759	93.00%	7,748	93.00%	7,759	93.00%
7,858	91.38%	7,827	91.38%	7,767	93.63%	7,762	93.63%	7,768	93.63%
7,865	93.88%	7,829	93.88%	7,775	94.63%	7,766	94.63%	7,771	94.63%
7,890	94.25%	7,882	94.25%	7,815	95.00%	7,813	95.00%	7,815	95.00%
7,936	95.25%	7,894	95.25%	7,847	95.63%	7,840	95.63%	7,847	95.63%
7,938	95.88%	7,922	95.88%	7,860	95.88%	7,849	95.88%	7,859	95.88%
7,994	97.13%	7,959	97.13%	7,877	97.13%	7,864	97.13%	7,874	97.13%
8,039	98.38%	8,022	97.38%	7,948	98.38%	7,941	98.38%	7,948	98.38%
8,043	98.63%	8,023	98.63%	7,990	98.63%	7,977	98.63%	7,988	98.63%
8,152	99.25%	8,137	99.25%	8,064	99.25%	8,057	99.25%	8,062	99.25%
8,159	99.75%	8,138	99.75%	8,106	99.75%	8,093	99.75%	8,104	99.75%
8,288	100.00%	8,268	100.00%	8,238	100.00%	8,225	100.00%	8,234	100.00%

Table 6K-2 - Cumulative Probability Plans 3, 4, 5, 6 and 7 ($ in Millions)

Plan 3	Plan 3	Plan 4	Plan 4	Plan 5	Plan 5	Plan 6	Plan 6	Plan 7	Plan 7
NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob
7,122	1.50%	7,072	1.50%	7,112	1.50%	7,094	1.50%	7,095	1.50%
7,175	4.50%	7,126	4.50%	7,165	4.50%	7,147	4.50%	7,148	4.50%
7,193	6.38%	7,160	7.00%	7,182	6.38%	7,184	7.00%	7,181	6.38%
7,229	8.88%	7,164	8.88%	7,219	8.88%	7,185	8.88%	7,187	8.88%
7,237	10.38%	7,186	10.38%	7,230	10.38%	7,207	10.38%	7,212	10.38%
7,246	14.13%	7,194	11.88%	7,236	14.13%	7,208	11.88%	7,214	11.88%
7,262	15.63%	7,217	15.63%	7,254	15.63%	7,238	15.63%	7,234	15.63%
7,299	20.63%	7,221	16.63%	7,289	20.63%	7,247	16.63%	7,252	16.63%
7,300	23.75%	7,230	21.63%	7,290	23.75%	7,253	21.63%	7,257	21.63%
7,308	25.63%	7,252	24.75%	7,300	25.63%	7,275	24.75%	7,273	24.75%
7,311	26.63%	7,269	27.75%	7,301	26.63%	7,291	27.75%	7,297	27.75%
7,333	28.50%	7,278	29.63%	7,324	28.50%	7,299	29.63%	7,298	29.63%
7,345	31.50%	7,285	31.50%	7,336	31.50%	7,299	31.50%	7,300	31.50%
7,370	37.75%	7,309	33.50%	7,359	37.75%	7,332	34.00%	7,338	34.00%
7,379	40.25%	7,312	34.75%	7,372	39.00%	7,335	36.00%	7,338	35.25%
7,382	41.50%	7,316	37.25%	7,372	41.50%	7,338	37.25%	7,340	37.25%
7,399	43.50%	7,321	43.50%	7,389	43.50%	7,344	43.50%	7,343	43.50%
7,416	47.25%	7,361	47.25%	7,407	47.25%	7,382	47.25%	7,383	47.25%
7,440	48.75%	7,370	48.75%	7,434	48.75%	7,384	48.75%	7,392	48.75%
7,450	51.88%	7,400	51.25%	7,442	51.88%	7,423	51.88%	7,424	51.88%
7,470	54.38%	7,403	53.75%	7,459	54.38%	7,426	54.38%	7,426	54.38%
7,499	55.38%	7,408	56.88%	7,492	55.38%	7,429	56.88%	7,437	56.88%
7,504	57.88%	7,415	57.88%	7,495	57.88%	7,433	57.88%	7,441	57.88%
7,511	59.75%	7,462	59.75%	7,501	58.25%	7,475	59.75%	7,478	59.75%
7,512	60.13%	7,495	62.88%	7,504	60.13%	7,520	62.88%	7,523	62.88%
7,565	60.88%	7,504	67.88%	7,554	60.88%	7,524	64.13%	7,525	63.25%
7,569	62.13%	7,506	69.13%	7,562	62.13%	7,530	69.13%	7,527	64.50%
7,575	65.25%	7,511	69.50%	7,565	65.25%	7,535	69.50%	7,538	69.50%
7,605	70.25%	7,550	70.50%	7,596	70.25%	7,579	70.50%	7,579	70.25%
7,619	70.88%	7,565	71.25%	7,608	70.88%	7,588	71.25%	7,588	71.25%
7,627	71.25%	7,596	77.50%	7,619	71.25%	7,621	77.50%	7,617	71.88%
7,653	71.63%	7,599	78.13%	7,642	71.63%	7,625	78.13%	7,624	78.13%
7,669	72.63%	7,625	80.63%	7,659	72.63%	7,643	80.63%	7,642	78.50%
7,676	78.88%	7,625	81.00%	7,666	78.88%	7,649	81.00%	7,644	78.88%
7,689	80.13%	7,633	81.38%	7,678	80.13%	7,649	81.38%	7,654	81.38%
7,701	80.38%	7,642	82.63%	7,690	80.38%	7,670	82.63%	7,674	82.63%
7,720	82.88%	7,660	82.88%	7,713	82.88%	7,688	82.88%	7,682	82.88%
7,735	83.63%	7,666	84.88%	7,725	83.63%	7,694	84.88%	7,687	84.13%
7,740	84.88%	7,669	86.13%	7,729	84.88%	7,695	86.13%	7,704	86.13%
7,769	85.50%	7,708	86.88%	7,761	85.50%	7,732	86.88%	7,727	86.88%
7,785	87.50%	7,717	90.00%	7,775	87.50%	7,734	90.00%	7,740	90.00%
7,789	88.00%	7,748	90.50%	7,778	88.00%	7,773	90.63%	7,768	90.63%
7,791	91.13%	7,755	91.13%	7,783	91.13%	7,776	91.13%	7,770	91.13%
7,830	91.50%	7,758	93.63%	7,822	91.50%	7,786	93.63%	7,790	93.63%
7,856	94.00%	7,803	94.63%	7,845	94.00%	7,824	94.63%	7,823	94.00%
7,889	94.25%	7,809	95.00%	7,880	94.25%	7,825	95.00%	7,835	95.00%
7,894	94.88%	7,842	95.63%	7,883	94.88%	7,870	95.63%	7,867	95.63%
7,915	95.88%	7,854	95.88%	7,908	95.88%	7,875	95.88%	7,871	95.88%
7,986	97.13%	7,894	97.13%	7,978	97.13%	7,915	97.13%	7,921	97.13%
7,995	98.38%	7,943	98.38%	7,984	98.38%	7,971	98.38%	7,968	98.38%
8,059	98.63%	7,989	98.63%	8,048	98.63%	8,020	98.63%	8,018	98.63%
8,110	99.25%	8,064	99.25%	8,102	99.25%	8,084	99.25%	8,084	99.25%
8,175	99.75%	8,105	99.75%	8,163	99.75%	8,136	99.75%	8,134	99.75%
8,305	100.00%	8,242	100.00%	8,297	100.00%	8,265	100.00%	8,266	100.00%

Table 6K-3 - Cumulative Probability Plans 8, 9, 10, 11, 12 and 13 ($ in Millions)

Plan 8	Plan 8	Plan 9	Plan 9	Plan 10	Plan 10	Plan 11	Plan 11	Plan 12	Plan 12	Plan 13	Plan 13
NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob	NPV	Cumulative Prob
7,073	1.50%	7,137	1.50%	7,073	1.50%	7,115	1.50%	7,114	1.50%	7,120	1.50%
7,127	4.50%	7,190	4.50%	7,126	4.50%	7,168	4.50%	7,167	4.50%	7,173	4.50%
7,145	7.00%	7,215	6.38%	7,152	7.00%	7,189	6.38%	7,189	7.00%	7,192	7.00%
7,169	8.50%	7,244	8.88%	7,166	8.88%	7,222	8.88%	7,213	8.50%	7,215	8.50%
7,176	10.38%	7,251	10.38%	7,180	10.38%	7,236	10.38%	7,215	10.38%	7,228	10.38%
7,187	11.38%	7,268	14.13%	7,195	11.88%	7,242	14.13%	7,227	11.88%	7,234	11.88%
7,190	12.88%	7,276	15.63%	7,202	12.88%	7,256	15.63%	7,235	12.88%	7,235	12.88%
7,214	17.88%	7,314	20.63%	7,219	16.63%	7,292	20.63%	7,259	17.88%	7,262	17.88%
7,229	21.63%	7,322	23.75%	7,221	21.63%	7,296	23.75%	7,268	21.63%	7,282	21.63%
7,247	24.75%	7,326	24.75%	7,245	24.75%	7,304	24.75%	7,291	24.75%	7,298	24.63%
7,252	27.75%	7,329	26.63%	7,263	27.75%	7,310	26.63%	7,296	27.75%	7,301	27.75%
7,271	29.63%	7,354	28.50%	7,273	29.63%	7,330	28.50%	7,315	29.63%	7,323	29.75%
7,275	31.63%	7,359	31.50%	7,288	31.50%	7,339	31.50%	7,323	31.63%	7,324	31.63%
7,289	32.88%	7,392	37.75%	7,290	33.50%	7,366	37.75%	7,328	33.50%	7,341	34.13%
7,292	34.75%	7,393	40.25%	7,295	34.75%	7,378	40.25%	7,337	36.00%	7,343	36.00%
7,296	37.25%	7,404	41.50%	7,308	37.25%	7,378	41.50%	7,337	37.25%	7,344	37.25%
7,317	43.50%	7,414	43.50%	7,315	43.50%	7,392	43.50%	7,360	43.50%	7,371	43.50%
7,347	45.00%	7,437	47.25%	7,356	47.25%	7,413	47.25%	7,389	45.00%	7,392	45.00%
7,354	48.75%	7,452	48.75%	7,364	48.75%	7,439	48.75%	7,398	48.75%	7,407	48.75%
7,369	51.25%	7,471	51.88%	7,383	51.25%	7,452	51.88%	7,421	51.25%	7,419	51.25%
7,376	52.25%	7,492	54.38%	7,388	53.75%	7,466	54.38%	7,421	52.25%	7,422	52.25%
7,377	54.75%	7,513	55.38%	7,396	54.75%	7,497	56.88%	7,425	54.75%	7,432	54.75%
7,398	57.88%	7,519	57.88%	7,402	57.88%	7,497	57.88%	7,438	57.88%	7,450	57.88%
7,450	59.75%	7,530	59.75%	7,458	59.75%	7,513	59.75%	7,490	59.75%	7,500	59.75%
7,470	64.75%	7,547	60.13%	7,481	62.88%	7,514	60.13%	7,522	64.75%	7,521	64.75%
7,471	67.88%	7,591	61.38%	7,489	67.88%	7,567	60.88%	7,522	67.88%	7,528	67.88%
7,478	69.13%	7,597	64.50%	7,490	69.13%	7,571	64.00%	7,523	69.13%	7,531	69.13%
7,501	70.13%	7,600	65.25%	7,521	69.50%	7,572	65.25%	7,556	70.13%	7,552	70.13%
7,543	70.50%	7,620	70.25%	7,526	70.50%	7,598	70.25%	7,588	70.50%	7,613	70.50%
7,572	76.75%	7,654	70.88%	7,574	71.25%	7,622	70.88%	7,623	76.75%	7,629	76.75%
7,586	79.25%	7,661	71.25%	7,582	77.50%	7,635	71.25%	7,634	79.25%	7,634	79.25%
7,596	80.00%	7,684	72.25%	7,600	78.13%	7,655	71.63%	7,641	80.00%	7,661	80.50%
7,603	81.25%	7,686	72.63%	7,611	80.63%	7,662	72.63%	7,657	81.25%	7,666	81.25%
7,615	81.88%	7,698	78.88%	7,619	81.88%	7,673	78.88%	7,663	81.88%	7,668	83.25%
7,617	83.88%	7,724	80.13%	7,628	82.25%	7,691	80.13%	7,672	83.88%	7,685	83.88%
7,639	84.25%	7,734	82.63%	7,641	84.25%	7,703	80.38%	7,688	84.25%	7,709	84.25%
7,657	84.50%	7,736	82.88%	7,643	84.63%	7,719	82.88%	7,701	84.63%	7,727	84.63%
7,660	84.88%	7,762	84.13%	7,650	84.88%	7,736	84.13%	7,710	84.88%	7,729	84.88%
7,684	86.13%	7,769	84.88%	7,669	86.13%	7,738	84.88%	7,733	86.13%	7,743	88.00%
7,688	89.25%	7,800	86.88%	7,704	89.25%	7,777	85.50%	7,736	89.25%	7,755	89.25%
7,719	91.75%	7,803	87.50%	7,711	90.00%	7,778	87.50%	7,771	90.00%	7,777	91.75%
7,721	92.50%	7,812	90.63%	7,735	92.50%	7,791	88.00%	7,773	92.50%	7,791	92.50%
7,745	93.00%	7,824	91.13%	7,738	93.00%	7,793	91.13%	7,797	93.00%	7,798	93.50%
7,748	94.00%	7,862	91.50%	7,756	93.63%	7,838	91.50%	7,800	94.00%	7,817	94.00%
7,765	94.63%	7,878	94.00%	7,779	94.63%	7,852	94.00%	7,811	94.63%	7,834	94.63%
7,817	95.00%	7,923	94.25%	7,812	95.00%	7,897	94.63%	7,863	95.00%	7,885	95.00%
7,839	95.63%	7,929	94.88%	7,836	95.63%	7,897	94.88%	7,895	95.63%	7,906	96.25%
7,846	95.88%	7,930	95.88%	7,844	95.88%	7,914	95.88%	7,895	95.88%	7,913	96.88%
7,851	97.13%	8,007	97.13%	7,872	97.13%	7,988	97.13%	7,902	97.13%	7,915	97.13%
7,940	98.38%	8,030	98.38%	7,937	98.38%	7,998	98.38%	7,996	98.38%	8,014	98.38%
7,971	98.63%	8,094	98.63%	7,974	98.63%	8,061	98.63%	8,030	98.63%	8,045	98.63%
8,056	99.25%	8,144	99.25%	8,059	99.25%	8,118	99.25%	8,108	99.25%	8,127	99.25%
8,086	99.75%	8,210	99.75%	8,089	99.75%	8,177	99.75%	8,146	99.75%	8,161	99.75%
8,218	100.00%	8,339	100.00%	8,227	100.00%	8,313	100.00%	8,274	100.00%	8,291	100.00%