NP

VOLUME 6

INTEGRATED RESOURCE PLAN AND RISK ANALYSIS

THE EMPIRE DISTRICT ELECTRIC COMPANY

4 CSR 240-22.060

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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, in compliance with all legal mandates and in a manner that serves the public interest and is consistent with state energy and environmental policies. In developing this integrated resource plan, Empire considered and analyzed demand-side resources, renewable energy, and supply-side resources on an equivalent basis while complying with all legal mandates that may affect selection of electric energy resources. The minimum present worth of long-run utility costs was the primary selection criterion for choosing the preferred resource plan, subject to certain constraints. 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, Empire has described and documented the process and rationale used by its decision makers to assess such tradeoffs and to determine the appropriate balance between minimization of expected costs and these other considerations in selecting the preferred resource plan and 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 horizon.
3. Rate increases associated with alternative resource plans.

However, in the end, considering all the selection criteria, Empire did select the base plan with the minimum present worth of long-run utility costs as the preferred plan.

1.2 Other Issues

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 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 a utility's sales. Two percent of this requirement must be solar. Some or the entire requirement may be satisfied by the purchase of Renewable Energy Credits (RECs). Each eligible kWh of energy generated within the state of Missouri counts as 1.25 kWh.

Current Dates	Current RES Percentage (no less than)
2011-2013	2%
2014-2017	5%
2018-2020	10%
Beginning in 2021	15%
Notes: 1. Percentage of electric utility's Missouri annual retail sales 2 Some or all of the requirements may be satisfied by the purchase of Renewable Energy Credits (RECs). 3. Each kWh of eligible energy generated within Missouri will count as 1.25 kWh.	

Table 6-1 - Missouri RES Requirements

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

1.3 Planning and Analysis

Empire considered and analyzed demand-side resources on an equivalent basis with supply-side resources, including renewable energy, as specified in 4 CRS 240-22.010(2)(A). Empire through its consultant, ABB, developed, considered, and analyzed the present worth of long-run utility costs for 19 alternative resource plans by calculating the net present value revenue requirements (PVRR) for each plan. Minimization of PVRR was the decisive criterion for determination of the fiscal rank of each plan. Other factors, as noted above and including risk, rate impact, 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 new or more stringent legal mandates that could be imposed at some point during the planning horizon were evaluated for their potential impacts on the alternate resource supply plans. Further, minimizing the impact of the resource supply plan selections on potential rate increases was an integral facet of Empire's evaluations.

The details of Empire's integrated resource plan evaluation and risk analysis are further explained in this volume. Table 6-2 – Summary of Alternative plans in Section 3 provides an overview of each plan. The ABB 2016 IRP report is attached as an appendix to this volume.

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:

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;

2.1 Present Worth of Utility Revenue Requirements

The annual revenue requirement includes the total cost of Empire's electric operations and any costs for probable environmental compliance. The annual revenue requirement is the total of Empire's annual expenses and its authorized return on rate base. 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 multiplying the discount rate by the expected future Annual Revenue Requirement for any given year. When applied to each year in the planning period, the sum of the Present Value of Annual Revenue Requirements produces the net PVRR for the period.

2. Present worth of probable environmental costs;

2.2 Present Worth of Probable Environmental Costs

The present worth of probable environmental costs were developed based upon the expected risk levels for implementation of CO_2 regulations on existing generation:

- High: 15 percent CO_2 regulation by 2022
- Moderate: 50 percent CO_2 regulation by 2022 (the base assumption)
- Low: 25 percent CO_2 regulation by 2022
- No: no CO_2 regulations throughout the 20-year planning period

Figure 6-1 provides a decision tree illustration of the risk distribution that was applied.

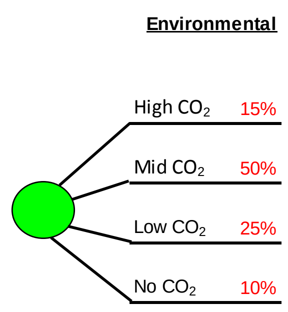

Figure 6-1 - Environmental Probabilities

Synapse CO_2 cost estimates were used for the projected CO_2 allowance prices in the three scenarios that considered carbon costs.

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

2.3 Present Worth of DSM Participant's Costs

Demand-Side Management (DSM) program costs were direct inputs to the integrated 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).

4. Levelized annual average rates;

2.4 Levelized Annual Average Rates

The total expected annual revenue requirement divided by the forecasted total retail energy sales provided the annual average rates. The simple average of the 20-year estimate of annual rates provided the levelized annual average rates.

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

2.5 Maximum Single-Year Increase in Annual Average Rates

Each year-by-year percent change in the annual average rates were calculated and analyzed to determine the maximum incremental increase.

> *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*

2.6 Financial Ratios

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

> *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).*

2.7 Other Measures for Assessing Relative Performance Plans

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).

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

2.8 Utility Discount Rate

Empire utilized a discount rate of 6.59 percent for all analyses of alternative resource plans. All PVRR dollar amounts were discounted back to 2016 dollars.

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.

Empire developed 19 alternative resource plans covering various combinations of supply-side resources, demand-side resources, renewables, and fueling options. *Table 6-2* provides a summary of Empire's alternative resource plans.

Plan	Plan Description	Plan Type	DSM Portfolio	RPS	Carbon Costs for DSM Screening
1	Base Scenario	Base Plan	RAP Portfolio	None	Weighted
2	Base Scenario With RPS	Base Plan	RAP Portfolio	15 to 20% by 2021	Weighted
3	RAP + DSM	Base Plan	RAP + DSM	15 to 20% by 2021	Weighted
4	RAP – DSM	Base Plan	RAP – DSM	15 to 20% by 2021	Weighted
5	No DSM	Base Plan	None	15 to 20% by 2021	N/A
6	Federal Renewable Incentives	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
7	High Environmental DSM	Other Contingency Plan	High Environmental	15 to 20% by 2021	High
8	Low Environmental DSM	Other Contingency Plan	Low Environmental	15 to 20% by 2021	Low
9	No Environmental DSM	Other Contingency Plan	No Environmental	15 to 20% by 2021	None
10	Low Load	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
11	High Load	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
12	High-High Load	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
13	Low Fuel	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
14	High Fuel	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
15	Aggressive Electric Vehicle	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
16	Early Asbury Retirement	Other Contingency Plan	RAP Portfolio	15 to 20% by 2021	Weighted
17	Highly Aggressive DSM	Required Plan	MAP Portfolio	15 to 20% by 2021	Weighted
18	Aggressive Capacity DSM	Required Plan	Aggressive Capacity Portfolio	15 to 20% by 2021	Weighted
19	Aggressive Renewable	Required Plan	None	Only renewables utilized	N/A
Notes: DSM – Demand-side Management RAP – Realistic Achievable Potential MAP – Maximum Achievable Potential RPS – Renewable Portfolio Standard					

Table 6-2 - Summary of Alternative Resource Plans

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—

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;

3.1.1 Rule Compliant Alternative Resource Plans

Plan 1 (Base Case) was originally created to be a low cost plan without forcing it to adhere to RES requirements. However, based on the planning assumptions and the capacity expansion model results, this plan complied with the RES requirement even without forcing the plan to do so. Therefore, Plan 1 and Plan 2 (Plan 2 was the base case *required* to meet the RES) are equivalent in this case. All other plans were designed to comply with the RES mandates. Base plans 1 through 4 all consider some form of the realistically achievable potential (RAP) demand-side management (DSM), which includes RAP, RAP + and RAP –. Plan 5 is the only base plan that does not have a demand-side portfolio. The IRP Rule requires the planning process to utilize demand-side resources to the maximum amount that comply with legal mandates, and are consistent with the public interest and achieve state energy policies. There is also a goal of achieving all *cost-effective* demand-side savings. Plan 5, the no DSM case, was designed to test for demand-side resource cost effectiveness. Cost-effectiveness is a key component of determining if demand-side programs are in the public interest. At this time, no mandated target levels exist for DSM in Missouri. Therefore, all base plans and contingency plans are considered compliant with legal mandates.

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;

3.1.2 All-Renewable Resource Plan

Plan 19 (Aggressive Renewable) was developed to utilize only renewable energy resources for new generation including wind, landfill gas, solar, and biomass generation. It is the aggressive renewable energy resource plan for planning purposes only.

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;

3.1.3 All-Demand-Side Resource Plan

Plan 18 (Aggressive Capacity DSM) was developed using only DSM to meet future capacity needs, but also includes sufficient renewable resources for compliance with the RES (15 to 20 percent by 2021). It is the aggressive demand-side resource plan for planning purposes only.

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 potential 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;

3.1.4 All Other Mandated Resources Plan

Plans 17 (Aggressive DSM), Plan 18 (only DSM can be used as a future resource up to the demand-side maximum achievable potential) and Plan 19 (only renewables can be used for future resource needs) are required by the IRP Rule. Empire references these resource plans as "Required Plans." Empire is not aware of any other mandated 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;

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

As discussed in Section 3.1.1, all base and contingency plans are considered to be compliant plans.

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

3.1.6 Special Contemporary Issue Plan

In File No. EO-2016-0040, the Commission issued an order on October 28, 2015 establishing eleven (11) special contemporary planning issues for Empire to analyze and document in its 2016 triennial Integrated Resource Plan. These issues are addressed in Section 8 at the end of this volume.

7. Any other plan specified by commission order; and

3.1.7 Other Commission-Specified Plans

No other plans were specified by Commission order.

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

3.1.8 Other Utility-Suggested Plans

Aside from plans 17-19 which are required by the IRP Rule, Empire developed several plans using combinations of various assumptions to determine the potential impacts under such occurrences. Plans 1-5 are considered base plans, since they utilize the base assumptions for each of the critical uncertain factors from the decision tree. Plan 1 was developed to determine the least cost plan without regard to the renewable energy standard (RES). However, Plan 1 and all plans did meet the RES, so the resource “build out” in Plan 1 is the same as Plan 2, which did require the RES be met. The primary difference in the base plans was the level of DSM (this included the three levels of RAP DSM (RAP, RAP- and RAP+) and a no DSM case). Plans 6-16 are considered contingency plans. Plan 6 examined the potential impact, if any, of current renewable incentives being in place for the entire planning horizon. Due to environmental uncertainty, Plans 7-9 considered various levels of future carbon costs. Plans 10-12 were developed to judge the potential impacts of higher or lower load growth. Similarly, Plans 13-14 were run to test the impacts of higher or lower fuel and market prices. Plan 15 was a special case to examine a potential future with an aggressive penetration of electric vehicles over the next twenty years. And finally, Plan 16 was a special “what-if” case to determine the impact of an early retirement of the Asbury coal-fired unit for any reason, but particularly due to potential greenhouse gas regulations. For IRP purposes, Asbury was planned to be retired in 2035, but in the early retirement case (Plan 16) it was assumed to retire in 2022 when it was assumed that carbon compliance would begin (for planning purposes) in the environmental scenarios that assumed some level of carbon costs.

(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).

3.1.9 Load-Building Programs in Plans

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

(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;

3.1.10 Potential Retirement or Life Extension of Existing Generating Plants

All of the resource plans included the same basic parameters regarding Empire's existing generating plants. As this IRP is being developed, Riverton 12 is in the process of being converted to combined cycle unit. It is assumed to be a combined cycle for the 20-year planning horizon. *For the purposes of this IRP*, all resource plans assume the retirement of Energy Center 1 in 2023, Energy Center 2 in 2026, Riverton 10 and 11 in 2033, and Asbury 1 in 2035.

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

3.1.11 Additions of Environmental Equipment at Generating Plants

All Empire resource plans incorporated the ongoing conversion of the Riverton 12 gas turbine from simple cycle to combined cycle arrangement which includes a selective catalytic converter (SCR) and a CO oxidation catalyst in the heat recovery steam generator (HRSG). The environmental retrofit project at Asbury was completed in December 2014. Iatan 1 was retrofitted with new emission controls equipment in 2009. Iatan 2 and Plum Point were constructed with new emissions controls. The State Line Combined Cycle Plant is already equipped with dry low NO_x burners on each gas turbine and an SCR on each HRSG.

No other major upgrades or additional environmental equipment are expected to be necessary at Empire's existing supply-side resources during the planning horizon for this IRP. For additional information, please refer to Volume 4 Supply-Side Resource Analysis.

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

3.1.12 Conclusion of Any DSM Programs

At one time, Empire offered a demand-side portfolio in each of its four states, but at the time of this IRP filing, Empire only offers demand-side programs in Missouri and Arkansas. 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, 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. 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. The conclusion of existing DSM programs are discussed further in the description of the preferred plan and the resource acquisition strategy in Volume 7 Resource Acquisition and Strategy Selection.

Missouri	Arkansas
● ENERGY STAR® New Homes Program	● Arkansas Weatherization (Community Action Agency Program)
● High Efficiency Air Conditioner Rebate Program	● Arkansas Weatherization (Empire Contractor Program)
● Home Performance with ENERGY STAR® Program	● High Efficiency AC Rebate Program
● Low-Income New Homes	● Small Appliance Rebate Program
● Low-Income Weatherization	● Commercial and Industrial Rebate Program
● Energize Missouri Program	● Small Business Lighting
● Building Operator Certification	● High-efficiency Residential Lighting (CFL)
● Commercial and Industrial Rebate Program	● Energy Star® Appliance
● Energize Missouri Industries Program	● Online Audit and Energy Calculator
	● School-Based Energy Education
	● AC Tune-up and Duct Sealing

Table 6-3 - Demand-Side Programs by State

(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.

3.1.13 DSM Utilized in Alternative Energy Plans

3.1.13.1 Avoided Energy Costs

Empire's objective in performing its integrated resource planning is to find a mix of supply-side resources and demand-side management (DSM) programs that will provide least-cost energy services to its customers. As per 4 CSR 240-22.050, the DSM alternatives to be considered were screened using avoided costs developed specifically for the demand-side management programs. The screening was performed by Applied Energy Group, Inc. (AEG) using avoided energy costs developed by ABB. The DSM alternatives that passed the AEG screening tests were input into the ABB Capacity Expansion Module (CEM) as modifications to the load forecast. CEM optimized supply-side resources around the DSM-modified load, completely enumerating all possible supply-side combinations and developing least cost integrated resource plans.

ABB created four forward views of the Southwest Power Pool – Kansas/Missouri (SPP-KSMO) regional electricity market; four environmental scenarios and a weighted average for the four environmental scenarios. Three avoided costs cases were specified with levels of mitigation that are more stringent than existing requirements which are judged to have a nonzero probability of being imposed at some point within the planning horizon. Figures 6-2, 6-3 and 6-4 show the avoided energy costs for the no CO_2, base, moderate and high environmental cases, and the weighted average for all four.

Source: ABB Advisors

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

Figure 6-2 - Annual Average Avoided Energy Cost (Nominal $/MWh)

Source: ABB Advisors

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

Figure 6-3 - Annual On-Peak Avoided Energy Cost (Nominal $/MWh)

Source: ABB Advisors

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

Figure 6-4 - Annual Off-Peak Avoided Energy Cost (Nominal $/MWh)

3.1.13.2 DSM Alternatives after Avoided Cost Screening

Numerous demand-side resource candidates were considered in the screening process. The DSM programs that passed AEG's screening tests for all levels for the environmental scenarios and were passed on to ABB's CEM were as follows:

For Residential:

- Residential Lighting
- Residential Appliance Recycling
- Whole House Efficiency
- Residential Behavioral
- Low Income Whole House Efficiency
- Low Income Behavioral
- Low Income Weatherization
- Demand Load Control

For Commercial:

- C&I Prescriptive Rebate
- C&I Custom Rebate
- Strategic Energy Management
- C&I Retro-Commissioning
- Curtailment Agreement

The schedules for DSM programs that passed AEG screening tests for each of the environmental portfolios are provided in *Table 6-4*.

DSM Programs	RAP-	RAP	RAP+	High CO_2	Mid CO_2	Low CO_2	No CO_2	MAP	Aggressive Capacity
Residential Lighting	2017	2017	2017	2017	2017	2017	2017	2017	2017
Residential Appliance Recycling	2022	2022	2022	2020	2020	2021	2022	2022	2022
Whole House Efficiency	2017	2017	2017	2017	2017	2017	2017	2017	2017
Residential Behavioral	2017	2017	2017	2017	2017	2017	2017	2017	2017
Low Income Whole House Efficiency	2017	2017	2017	2017	2017	2017	2017	2017	2017
Low Income Behavioral	2020	2020	2020	2020	2020	2020	2020	2020	2020
Low Income Weatherization	-	-	-	-	-	-	-	-	2017
Demand Load Control	2022	2022	2021	2022	2022	2022	2022	2020	2022
C&I Prescriptive Rebate	2017	2017	2017	2017	2017	2017	2017	2017	2017
C&I Custom Rebate	2017	2017	2017	2017	2017	2017	2017	2017	2017
Strategic Energy Management	2031	2031	2031	2028	2030	-	-	2032	2032
C&I Retro -commissioning	2030	2030	2030	2026	2028	-	-	2030	2030
Curtailment Agreement	2029	2029	2026	2029	2029	2029	2029	2026	2026

Table 6-4 - Start Year for DSM Program Participation by Portfolio

3.1.13.3 Existing Supply-Side Resource Schedule Assumptions

The resource schedule assumptions for Empire's base, intermediate, peaking and intermittence supply-side resources are presented separately on the following pages.

Table 6-5 provides Empire's base capacity resources over the 20-year planning period. Asbury 1 is projected to retired for purposes of the 2016 IRP in 2035.

Plant	Asbury	Iatan	Iatan	Plum Point	Ozark Beach	Total Capacity, MW
Unit	1	1	2	(1)		
Fuel	Coal	Coal	Coal	Coal	Water	
Type	Steam	Steam	Steam	Steam	Hydro	
2016	194	85	105	50	16	450
2017	194	85	105	50	16	450
2018	194	85	105	50	16	450
2019	194	85	105	50	16	450
2020	194	85	105	50	16	450
2021	194	85	105	50	16	450
2022	194	85	105	50	16	450
2023	194	85	105	50	16	450
2024	194	85	105	50	16	450
2025	194	85	105	50	16	450
2026	194	85	105	50	16	450
2027	194	85	105	50	16	450
2028	194	85	105	50	16	450
2029	194	85	105	50	16	450
2030	194	85	105	50	16	450
2031	194	85	105	50	16	450
2032	194	85	105	50	16	450
2033	194	85	105	50	16	450
2034	194	85	105	50	16	450
2035	-	85	105	50	16	256
Note: (1) Does not include Empire's 50 MW Plum Point PPA that extends throughout the planning period.						

Table 6-5 - Empire Base Capacity Resources for All Plans

Table 6-6 provides the sequence and schedule for Empire's intermediate capacity resources throughout the planning period. The ongoing conversion of Riverton 12 from simple cycle to combined cycle that will be completed in mid-2016 is Empire's only contemplated change to the intermediate supply-side resources. The following table shows the completed Riverton 12 combined cycle conversion.

Plant	State Line	Riverton	Total Capacity, MW
Fuel	Natural Gas		
Type	Combined Cycle		
2016	297	250	547
2017	297	250	547
2018	297	250	547
2019	297	250	547
2020	297	250	547
2021	297	250	547
2022	297	250	547
2023	297	250	547
2024	297	250	547
2025	297	250	547
2026	297	250	547
2027	297	250	547
2028	297	250	547
2029	297	250	547
2030	297	250	547
2031	297	250	547
2032	297	250	547
2033	297	250	547
2034	297	250	547
2035	297	250	547

Table 6-6 - Empire Intermediate Capacity Supply-Side Resources

Table 6-7 provides the sequence and schedule for the end of life of Empire's peaking capacity resources. For IRP purposes, Energy Center 1 and 2 are assumed to retire in 2023 and 2026, respectively. Riverton 10 and 11 are assumed to retire in 2033 for IRP purposes.

Plant	Riverton		Energy Center				State Line	Total Capacity, MW
Unit	10	11	1	2	3	4	1	
Type	GT	GT	GT	GT	Aero	Aero	GT	
2016	16	17	82	82	49	49	94	389
2017	16	17	82	82	49	49	94	389
2018	16	17	82	82	49	49	94	389
2019	16	17	82	82	49	49	94	389
2020	16	17	82	82	49	49	94	389
2021	16	17	82	82	49	49	94	389
2022	16	17	82	82	49	49	94	389
2023	16	17	-	82	49	49	94	307
2024	16	17	-	82	49	49	94	307
2025	16	17	-	82	49	49	94	307
2026	16	17	-	-	49	49	94	225
2027	16	17	-	-	49	49	94	225
2028	16	17	-	-	49	49	94	225
2029	16	17	-	-	49	49	94	225
2030	16	17	-	-	49	49	94	225
2031	16	17	-	-	49	49	94	225
2032	16	17	-	-	49	49	94	225
2033	-	-	-	-	49	49	94	192
2034	-	-	-	-	49	49	94	192
2035	-	-	-	-	49	49	94	192

Table 6-7 - Empire Peaking Capacity Supply-Side Resources

Table 6-8 provides the sequence and schedule for the expiration of Empire's wind purchased power agreement (PPA) energy resources which are intermittent 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 near the end of 2025, but it can be extended five years to expire near the end of 2030. The Meridian Way wind resource PPA is scheduled to end in December 2028. The nameplate capacity of each wind resource and the total accredited capacity are shown in the following table.

Project	Elk River	Meridian Way	Total Capacity, MW	Accredited Capacity, MW
Location	Kansas	Kansas		
2016	150	105	255	36
2017	150	105	255	36
2018	150	105	255	36
2019	150	105	255	36
2020	150	105	255	36
2021	150	105	255	36
2022	150	105	255	36
2023	150	105	255	36
2024	150	105	255	36
2025	150	105	255	36
2026	150	105	255	36
2027	150	105	255	36
2028	150	105	255	36
2029	150	-	150	17
2030	150	-	150	17
2031	-	-	-	-
2032	-	-	-	-
2033	-	-	-	-
2034	-	-	-	-
2035	-	-	-	-

Table 6-8 - Empire Renewable Intermittent Resources

3.1.14 Alternative Resource Plan Descriptions

Tables 6-9 and *6-10* highlight the supply-side resource expansion components for each of Empire's alternative resource plans.

YEAR	Plan 1- Base (RPS Not Required)	Plan 2-Base (Meets RPS)	Plan 3-RAP+	Plan 4-RAP-	Plan 5-No DSM	Plan 6-Fed Renew Incent	Plan 7-High CO2	Plan 8-Low CO2	Plan 9-No CO2	Plan 10-Low Load
2018										
2019										
2020										
2021										
2022										
2023										
2024										
2025										
2026										
2027										
2028										
2029	100 MW Wind	100 MW Wind	100 MW Wind	100 MW CC; 100 MW Wind	100 MW CC; 100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind
2030										
2031	100 MW CC; 150 MW Wind	100 MW CC; 150 MW Wind	150 MW Wind	150 MW Wind	150 MW Wind	100 MW CC; 150 MW Wind	100 MW CC; 150 MW Wind	100 MW CC; 150 MW Wind	100 MW CC; 150 MW Wind	150 MW Wind
2032										
2033			100 MW CC							100 MW CC
2034										
2035	200 MW CC	200 MW CC	200 MW CC	200 MW CC	200 MW CC	200 MW CC	200 MW CC	200 MW CC	214 MW CT Frame F	100 MW CC

Table 6-9 - Supply-Side Expansion Plans

YEAR	Plan 11-High Load	Plan 12-High-High Load	Plan 13-Low Fuel	Plan 14-High Fuel	Plan 15-Electric Vehicles	Plan 16-Asbury Retirement	Plan 17-MAP	Plan 18-Aggressive DSM Capacity	Plan 19-Aggressive Renewables
2018									
2019									
2020									
2021									
2022									
2023						100 MW CC			
2024									
2025									
2026		100 MW CC				100 MW CC			
2027	100 MW CC								
2028									
2029	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW CC; 100 MW Wind	100 MW Wind	100 MW Wind		100 MW Wind; 5 MW Battery; 2.5 MW Landfill Gas; 15 MW Market
2030									5 MW Battery; 20 MW Market
2031	150 MW Wind	150 MW Wind	100 MW CC; 150 MW Wind	100 MW CC; 150 MW Wind	150 MW Wind	100 MW CC; 150 MW Wind	150 MW Wind	10 MW Market	200 MW Wind; 30 MW Market
2032								15 MW Market	5 MW Solar; 25 MW Market
2033		100 MW CC			100 MW CC		100 MW CC	60 MW Market	100 MW Wind; 2.5 MW Landfill Gas; 5 Biomass; 5 MW Solar; 50 MW Market
2034								65 MW Market	40 MW Market
2035	200 MW CC	200 MW CC	214 MW CT Frame F	200 MW CC	200 MW CC		200 MW CC	270 MW Market	240 MW Market

Table 6-10 - Supply-Side Expansion Plans (Continued)

Each of the alternative resource plans are further described below and in the capacity balance tables that follow. Recent trends in energy efficiency and distributed generation appear to have moved the Company more towards a winter peaking situation. The normal weather forecast from this IRP results in the annual peak occurring during the winter season. However, in this IRP, the need for new resources, as determined by the capacity balance, is still driven by the summer peak when the natural gas units have a lower capacity rating due to warmer ambient temperatures. As a result, both the summer and winter peaks are important, and in compliance with 4 CSR 240-22.080(2)(D), the forecast of capacity balance table is presented for both the summer and the winter for each alternate resource plan. All of the base and contingency plans were RES compliant.

1. Plan 1 (Base Case): The Base Plan applied the existing Empire resources as described above and realistically achievable potential (RAP) DSM. It was not forced to adhere to RES requirements. However, based on the planning assumptions and the capacity expansion model results, this plan complied with the RES requirement even without forcing the plan to do so. Carbon costs for DSM screening were based on the probable environmental costs. The model satisfied future capacity needs by installing natural gas-fired, combined cycle units in 2031 (100 MW) and 2035 (200 MW). Empire's existing wind PPAs expired and were replaced in 2029 (100 MW) and 2031 (150 MW). The Base portfolio of RAP DSM beginning at 0.5 MW (summer) in 2017 was employed throughout the planning period, increasing to 23.8 MW (summer) by 2035.

2. Plan 2 (Base Case Meets RPS): This plan utilized all Base plan assumptions and RAP DSM as described above, and was required to have sufficient renewable energy resources for compliance with existing state renewable energy standards (RES), that is a minimum of 15 percent by 2021 and continuing as required for State RES compliance. Carbon costs for DSM screening were based on probable environmental costs. The model satisfied future capacity needs by installing the same resources as in Plan 1 – 100 MW combined cycle in 2031, 200 MW combined cycle in 2035, 100 MW of wind PPA in 2029, and 150 MW of Wind PPA in 2031.

3. Plan 3 (RAP + DSM): Plan 3 was run from the Base plan to examine the impacts of increased DSM participation. The same resources as required in Plans 1 and 2 were added in Plan 3 but with slightly different timing. Wind PPAs were added in 2029 (100) and 2031 (150), a 100 MW combined cycle unit in 2033 and a 200 MW combined cycle unit in 2035. With increased participation levels, DSM began at approximately 0.6 MW (summer) in 2017 and grew to approximately 32.4 MW (summer) by 2035.

4. Plan 4 (RAP - DSM): Plan 4 was run from the Base plan to examine the impacts of DSM participation at a level closer to historical actuals in the early part of the study period. Future capacity needs were satisfied by installing combined cycle units (100 MW in 2029 and 200 MW in 2035) and Wind PPAs in 2029 (100 MW) and 2031 (150 MW). With typical experience levels, DSM began at approximately 0.3 MW (summer) in 2017 and grew to approximately 11.9 MW (summer) by 2035.

5. Plan 5 (No DSM): This base plan examined meeting all future capacity needs without future DSM additions. Only conventional supply-side resources were added along with wind PPAs to meet RES requirements. As with the other base plans, future capacity needs were satisfied by combined cycle additions and Wind PPAs. Combined cycle units were installed in 2029 (100 MW) and 2035 (200 MW). Renewable resources were added in the form of a 100-MW wind PPA in 2029 and a 150 MW wind PPA in 2031.

6. Plan 6 (Federal Renewable Incentives): This contingency plan started with the assumptions of Plan 2 and added Federal Renewable Incentives, which reflected high and continuing levels of investment tax credits for wind and solar resources. The same resources were needed in the future as for Plans 1 and 2 – 100 MW wind PPA in 2029, 100 MW combined cycle and 150 MW wind PPA in 2031, and 200 MW combined cycle in 2035.

7. Plan 7 (High Carbon Costs): Plan 7 was a contingency plan that started with the Base plan to which the high forecasts were applied for a high environmental portfolio DSM based on higher avoided costs, natural gas, and electric market prices. High carbon costs were used for the DSM modeling. The same resources (combined cycle and Wind PPA) were added in Plan 7 as in Plan 6 and with the same timing (which are identical to those in Plans 1 and 2 as well).

8. Plan 8 (Low Carbon Costs): Plan 8 was a contingency plan that started with the Base plan to which the low carbon forecasts were applied for a low environmental portfolio DSM based on lower avoided costs, natural gas, and electric market prices. Low carbon costs were used for the DSM modeling. The same resources (combined cycle and Wind PPA) were added in Plan 8 as in Plan 6 and with the same timing (which are identical to those in Plans 1 and 2 as well).

9. Plan 9 (No Carbon Costs): Plan 9 was a contingency plan that started with the Base plan to which no carbon costs were applied. This plan utilized the RAP level DSM. Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW). A 100 MW combined cycle unit was added in 2031 and a combustion turbine (214 MW) was added in 2035.

10. Plan 10 (Low Load): This contingency plan modeled the impact of less than expected load growth on the Base plan with RAPDSM portfolio. 100 MW combined cycle units were added in 2033 and 2035. New Wind PPAs were installed in 2029 (100 MW) and 2031 (150 MW).

11. Plan 11 (High Load): The impact of higher than expected load growth on the Base plan was modeled for contingency with RAP DSM portfolio. The timing of resource additions was slightly different than other base plans with 100 MW

combined cycle in 2027 and a 200 MW combined cycle unit in 2035. Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW).

12. Plan 12 (High-High Load): The impact of even higher than expected load growth on the Base plan was modeled for contingency with RAP DSM portfolio. Combined cycle additions included 100 MW in 2026, 100 MW in 2033 and 200 MW in 2035. Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW).

13. Plan 13 (Low Fuel): This contingency plan examined the impact of low fuel and electric market prices on the Base plan including RAP DSM portfolio. A combined cycle resource of 100 MW was added in 2031. Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW). A combustion turbine of 214 MW was added in 2035.

14. Plan 13 (High Fuel): This contingency plan examined the impact of high fuel and electric market prices on the Base plan including RAP DSM portfolio. The same resources were added in Plan 14 as in plans 1 and 2.

15. Plan 15 (Aggressive Electric Vehicle): The impact of a high penetration of electric vehicles on the Base plan was modeled in this contingency plan including RAP DSM portfolio. Combined cycle resources were added in 2029 (100 MW), 2033 (100 MW) and 2035 (200 MW). Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW).

16. Plan 16 (Early Asbury Retirement): The impact of retiring Asbury in 2022 was modeled in this contingency plan using on the Base plan including RAP DSM portfolio. Combined cycle resources of 100 MW were added in 2023, 2026 and 2031. Wind PPAs were added in 2029 (100 MW) and 2031 (150 MW).

17. Plan 17 (Highly Aggressive DSM): The maximum achievable potential (MAP) DSM portfolio was modeled in this required plan. The same resources were added as in Plan 3 with the same timing – Wind PPAs and combined cycle units. DSM began at approximately 0.7 MW (summer) in 2017 and grew to approximately 41 MW (summer) by 2035.

18. Plan 18 (Aggressive Capacity DSM): This required plan modeled the use of only DSM to meet all future capacity needs. No supply-side resources were added. DSM began at approximately 0.5 MW (summer) in 2017 and grew to approximately 36.6 MW (summer) by 2035.

19. Plan 19 (Aggressive Renewable): This required plan examined the impact of meeting all future capacity requirements exclusively by renewable resources. Future capacity needs were satisfied by Wind PPAs, battery, landfill gas, solar, and biomass as well as buying from the market. Specifically, 100 MW Wind

PPA, 5 MW of batteries and 2.5 MW of landfill gas were installed in 2029. Another 5 MW battery increment was installed in 2030. A 200 MW Wind PPA was installed in 2031. 5 MW of solar was installed in 2032. In 2033, 100 MW Wind PPA, 2.5 MW of landfill gas, 5 MW Biomass, and 5 MW of Solar were installed.

Tables 6-11 through 6-48 provide the sequence and schedule for all demand-side and supply-side resources for each of the alternative resource plans for each of summer and winter.

Tables 6-11 through 6-48

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Table 6-11 – Summer Forecast of Capacity Balance for the Base Scenario - Plan 1

Table 6-12 – Winter Forecast of Capacity Balance for the Base Scenario - Plan 1

NP

Table 6-13 – Summer Forecast of Capacity Balance for Base with RPS - Plan 2

NP

Table 6-14 – Winter Forecast of Capacity Balance for Base with RPS - Plan 2

NP

Table 6-15 – Summer Forecast of Capacity Balance for RAP + DSM - Plan 3

NP

Table 6-16 – Winter Forecast of Capacity Balance for RAP + DSM - Plan 3

Table 6-17 – Summer Forecast of Capacity Balance for RAP - DSM Scenario - Plan 4

NP

Table 6-18 – Winter Forecast of Capacity Balance for RAP - DSM Scenario - Plan 4

Table 6-19 – Summer Forecast of Capacity Balance for No DSM Scenario - Plan 5

NP

Table 6-20 – Winter Forecast of Capacity Balance for No DSM Scenario - Plan 5

Table 6-21 – Summer Forecast of Capacity Balance for Federal Renewable Incentives - Plan 6

Table 6-22 – Winter Forecast of Capacity Balance for Federal Renewable Incentives - Plan 6

NP

Table 6-23 – Summer Forecast of Capacity Balance for High Environmental DSM Scenario - Plan 7)

NP

Table 6-24 – Winter Forecast of Capacity Balance for High Environmental DSM Scenario - Plan 7)

NP

Table 6-25 – Summer Forecast of Capacity Balance for Low Environmental DSM Scenario - Plan 8

NP

Table 6-26 – Winter Forecast of Capacity Balance for Low Environmental DSM Scenario - Plan 8

Table 6-27 – Summer Forecast of Capacity Balance for No Environmental DSM Scenario - Plan 9

NP

Table 6-28 – Winter Forecast of Capacity Balance for No Environmental DSM Scenario - Plan 9

NP

Table 6-29 - Summer Forecast of Capacity Balance for Low Load Scenario - Plan 10

NP

Table 6-30 - Winter Forecast of Capacity Balance for Low Load Scenario - Plan 10

Table 6-31 – Summer Forecast of Capacity Balance for High Load Scenario - Plan 11

NP

Table 6-32 – Winter Forecast of Capacity Balance for High Load Scenario - Plan 11

Table 6-33 – Summer Forecast of Capacity Balance for High-High Load Scenario - Plan 12

NP

Table 6-34 – Winter Forecast of Capacity Balance for High-High Load Scenario - Plan 12

Table 6-35 – Summer Forecast of Capacity Balance for Low Fuel Scenario - Plan 13

Table 6-36 – Winter Forecast of Capacity Balance for Low Fuel Scenario - Plan 13

NP

Table 6-37 – Summer Forecast of Capacity Balance for High Fuel Scenario - Plan 14

NP

Table 6-38 – Winter Forecast of Capacity Balance for High Fuel Scenario - Plan 14

Table 6-39 – Summer Forecast of Capacity Balance for Electric Vehicle Load Scenario - Plan 15

Table 6-40 – Winter Forecast of Capacity Balance for Electric Vehicle Load Scenario - Plan 15

NP

Table 6-41 – Summer Forecast of Capacity Balance for Early Asbury Retirement Scenario - Plan 16

NP

Table 6-42 – Winter Forecast of Capacity Balance for Early Asbury Retirement Scenario - Plan 16

NP

Table 6-43 – Summer Forecast of Capacity Balance for Highly Aggressive DSM - Plan 17

Table 6-44 – Winter Forecast of Capacity Balance for Highly Aggressive DSM - Plan 17

NP

Table 6-45 – Summer Forecast of Capacity Balance for Aggressive Capacity DSM Scenario - Plan 18

NP

Table 6-46 – Winter Forecast of Capacity Balance for Aggressive Capacity DSM Scenario - Plan 18

Table 6-47 – Summer Forecast of Capacity Balance for Aggressive Renewable Scenario - Plan 19

Table 6-48 – Winter Forecast of Capacity Balance for Aggressive Renewable Load Scenario - Plan 19

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:

(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;

4.1 Performance Measures of Resource Plans

The performance of each alternative resource plan with respect to the stated performance measures is provided in *Table 6-49*.

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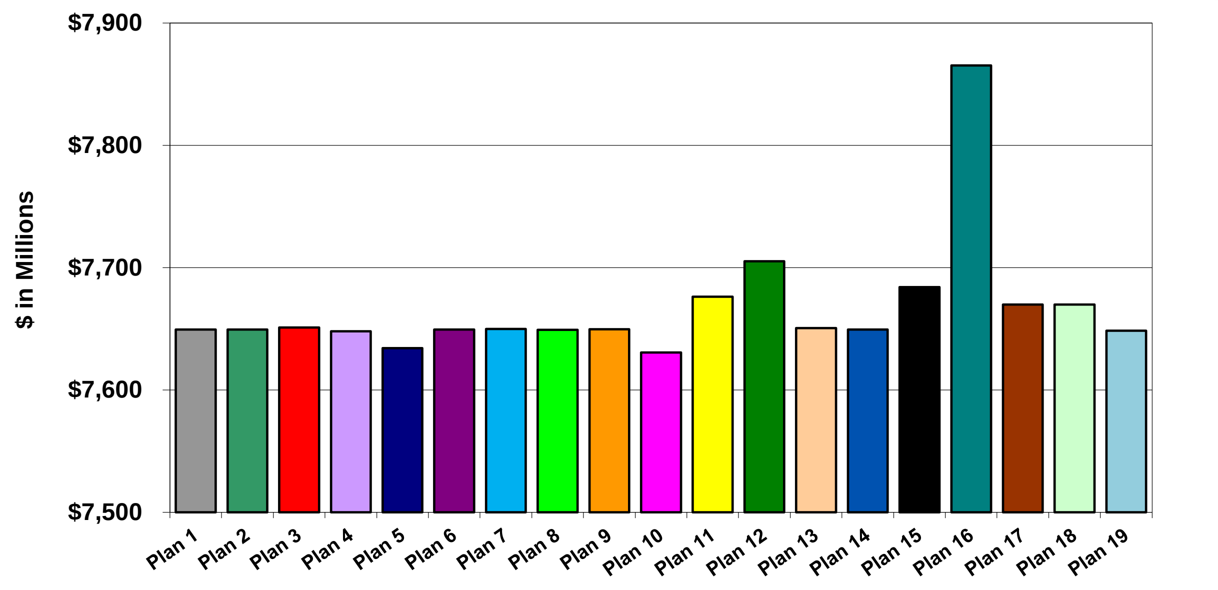
Table 6-49 - Alternative Resource Plan Performance

Table 6-50 provides a reference listing for each alternative resource plan.

Plan No.	Plan Description
1	Base Case
2	Base Case with RPS
3	RAP + DSM
4	RAP – DSM
5	No DSM
6	Federal Renewable Incentives
7	High Environmental DSM
8	Low Environmental DSM
9	No Environmental DSM
10	Low Load
11	High Load
12	High-High Load
13	Low Fuel
14	High Fuel
15	Electric Vehicle Load
16	Early Asbury Retirement
17	Highly Aggressive DSM
18	Aggressive Capacity DSM
19	Aggressive Renewable

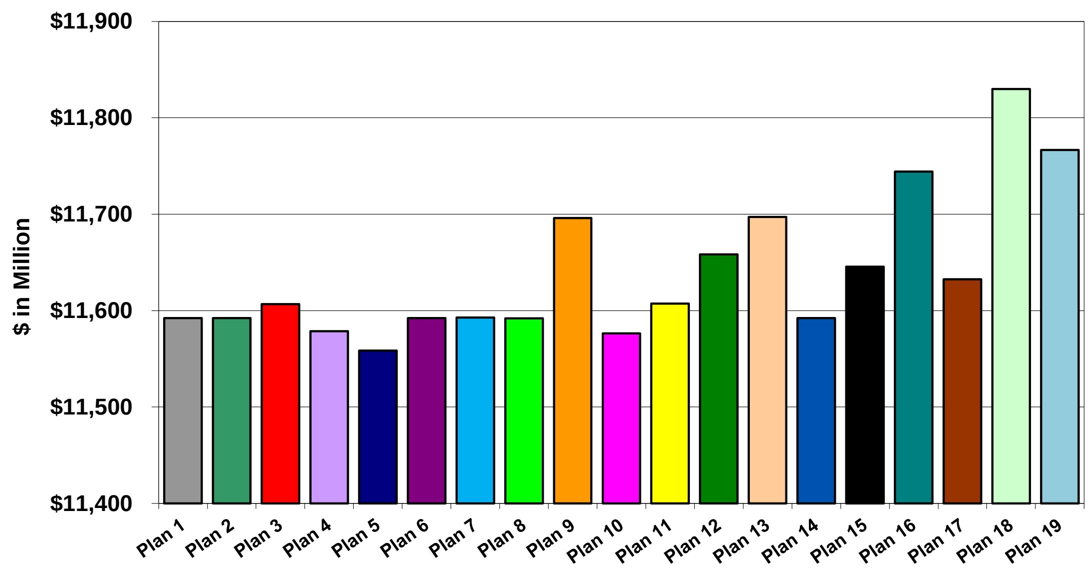
Table 6-50 - Plan Legend

The deterministic PVRR for each of Empire's alternative resource plans over the twenty-year planning horizon is shown in *Figure 6-5.* The deterministic PVRR for each plan over the forty-year period 2016-2055, including end effects, is shown in *Figure 6-6*.



(Source: ABB Advisors.)

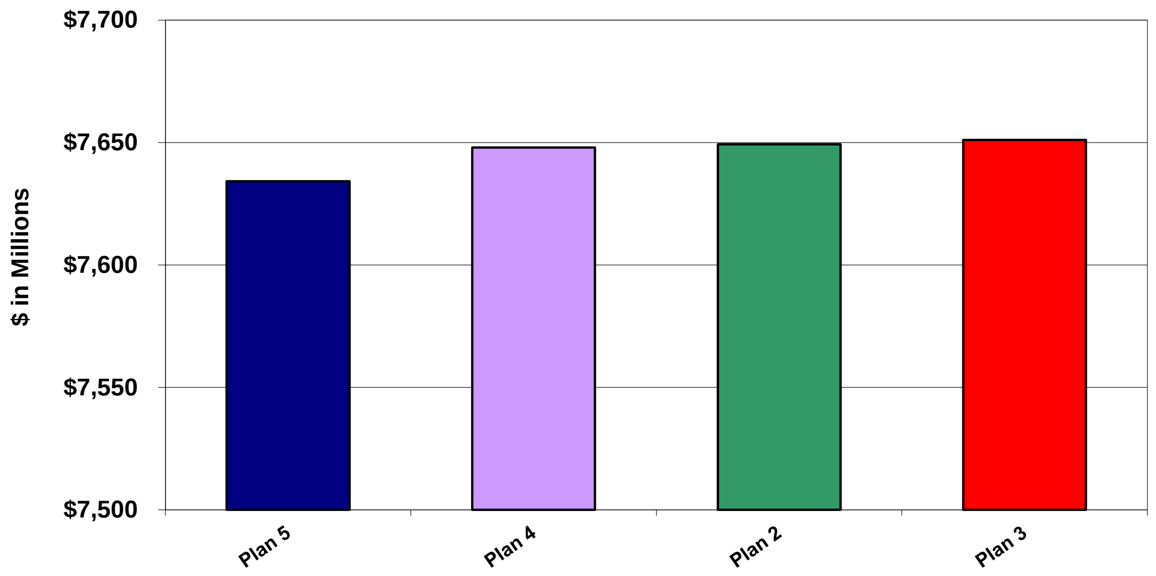
Figure 6-5 - Deterministic 20-Year NPVRR of All Plans



(Source: ABB Advisors)

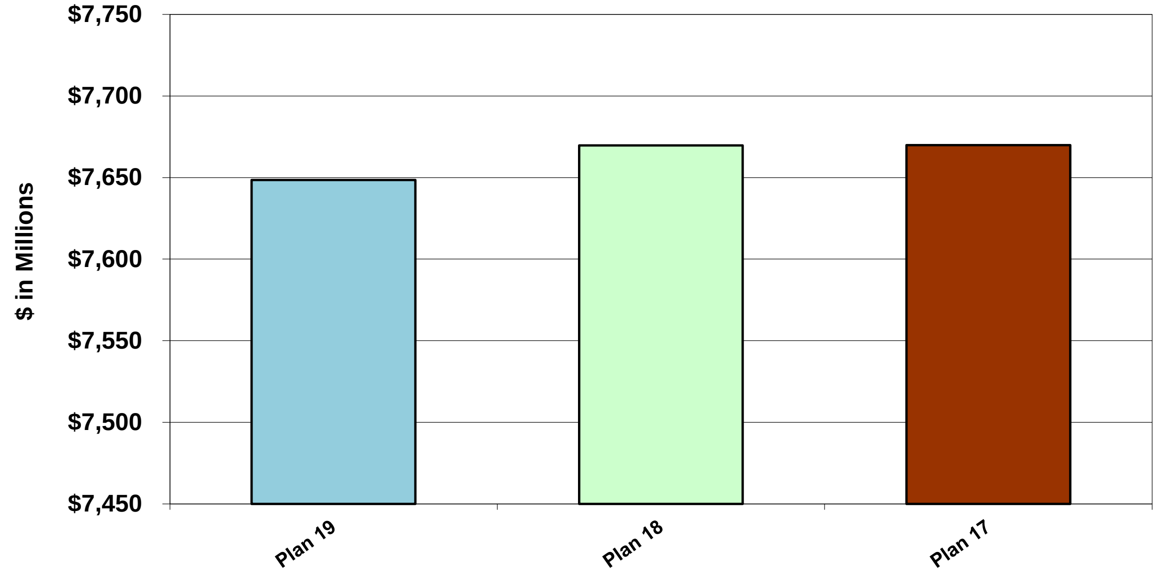
Figure 6-6 - All Plans with End Effects – 40-Year Deterministic PVRR (2016-2055)

Plans 1-5 are base plans and plans 6-16 are contingency plans. Plan 1 and Plan 2 have the same resulting resource plan, so Plan 1 is not shown in the following figures. Plans 17-19 are plans required by a rule for planning purposes and are not comparable to the other plans. *Figures 6-7* through *6-9* illustrate the 20-year PVRR based upon these groupings. *Figure 6-10* indicates the annual rate increase as a percentage of average rate revenue for each of the alternative resource plans. *Figures 6-11* through *6-13* provide the deterministic results of all the plans, including capital cost of plant in service, capacity margins, and average rate revenues (cents per kWh).



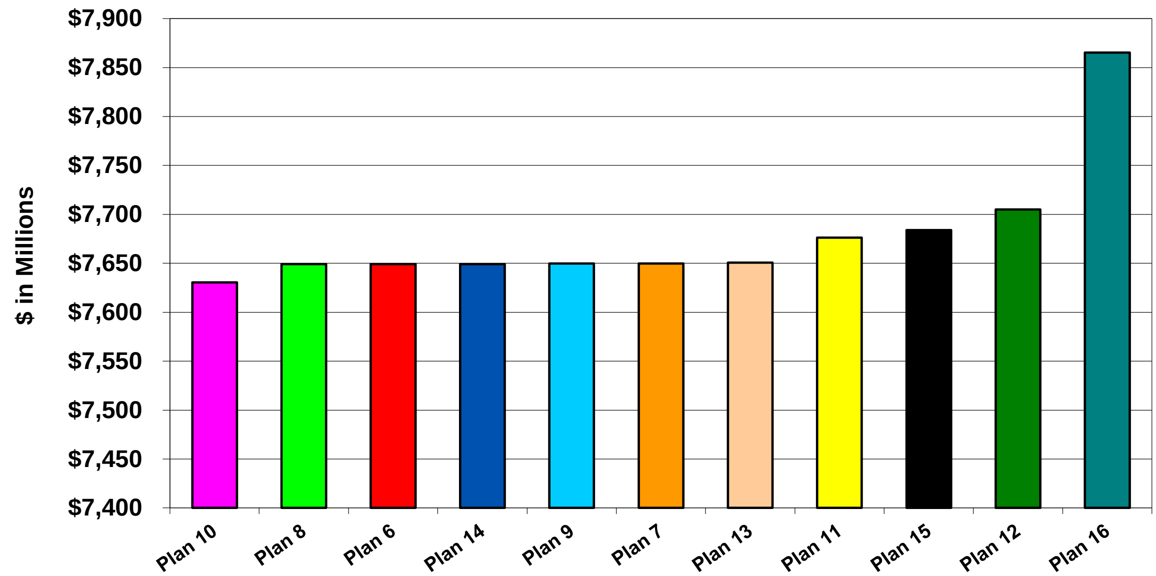
(Source: ABB Advisors.)

Figure 6-7 - 20-Year NPVRR of Base Plans



(Source: ABB Advisors.)

Figure 6-8 - 20-Year NPVRR of the Rule-Required Plans



(Source: ABB Advisors.)

Figure 6-9 - 20-Year NPVRR of Contingency Plans

(Source: ABB Advisors.)

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Figure 6-10 - Annual Rate Increases for All Plans

(Source: ABB Advisors.)

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Figure 6-11 - Plant in Service

(Source: ABB Advisors.)

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Figure 6-12 - Capacity Margins of All Plans

(Source: ABB Advisors.)

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Figure 6-13 - Average Rate Revenue of All Plans

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

4.2 Graphic Analysis of Plans

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

4.2.1 DSM Impact on Peak Demand

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 *Figures 6-13* through *6-21*. Nine separate figures cover the 19 alternate resource plans as nine separate DSM portfolios were evaluated. The corresponding tables of values for all these figures are provided in Appendix 6B.

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Figure 6-14 - DSM Impact on Plan 1 Loads (Also applies to Plans 2, 6 and 10-16)

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Figure 6-15 - DSM Impact on Plan 3 Loads

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Figure 6-16 - DSM Impact on Plan 4 Loads

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Figure 6-17 - DSM Impact on Plan 5 Loads (Also applies to Plan 19)

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Figure 6-18 - DSM Impact on Plan 7 Loads

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Figure 6-19 - DSM Impact on Plan 8 Loads

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Figure 6-20 - DSM Impact on Plan 9 Loads

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Figure 6-21 - DSM Impact on Plan 17 Loads

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Figure 6-22 - DSM Impact on Plan 18 Loads

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

4.2.2 DSM Program Composition of Plans

The composition by program and demand-side rate of the capacity provided by DSM resources for each resource plan is shown in *Figures 6-23* through *6-30*. The corresponding tables of values for all these figures are provided in Appendix 6C. Since plans 5 and 19 did not use any DSM, no figure has been provided for them.

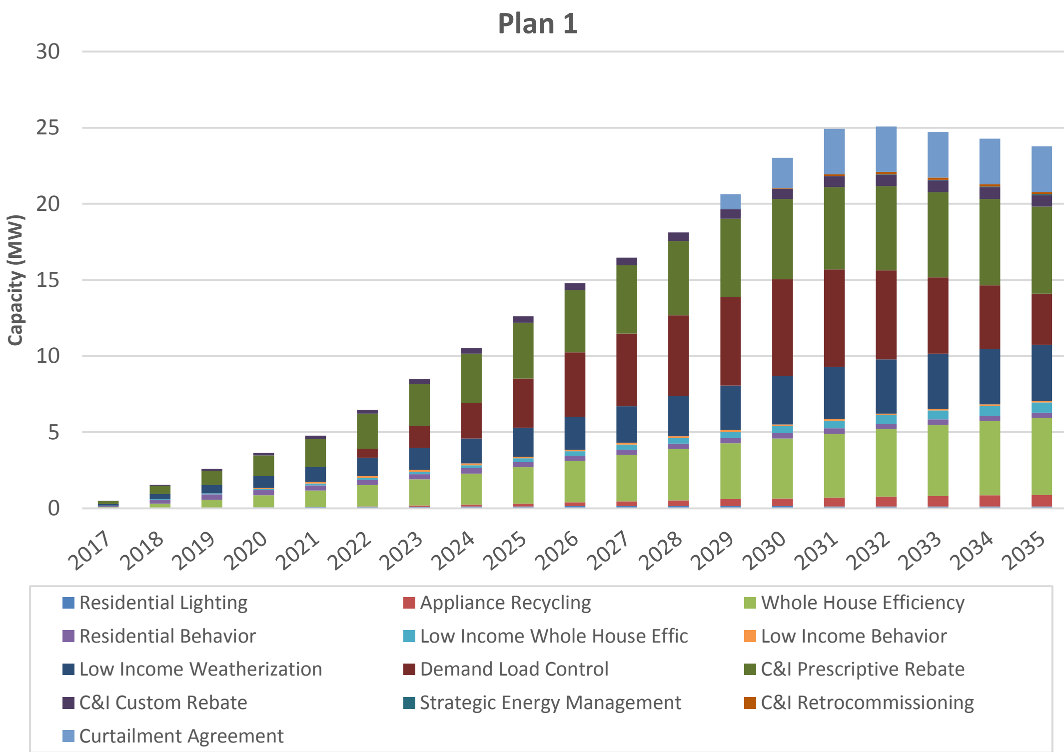

Figure 6-23 - DSM Composition of Plan 1 (Also applies to Plans 2, 6, 10-16)

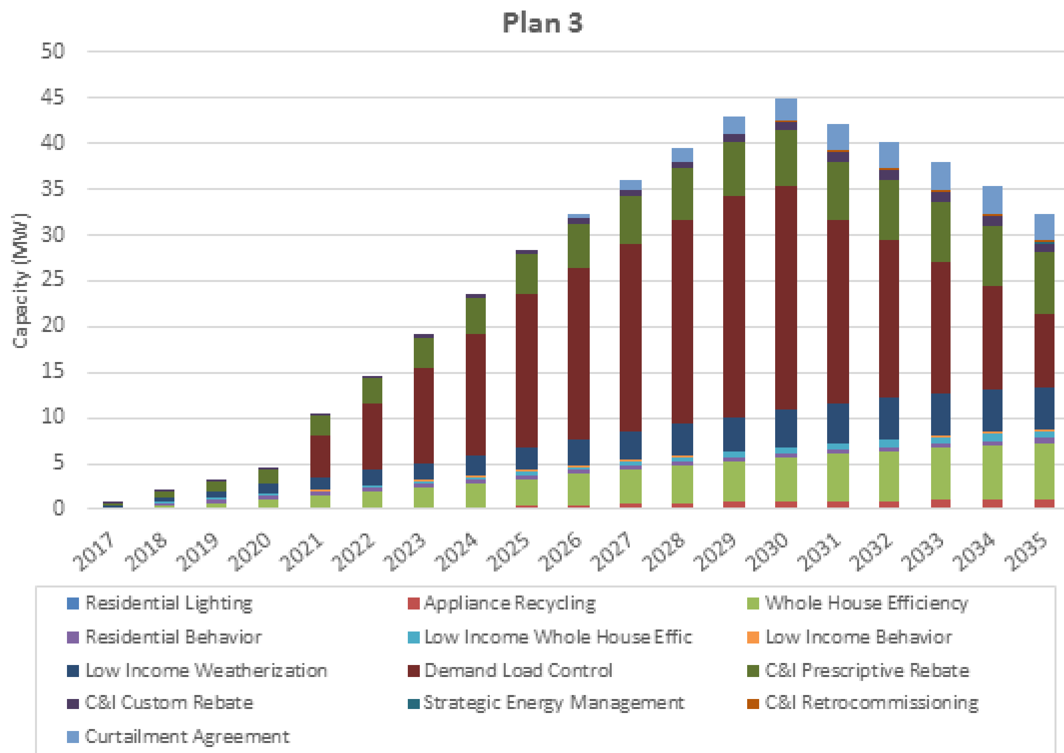

Figure 6-24 - DSM Composition of Plan 3

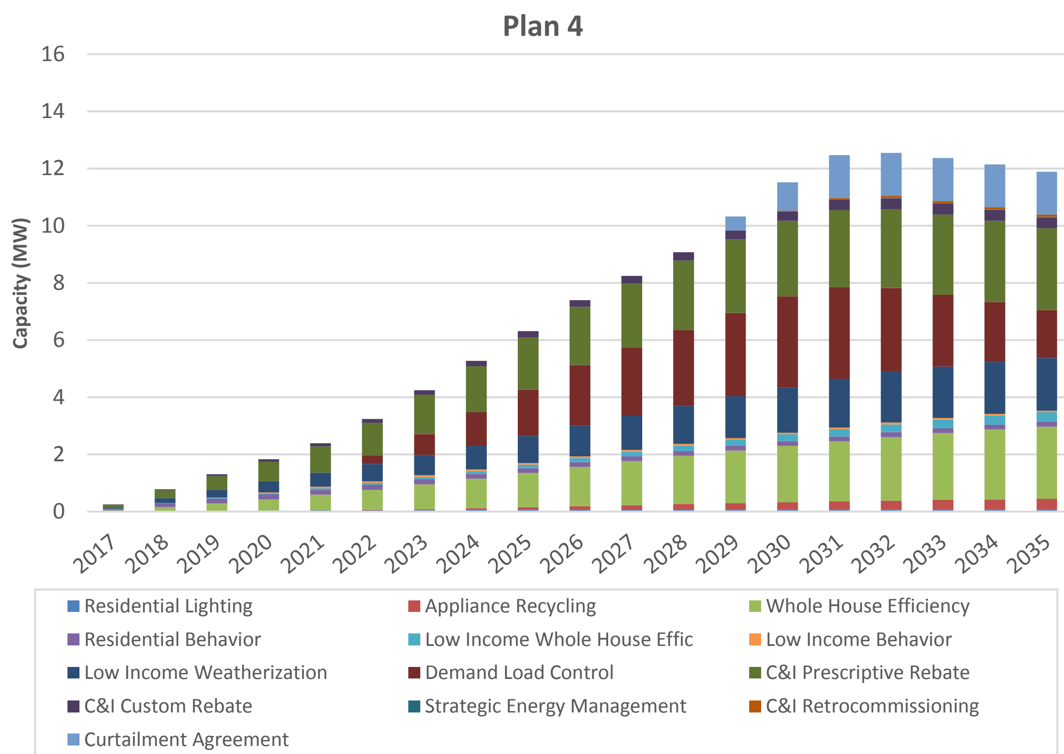

Figure 6-25 - DSM Composition of Plan 4
(NOTE: Plans 5 and 19 are blank and thus a figure is not provided)

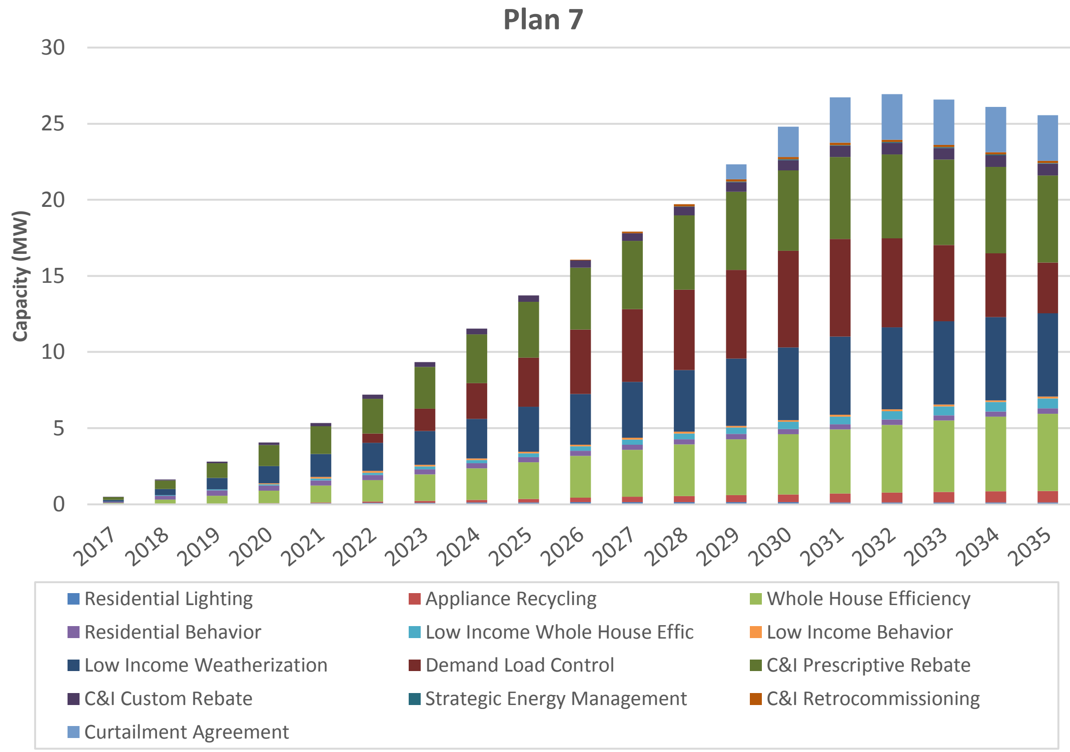

Figure 6-26 - DSM Composition of Plan 7

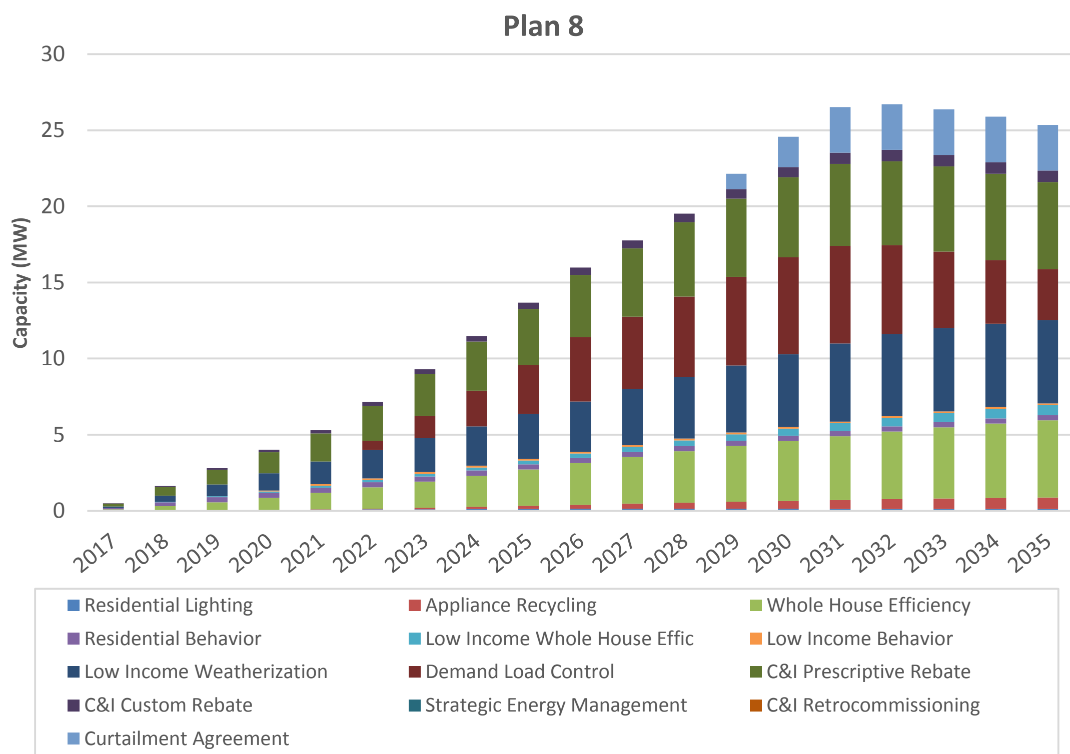

Figure 6-27 - DSM Composition of Plan 8

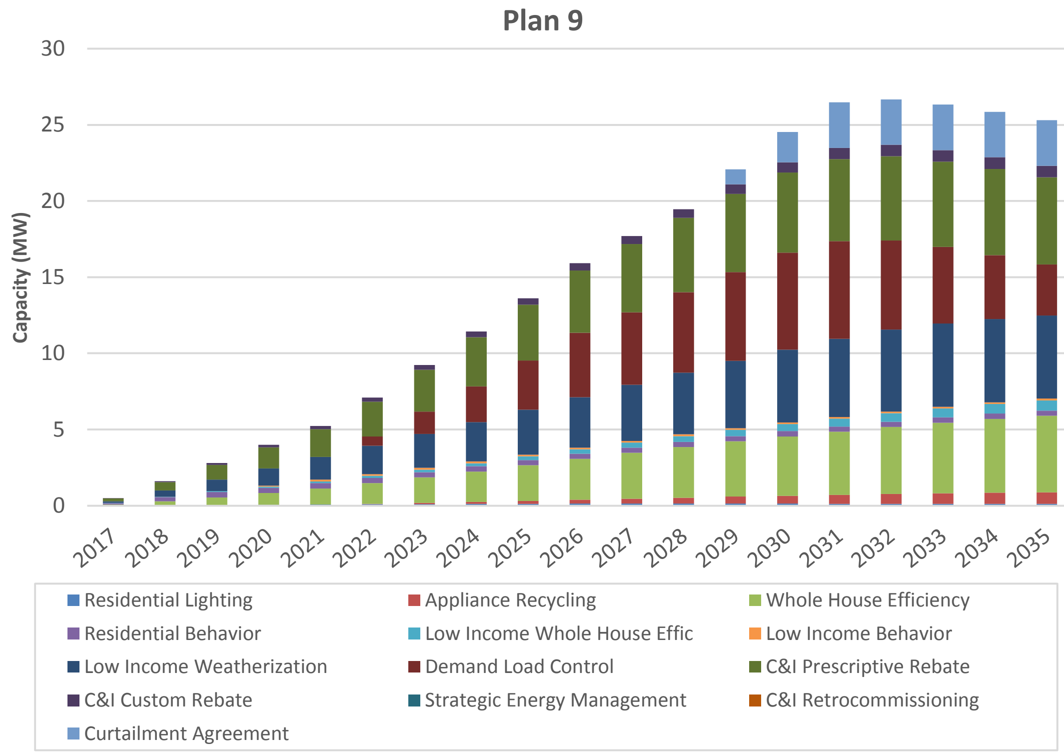

Figure 6-28 - DSM Composition of Plan 9

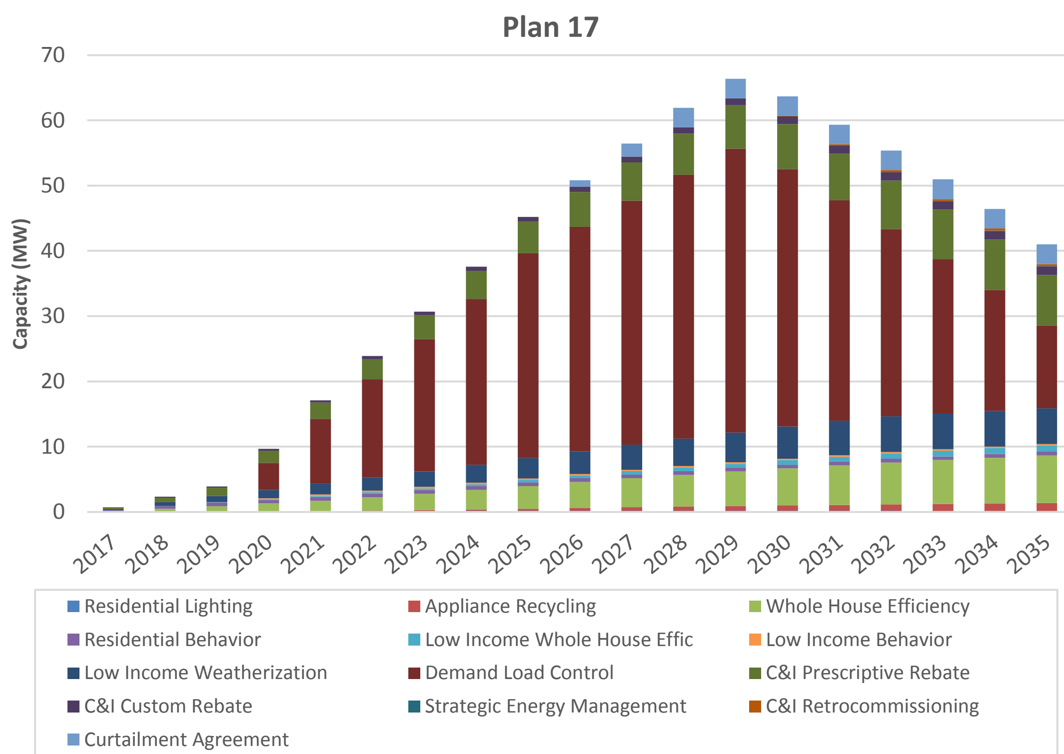

Figure 6-29 - DSM Composition of Plan 17

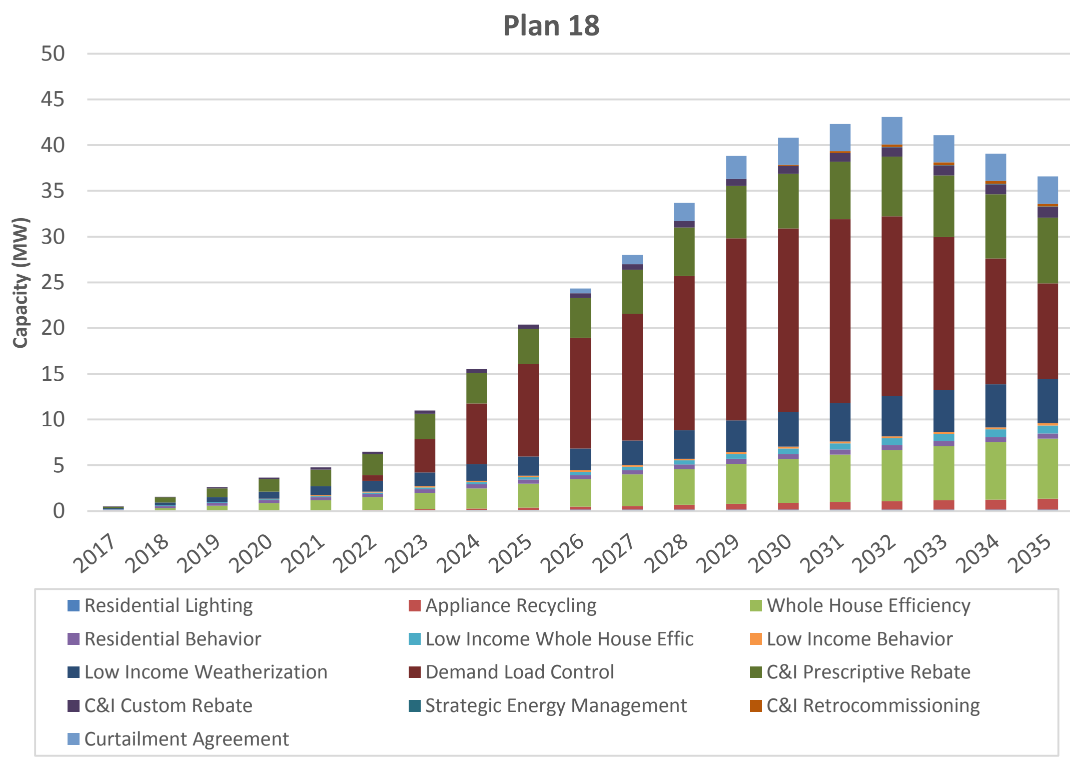

Figure 6-30 - DSM Composition of Plan 18

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;

4.2.3 Supply-Side Composition of Plans

The composition by supply-side resource of the capacity supplied to the transmission grid by supply-side resources for each resource plan is shown in *Figures 6-31* through *6-47*. The corresponding tables of values for all these figures are provided in Appendix 6D.

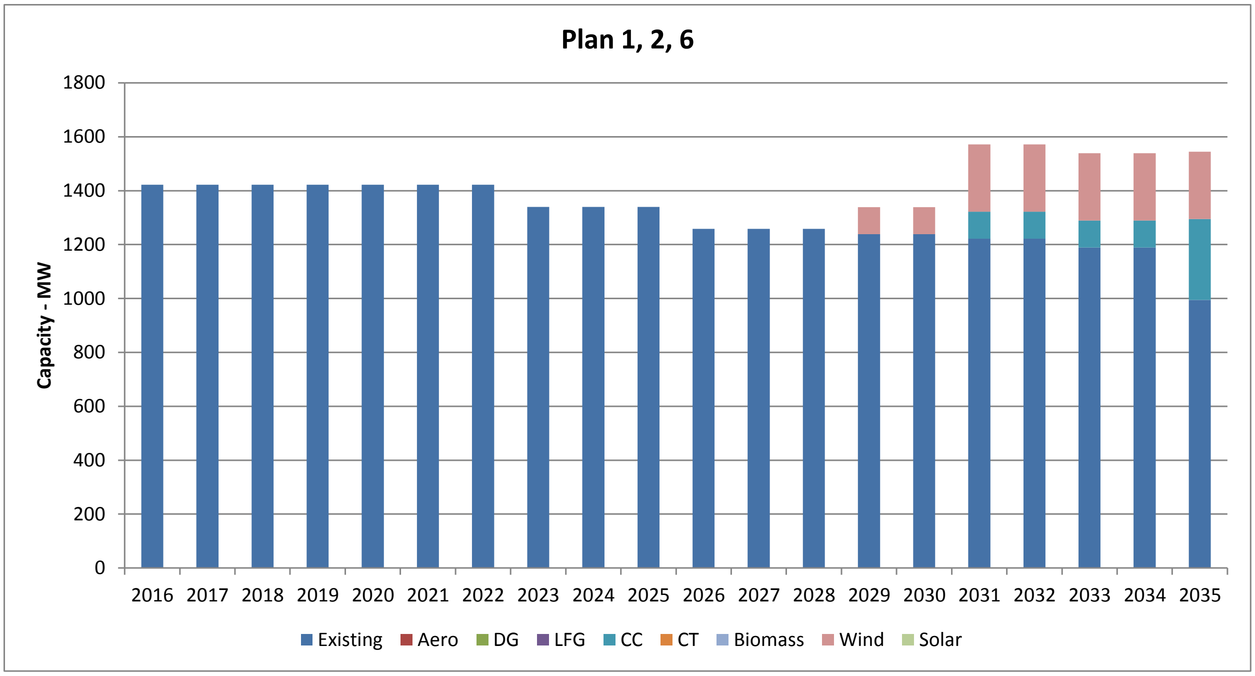

Figure 6-31 - Supply-Side Resource Composition of Plan 1, 2, 6

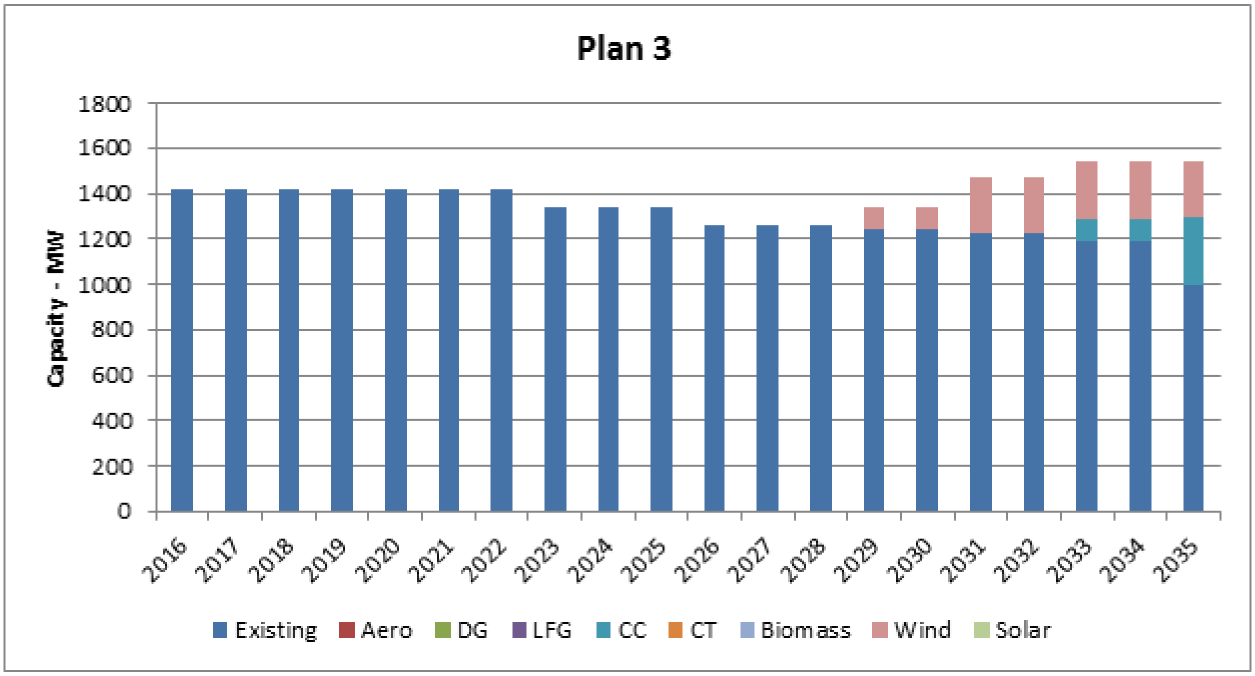

Figure 6-32 - Supply-Side Resource Composition of Plan 3

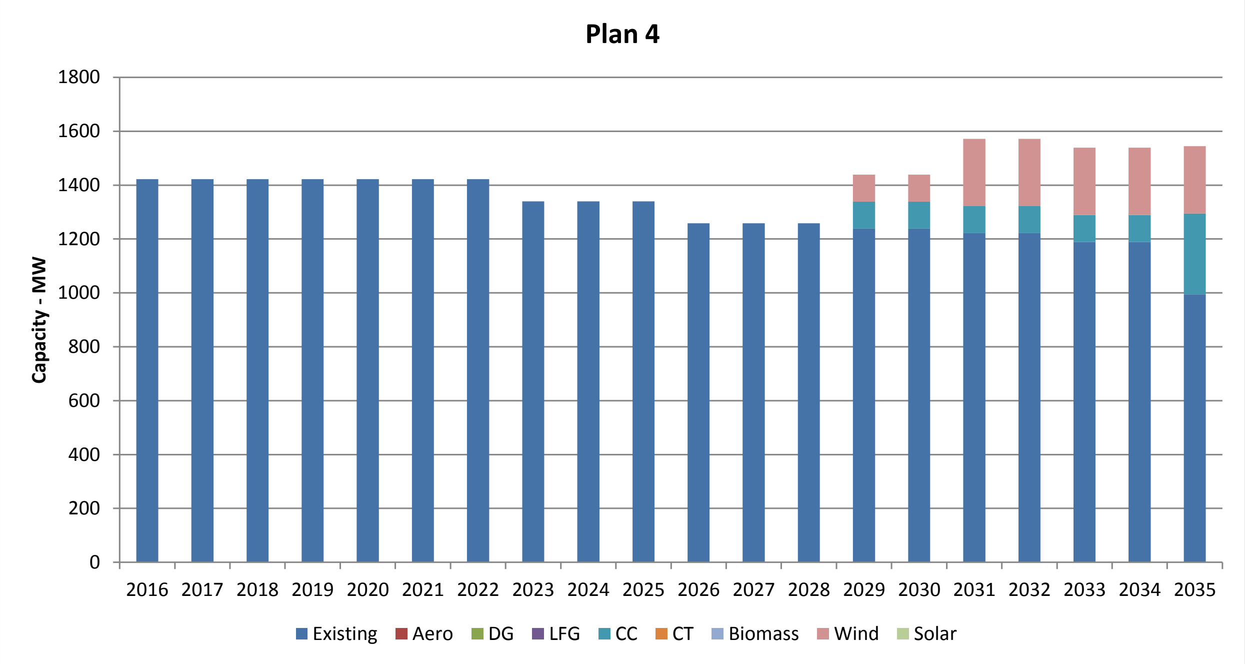

Figure 6-33 - Supply-Side Resource Composition of Plan 4

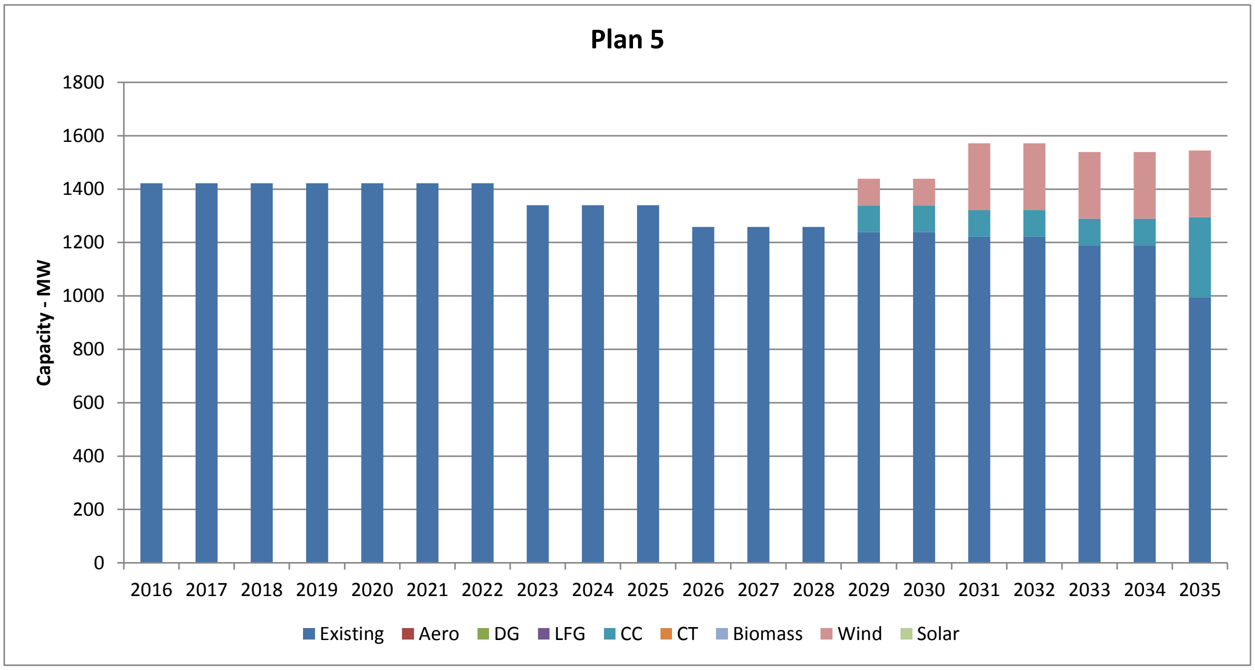

Figure 6-34 - Supply-Side Resource Composition of Plan 5

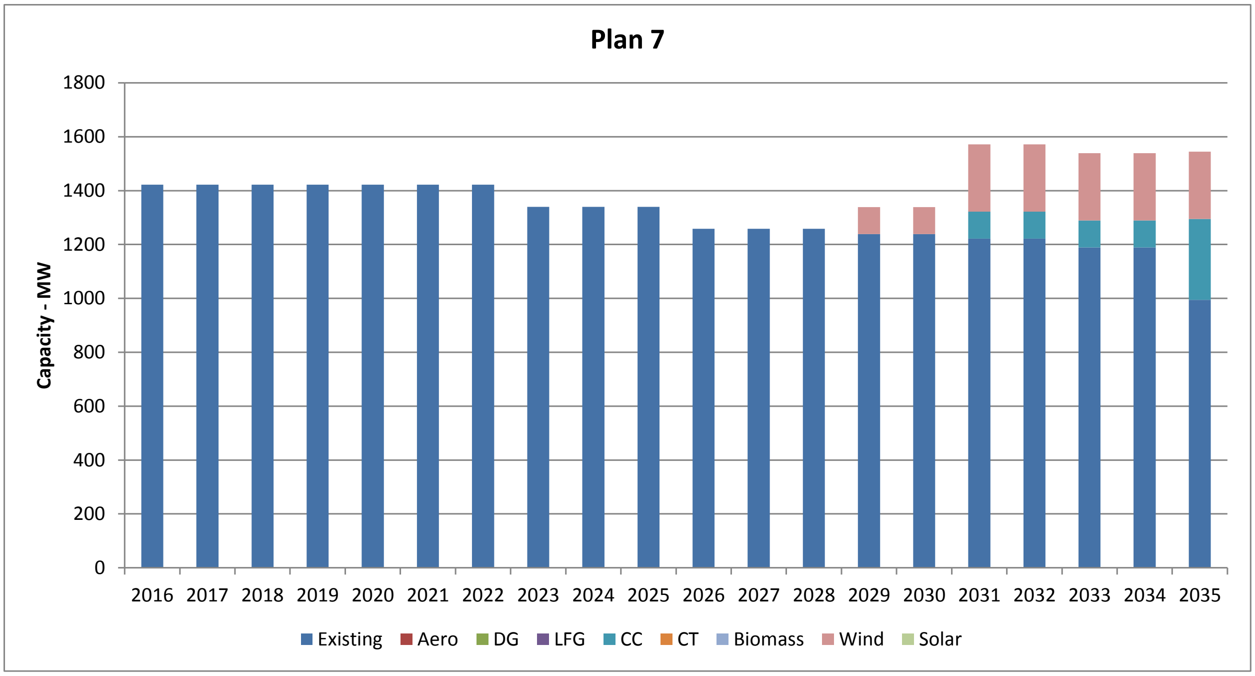

Figure 6-35 - Supply-Side Resource Composition of Plan 7

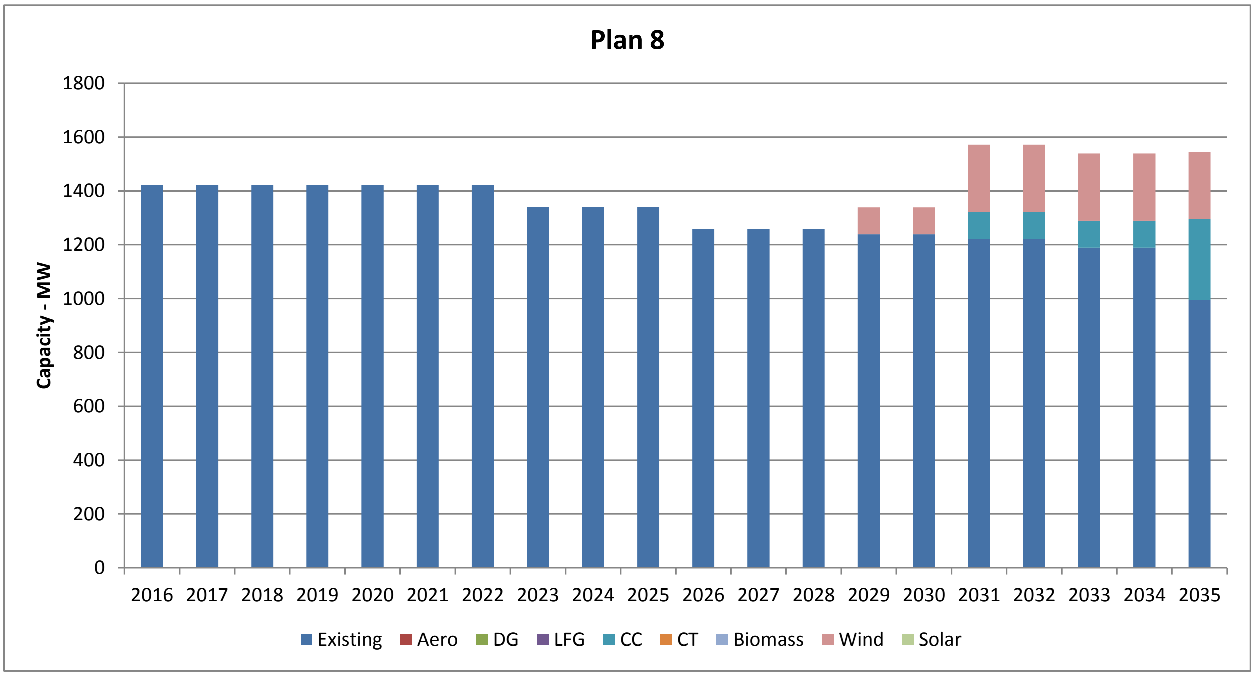

Figure 6-36 - Supply-Side Resource Composition of Plan 8

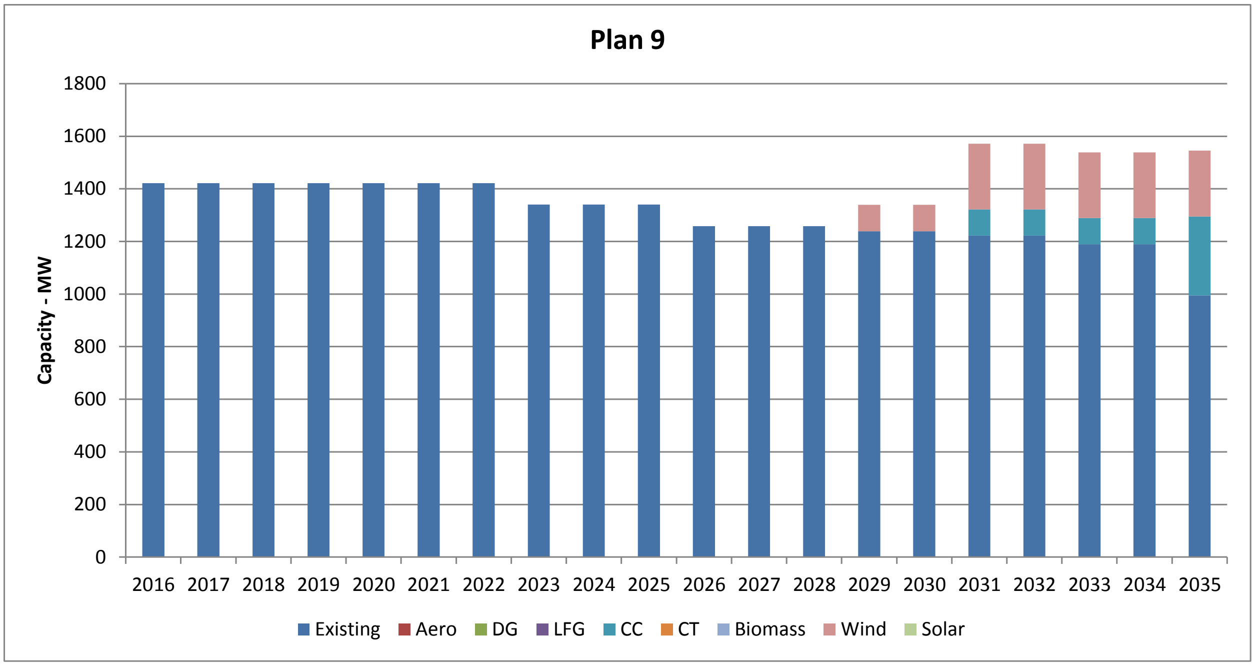

Figure 6-37 - Supply-Side Resource Composition of Plan 9

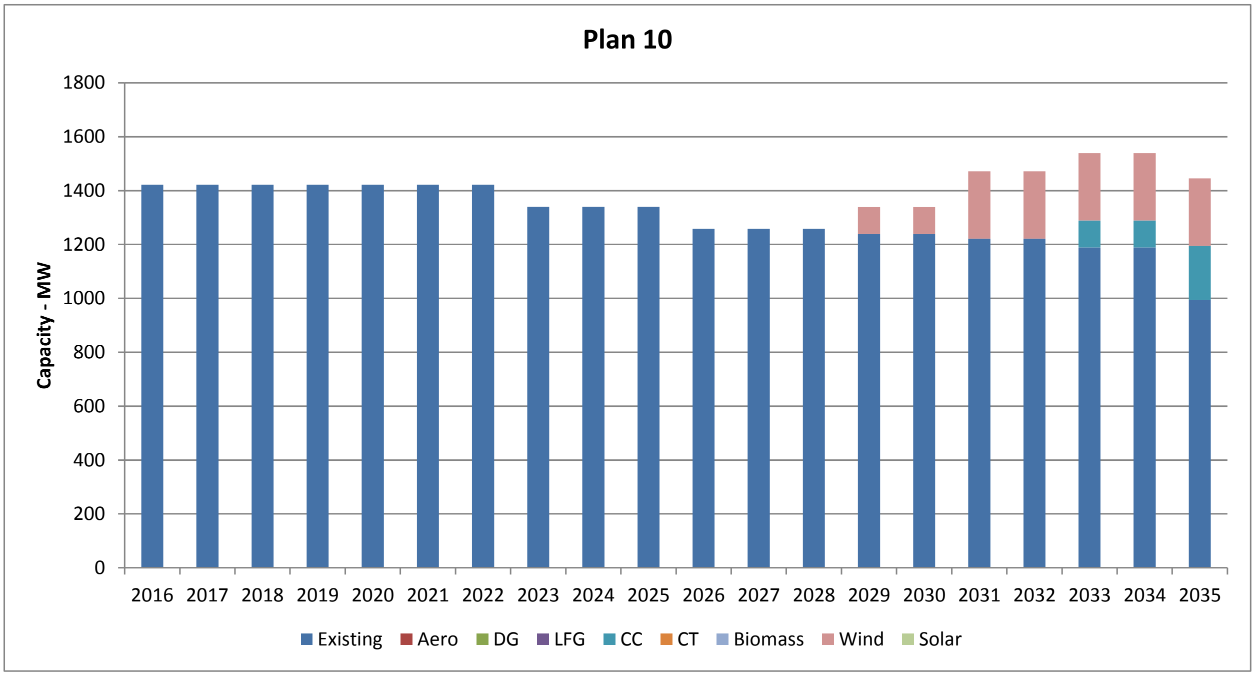

Figure 6-38 - Supply-Side Resource Composition of Plan 10

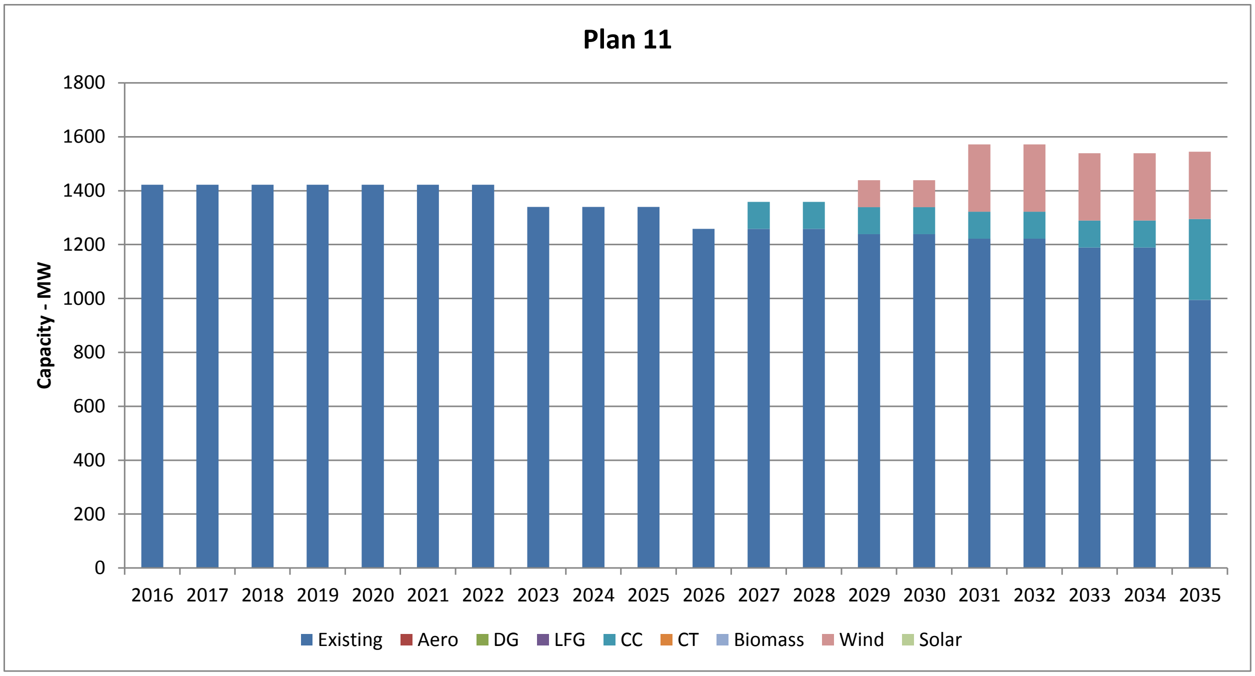

Figure 6-39 - Supply-Side Resource Composition of Plan 11

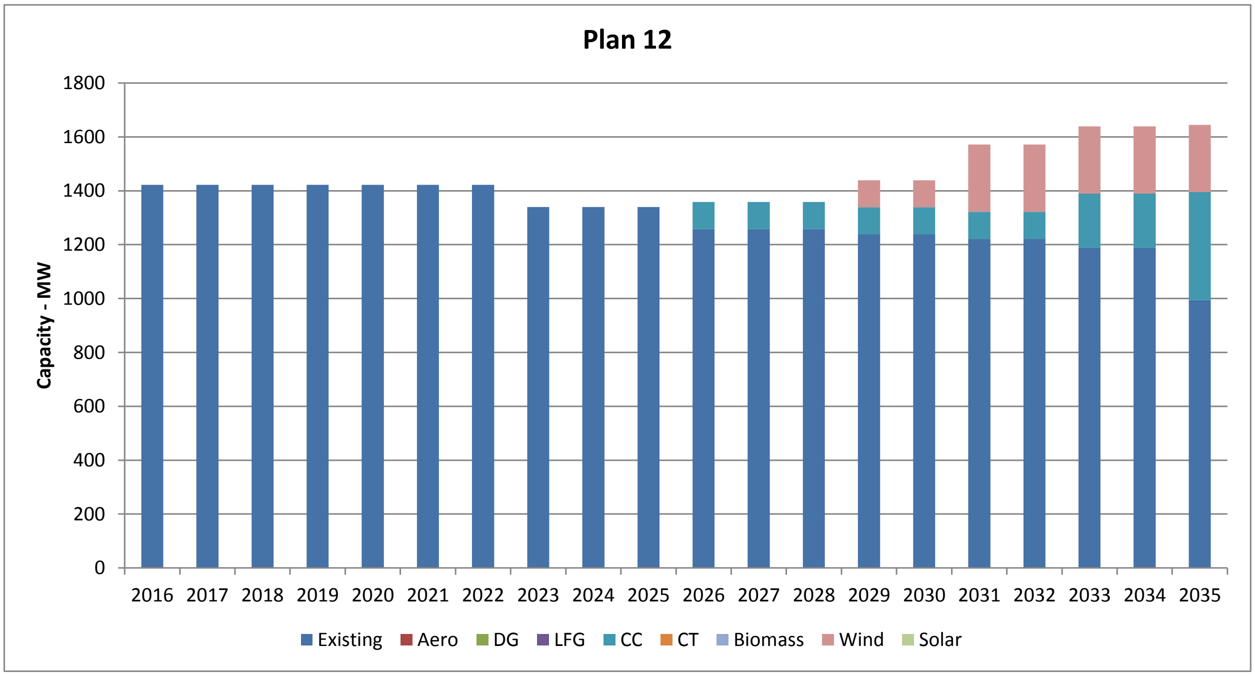

Figure 6-40 - Supply-Side Resource Composition of Plan 12

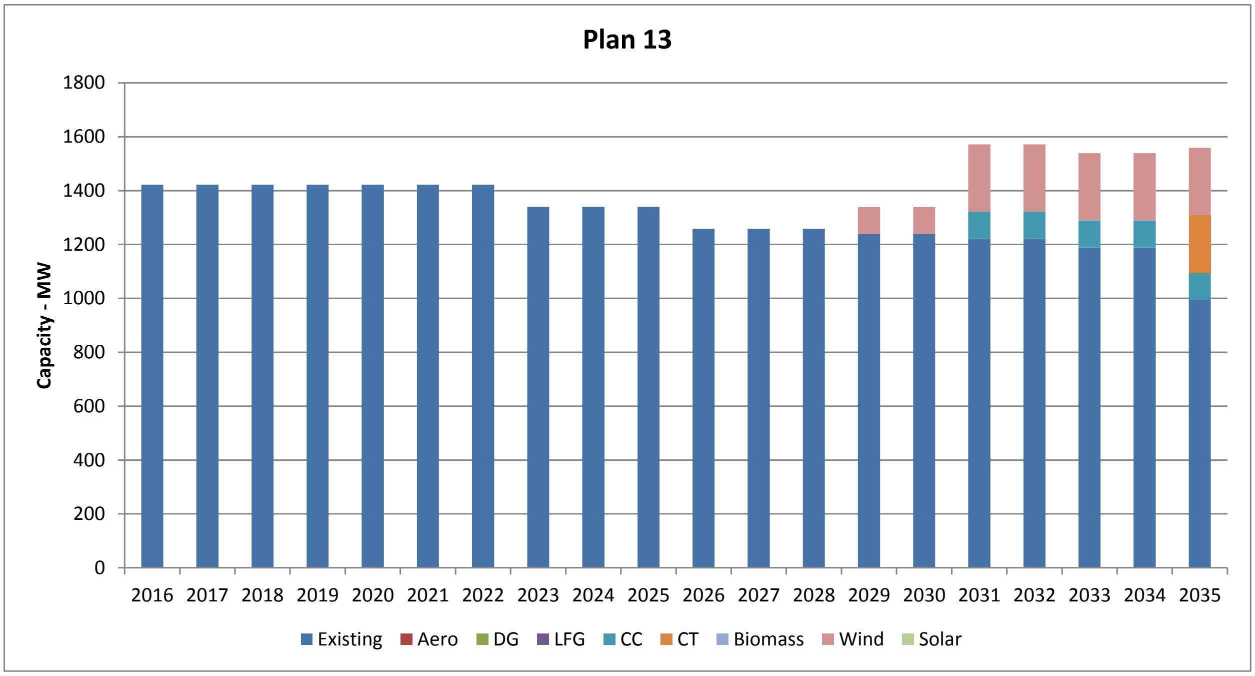

Figure 6-41 - Supply-Side Resource Composition of Plan 13

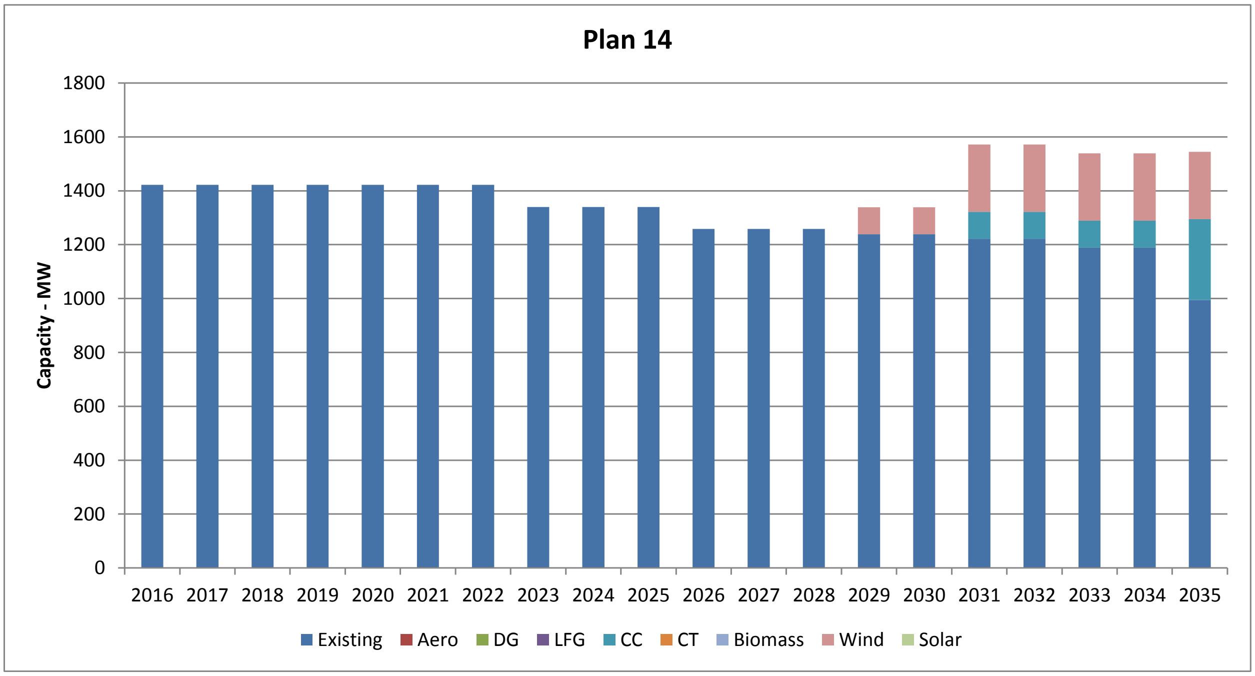

Figure 6-42 - Supply-Side Resource Composition of Plan 14

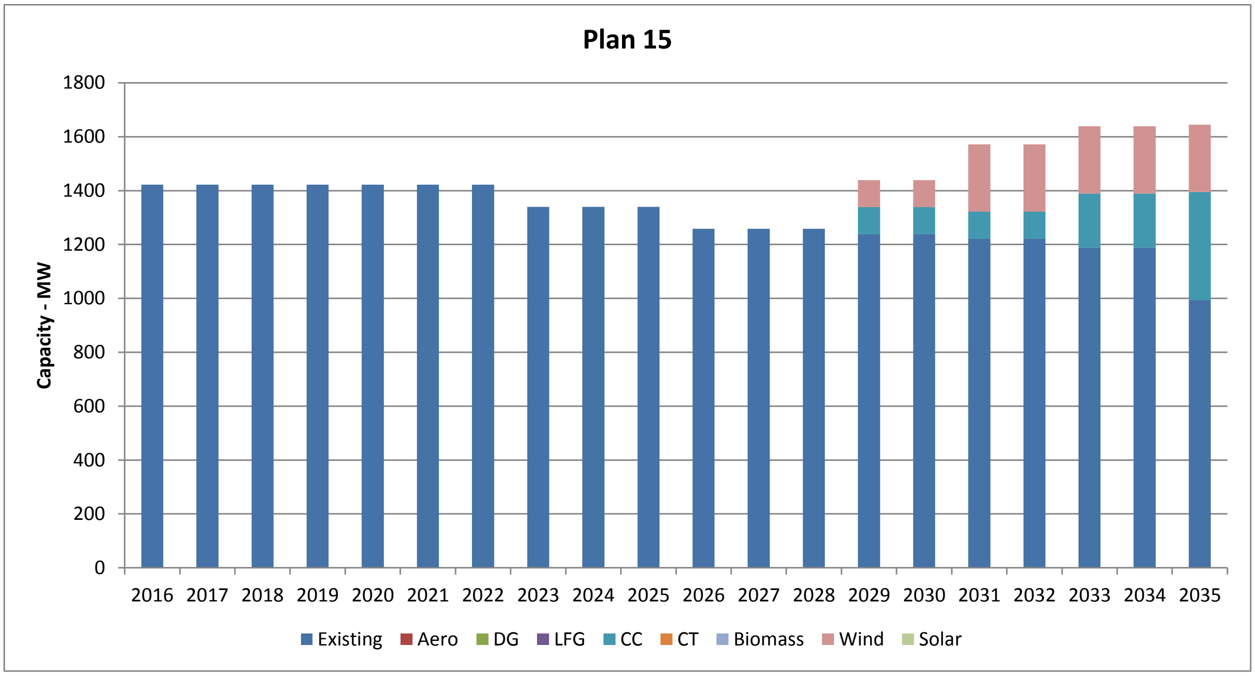

Figure 6-43 - Supply-Side Resource Composition of Plan 15

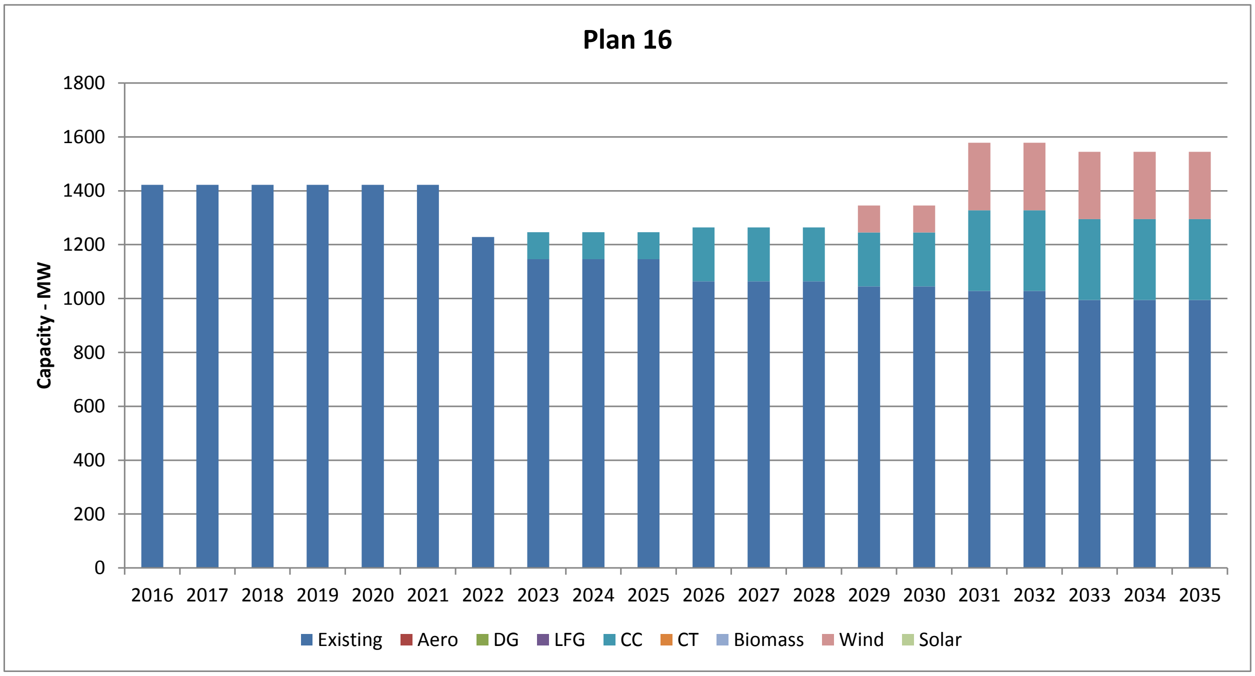

Figure 6-44 - Supply-Side Resource Composition of Plan 16

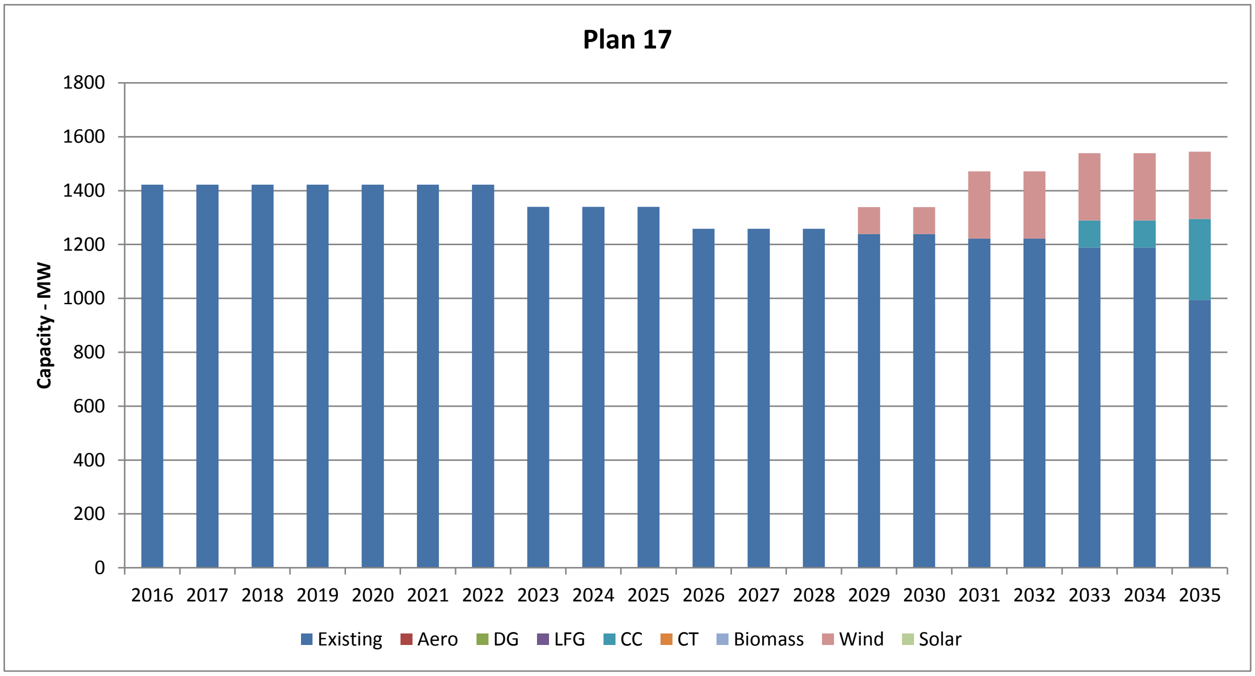

Figure 6-45 - Supply-Side Resource Composition of Plan 17

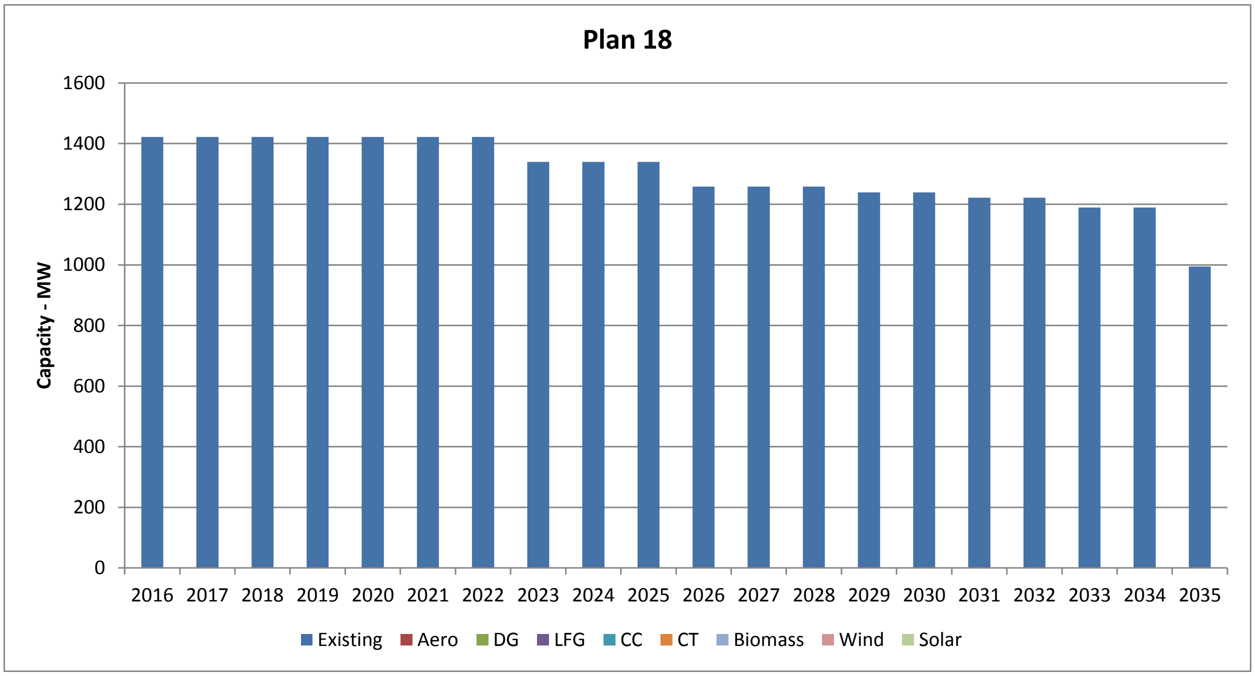

Figure 6-46 - Supply-Side Resource Composition of Plan 18

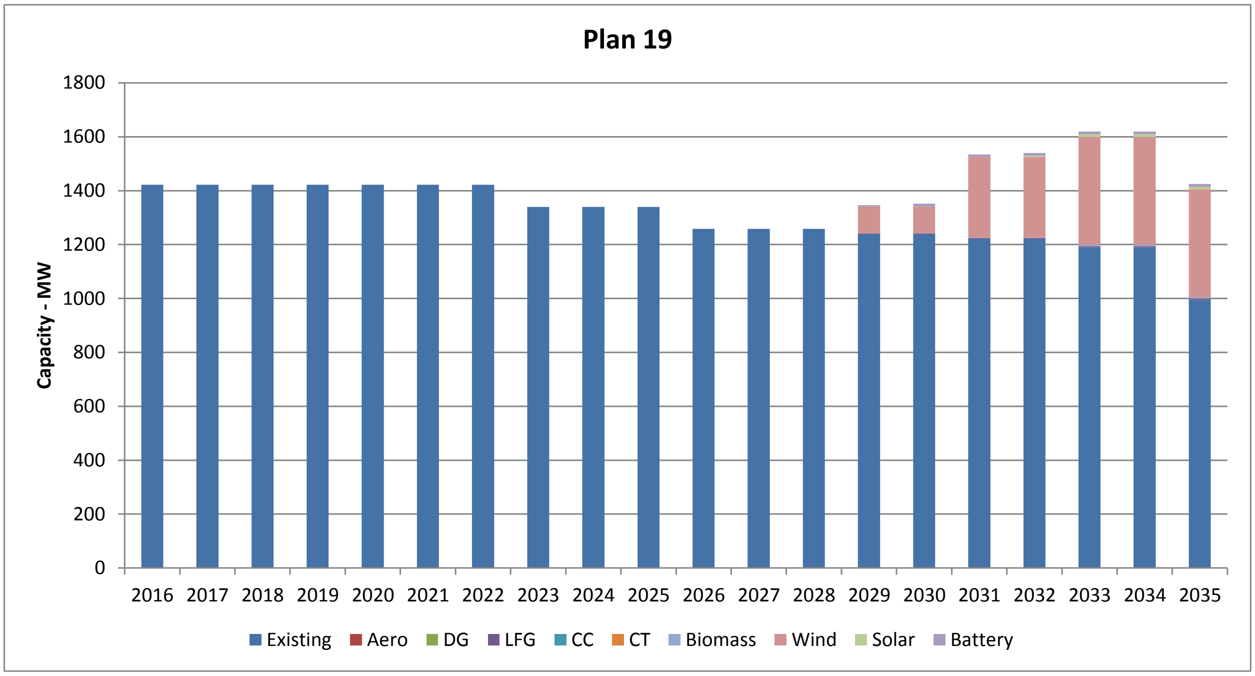

Figure 6-47 - Supply-Side Resource Composition of Plan 19

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

4.2.4 DSM Impacts on Annual Energy

The combined impact of all demand-side resources on the base-case forecast of annual energy requirements for each alternative resource plan is shown in *Figures 6-48* through *6-56*. The corresponding tables of values for all these figures are provided in Appendix 6E.

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Figure 6-48 - Impact of DSM on Annual Energy Requirements of Plan 1 (Also Applies to Plans 2, 6, 10-16)

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Figure 6-49 - Impact of DSM on Annual Energy Requirements of Plan 3

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

Figure 6-50 - Impact of DSM on Annual Energy Requirements of Plan 4

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

Figure 6-51 - Impact of DSM on Annual Energy Requirements of Plan 5 (Also Applies to Plan 19)

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Figure 6-52 - Impact of DSM on Annual Energy Requirements of Plan 7

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Figure 6-53 - Impact of DSM on Annual Energy Requirements of Plan 8

NP

Highly Confidential in its Entirety

Figure 6-54 - Impact of DSM on Annual Energy Requirements of Plan 9

Highly Confidential in its Entirety

Figure 6-55 - Impact of DSM on Annual Energy Requirements of Plan 17

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Figure 6-56 - Impact of DSM on Annual Energy Requirements of Plan 18

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

4.2.5 Composition of DSM to Annual Energy

The composition by program and demand-side rate of the annual energy provided by demand-side resources for each alternative resource plan is shown in Figures 6-57 through 6-64. The corresponding tables of values for all these figures are provided in Appendix 6F. Since plans 5 and 9 were configured without using DSM, no figures have been provided for them.

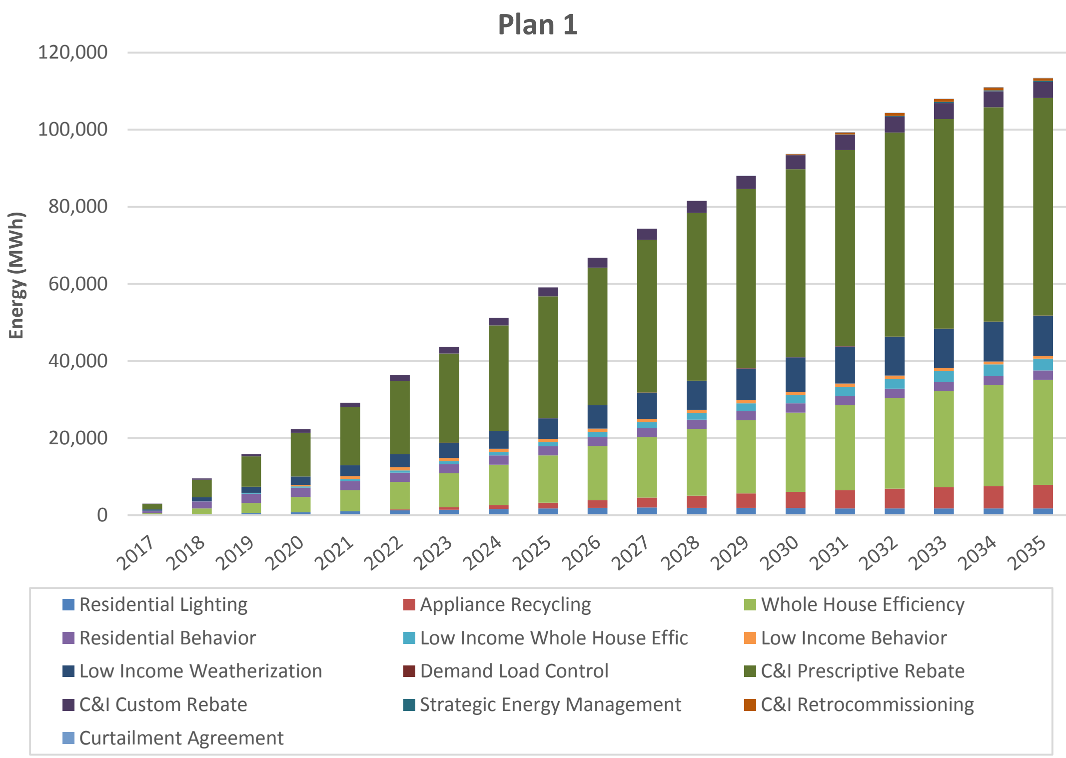


Figure 6-57 - Composition of DSM Energy Provided in Plan 1 (Also Applies to Plans, 2, 6, 10-16)

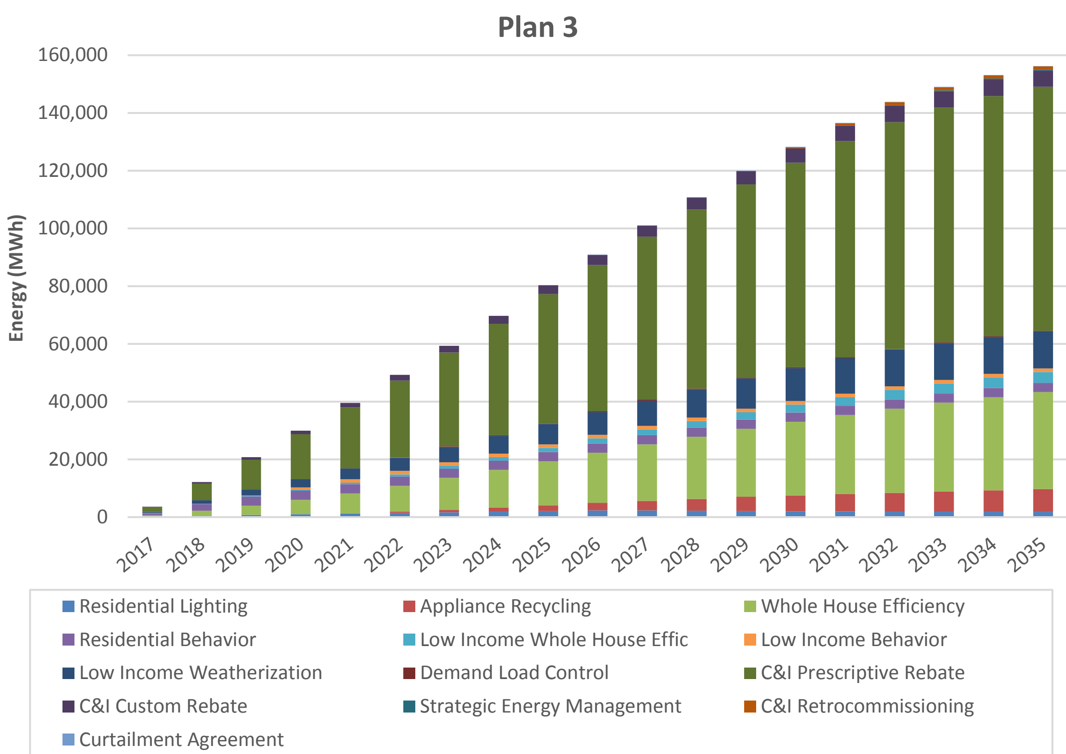


Figure 6-58- Composition of DSM Energy Provided in Plan 3

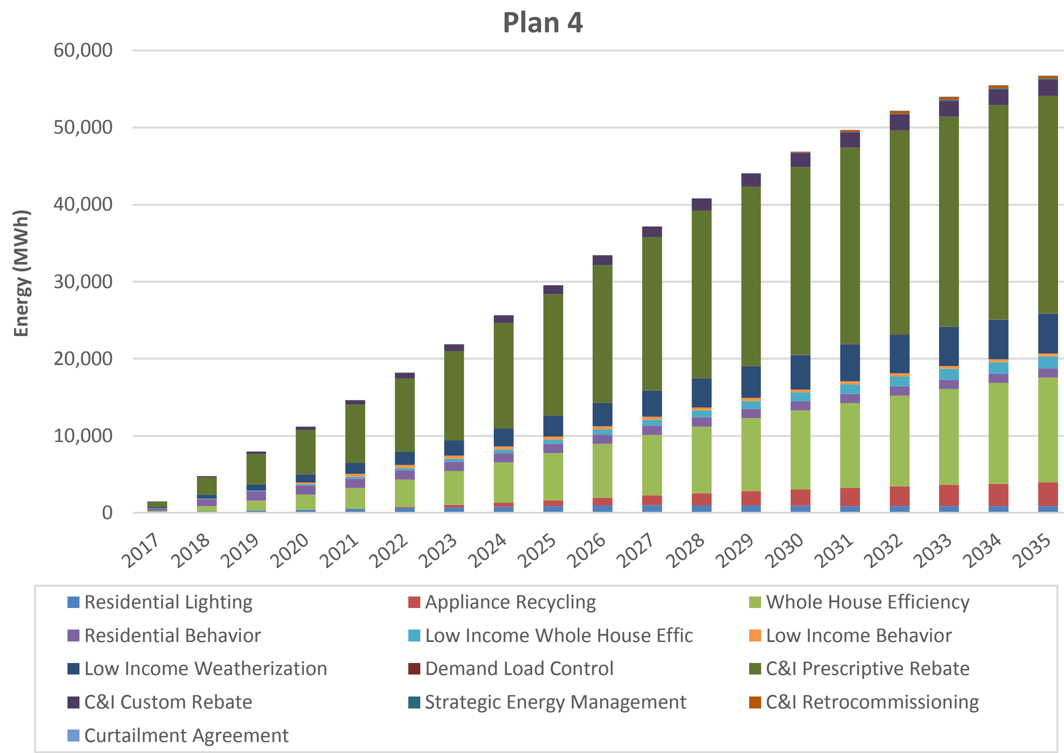


Figure 6-59 - Composition of DSM Energy Provided in Plan 4

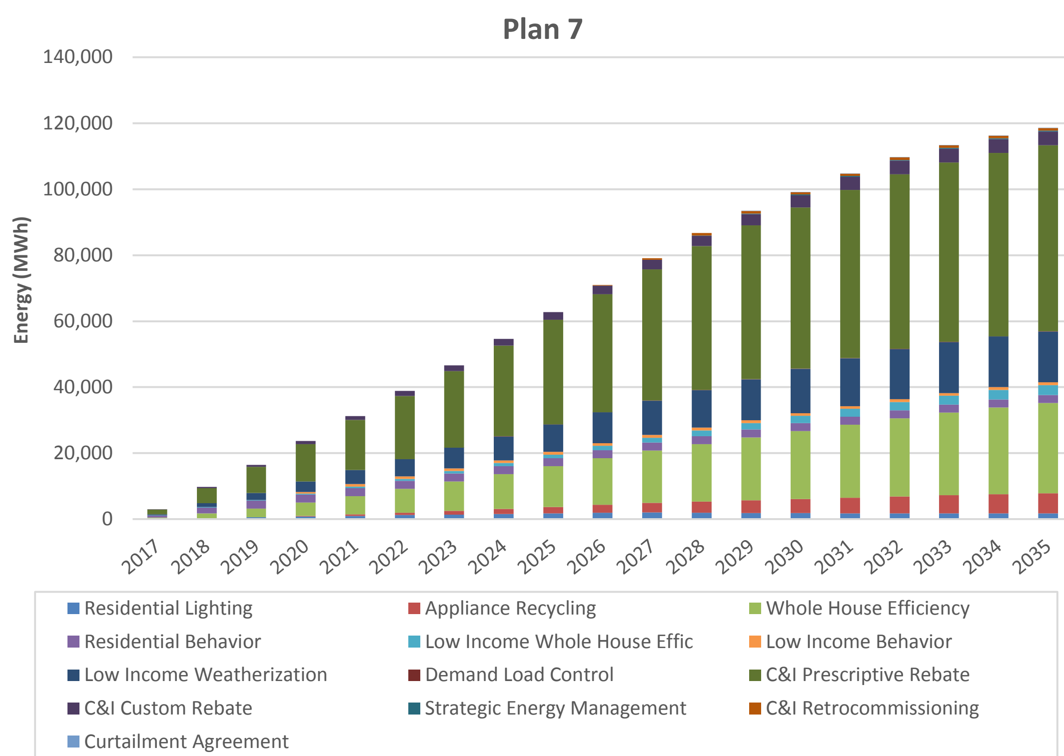


Figure 6-60 - Composition of DSM Energy Provided in Plan 7

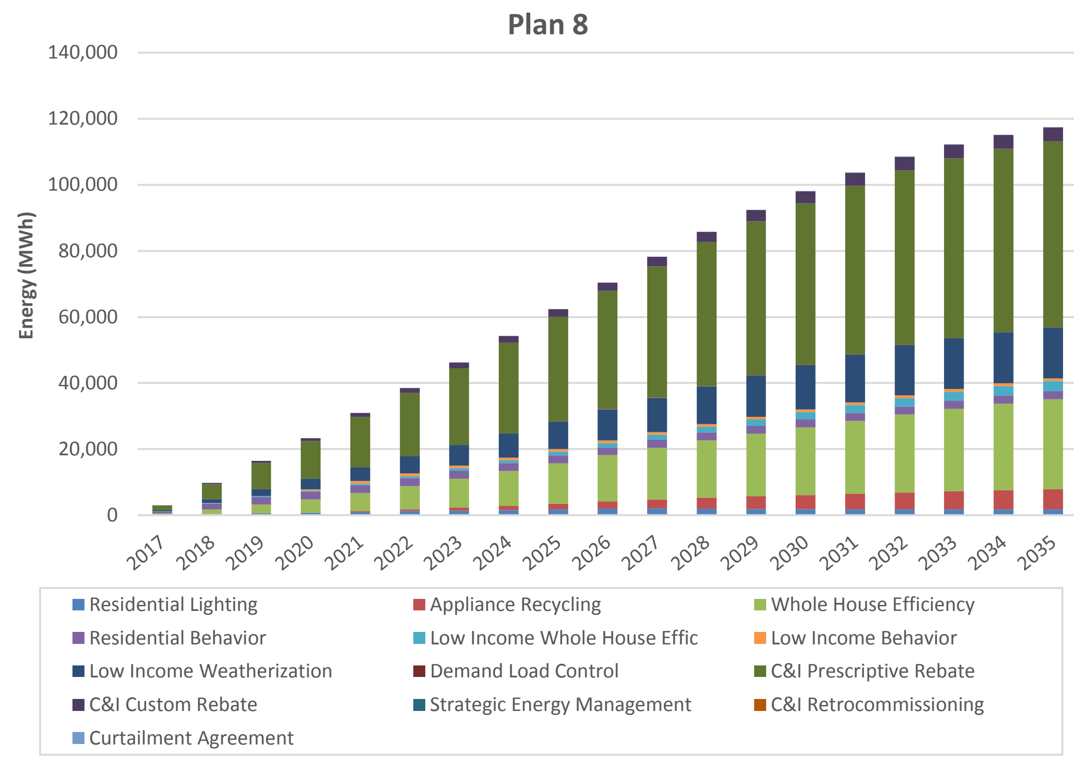


Figure 6-61 - Composition of DSM Energy Provided in Plan 8

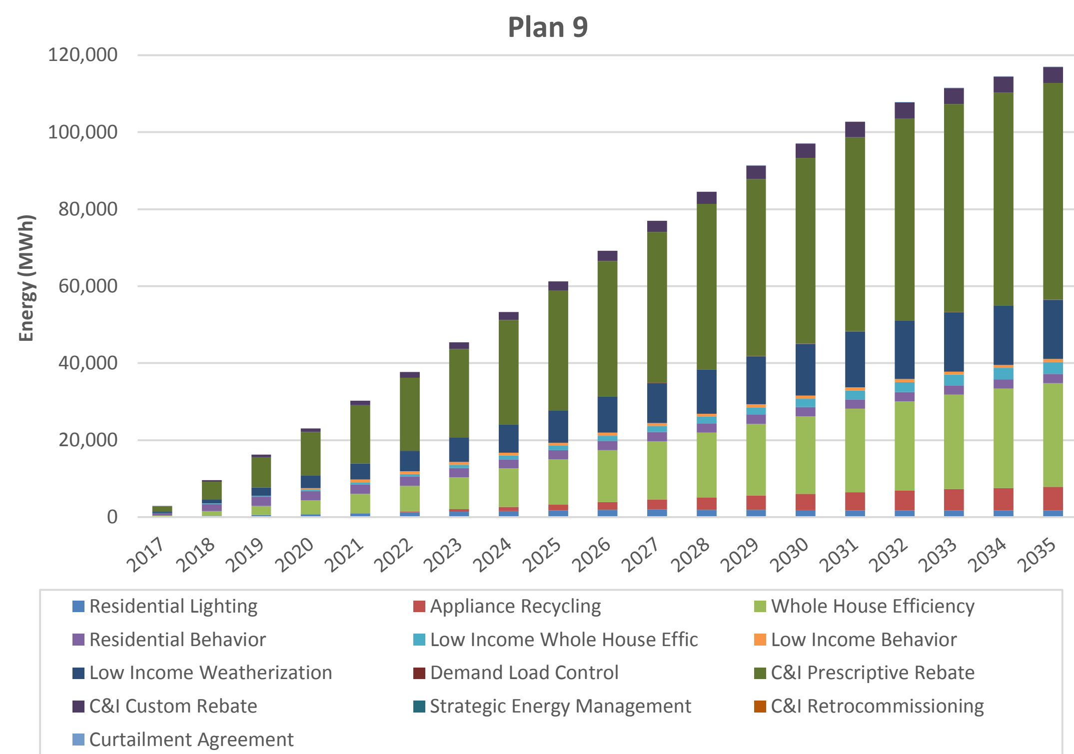


Figure 6-62 - Composition of DSM Energy Provided in Plan 9

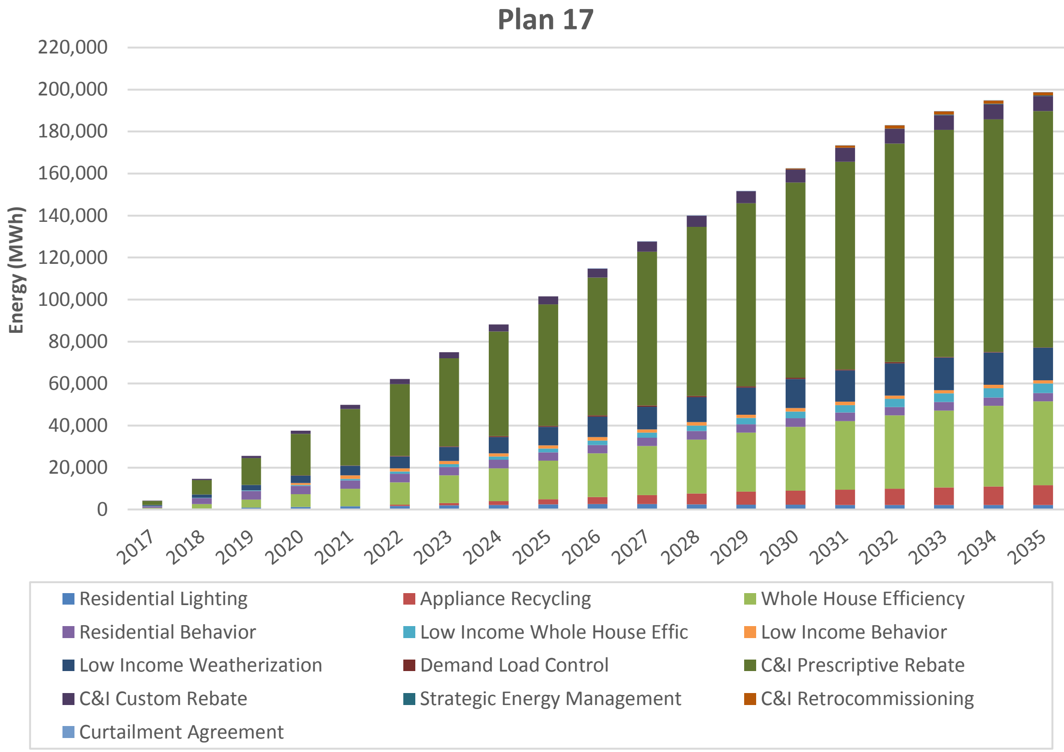


Figure 6-63 - Composition of DSM Energy Provided in Plan 17

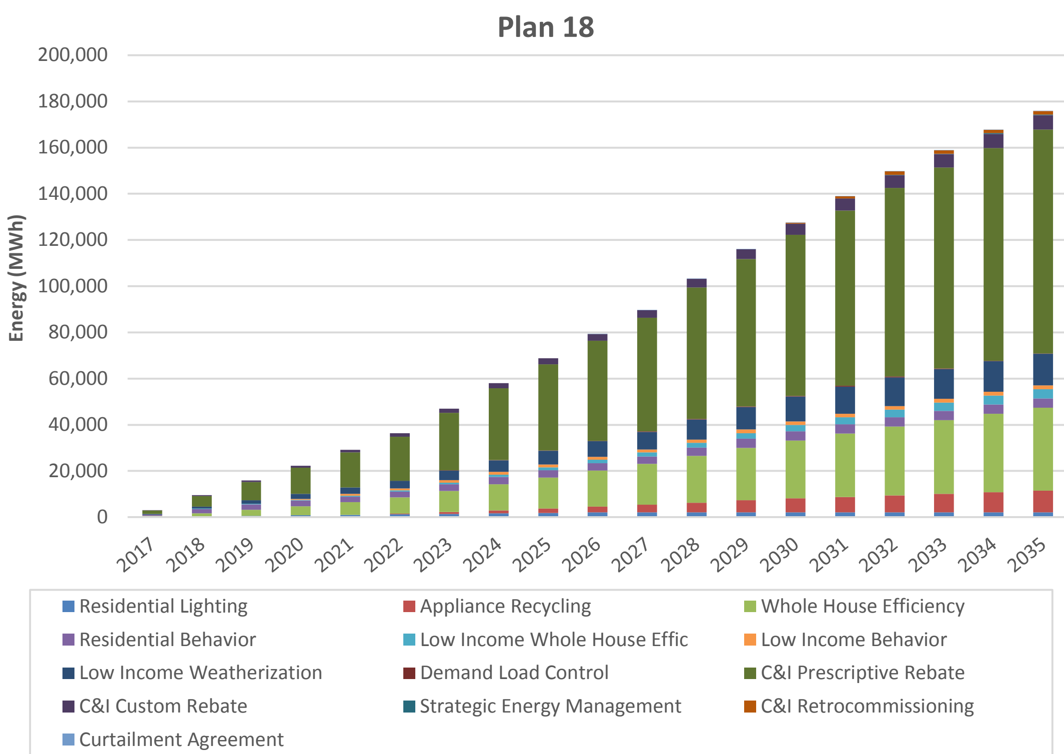


Figure 6-64 - Composition of DSM Energy Provided in Plan 18

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;

4.2.6 Supply-Side Resource Contribution to Energy

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 *Figures 6-65* through *6-81*. Since it is not possible to determine the specific source of energy for losses, the losses are not shown. The corresponding tables of values for all these figures are provided in Appendix 6G.

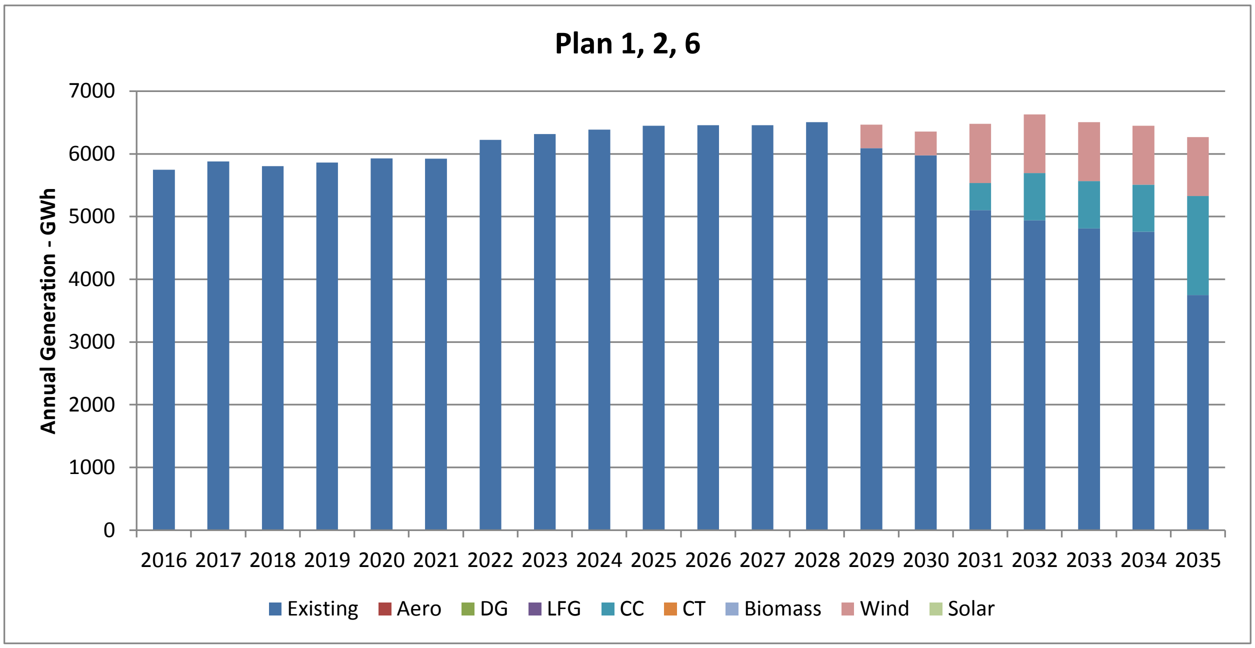


Figure 6-65 - Composition of Supply-Side Energy for Plan 1, 2, 6

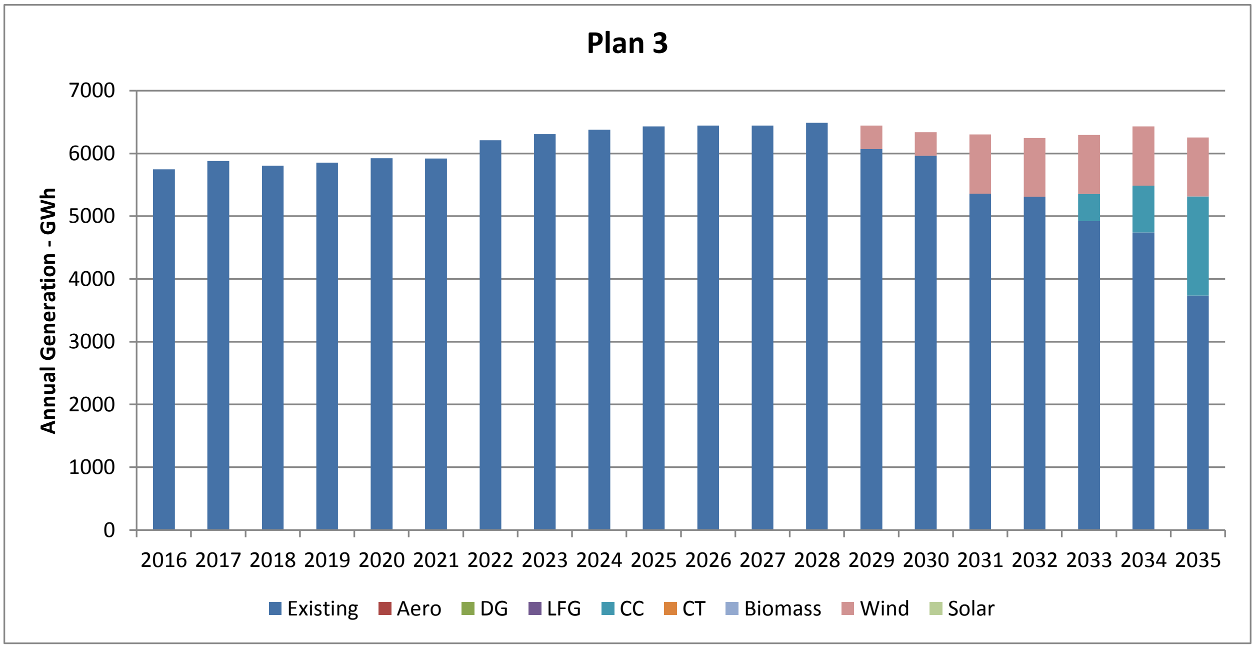


Figure 6-66 - Composition of Supply-Side Energy for Plan 3

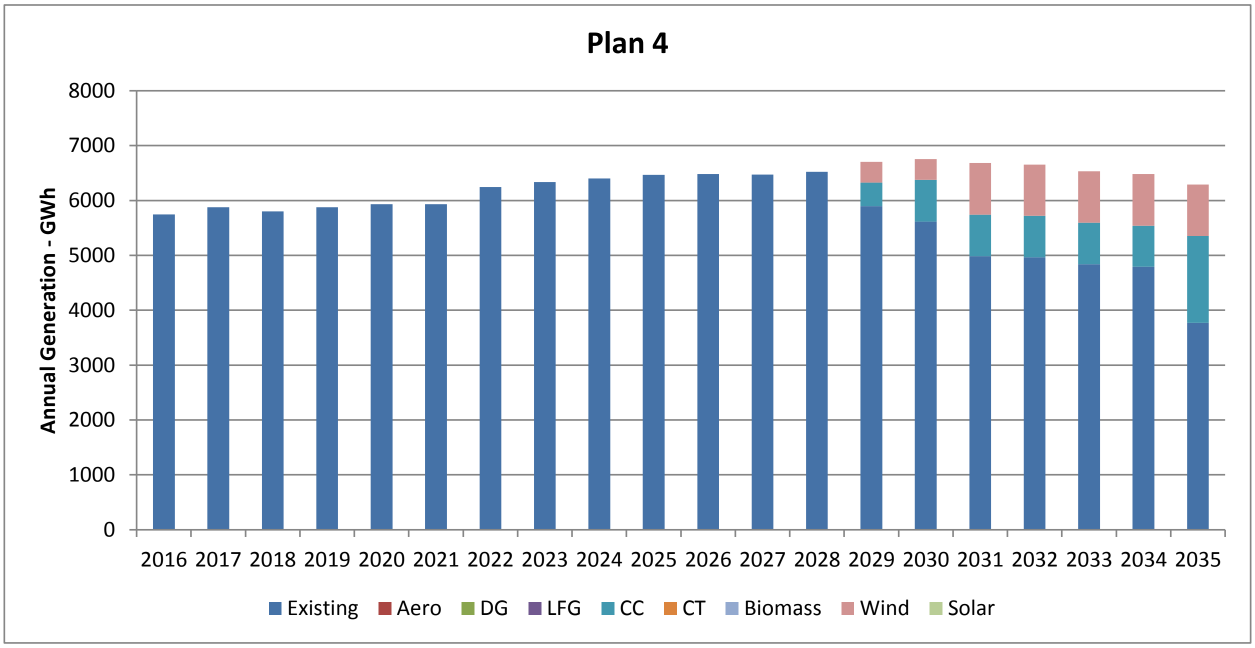


Figure 6-67 - Composition of Supply-Side Energy for Plan 4

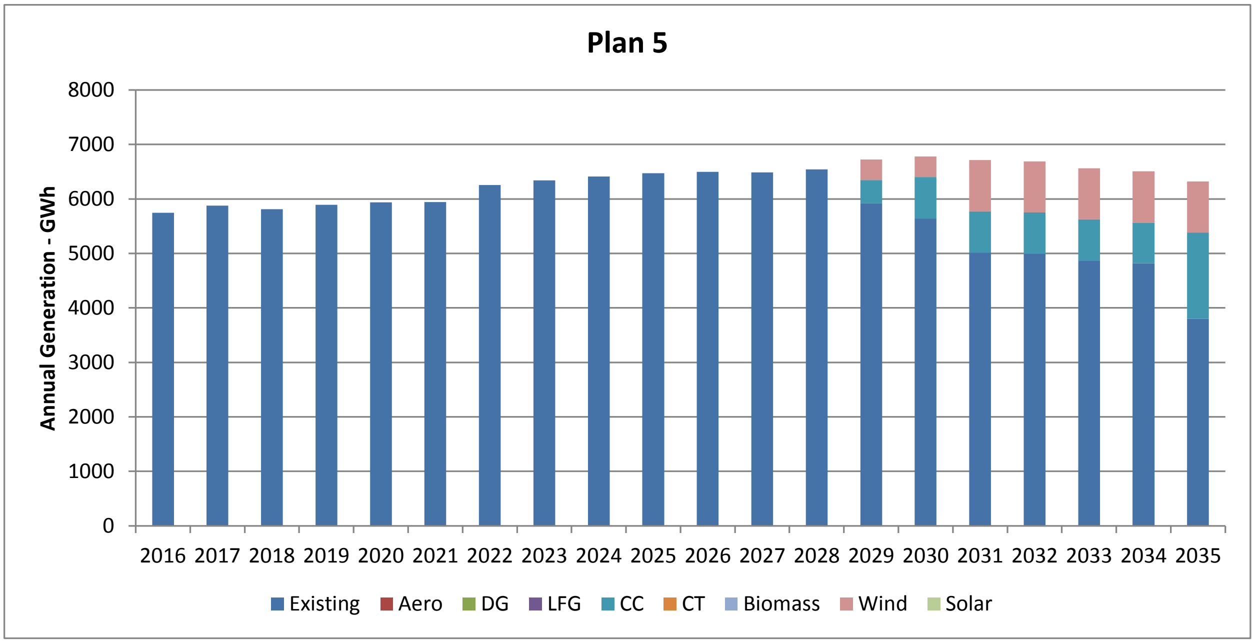


Figure 6-68 - Composition of Supply-Side Energy for Plan 5

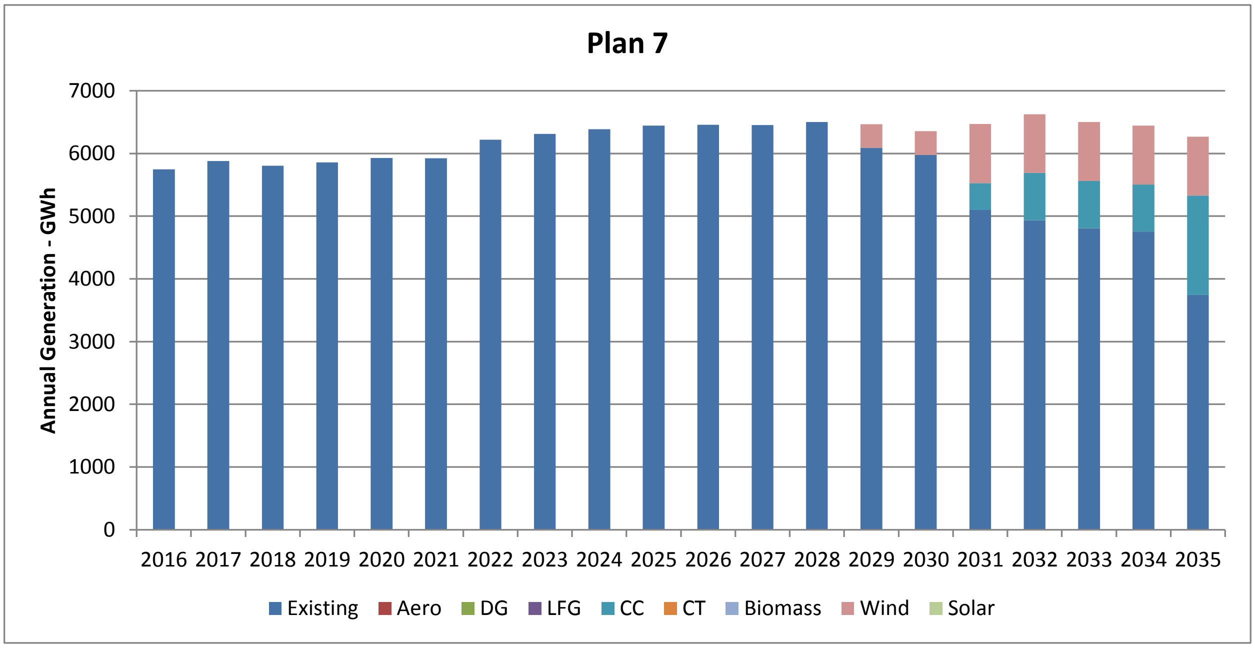


Figure 6-69 - Composition of Supply-Side Energy for Plan 7

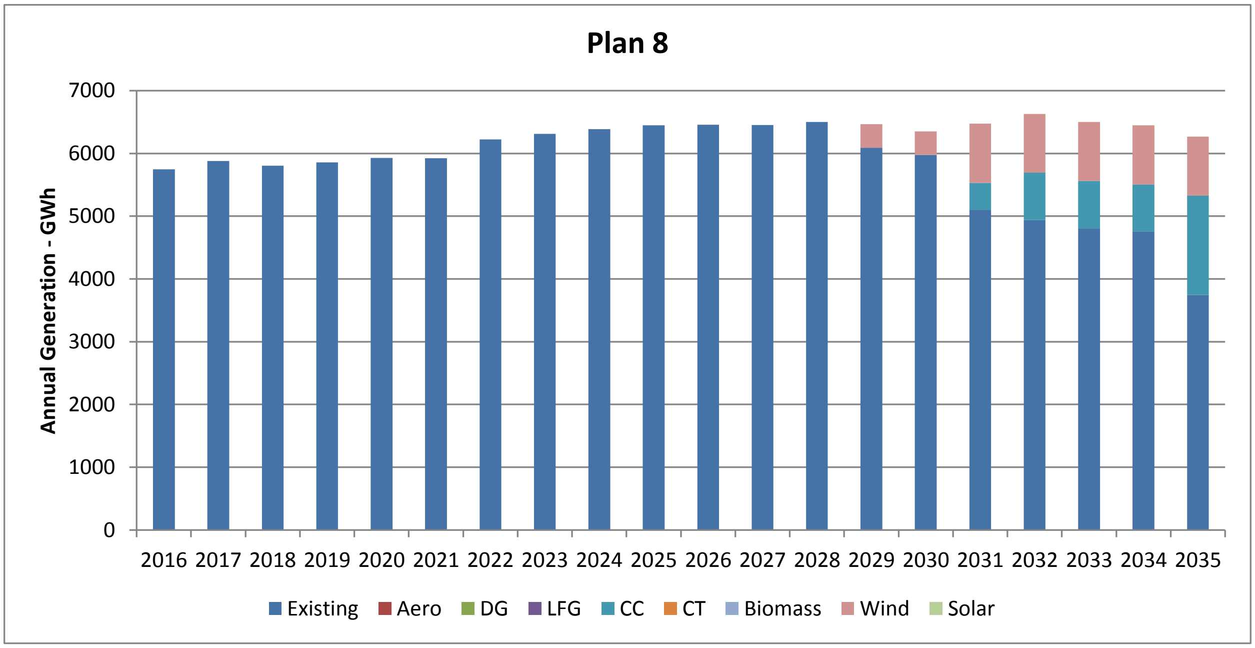


Figure 6-70 - Composition of Supply-Side Energy for Plan 8

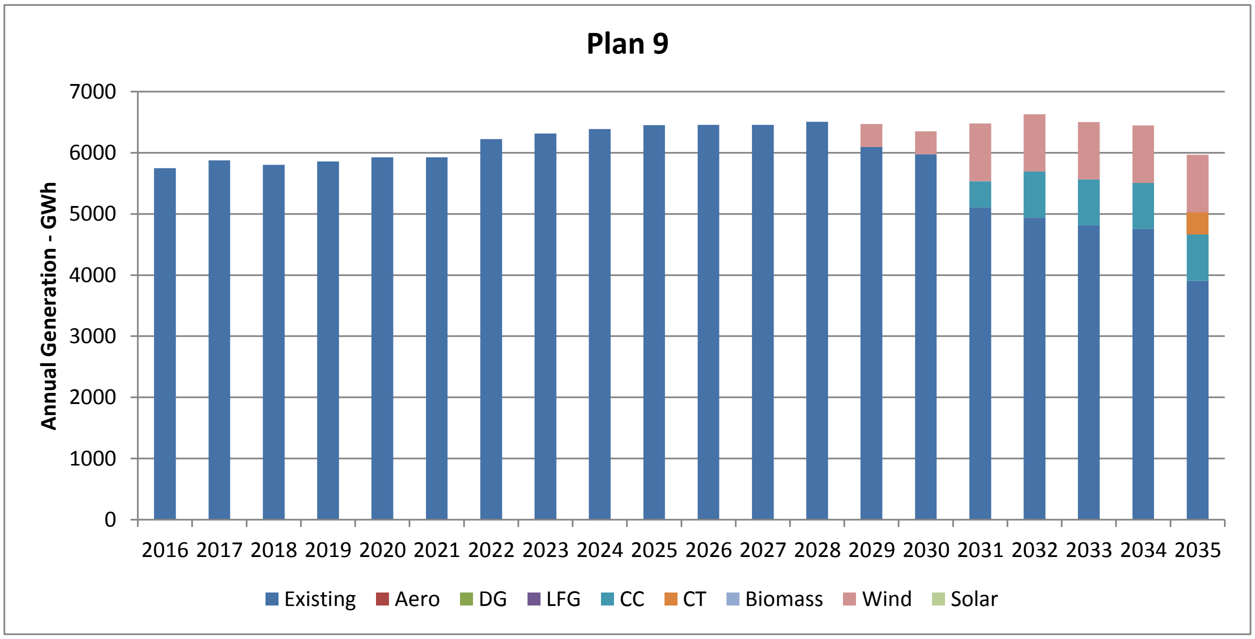


Figure 6-71 - Composition of Supply-Side Energy for Plan 9

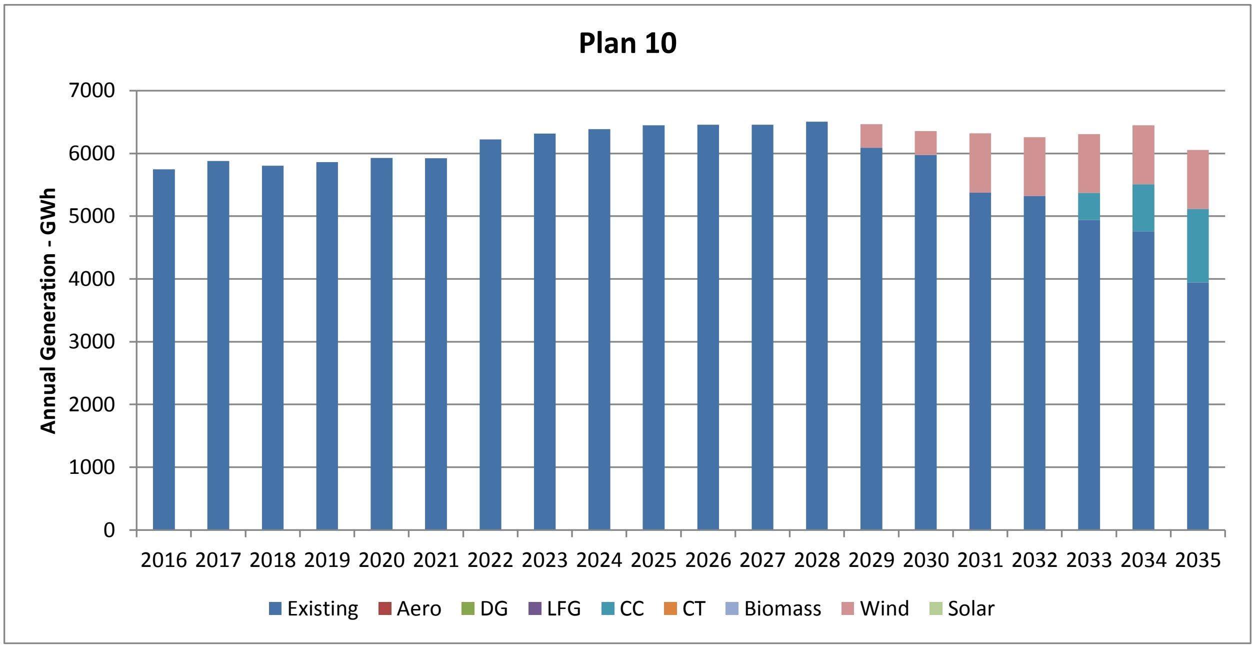


Figure 6-72 - Composition of Supply-Side Energy for Plan 10

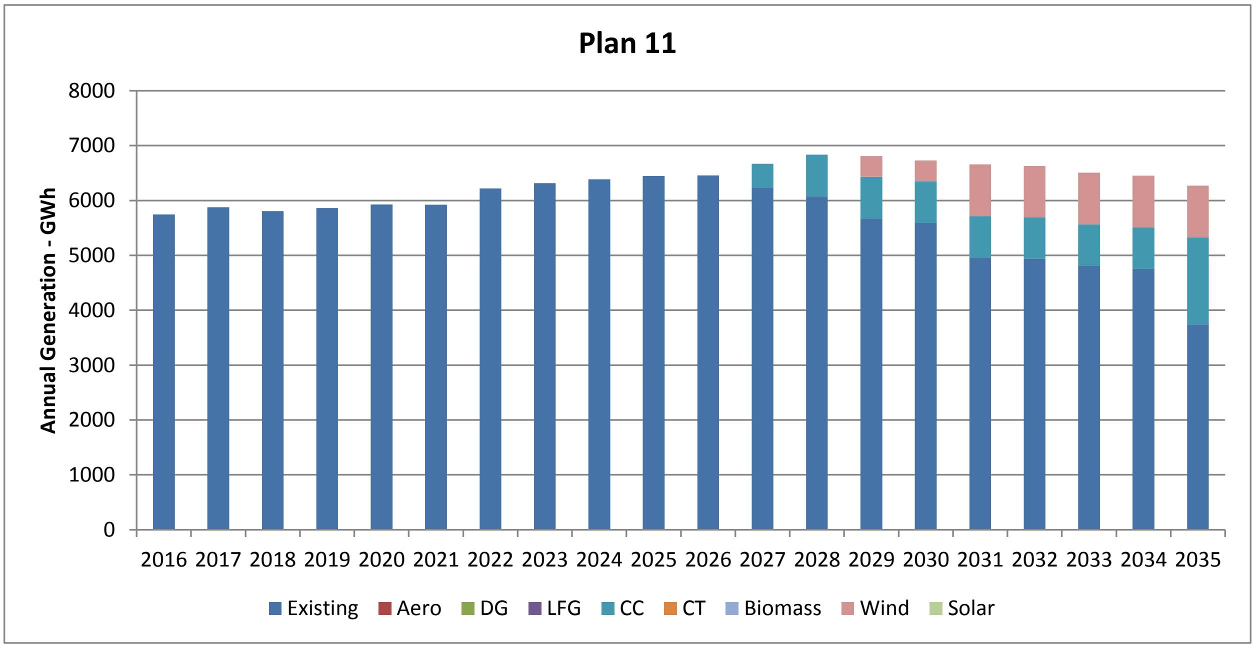


Figure 6-73 - Composition of Supply-Side Energy for Plan 11

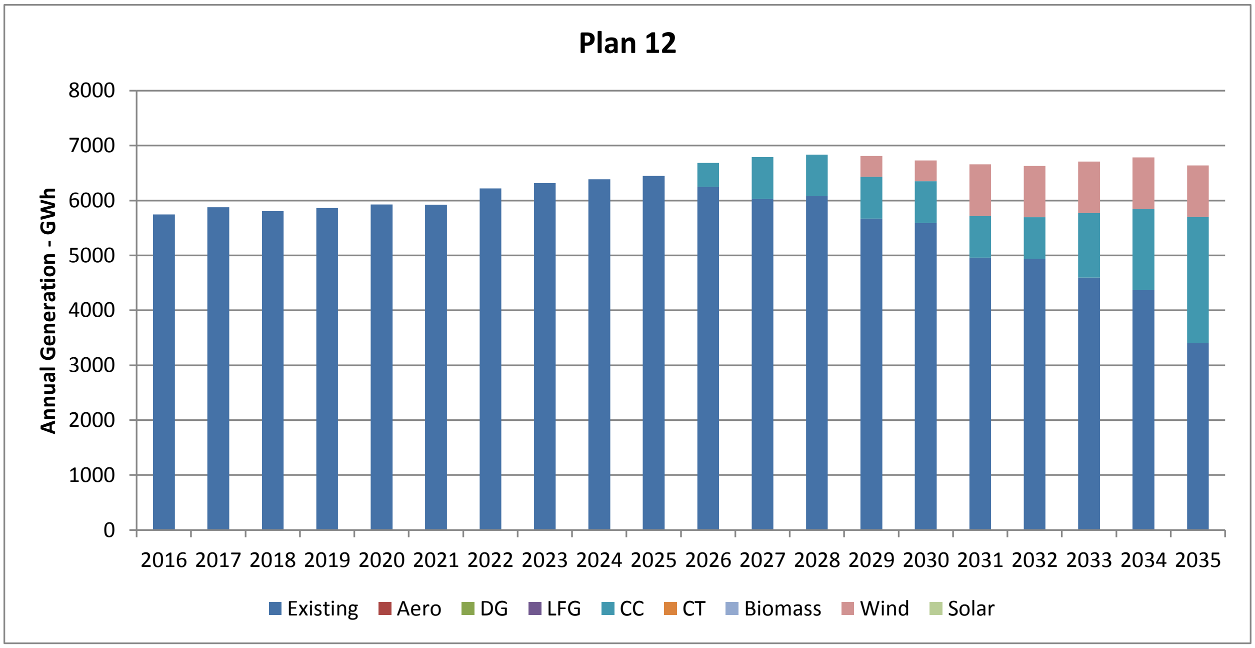


Figure 6-74 - Composition of Supply-Side Energy for Plan 12

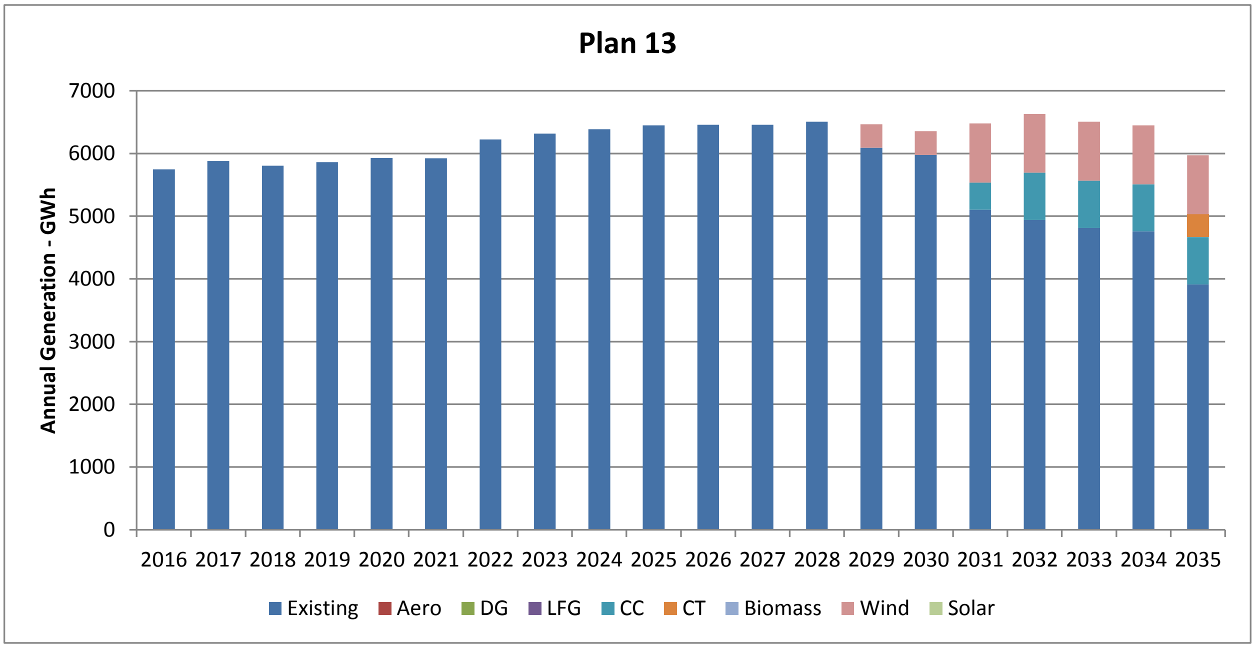


Figure 6-75 - Composition of Supply-Side Energy for Plan 13

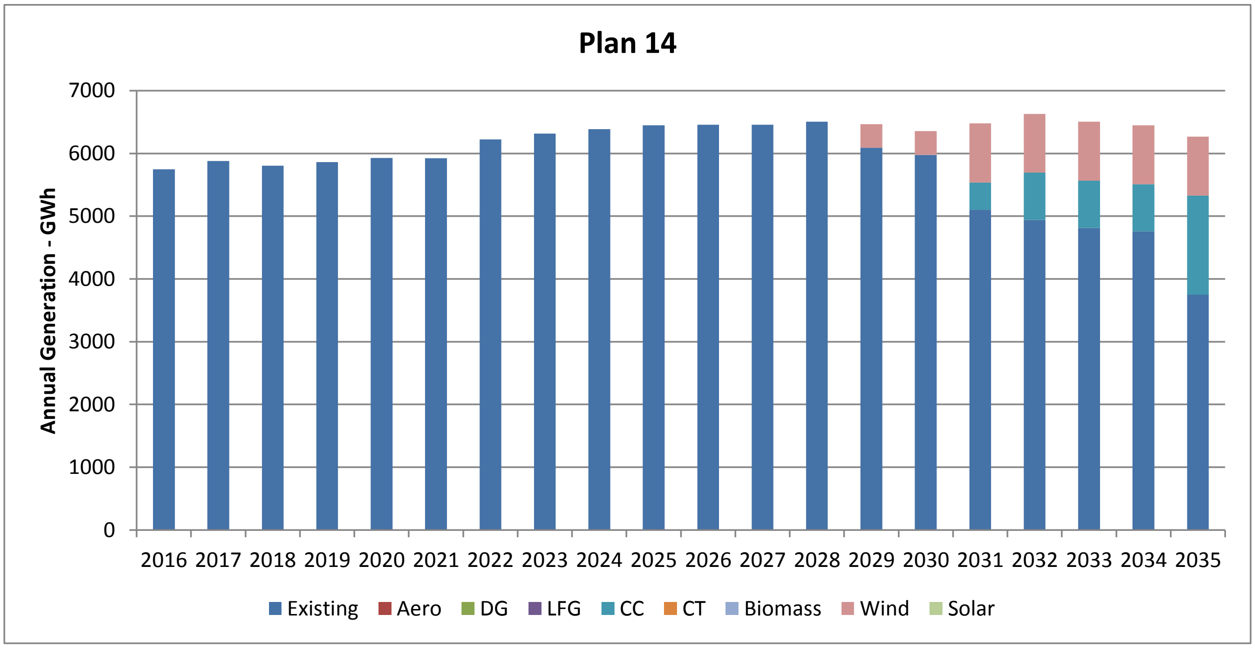


Figure 6-76 - Composition of Supply-Side Energy for Plan 14

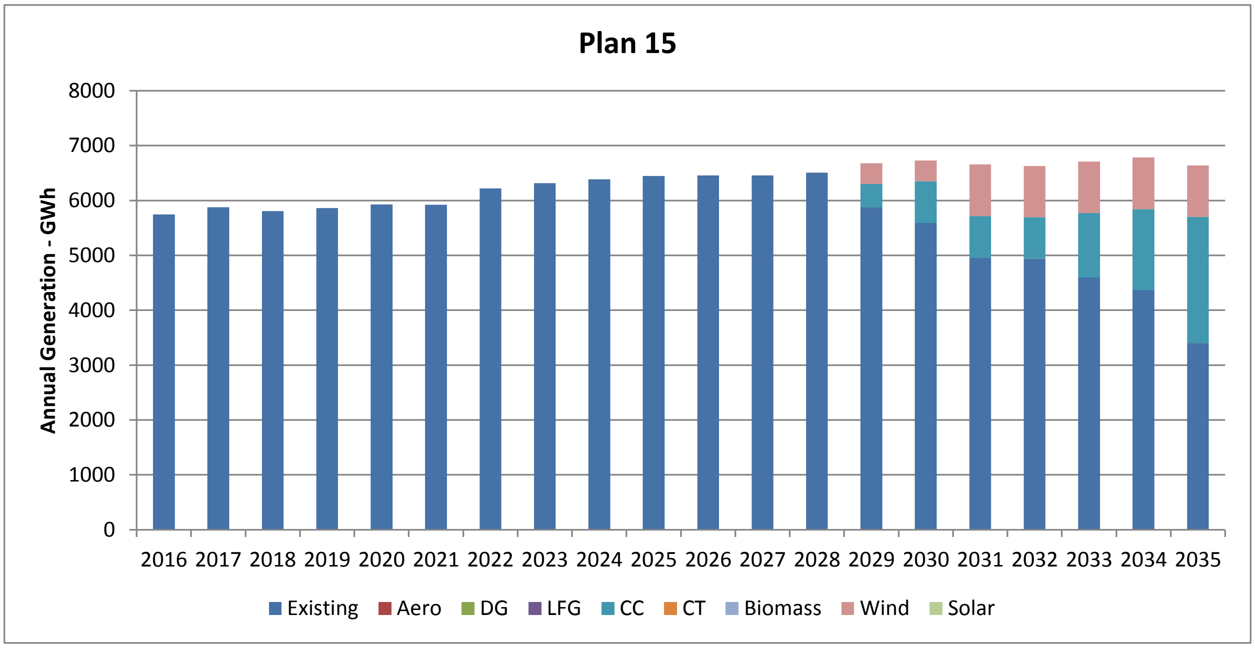


Figure 6-77 - Composition of Supply-Side Energy for Plan 15

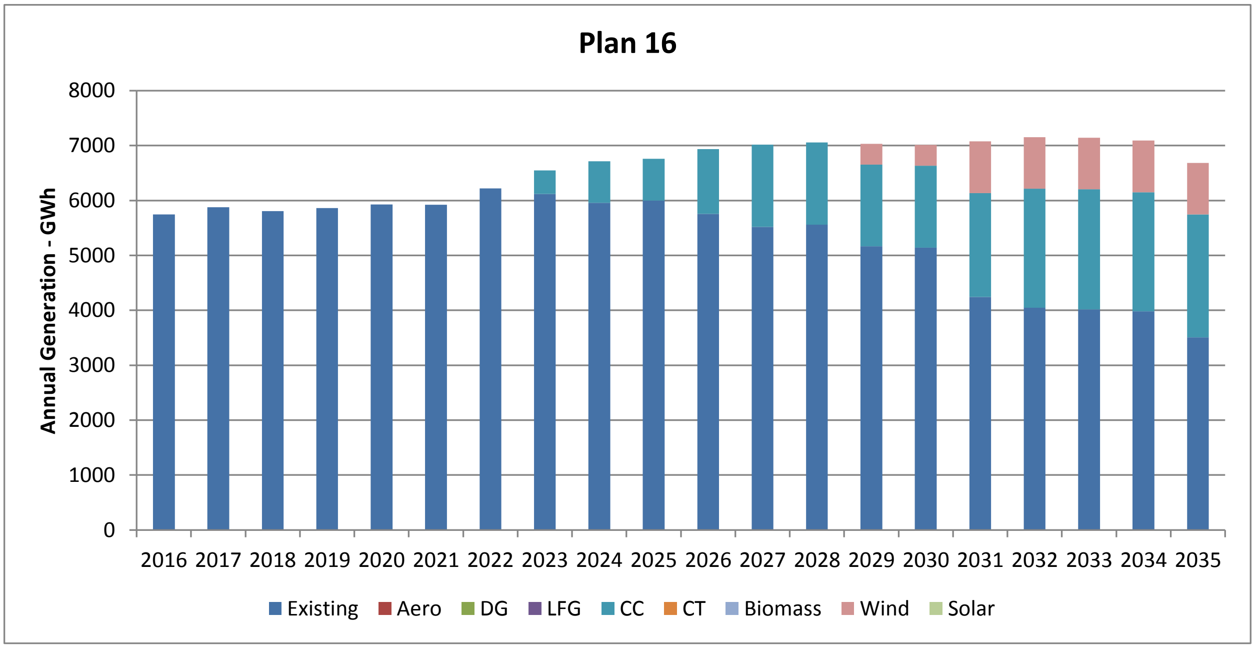


Figure 6-78 - Composition of Supply-Side Energy for Plan 16

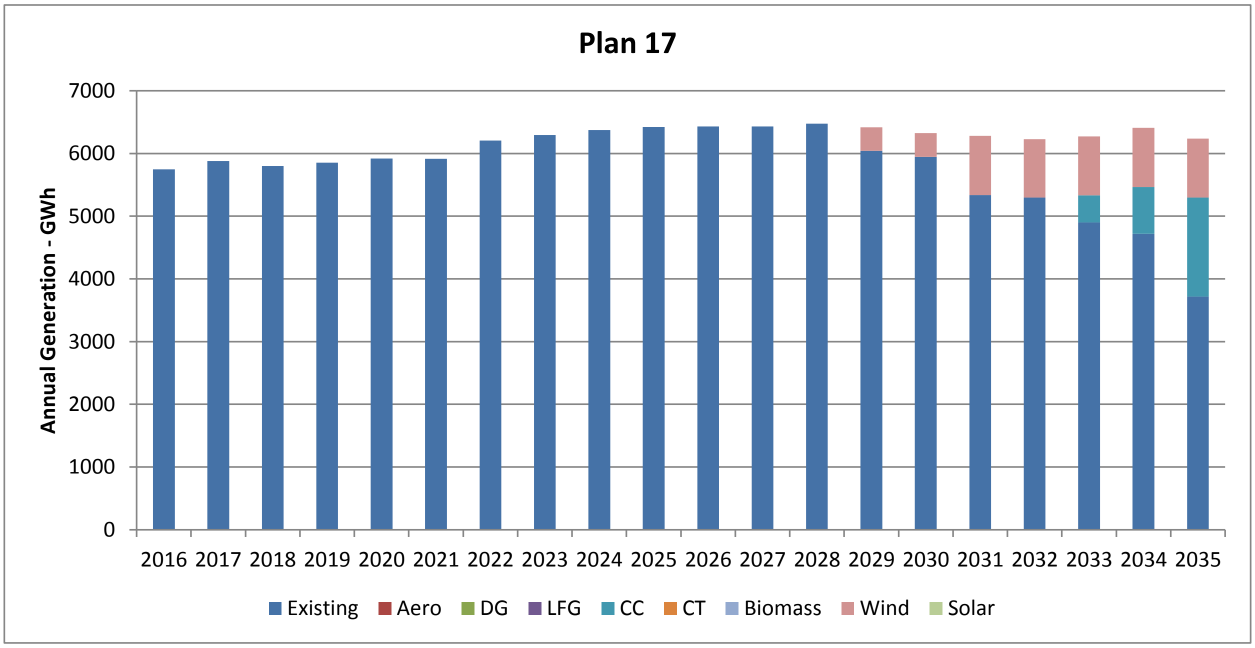


Figure 6-79 - Composition of Supply-Side Energy for Plan 17

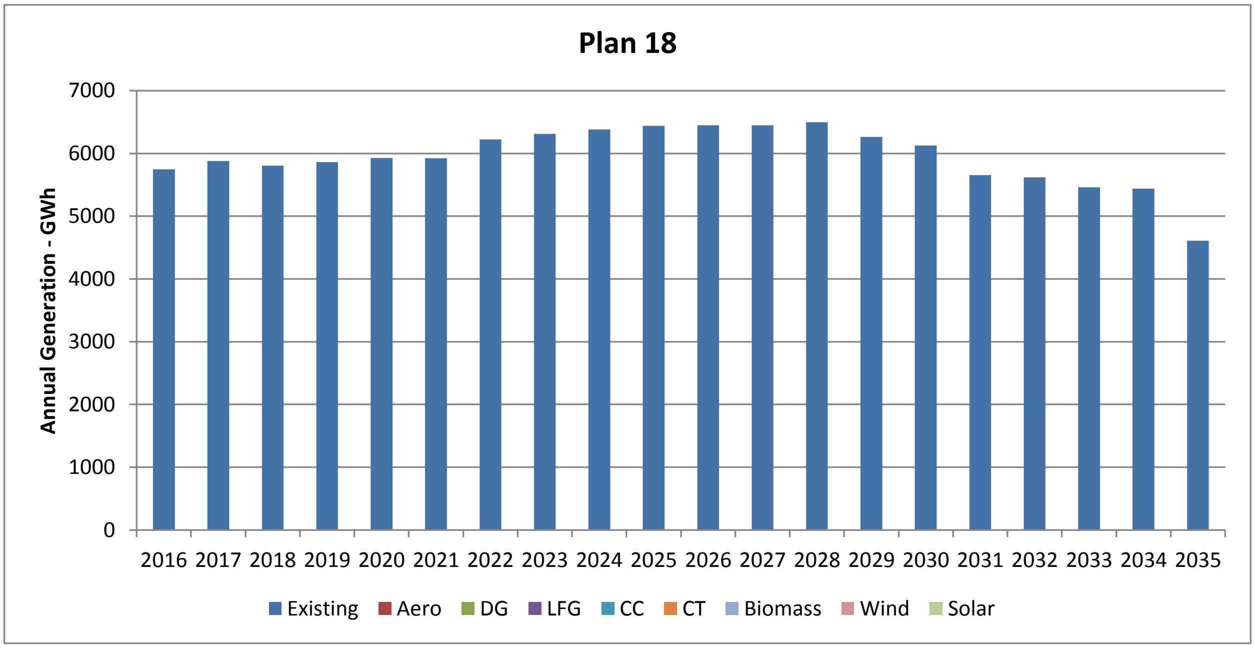


Figure 6-80 - Composition of Supply-Side Energy for Plan 18

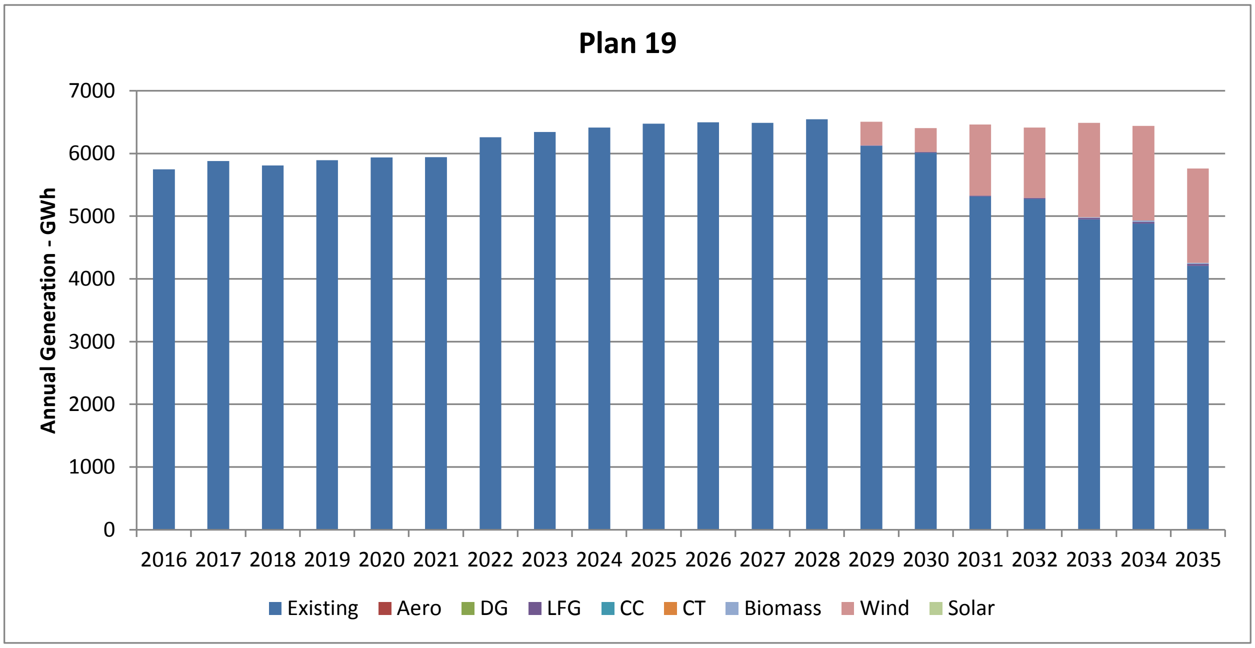


Figure 6-81 - Composition of Supply-Side Energy for Plan 19

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

4.2.7 Annual Emissions of Plans by Pollutant

The annual emissions for NO_x, SO_x, and CO_2 for each alternative resource plan are provided on *Figures 6-82* through *6-98*. The corresponding tables of values for all these figures are provided in Appendix 6H.

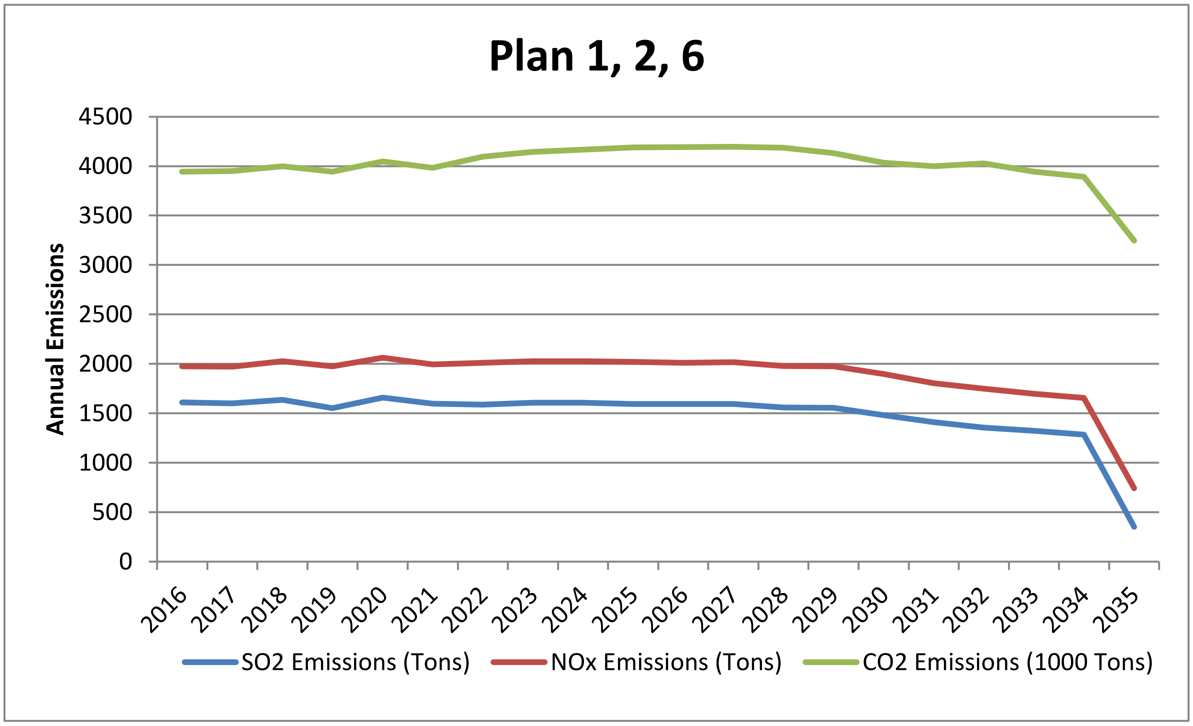


Figure 6-82 - Annual Emissions of Plan 1, 2, 6

NP

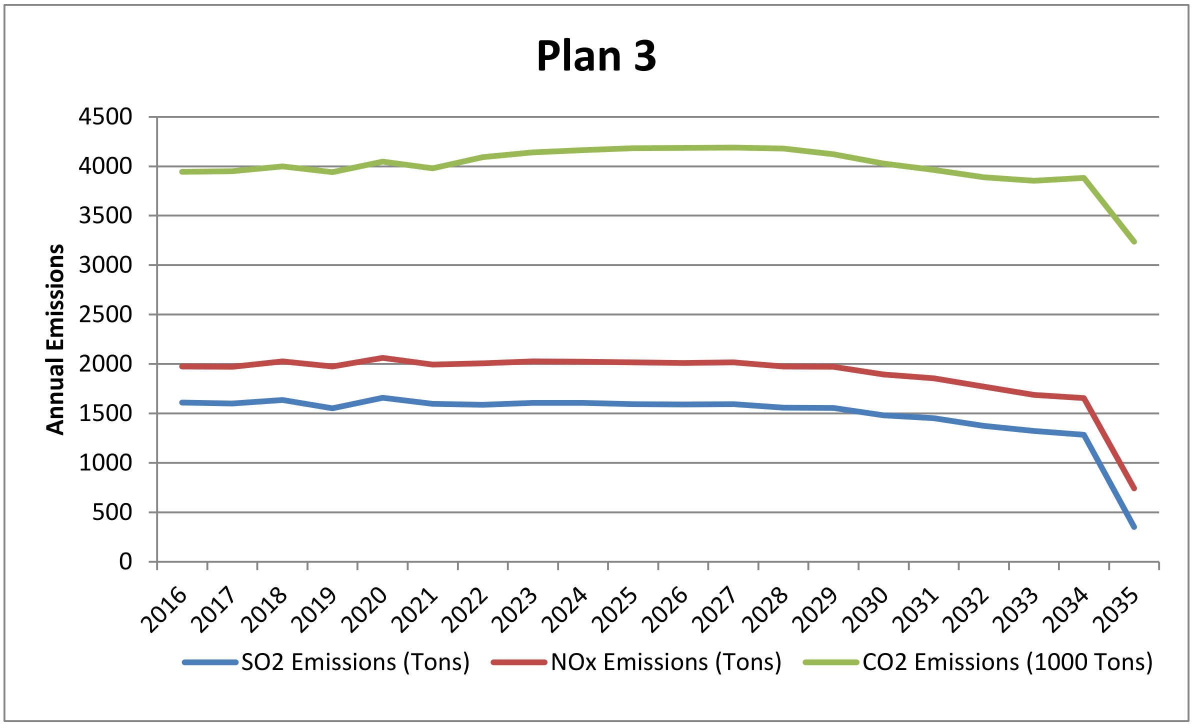


Figure 6-83 - Annual Emissions of Plan 3

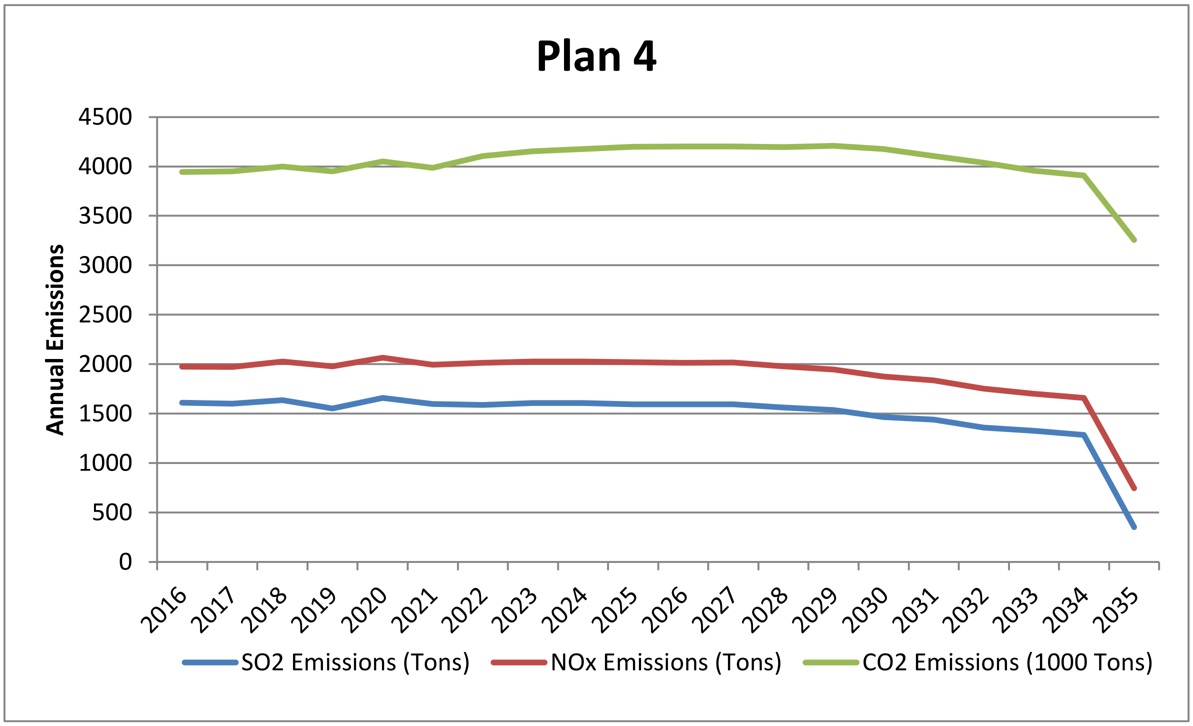


Figure 6-84 - Annual Emissions of Plan 4

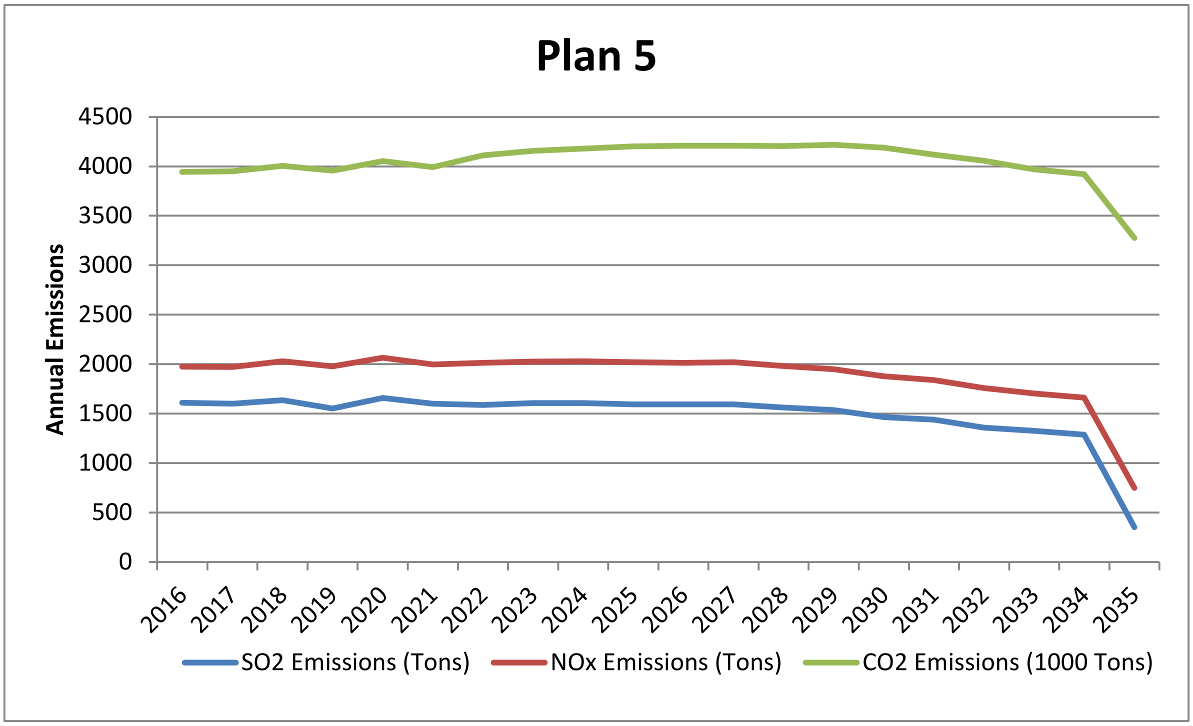


Figure 6-85 - Annual Emissions of Plan 5 (Also Applies to Plan 19)

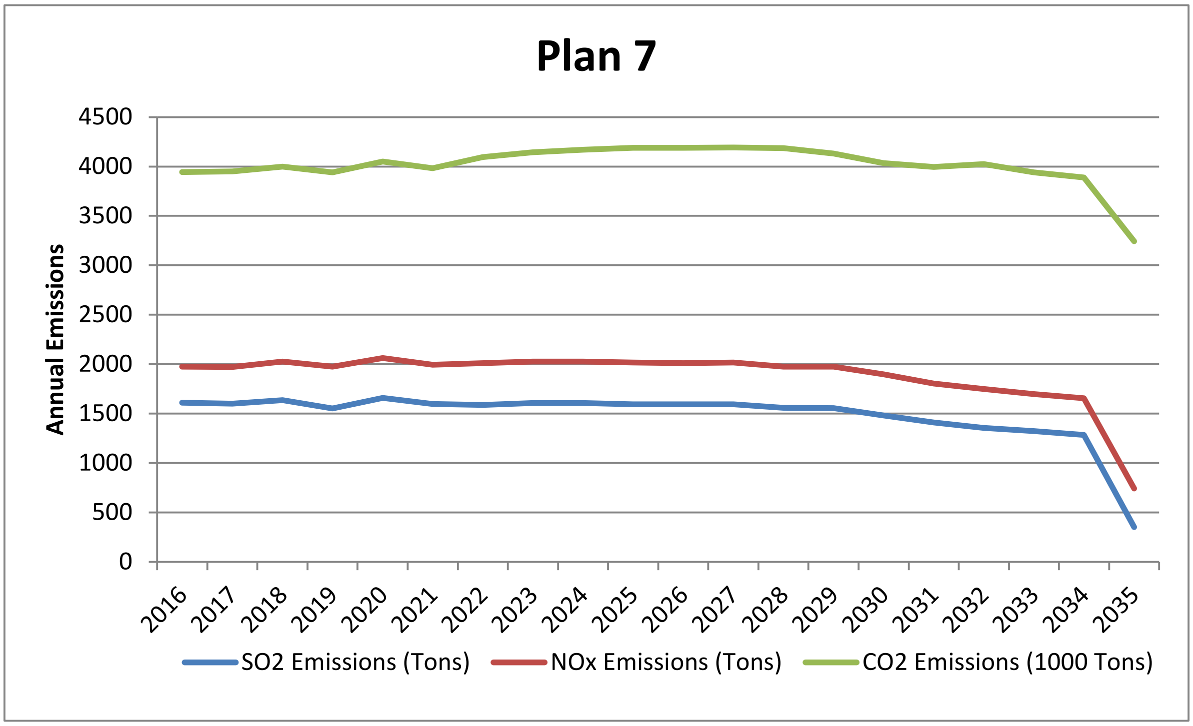


Figure 6-86 - Annual Emissions of Plan 7

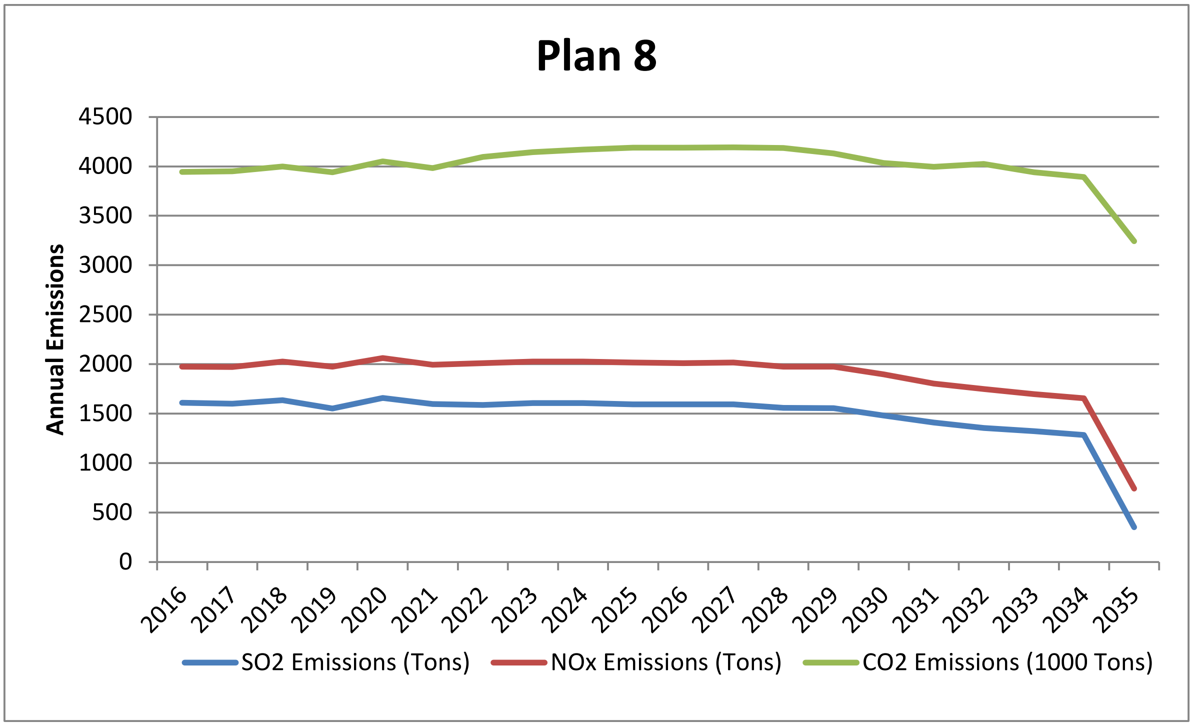


Figure 6-87 - Annual Emissions of Plan 8

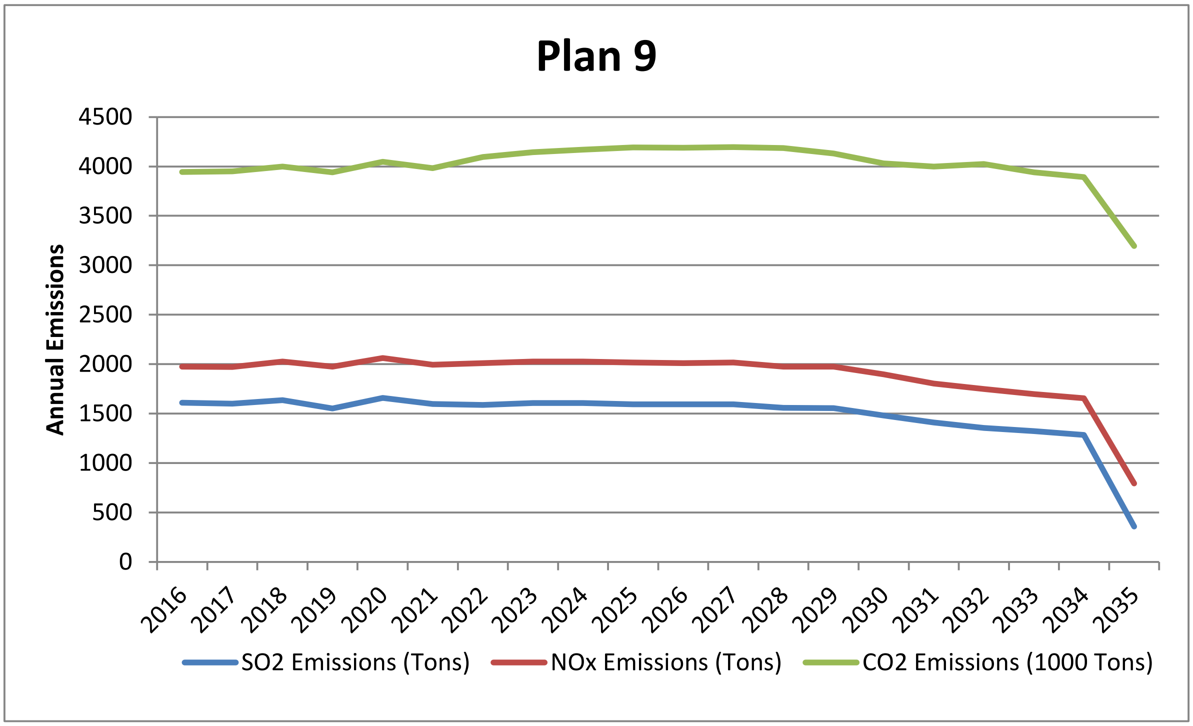


Figure 6-88 - Annual Emissions of Plan 9

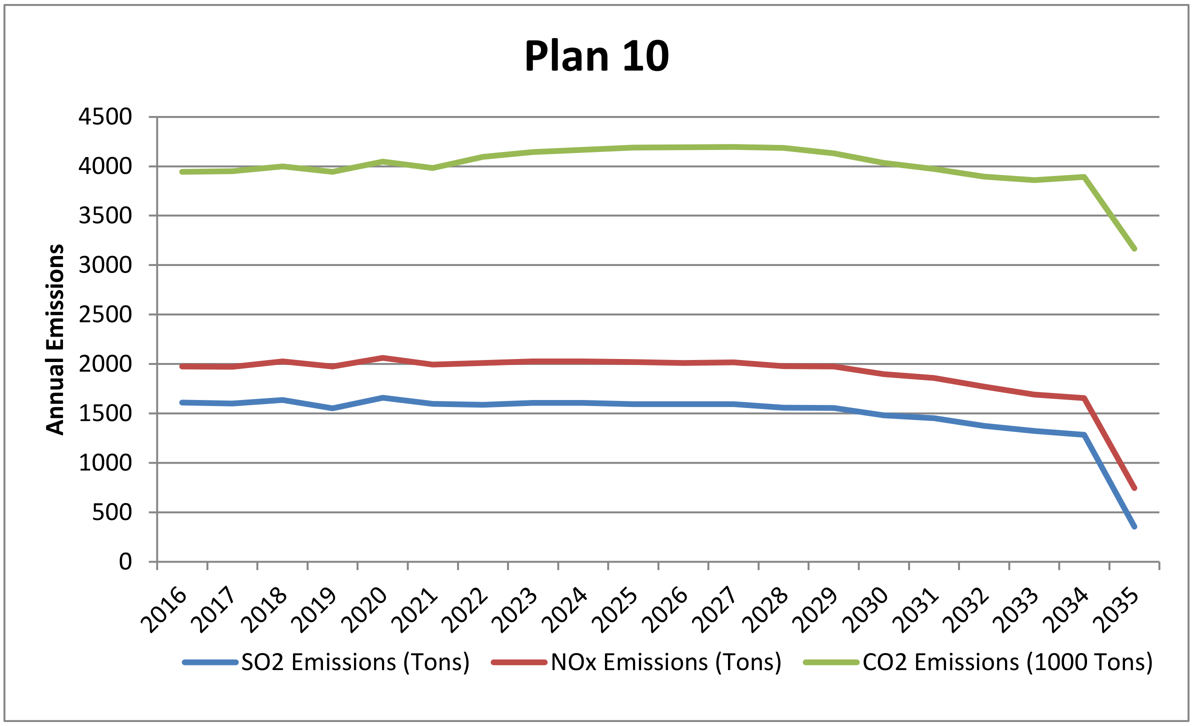


Figure 6-89 - Annual Emissions of Plan 10

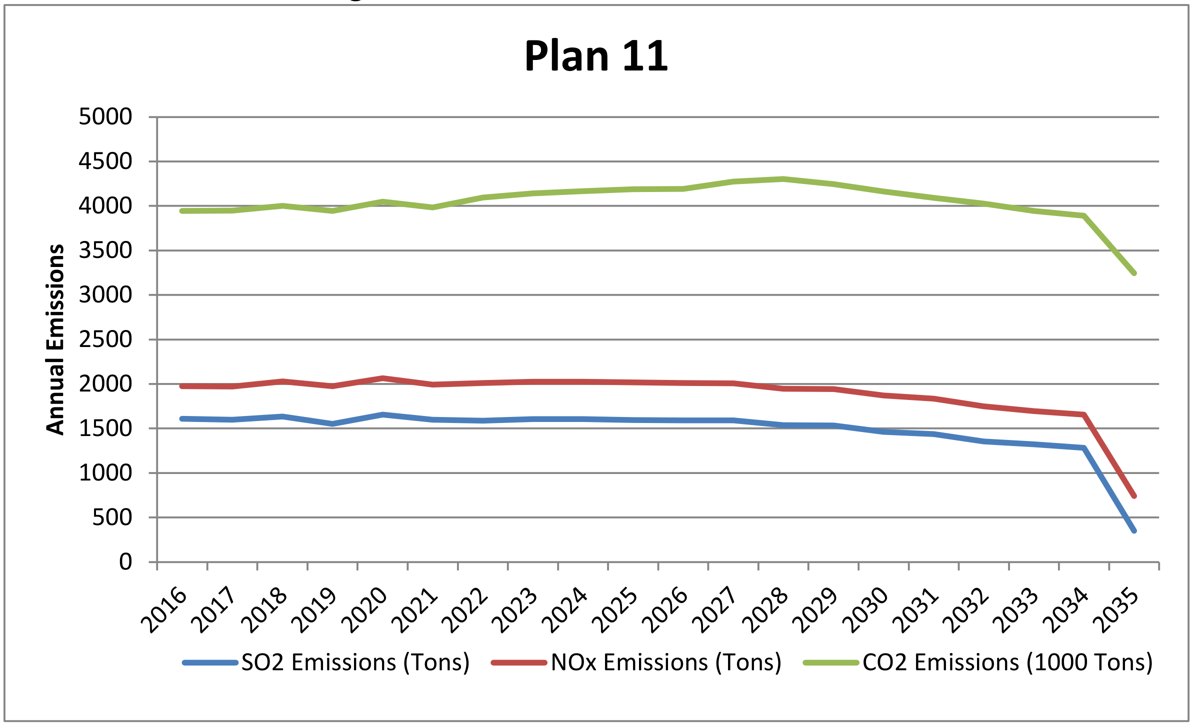


Figure 6-90 - Annual Emissions of Plan 11

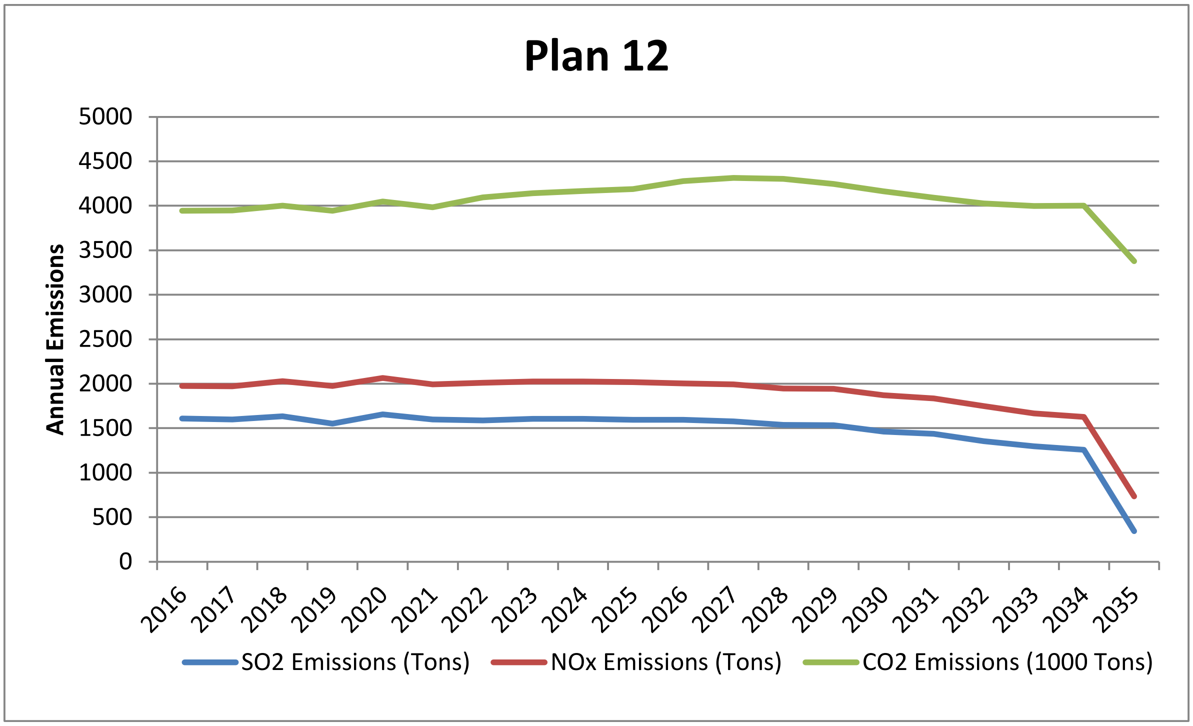


Figure 6-91 - Annual Emissions of Plan 12

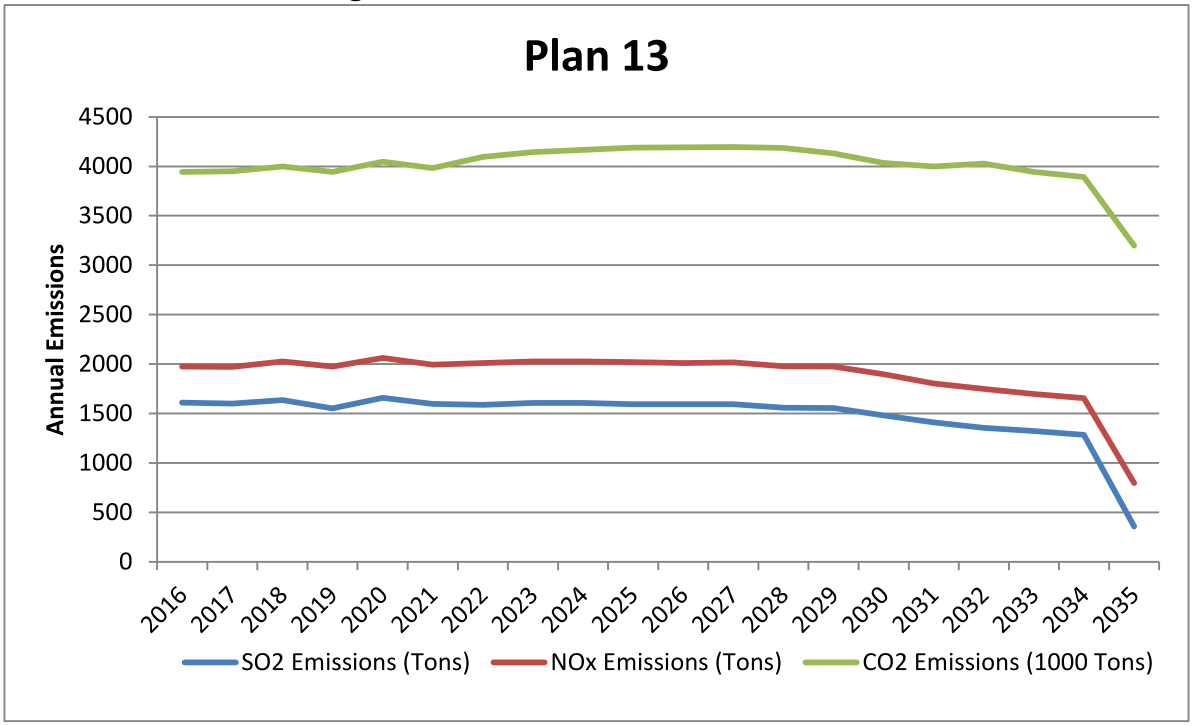


Figure 6-92 - Annual Emissions of Plan 13

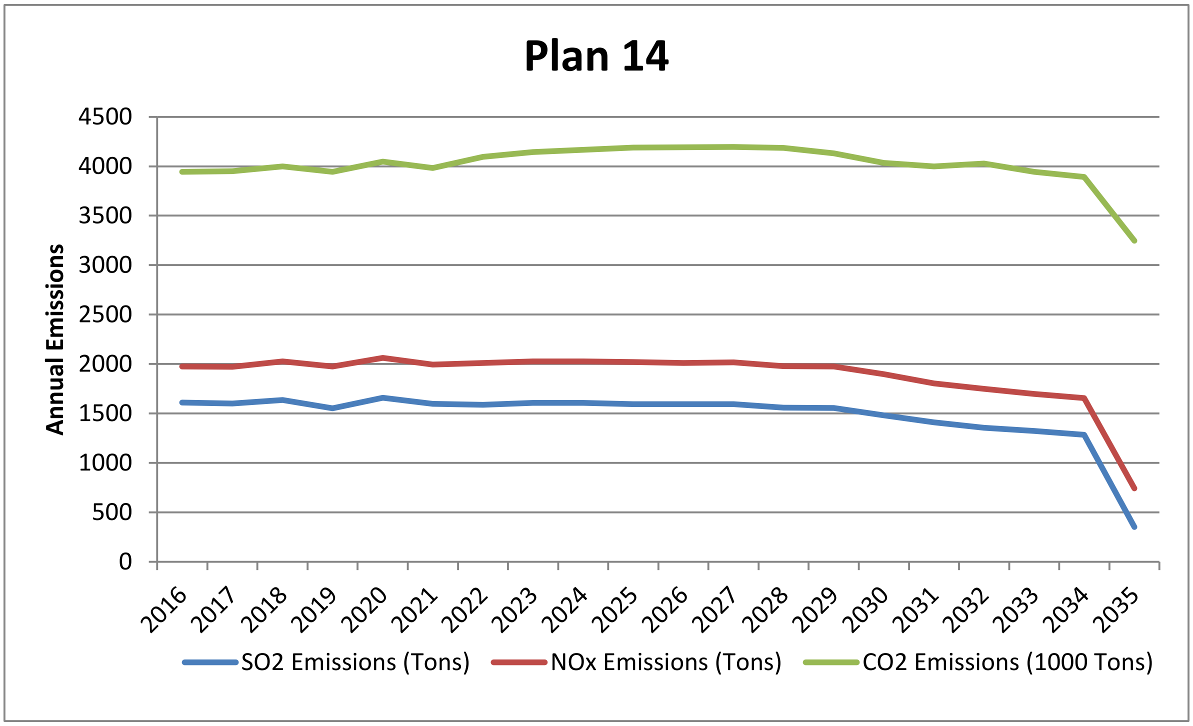


Figure 6-93 - Annual Emissions of Plan 14

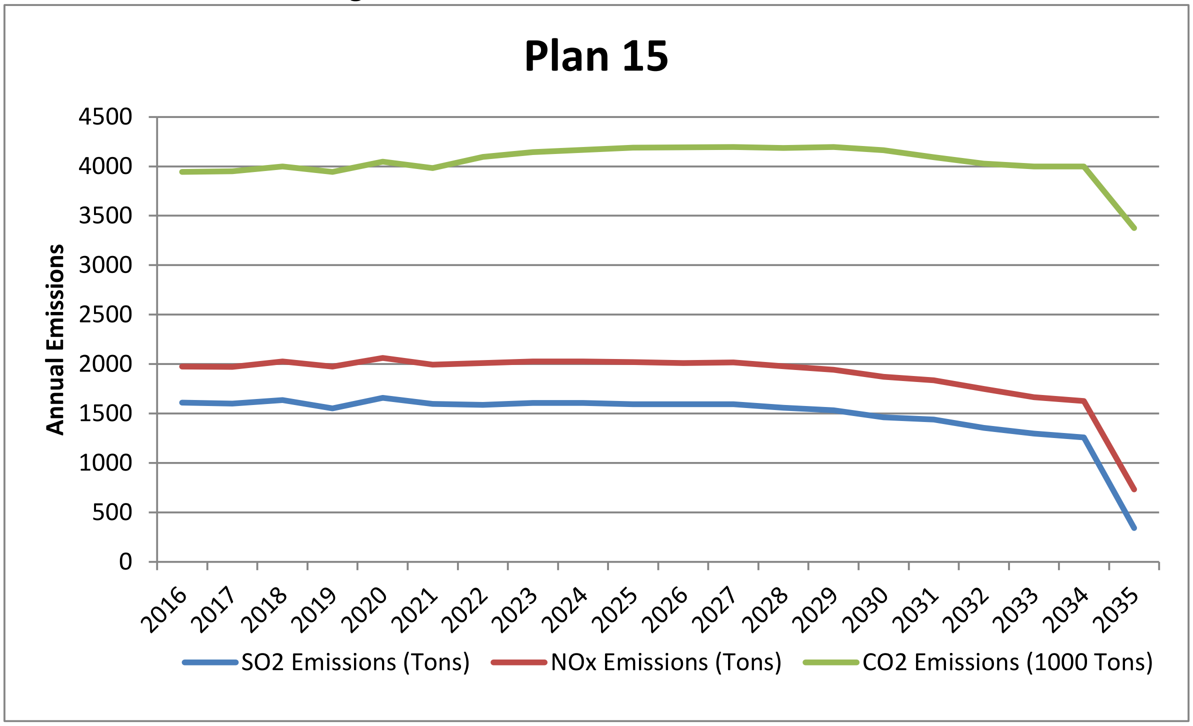


Figure 6-94 - Annual Emissions of Plan 15

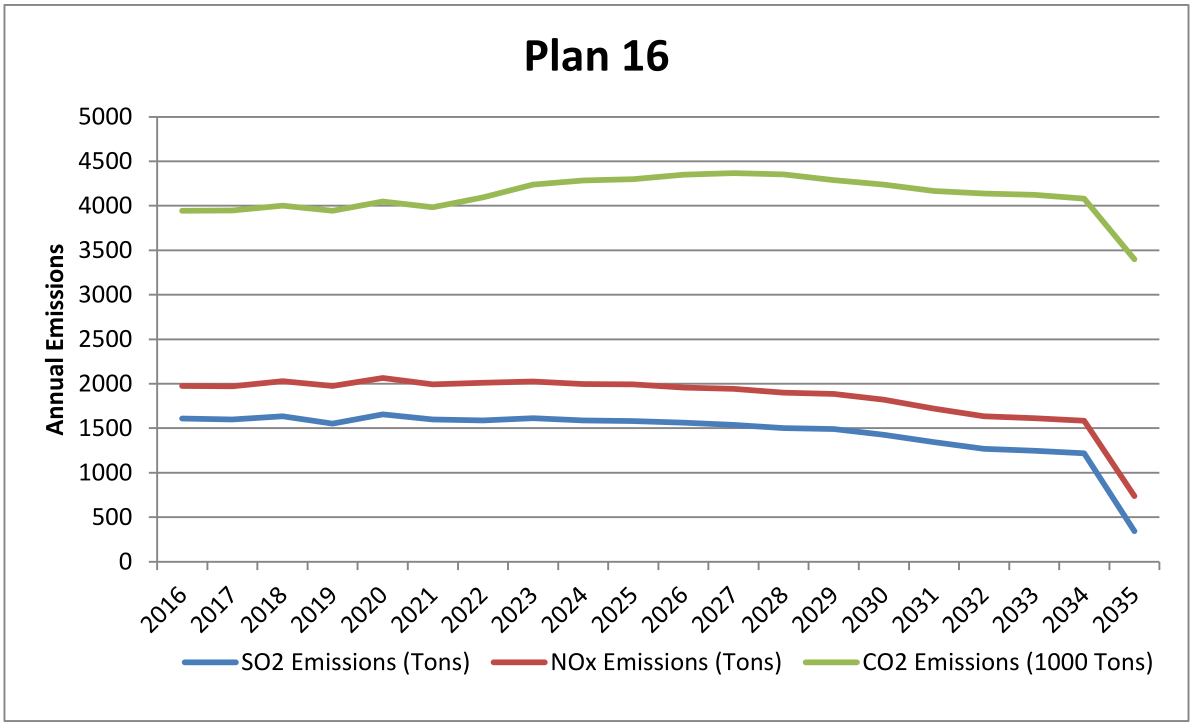


Figure 6-95 - Annual Emissions of Plan 16

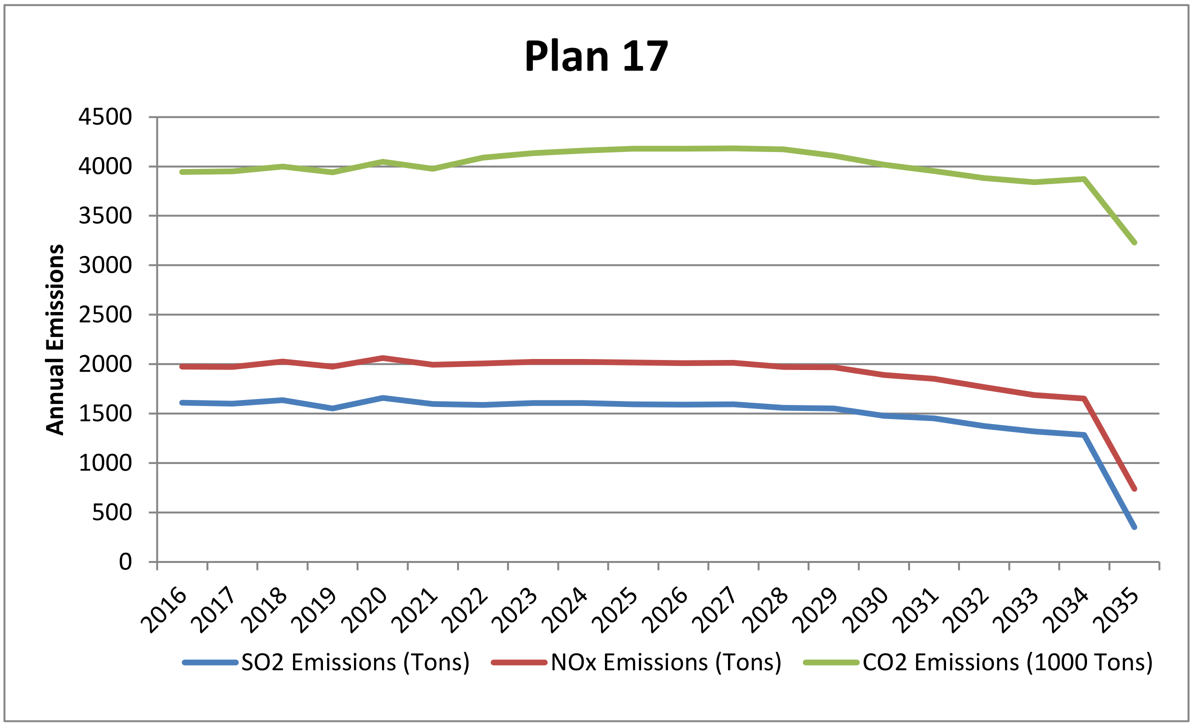


Figure 6-96 - Annual Emissions of Plan 17

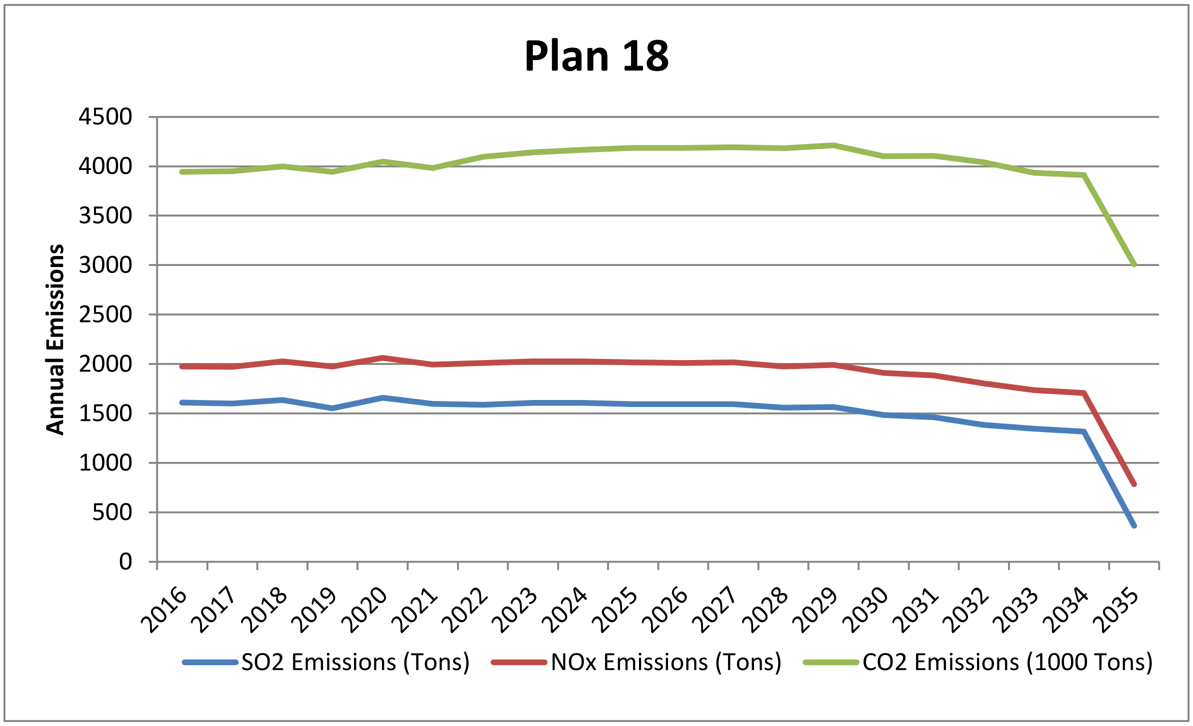


Figure 6-97 - Annual Emissions of Plan 18

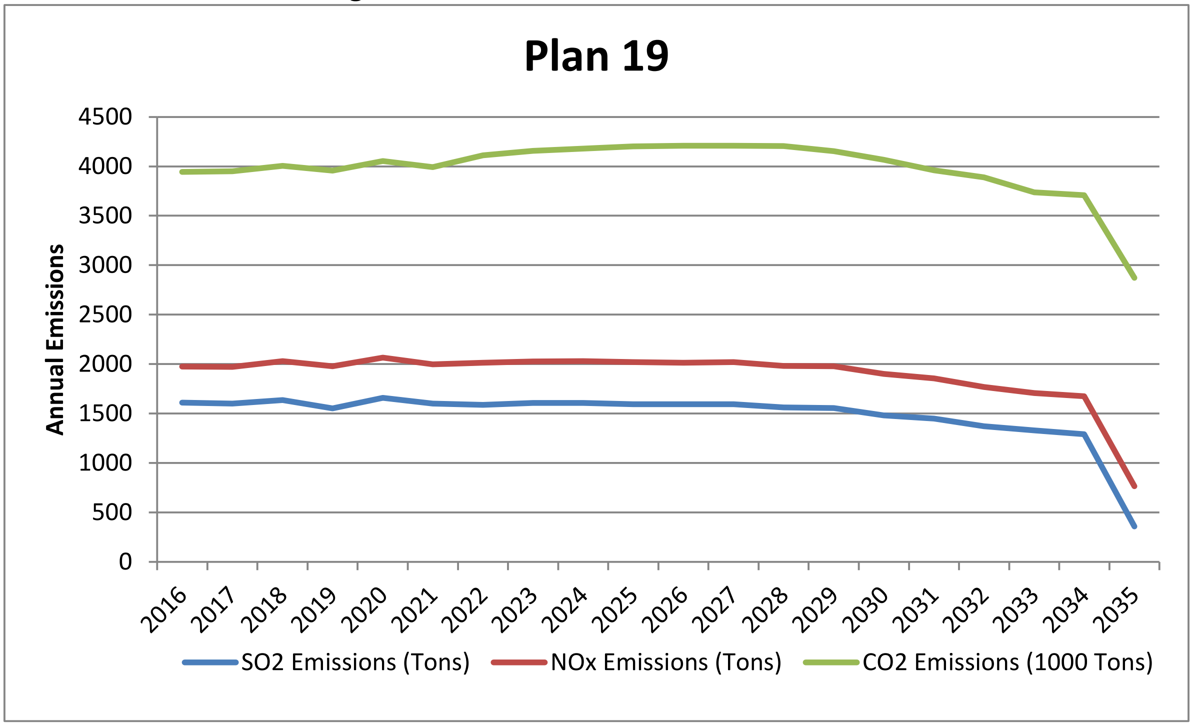
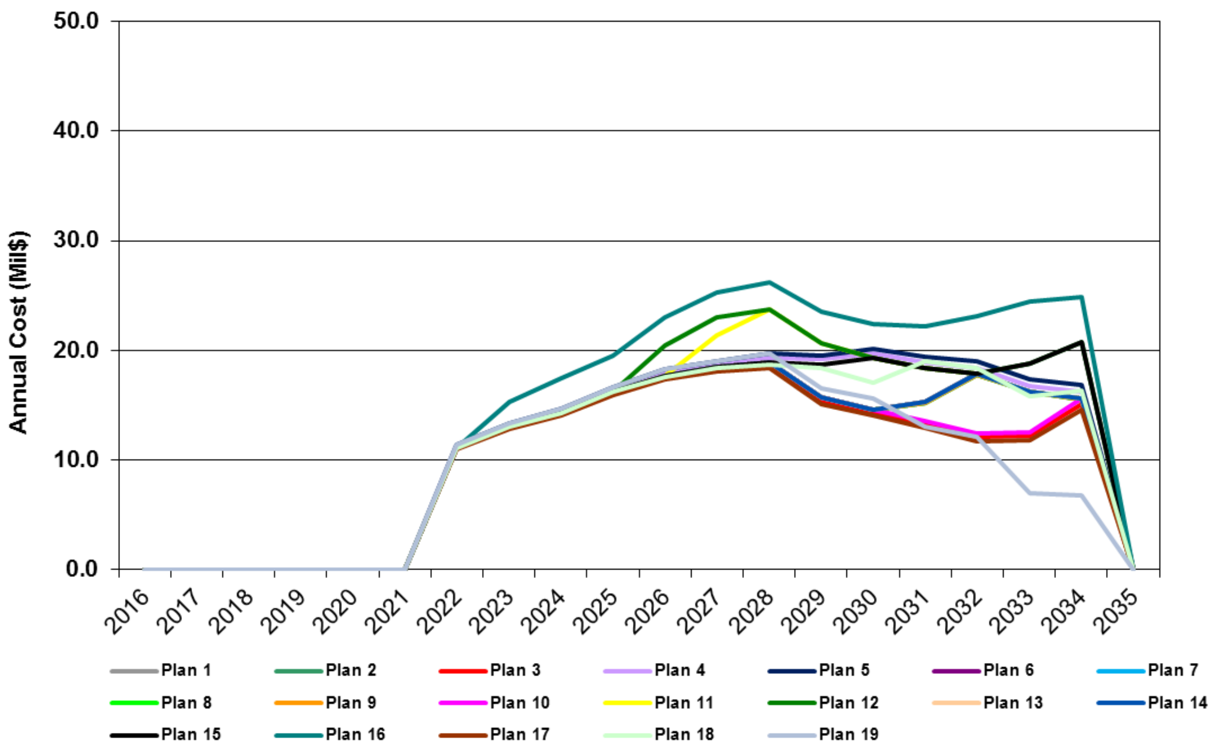


Figure 6-98 - Annual Emissions of Plan 19

8. Annual probable environmental costs; and

4.2.8 Annual Probable Environmental Cost for Each Plan

The total annual probable environmental costs for each alternative resource plan are shown in *Figure 6-99*. The corresponding table of values for this figure is provided in Appendix 6I.



(Source: ABB Advisors.)

Figure 6-99 - Annual Probable Environmental Costs for Each Alternative Resource Plan

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

4.2.9 Forecast of Capacity Balance Tables

The forecast of capacity balance spreadsheets for each alternative resource plan for each of summer and winter were provided in *Tables 6-11* through *6-48*.

(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—

4.3 Economic Impact of Alternative Resource Plans

Three costs are associated with DSM programs: 1) direct program costs; 2) lost margin, also referred to as shared savings, lost contributions to fixed costs or throughput disincentive; and 3) incentive costs. Empire did not include any incentive costs in these alternative resource plans and analyses.

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

4.3.1 Performance Measure Results for Each Plan

The performance measures of each alternative resource plan are provided in *Tables 6-51* through *6-69.*

Highly Confidential in its Entirety
Table 6-51 - Plan 1 Performance

Highly Confidential in its Entirety
Table 6-52 - Plan 2 Performance

****Highly Confidential in its Entirety****
Table 6-53 - Plan 3 Performance

****Highly Confidential in its Entirety****
Table 6-54 - Plan 4 Performance

Highly Confidential in its Entirety

Table 6-55 - Plan 5 Performance

Highly Confidential in its Entirety

Table 6-56 - Plan 6 Performance

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

Table 6-57 - Plan 7 Performance

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

Table 6-58 - Plan 8 Performance

Highly Confidential in its Entirety

Table 6-59 - Plan 9 Performance

Highly Confidential in its Entirety

Table 6-60 - Plan 10 Performance

Highly Confidential in its Entirety
Table 6-61 - Plan 11 Performance

Highly Confidential in its Entirety
Table 6-62 - Plan 12 Performance

Highly Confidential in its Entirety

Table 6-63 - Plan 13 Performance

Highly Confidential in its Entirety

Table 6-64 - Plan 14 Performance

Highly Confidential in its Entirety

Table 6-65 - Plan 15 Performance

Highly Confidential in its Entirety

Table 6-66 - Plan 16 Performance

****Highly Confidential in its Entirety****
Table 6-67 - Plan 17 Performance

****Highly Confidential in its Entirety****
Table 6-68 - Plan 18 Performance

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

Table 6-69 - Plan 19 Performance

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.

4.3.2 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;

Perfect rate making was the basis for development and analysis of alternative resource plans; that is, exact and timely recovery of all costs in rates. Price elasticity was inherently incorporated into the load forecast address in Volume 3, which became the basis for all alternative plans.

4.3.3 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;

Each of the plans (with the exception of Plan 18 which can only utilize DSM) contains some level of renewables. Plan 19 (Aggressive Renewable) modeled the scenario in which all future resource requirements would be exclusively met by renewable resources as required by 4 CSR 240-22.060(3)(A)2. In general, increasing the amount of renewable energy resources beyond the level required by MO-RES increased the PVRR.

4.3.4 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 Empire is aware, that require Empire to implement more energy efficiency or demand-side resources. However, as required by 4 CSR 240-22.060 (3)(A)3, Empire modeled the use of only DSM resources to meet all future resource needs in Plan 18 (Aggressive Capacity DSM). Also, Plans 2 through 4 were developed with varying levels of RAP DSM and the base assumptions. In general, the higher the amount of DSM in the base plans, the higher the PVRR. The low cost base plan was Plan 5, which contained no new DSM.

4.3.5 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 Empire is aware, that require Empire to implement more energy resources than required to comply with any other energy resource updates.

4.3.6 IRP Analysis Software

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

The ABB consultants used their proprietary software to model and analyze the alternative resource plans. Strategic Planning powered by MIDAS Gold® was utilized to measure and analyze the consumer value of competition.

Strategic Planning includes multiple modules for an enterprise-wide strategic solution. These modules are: Markets, Capacity Expansion, Portfolio, Financial, and Risk.

Strategic Planning is an integrated, fast, multi-scenario zonal market model capable of capturing many aspects of regional electricity market pricing, resource operation, asset, and customer value. The markets and portfolio modules are hourly, multi-market, chronologically correct market production modules used to derive market prices, evaluate power contracts, and develop regional or utility-specific resource plans. The financial and risk modules provide full financial results and statements and decision making tools necessary to value customers, Strategic Planning includes multiple modules for an enterprise-wide strategic solution.

<u>Markets Module</u>

Generates zonal electric market price forecasts for single and multi-market systems by hour and chronologically correct for 30 years. Prices may be generated for energy-only, bid, or ICAP based bidding processes. Prices generated reflect trading between transaction groups where transaction group may be best defined as an aggregated collection of control areas where congestion is limited and market prices are similar. Trading is limited by transmission paths and constraints quantities.

The markets module was not utilized for this project. Market prices were taken from the Spring Reference Case.

Market prices were used from the Spring 2015 Midwest Reference Case. ABB uses a fundamentals-based methodology to forecast power prices in each region of North America. Based on its proprietary PROMOD IV® software—a proven data management and production simulation model—ABB simulates the operation of each region of North America. PROMOD IV 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.

For each region, PROMOD IV 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.

PROMOD IV provides valuable information on the dynamics of the marketplace through its ability to determine the effects of transmission congestion, fuel costs, generator availability, bidding behavior, and load growth on market prices. PROMOD IV performs an 8760-hour commitment and dispatch recognizing both generation and transmission impacts. PROMOD IV forecasts hourly energy prices, unit generation, revenues and fuel consumption, and transmission flows.

The heart of PROMOD IV 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.

Portfolio Module

The portfolio module is used to perform utility- or region-specific portfolio analyses. Simulation times are faster than running the markets module and it allows for more detailed operational characteristics for a utility-specific fleet. The generation fleet is dispatched competitively against pre-solved market prices from the markets module or other external sources. Native load may also be used for non-merchant/regulated entities with a requirement to serve.

Operates generation fleet based on unit commitment logic which allows for plant-specific parameters of:

- Ramp rates
- Minimum/Maximum run times
- Start-up costs

The decision to commit a unit may be based on one-day, three-day, seven-day, and month criteria. Forced outages may be based on monte-carlo or frequency duration with the capability to perform detailed maintenance scheduling. Resources may be de-committed based on transmission export constraints.

Portfolio module has the capability to operate a generation fleet against single or multiple markets to show interface with other zones. In addition, physical, financial, and fuel derivatives with pre-defined or user-defined strike periods, unit contingency, replacement policies, or load following for full requirement contracts are active.

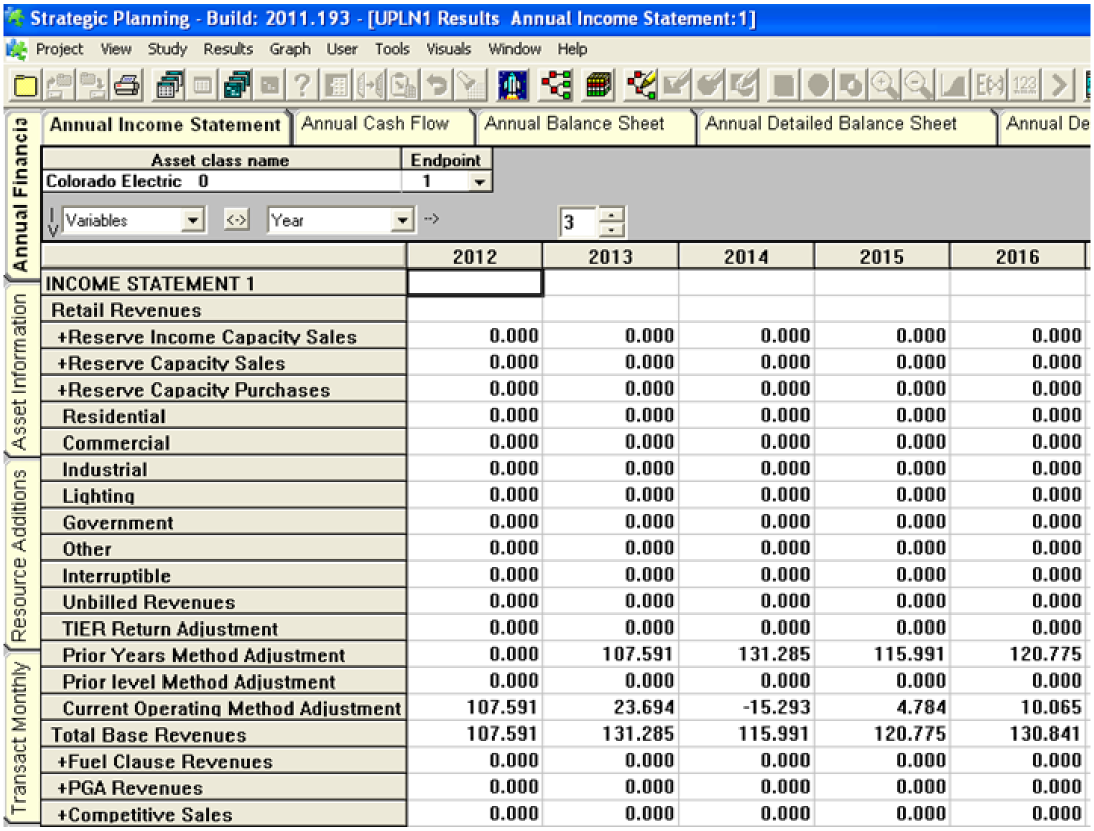
Capacity Expansion Module

Capacity Expansion automates screening and evaluation of generation capacity expansion, transmission upgrades, strategic retirement, and other resource alternatives. It is a detailed and fast economic optimization model that simultaneously considers resource expansion investments and external market transactions. With Capacity Expansion, the optimal resource expansion strategy is determined based on an objective function subject to a set of constraints. The typical criterion for evaluation is the expected present value of revenue requirements (PVRR) subject to meeting load plus reserves, and various resource planning constraints. It develops long-term resource expansion plans with type, size, location, and timing of capital projects over a 30-year horizon.

Decisions to build generating units or expand transmission capacity, purchase or sell contracts, or retire generating units are made based on the expected market value (revenue) less costs including both variable and fixed cost components. The model is a mixed integer linear program (MILP) in which the objective is minimization of the sum of the discounted costs of supplying customer loads in each area with load obligations. The model can be used to also represent areas that provide energy and capacity from power stations or contracts, but have no load obligations. The model includes all existing and proposed plants and transmission lines in a utility system.

Financial Module

The financial module allows the user the ability to model other financial aspects regarding costs exterior to the operation of units and other valuable information that is necessary to properly evaluate the economics of a generation fleet. The financial module produces bottom-line financial statements to evaluate profitability and earnings impacts.



Strategic Planning - Build: 2011.193 - [UPLN1 Results Annual Income Statement:1]

Asset class name	Endpoint
Colorado Electric 0	1

	2012	2013	2014	2015	2016
INCOME STATEMENT 1					
Retail Revenues					
+Reserve Income Capacity Sales	0.000	0.000	0.000	0.000	0.000
+Reserve Capacity Sales	0.000	0.000	0.000	0.000	0.000
+Reserve Capacity Purchases	0.000	0.000	0.000	0.000	0.000
Residential	0.000	0.000	0.000	0.000	0.000
Commercial	0.000	0.000	0.000	0.000	0.000
Industrial	0.000	0.000	0.000	0.000	0.000
Lighting	0.000	0.000	0.000	0.000	0.000
Government	0.000	0.000	0.000	0.000	0.000
Other	0.000	0.000	0.000	0.000	0.000
Interruptible	0.000	0.000	0.000	0.000	0.000
Unbilled Revenues	0.000	0.000	0.000	0.000	0.000
TIER Return Adjustment	0.000	0.000	0.000	0.000	0.000
Prior Years Method Adjustment	0.000	107.591	131.285	115.991	120.775
Prior level Method Adjustment	0.000	0.000	0.000	0.000	0.000
Current Operating Method Adjustment	107.591	23.694	-15.293	4.784	10.065
Total Base Revenues	107.591	131.285	115.991	120.775	130.841
+Fuel Clause Revenues	0.000	0.000	0.000	0.000	0.000
+PGA Revenues	0.000	0.000	0.000	0.000	0.000
+Competitive Sales	0.000	0.000	0.000	0.000	0.000

Figure 6-100 - Sample Report

Risk Module

Risk module provides users the capability to perform stochastic analyses on all other modules and review results numerically and graphically. Stochastics may be performed on both production and financial variables providing flexibility not available in other models.

Strategic Planning has the functionality of developing probabilistic price series by using a four-factor structural approach to forecast prices that captures the uncertainties in regional electric demand, resources, and transmission. Using a Latin Hypercube-based stratified sampling program, Strategic Planning generates regional forward price curves across multiple scenarios. Scenarios are driven by variations in a host of market price "drivers" (e.g. demand, fuel price, availability, hydro year, capital expansion cost, transmission availability, market electricity price, reserve margin, emission price, electricity price, and/or weather) and takes into account statistical distributions, correlations, and volatilities for three time periods (i.e. short-term hourly, mid-term monthly, and long-term annual) for each transact group. By allowing these uncertainties to vary over a range of possible values a range or distribution of forecasted prices are developed.

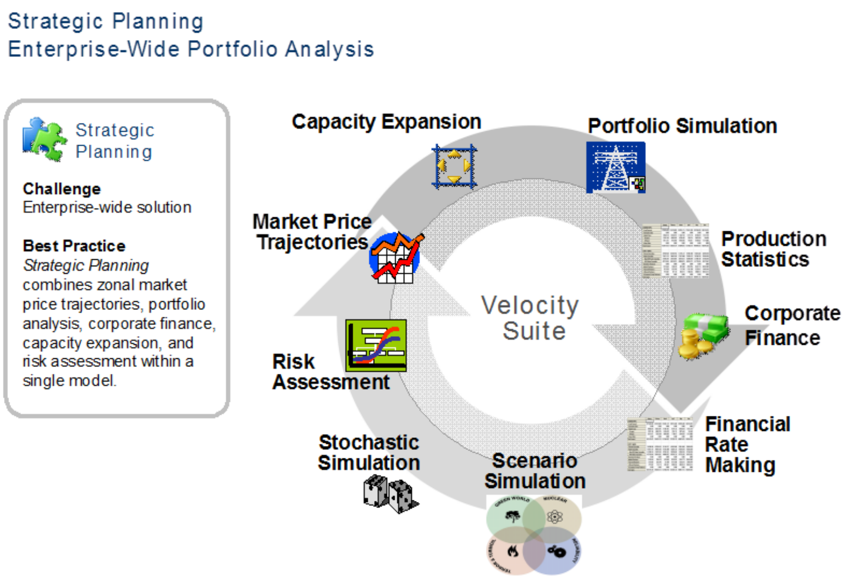


Figure 6-101 - Overview of Process

SECTION 5 UNCERTAIN FACTORS

(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.

Empire compiled information concerning the risks listed in the rule from subject matter experts within the company and from its consultants. The base and variations above and below the base (e.g. low, mid, high, high-high) were also assigned a subjective probability by the subject matter experts. *Table 6-70* contains the list of uncertain factors developed by Empire and how there were addressed in this IRP.

Uncertain Factor	Critical Factor in Decision Tree	Addressed in IRP
A. Load Growth	Yes	The range of future load growth is fundamental to Empire's need for generating resources in the future. It is deemed to be a critical uncertain factor.
B. Interest Rates	Yes	Interest rates affect the capital costs for new generation. This effect is incorporated in the capital and transmission cost and deemed to be a critical uncertain factor
C. Changes in Legal Mandates	No	Empire developed plans to meet the Missouri RPS rules. Based on the Bingaman bill proposal, Empire would not be required to add additional renewable resources beyond their current Missouri requirements.
D. Fuel Prices	Yes	Since fuel prices comprise a significant portion of the production costs, this factor is deemed to be a critical uncertain factor. It was paired with market prices in the uncertainty analysis.
E. Siting and permitting costs and schedules for Transmission	Yes	Siting and permitting costs for new generation and associated transmission facilities are incorporated in the capital and transmission costs variable which has been deemed to be a critical uncertain factor.
F. Project Construction Costs/ Schedule	Yes	Construction costs for new generation and transmission facilities are incorporated in the capital and transmission costs variable which has been deemed to be a critical uncertain factor. Project Schedule was not considered as a critical uncertain factor because ABB used the Capacity Expansion Module which optimizes the in-service date of a resource.
G. Purchase Power	Yes	Purchase power costs are deemed to be a critical uncertain factor and are captured in the market price for power.

H. Prices for Emission al-lowances	Yes	SO_2, NO_x and coal prices are outputs for the carbon scenarios discussed in Chapter 3 section titled CO_2 Tax Probabilities.
I. Fixed O&M	No	High and Low fixed O&M costs were analyzed for plans 1 - 17. Analysis results showed no material changes in the optimal expansion plans as the costs were varied; therefore fixed O&M is not deemed to be a critical uncertain factor.
J. Equivalent or full- and par-tial Forced Outage Rates	No	High and Low forced outage rates were analyzed for plans 1-17. Analysis results showed no material changes in the optimal expansion plans as the rates were varied; therefore forced outage rates are not deemed to be a critical uncertain factor.
K. DSM Load Impacts/ Rates	No	In addition to the five levels of DSM (Base (RAP), MAP, No CO2 Avoided Costs, Low CO2 Avoided Costs, High CO2 Avoided Costs, Aggressive Portfolio, and Aggressive Capacity), Empire modeled a RAP+, and a RAP-. Uncertainty around DSM was captured by modeling these additional plans.
L. Variable O&M	No	High and Low variable O&M costs were analyzed for plans 1-17. Analysis results showed no material changes in the optimal expansion plans as the costs were varied; therefore variable O&M is not deemed to be a critical uncertain factor.

Table 6-70 - Uncertain Factors

Table 6-71 contains the uncertain factor ranges for the candidate factors that were not screened out or considered critical.

Uncertain Factor	Value	Coal with CCS	Aero CT	E Frame Type CT	F Frame Type CT	CC Duct Fired	RICE	Small Mod Nuke	DG-Mirco	DG-CHP
Project Cost	Low	$ 228.786	$ 68.491	$ 82.936	$115.190	$ 91.241	$ 56.253	$ 171.244	$ 3.898	$ 24.065
($MM)	Base	$ 269.161	$ 80.578	$ 97.572	$135.517	$ 107.342	$ 66.180	$ 201.463	$ 4.585	$ 28.311
	High	$ 322.993	$ 96.693	$ 117.086	$162.620	$ 128.811	$ 79.416	$ 241.756	$ 5.502	$ 33.973
Fixed O&M	Low	$26.45	$26.29	$13.13	$6.05	$10.17	$7.88	$74.34	$149.52	$143.63
($/kW-yr)	Base	$31.12	$30.93	$15.44	$7.12	$11.96	$9.27	$87.45	$175.90	$168.98
	High	$35.79	$35.57	$17.76	$8.19	$13.76	$10.66	$100.57	$202.29	$194.32
Variable O&M	Low	$9.21	$5.54	$6.10	$2.16	$2.16	$2.34	$1.08	N/A	N/A
($/MWh)	Base	$11.51	$6.93	7.62*	$2.70*	$2.70*	$2.93	$1.35	Included in FOM	Included in FOM
	High	$13.81	$8.31	$9.14	$3.24	$3.24	$3.51	$1.62	N/A	N/A
EFOR	Low	3.4%	20.0%	22.4%	6.6%	5.9%	1.6%	5.2%	0.0%	0.0%
(%)	Base	5.2%	30.8%	34.5%	10.2%	9.1%	2.5%	8.0%	0.0%	0.0%
	High	7.0%	41.6%	46.6%	13.8%	12.3%	3.4%	10.8%	0.0%	0.0%
	*Includs Major Maintenance									
Uncertain Factor	**Value**	**IGCC with CCS**	**Trad Nuke**	**Wind Own**	**Wind PPA**	**Indigenous Wind**	**Biomass**	**Landfill Gas**	**Solar**	**Battery Storage**
Project Cost	Low	$ 308.779	$ 226.994	$ 83.756	N/A	N/A	$ 28.444	$ 17.415	$ 19.985	$ 36.239
($MM)	Base	$ 363.269	$ 267.051	$ 98.537	N/A	N/A	$ 33.463	$ 20.488	$ 23.512	$ 42.634
	High	$ 435.923	$ 320.462	$ 118.244	N/A	N/A	$ 40.156	$ 24.585	$ 28.215	$ 51.161
Fixed O&M	Low	$30.10	$74.34	$20.30	N/A	N/A	$165.85	$149.27	$16.17	$49.42
($/kW-yr)	Base	$35.41	$87.45	$23.88	N/A	N/A	$195.12	$175.61	$19.02	$58.15
	High	$40.73	$100.57	$27.47	N/A	N/A	$224.39	$201.95	$21.88	$66.87
Variable O&M	Low	$13.35	$1.08	$0.00	$39.02	$46.83	$7.80	$15.61	N/A	N/A
($/MWh)	Base	$16.68	$1.35	$0.00	$48.78	$58.54	$9.76	$19.51	Included in FOM	Included in FOM
	High	$20.02	$1.62	$0.00	$58.54	$70.25	$11.71	$23.41	N/A	N/A
EFOR	Low	7.8%	5.2%	4.6%	4.6%	4.6%	3.9%	17.8%	0.0%	0.0%
(%)	Base	12.0%	8.0%	7.0%	7.0%	7.0%	6.0%	27.4%	0.0%	0.0%
	High	16.2%	10.8%	9.5%	9.5%	9.5%	8.1%	37.0%	0.0%	0.0%

Table 6-71 - Uncertain Factor Ranges

ABB used its Capacity Expansion Module to test the uncertain factors shown in *Table 6-71*. The model was run using the LP solver to achieve optimal solution results. In this case, the model solved for the Present Value of Revenue Requirements by adding the exact amount of resources in increments of one MW to achieve the reserve margin target. Preliminary candidate resource plans 1-17 were analyzed using the varying value levels (low/base/high) in the Capacity Expansion Module to see if different technologies would be selected from the base value technologies.

The conclusion from the analysis results showed no material changes in the optimal expansion plans as the costs were varied except in the project high capital cost case. *Table 6-72* contains the high financing costs that were combined with high capital cost and passed onto the risk analysis.

Uncertain Factor	Base	High
Probability	70%	30%
Long Term Interest Rates	5.35	7.35
Return on Ratebase	7.63	8.65

Table 6-72 - High Financing Costs

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, interest rates, changes in legal mandates, fuel prices, siting and permitting costs and schedules for transmission, project construction costs/schedule, purchased power costs, prices for emission allowances, fixed O&M, outage rates, DSM load impacts and rates, and variable O&M. These factors have the greatest potential to influence the resource plans or “move the meter”, as the alternative plans demonstrated. Thus these factors were deemed to be the critical uncertain factors.

Risk profiles were developed to assess the risks associated with decisions under uncertainty for this study. Empire and ABB used decision analysis techniques to examine the four critical uncertain factors: Market Prices, Load, Capital/Transmission/Interest Costs, and Environmental Costs.

Market prices were developed for SPP-KSMO with the use of the various gas price forecasts developed by the Power and Fuels Module. Multipliers were used to change coal and oil prices to correlate with the gas prices.

Load forecasts were developed by Empire and Itron.

Capital/Transmission/Interest Costs were combined into a single factor for analysis. Capital cost uncertainty was done for high and base probabilities. In the high scenario, capital and transmission costs for all expansion units were 1.2 times that of the base scenario. Interest rates were increased two basis points for the high scenario and the corresponding higher return on rate base was used.

SO_2 and NO_x emission price forecasts were developed by using resources from the Department of Energy and ABB.

Tornado diagrams provide information on the driving factors that influence PVRR and can also provide insight into where a risk aversion strategy could be focused to drive PVRR to lower levels or mitigate risk. Tornado diagrams are useful for deterministic sensitivity analysis, comparing the relative importance of variables. Each variable/uncertainty considered is estimated for what the low-base-high outcomes would be. The sensitive variable is modeled as uncertain value while all other variables are held at baseline values. The major driver of PVRR uncertainty for all plans in this IRP is capital costs uncertainty followed by environmental costs. *Figures 6-101* through *6-118* are Tornado Diagrams that illustrate the influence that uncertain factors have on each of the alternate resource plans.

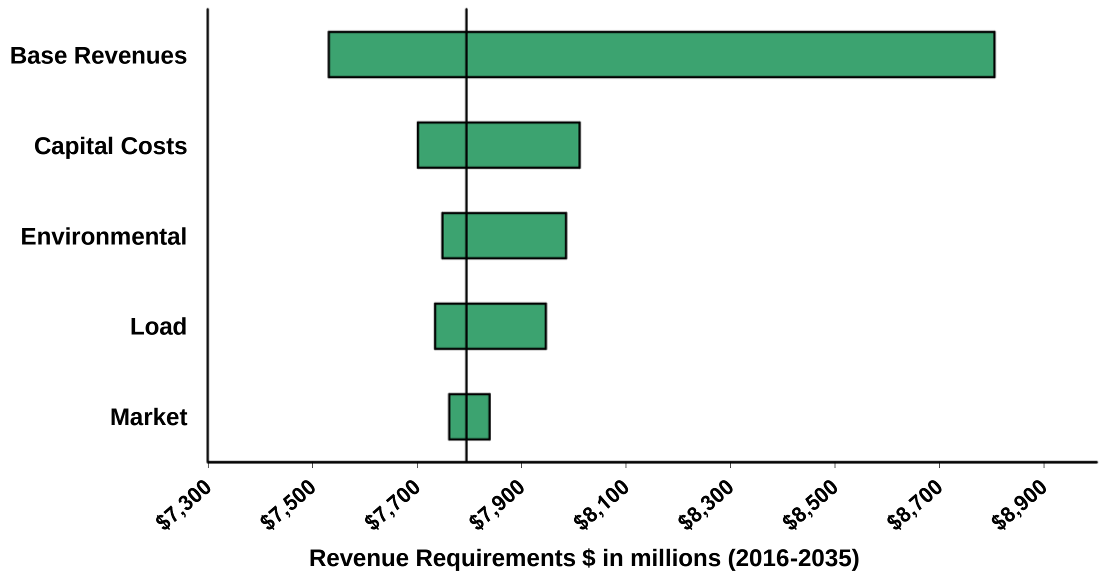


Figure 6-102 - Plans 1 and 2 (Base Case and Base Case Meets RPS) Tornado Diagram

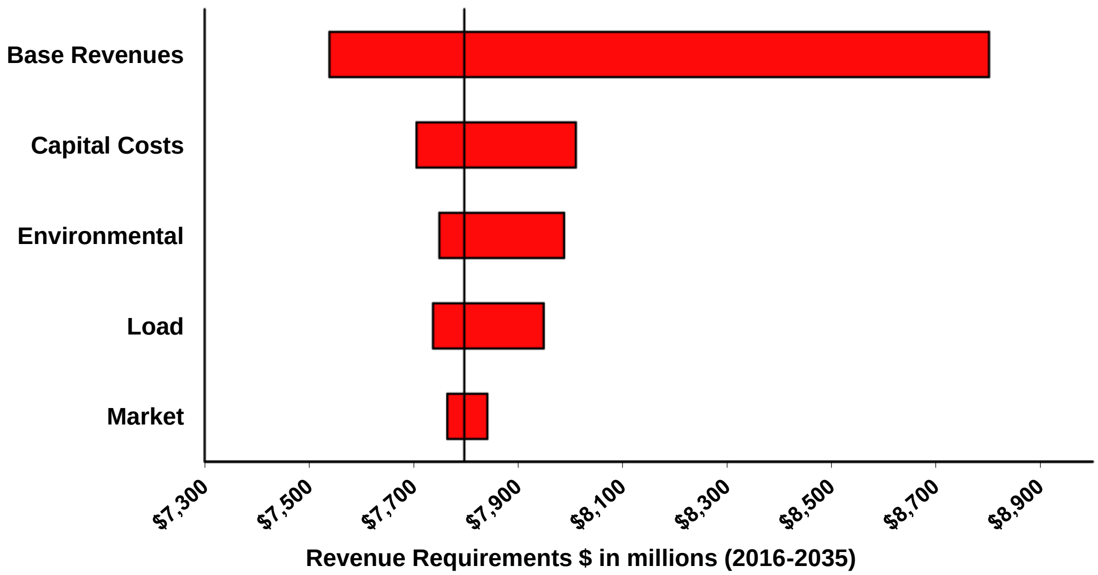


Figure 6-103 - Plan 3 (RAP + DSM) Tornado Diagram

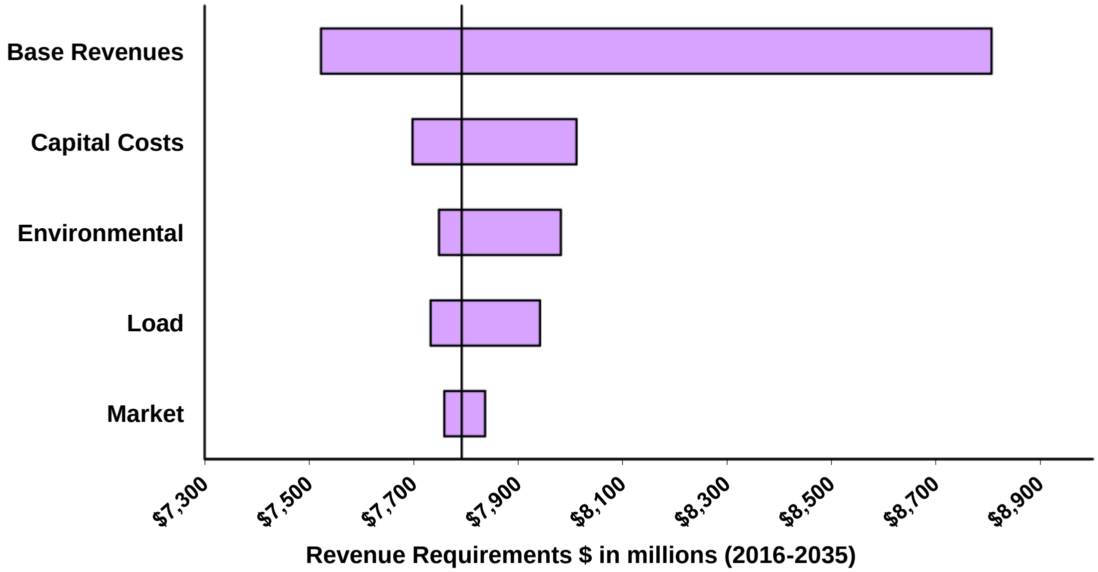


Figure 6-104 - Plan 4 (RAP - DSM) Tornado Diagram

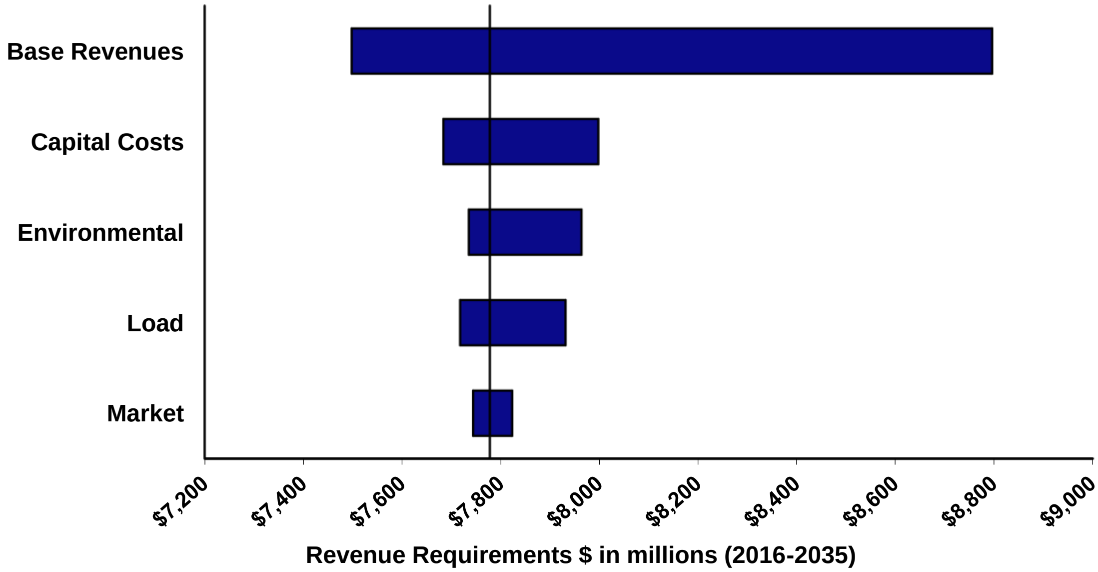


Figure 6-105 - Plan 5 (No DSM) Tornado Diagram

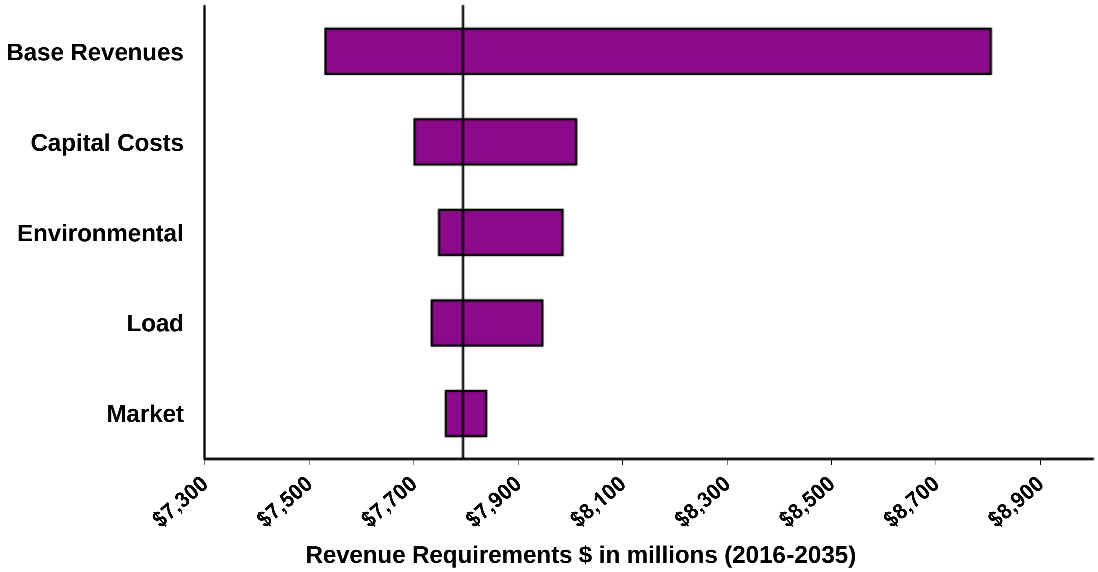


Figure 6-106 - Plan 6 (Federal Renewable Incentives) Tornado Diagram

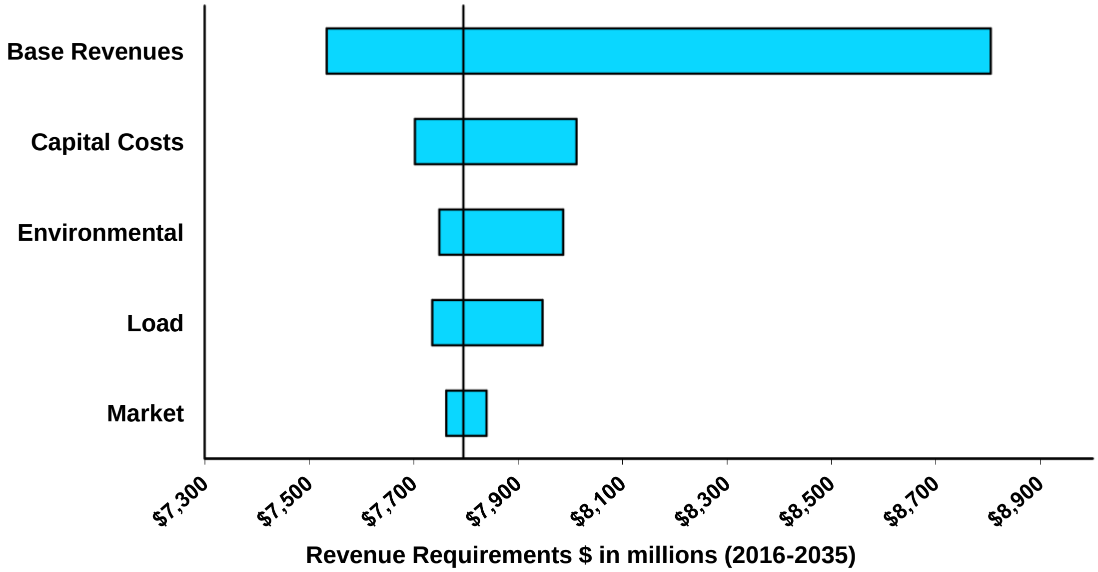


Figure 6-107 - Plan 7 (High Environmental DSM) Tornado Diagram

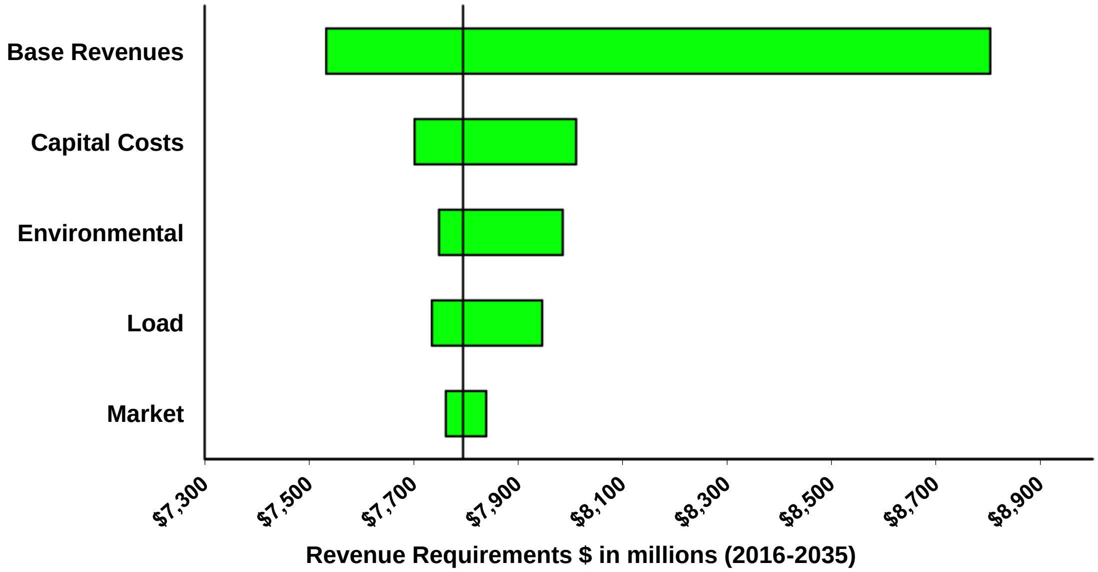


Figure 6-108 - Plan 8 (Low Environmental DSM) Tornado Diagram

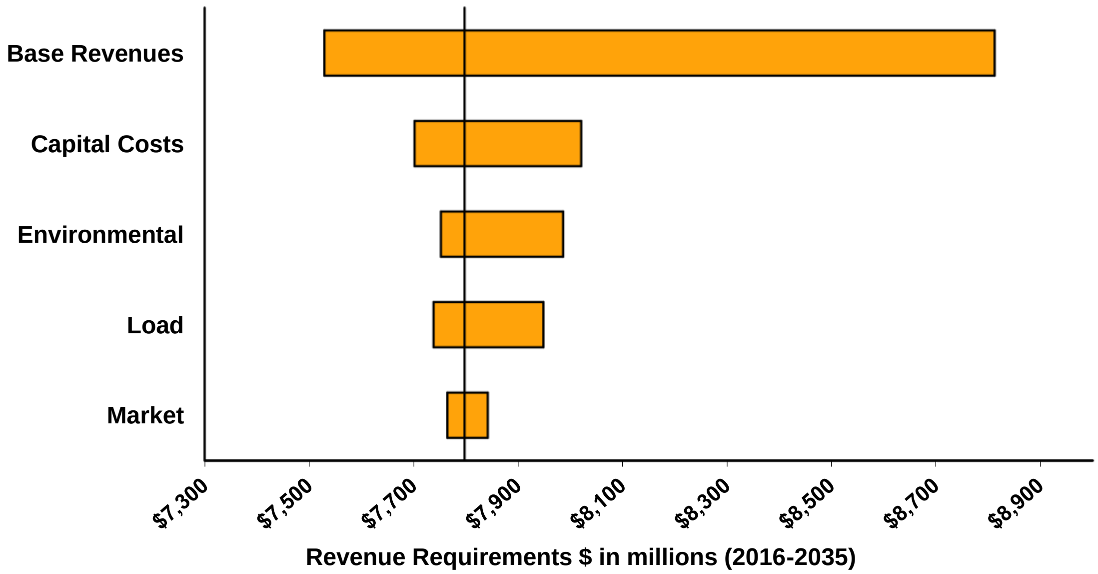


Figure 6-109 - Plan 9 (No Environmental DSM) Tornado Diagram

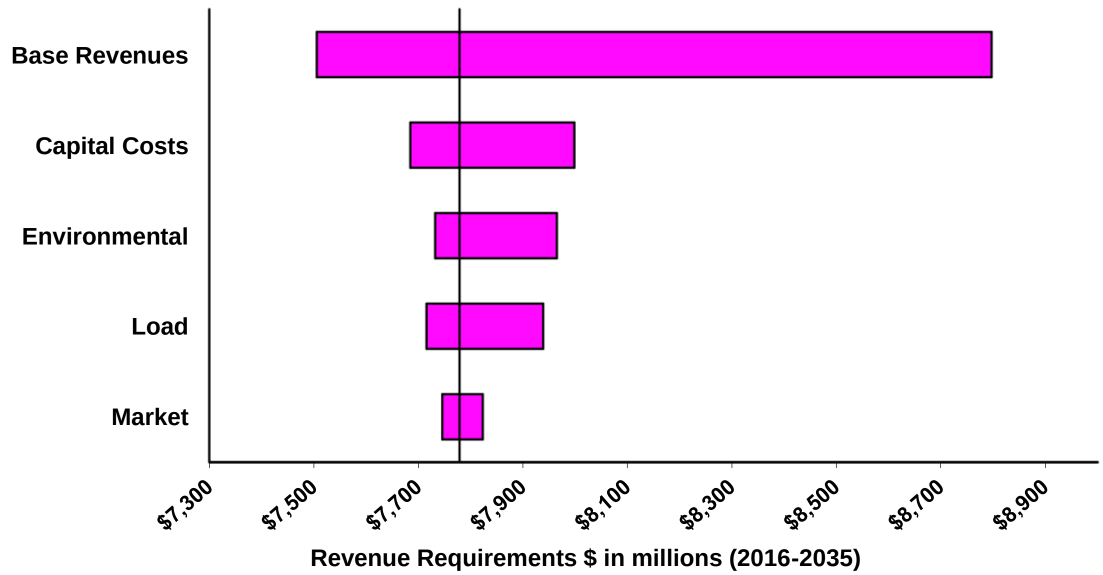


Figure 6-110 - Plan 10 (Low Load) Tornado Diagram

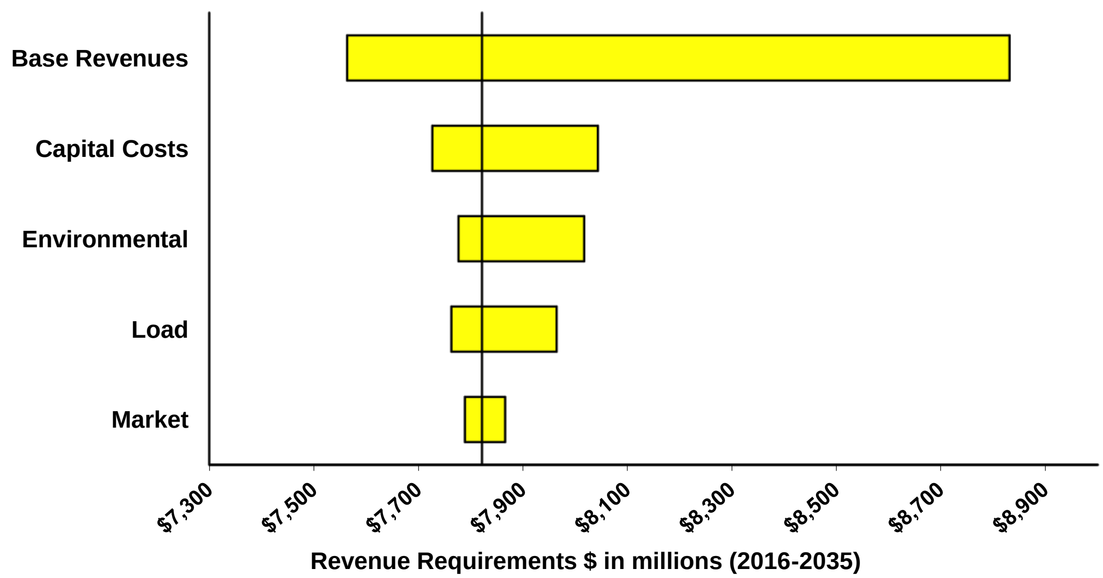


Figure 6-111 - Plan 11 (High Load) Tornado Diagram

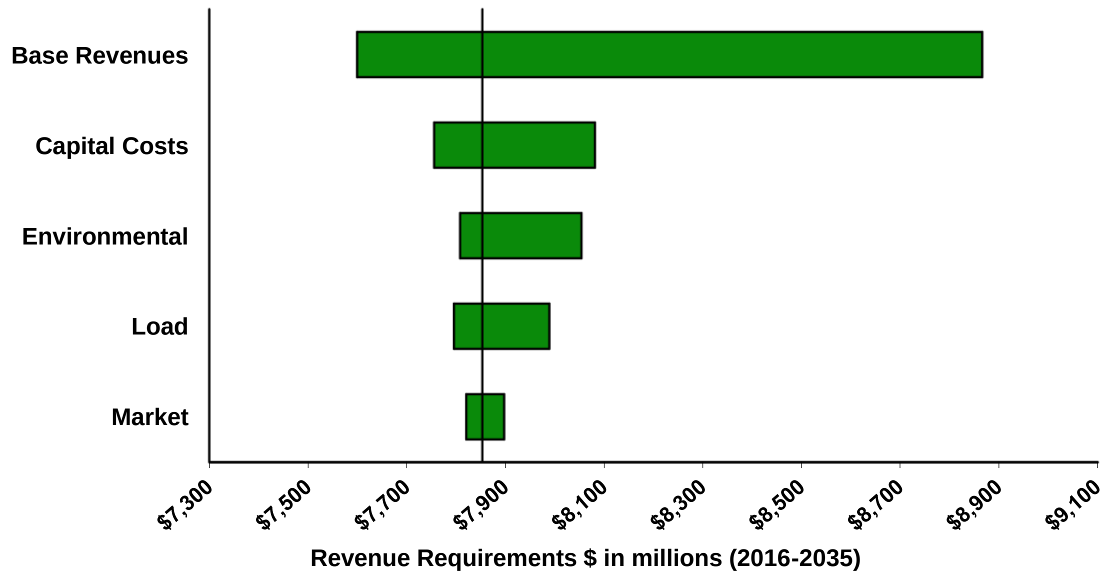


Figure 6-112 - Plan 12 (High-High Load) Tornado Diagram

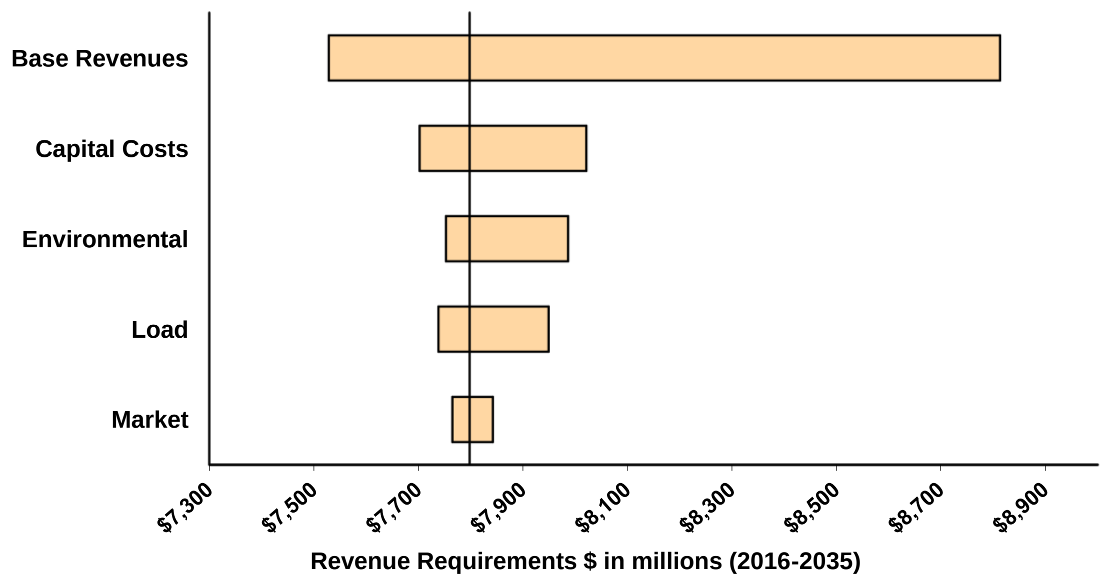


Figure 6-113 - Plan 13 (Low Fuel) Tornado Diagram

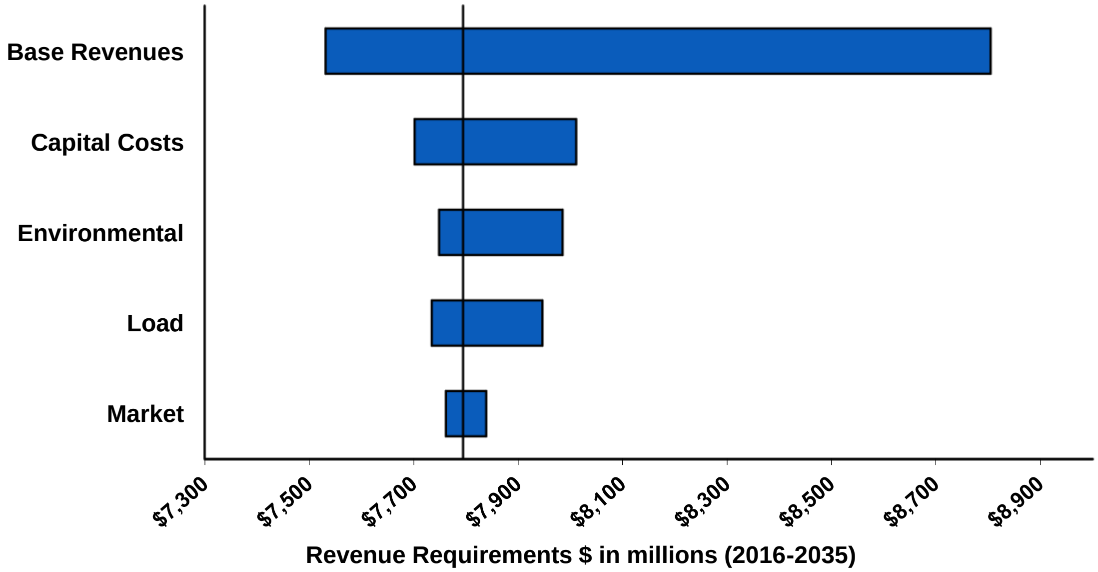


Figure 6-114 - Plan 14 (High Fuel) Tornado Diagram

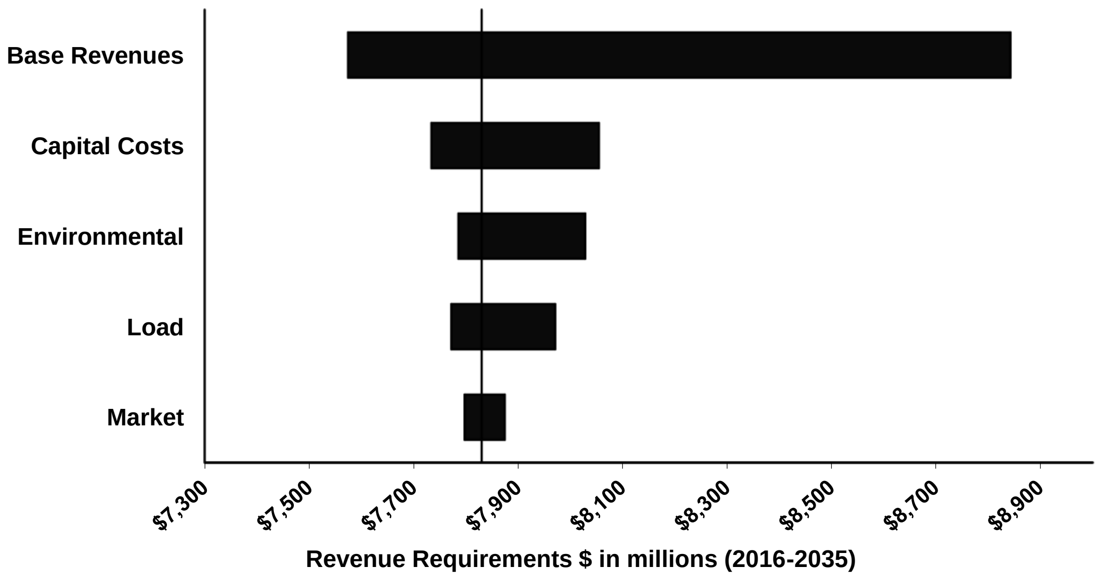


Figure 6-115 - Plan 15 (Electric Vehicle Load) Tornado Diagram

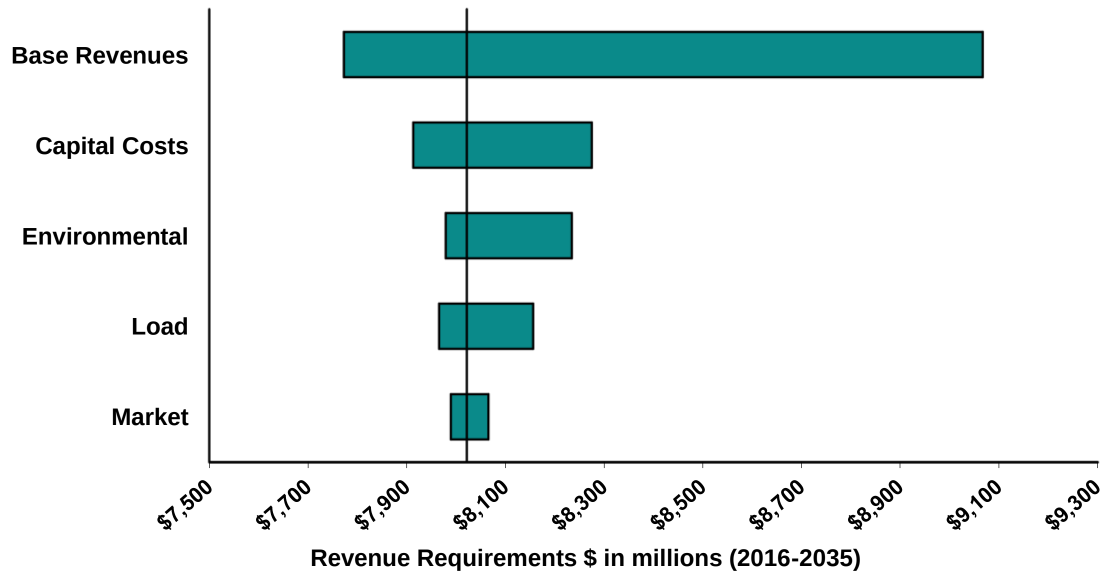


Figure 6-116 - Plan 16 (Early Asbury Retirement) Tornado Diagram

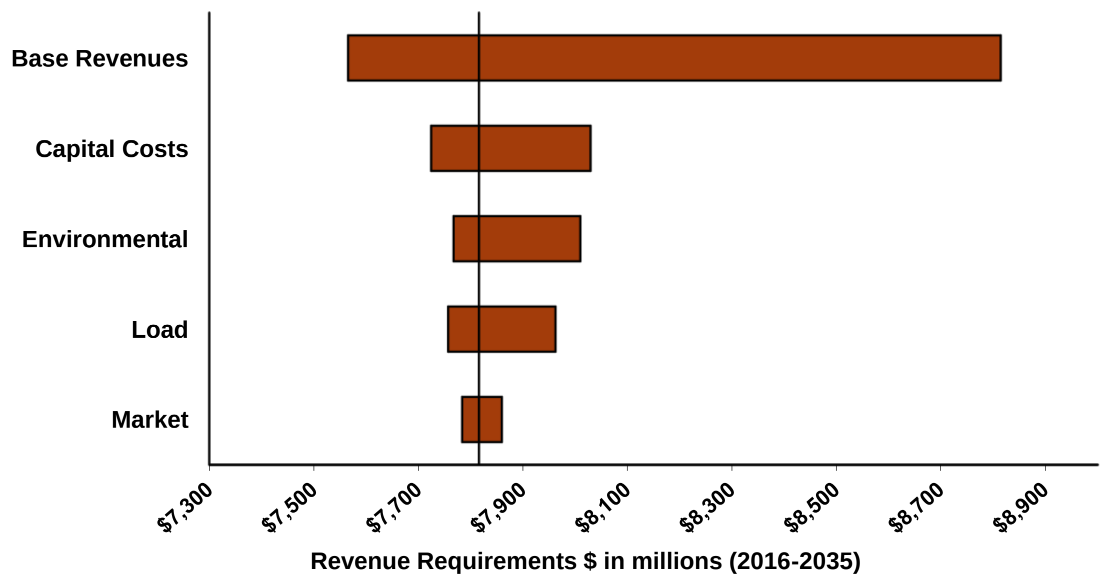


Figure 6-117 - Plan 17 (Highly Aggressive DSM) Tornado Diagram

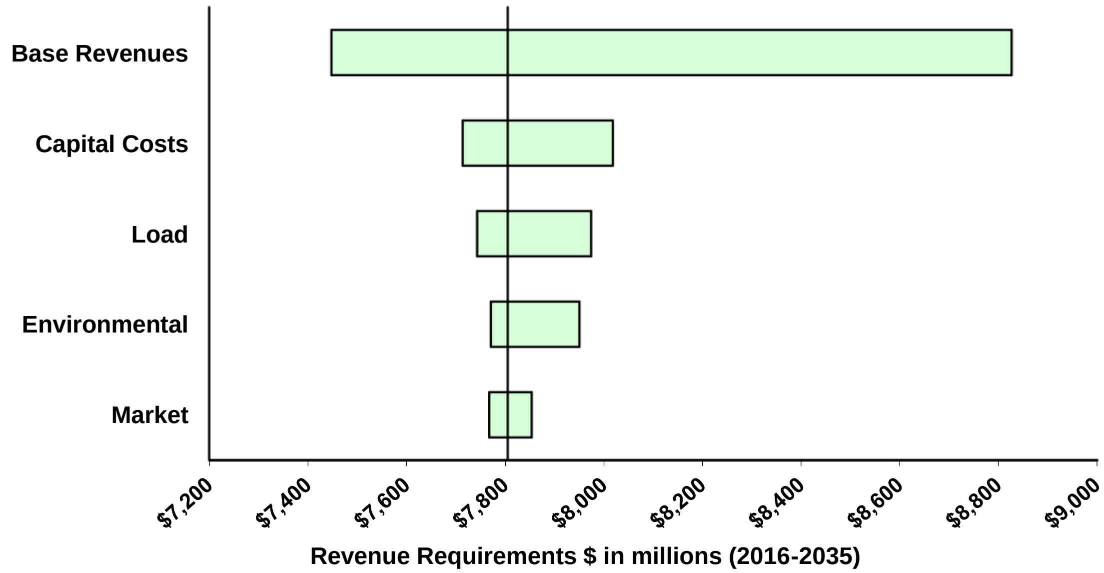


Figure 6-118 - Plan 18 (Aggressive Capacity DSM) Tornado Diagram

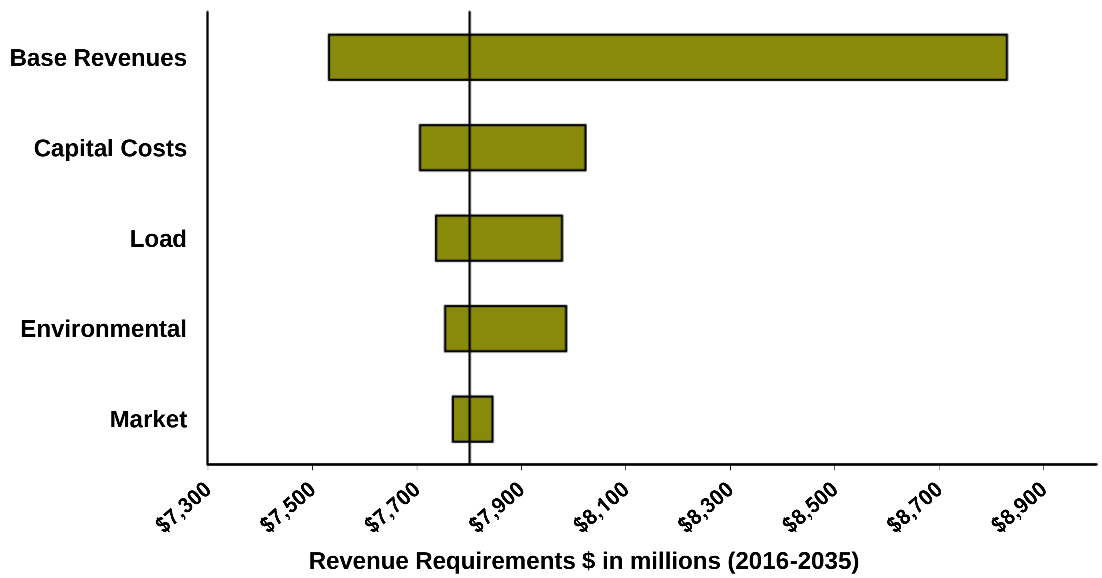


Figure 6-119 - Plan 19 (Aggressive Renewable) Tornado Diagram

Figure 6-119 adds the risk (stochastic) values for each plan to the calculated (deterministic) PVRR to present the total risk associated with each plan.

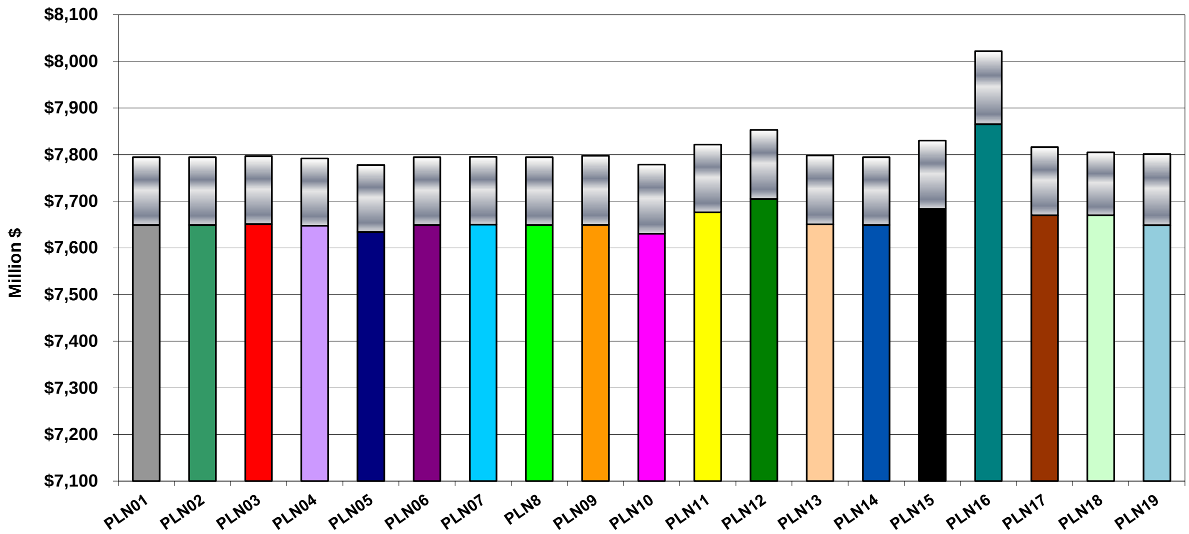


Figure 6-120 - PVRR with Risk Value for Alternative Resource Plans

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 6-120.*

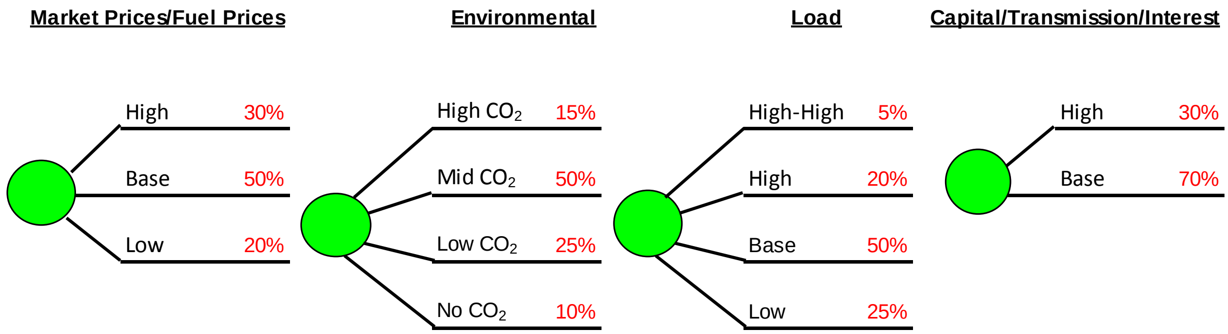


Figure 6-121 - Decision Tree Uncertainties

The decision tree represents the uncertainties considered for each plan that resulted in a total of 48 combinations or endpoints per plan or a total of 912 endpoints for all of the 19 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 performance of each resource plan is provided in *Table 6-73*.

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

Table 6-73 - Alternative Resource Plan Performance

(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 6-74 presents the standard deviation of performance measures for each of the alternative resource plans. However, certain performance measures are not influenced by risk and therefore have zero standard deviation values.

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Table 6-74 - Standard Deviation of Plan Performance Measures

Combining the uncertainty with the calculated PVRR for each plan provides a graphic comparison of the plans as shown previously in *Figure 6-119*.

(C) The utility shall provide—

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

Based on experience, Empire considered each of the critical uncertain factors to act independently. The decision tree approach determined the cumulative probability of the uncertainties considered for each plan and resulted in a total of 48 combinations or endpoints.

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

Uncertain factors were identified in Section 5 and those factors that were considered critical were described in Section 6. A common sense approach was used to examine results for impact or more literally, “what moved the meter”. Empire and ABB looked for changes in the magnitude and timing of the unconstrained resources utilized by each of the plan models, and identified the uncertain factors from variations in the results. The identified changes and their drivers were discussed with Empire’s internal IRP team. Empire presented the critical uncertain factors to the Missouri Stakeholder Group at the pre-integration meeting on November 20, 2015. During this November 20, 2015 meeting, the Stakeholder group suggested adding a high-high forecast to capture broader deviations from the high and low load forecast scenarios. Empire made this suggested change as shown in Figure 6-123.

The resulting critical uncertain factors are consistent with the two previous Empire IRP filings made in 2010 and 2013. However, Empire has updated the number of branches for each factor and their corresponding subjective probabilities specifically for this 2016 IRP.

For market/fuel prices, Empire began with the ABB high/base/low pricing forecasts. The base was subjectively set at 50 percent and the probability of higher prices was believed to be greater (30 percent) than for lower prices (20 percent). Recent low natural gas prices, due to shale gas development, are expected to have a higher likelihood of increasing than decreasing. *Figure 6-121* illustrates the probabilities selected for market/fuel prices uncertainty factor.

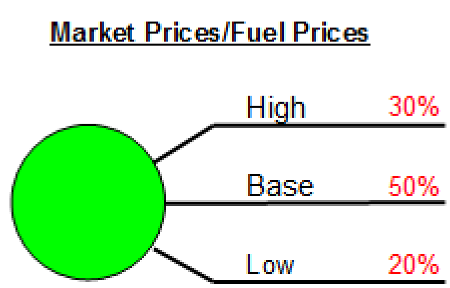

Figure 6-122 - Market Probabilities

As mentioned several times in the IRP reports, environmental uncertainty was difficult to model given the timing of this IRP filing. During the development of this IRP, the Environmental Protection Agency's (EPA) Clean Power Plan (CPP) under Section 111(d) of the Clean Air Act, moved from a proposal to a final rule to being stayed by the U.S. Supreme Court. The long-term status of the CPP and resulting state and/or regional compliance plans are still unclear at this time. While there is much uncertainty surrounding the CPP timing and potential compliance, Empire did address environmental costs in its 2016 IRP filing. Although the CPP is unclear, based upon industry knowledge and where it seems likely states may be headed with respect to each state compliance plan from preliminary meetings, Empire modeled various carbon scenarios with some sensitivity around certain key aspects of the CPP. The resulting range of environmental uncertainty and subjective probabilities modeled in this IRP are shown in Figure 6-122. Possible scenarios range from having no carbon costs during the study period to having low, mid and high levels of potential carbon costs. The mid-level, with potential carbon costs beginning in 2022, was given a probability of 50 percent and represents the base environmental assumption. All of the subjective probabilities were assigned by the Empire IRP team with input from its consultants.

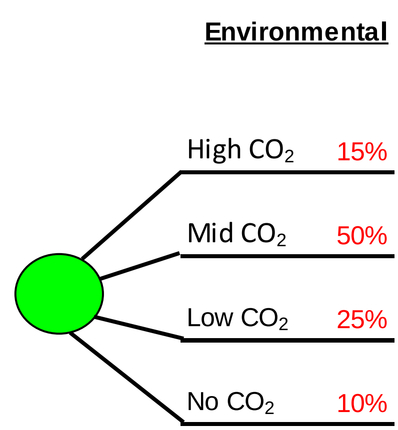

Figure 6-123 - Environmental Probabilities

Load forecast uncertainties were discussed in Section 8 of Volume 3, the technical volume dedicated to Load Analysis and Load Forecasting. *Figure 6-123* illustrates this portion of the decision 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. The high-high scenario is created as an extreme high scenario in response to stakeholder comments provided in the November 20, 2015 Stakeholder meeting. The high and low case bounds are created by increasing or decreasing the annual growth rate for each economic driver by 50%. For instance, the 2016 population base population growth is 0.411%. Increasing or decreasing the growth rate by 50% creates the high and low scenario population growth of 0.616% and 0.205%, respectively. The High-High scenario is created by increasing the System Peak forecast, per discussions with members of the stakeholder group, and back calculating net system loads based on the average load factor. The base level was given a subjective probability of 50 percent with the higher and lower forecasts equally representing the remaining probability. As mentioned, the higher forecasts were divided into a high and high-high forecast, with the more extreme high-high forecast assigned only five percent of the likelihood based on discussions with members of the stakeholder group.

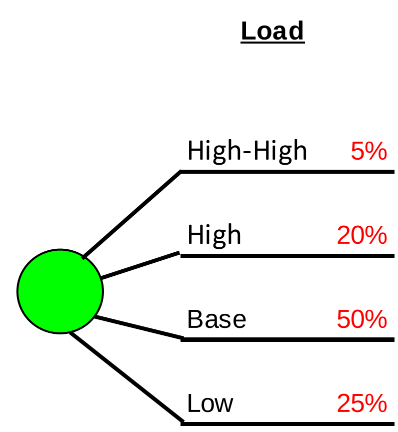

Figure 6-124 - Load Probabilities

Based on experience, capital/transmission/interest costs were combined into a single factor for analysis. Capital cost uncertainty was developed for high and base probabilities. Capital and transmission costs for all alternative resource plans were 1.2 times that of the base plan. Interest rates were increased two basis points for the high scenario and the corresponding higher return on ratebase was applied. Empire's experience with the engineer-procure-construct (EPC) contracting system for major projects has provided closer to budgeted results. This experience influenced the subjective probability weighting of 30 percent for high and 70 percent for base. *Figure 6-124* illustrates this portion of the decision tree.

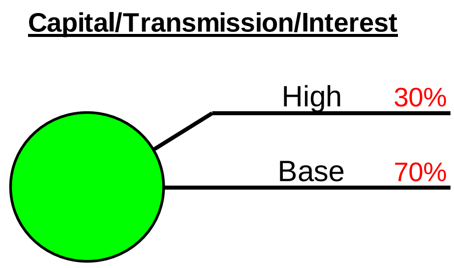

Figure 6-125 - Capital/Transmission/Interest Probabilities

7.2 Analysis of Uncertain Factors

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

The support underlying Empire's choice of ranges and probabilities for uncertain factors are provided in the ABB 2016 Integrated Resource Plan included in the Attachment.

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

Figures 6-125 through *6-128* are plots of the cumulative probability distribution of each distinct performance measure for each alternative resource plan. These plots are sometimes referred to as risk profiles.

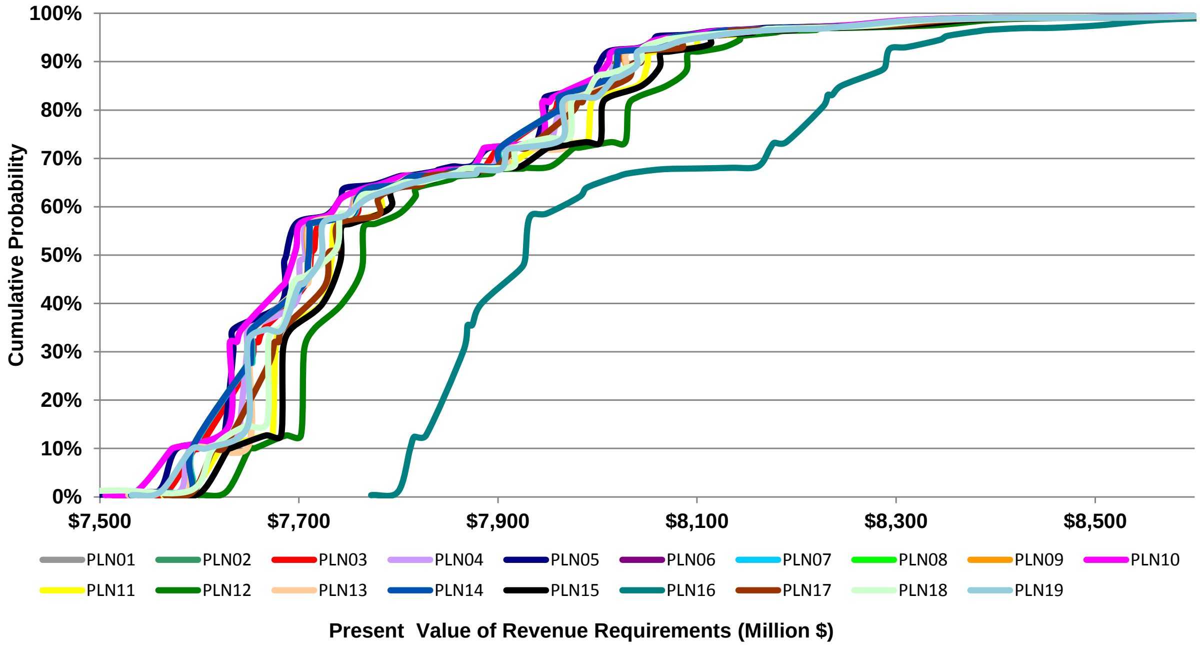

Figure 6-126 - Cumulative Probability of PVRR ($MM)

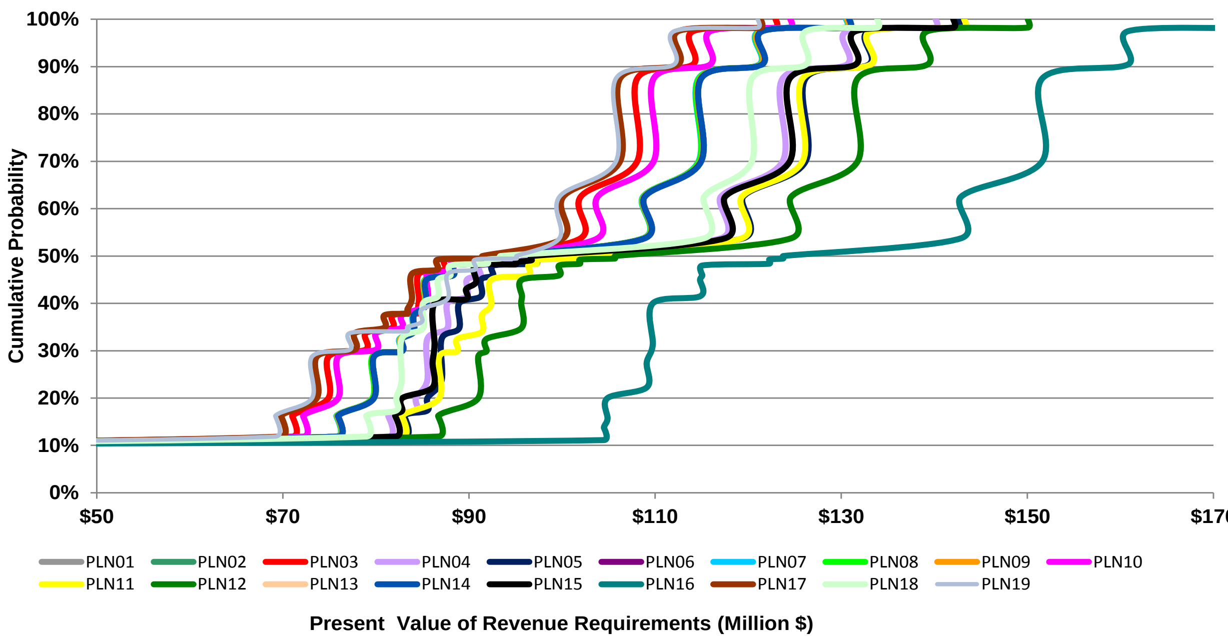

Figure 6-127 - Cumulative Probability of Probable Environmental Costs ($MM)

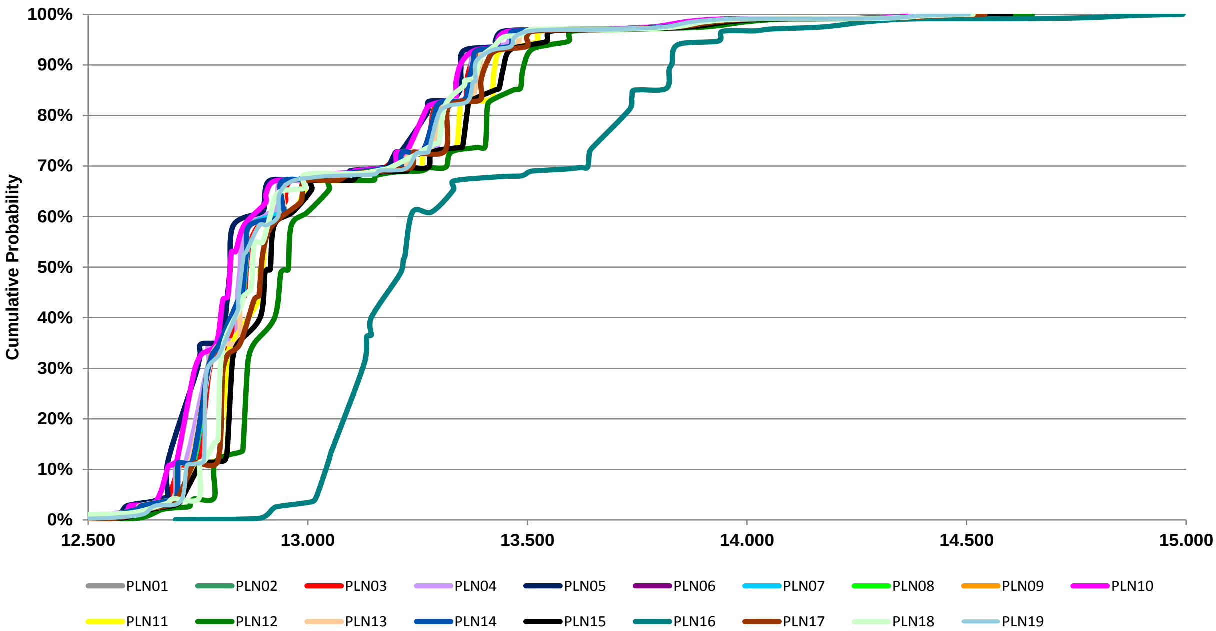

Figure 6-128 - Cumulative Probability of Average Rates (cents/kWh)

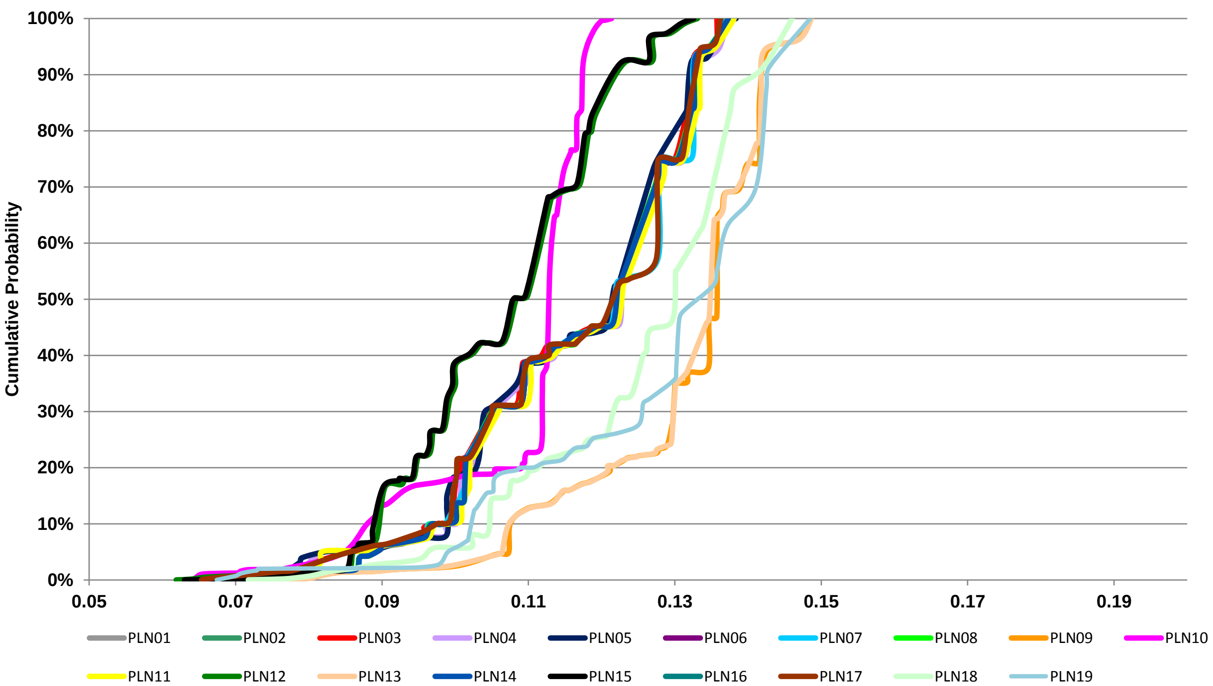

Figure 6-129 - Cumulative Probability of Rate Increases (%)

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

Table 6-71 provides the expected values of performance measures for each alternative resource plan. *Table 6-72* indicates the risk as the standard deviation of performance measure values for each alternative resource plan.

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

Table 6-75 - Expected Values of Plan Performance Measures

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

Table 6-76 - Standard Deviation of Plan Performance Measures

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.

ABB used its Strategic Planning (SP) power by MIDAS Gold chronological production cost model to perform its analysis of the various resource plans. SP performs a consecutive, hour-by-hour analysis driven by a full Monte Carlo forced outage logic which is calendar correct.

Generating units were modeled with forced outage rates to simulate their availability. Heat rates, fuel costs, fixed and variable operation and maintenance costs, scheduled maintenance outages, and emission costs were all considered in the SP model.

Future unserved hours were tracked annually in the SP simulation.

Figure 6-129 is a plot of the expected level of annual unserved hours for each alternative resource plan over the planning horizon.

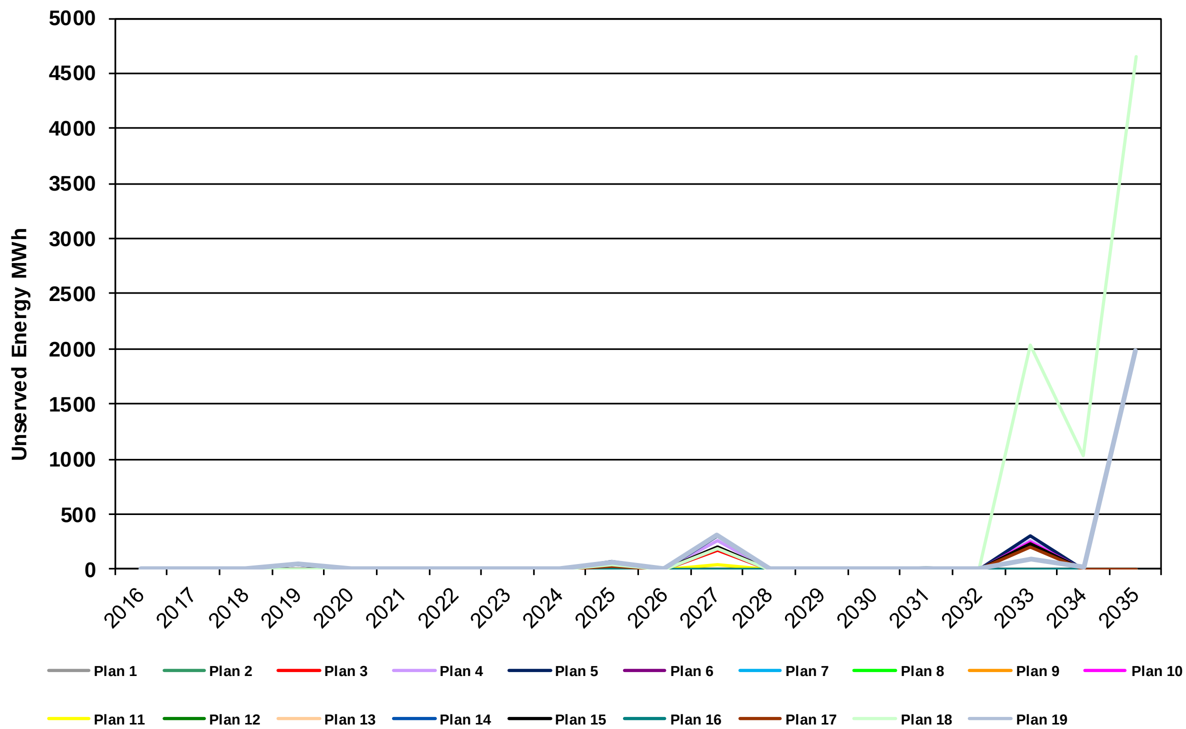

Figure 6-130 - Annual Unserved Hours for All Alternative Resource Plans

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-2016-0040, the Commission issued an order on October 28, 2015 establishing eleven (11) special contemporary planning issues for Empire to analyze and document in its 2016 triennial Integrated Resource Plan. The responses to these 11 issues (a-k) are provided below.

8.1.1 Emerging Energy Efficiency Technologies

(a) Review the impact of foreseeable emerging energy efficiency technologies throughout the 20-year planning period

Empire addressed similarly-worded Special Contemporary Issues in its 2014 and 2015 IRP Annual Updates. Empire—as well as its demand-side consultants—continues to monitor and observe trends in emerging energy efficiency technologies as a practice. Empire's response to this Special Contemporary Issue is very similar to the 2014 and 2015 annual update responses, with small changes to reflect its observations and application to the 2016 IRP.

The impacts of "foreseeable emerging energy efficiency technologies" are inherently difficult to analyze. Emerging technologies do not necessarily enter the market in a predictable manner, and the interactions between avoided costs, incremental costs, technology performance, and market acceptance are not always straightforward. Public policy also plays an important role in driving technology development, and in some cases (such as lighting) is the primary driver.

Empire filed an application for variance, approved on July 2, 2015, for 4 CSR 240-22.050 (1) (E). Per the approved variance, Empire addressed technology improvements by assessing the effect of impact and incremental cost trends on measure cost-effectiveness over the planning horizon. Empire included the effects of known improved technologies, accounting for proposed and approved changes in federal equipment standards as well as ENERGY STAR® and CEE efficiency requirements. Emerging technologies with unpredictable savings or barriers to market availability were not included.

Empire's contractor, AEG, is constantly monitoring the trends and feasibility of technologies that are available on the market as well as those expected to be on the market in the coming years (e.g., super-efficient air conditioners, cutting-edge LED lighting technologies, heat pump water heaters, heat pump clothes dryers, behavioral programs, the effects of codes and standards, etc.). AEG staff are active participants in several formalized and ongoing stakeholder processes to review, analyze, and package the latest measure assumptions for use in utility DSM programs; including the Pacific Northwest's Regional Technical Forum, the California Technical Forum, and the Illinois TRM Technical Advisory Committee. AEG's measure-development approach to potential studies (and potential study model) allow for technologies to enter program portfolios whenever they become viable and cost-effective throughout the multi-year time horizon.

AEG's definition of "emerging technology" when identifying and including specific measures in DSM potential studies is that a technology or practice is known and quantifiable, but is somewhere early on the adoption curve. While more time may be required to prove a measure's effects through evaluations, billing analysis, and other appropriate methods; if estimates of the measure parameters discussed above can be developed with sufficient quality for the purposes of resource planning, we include them in the analysis. This may mean a given emerging technology is in the labs (e.g., higher lumen-per-watt evolutions of LED lamps), common in other countries but not yet the U.S. (e.g., heat pump clothes dryers), or is being piloted by utility programs before mainstream adoption has occurred (e.g., smart, internet-enabled thermostats). This categorization frequently includes subjectivity, therefore AEG conducts a thorough review process with both the clients and external stakeholders. The measure list is distributed and discussed to ensure that all parties have been able to provide input and suggestions toward appropriately characterizing the portfolio of DSM resources.

Four DSM programs were added to the portfolio after 2019 as measures and programs become cost-effective. These programs include measures that may be considered emerging technology (for example, smart meters).

- Strategic Energy Management (2031-2035). The program is a systematic approach to delivering persistent energy savings to organizations by integrating energy management into regular business practices. Companies will be placed into groups that work alongside each other for one year or longer, coming together in periodic workshops. The group setting enhances participant action as they strive to perform in front of their peers. Structured groups are composed of 5 to 12 participants that are often located in the same geographical area, sharing best practices and learning together. The group is typically filled with participants from non-competing industries; however, upon mutual agreement, competitors may participate in the same group.

- Residential Demand Load Control (2021-2035). The program entails control of eligible cooling units for the summer peak season, space heating units for the winter peak season and electric water heaters for the summer and winter peak seasons. A switch is placed on the customer's equipment. During a peak event, a signal is sent to the switch and the equipment is cycled on/off to reduce consumption.

- Curtailment Agreement (2029-2035). Participating customers agree to reduce their demand by a specific amount or curtail their consumption to a pre-specified level. In return, they receive a fixed incentive payment in the form of capacity credits or reservation payments. Customers are paid to be on call even though actual load curtailments may not occur. The amount of the capacity payment varies with the load commitment and the length of the contract. Penalties may be assessed for under-performance or non-performance. Events may be called on a day-of or day-ahead basis as conditions warrant. This option is typically delivered by third party load aggregators and is most attractive for customers with maximum demand greater than 100 kW with flexible operations.

8.1.2 Emerging Storage Technologies

(b) Review the impact of foreseeable emerging energy storage technologies throughout the 20-year planning period

Empire addressed this special contemporary issue in its 2015 Annual Update. As noted in the 2015 Annual Update, storage technologies are "dispatchable" resources that may be used to manage customer or utility load profiles, provide critical back-up power, or provide storage for intermittent renewable resources. Large scale, stationary applications of storage technologies are limited by the high costs of the available technologies. In the near term, stationary applications on the utility system or at customer sites are expected to be limited to conventional battery storage for back-up and emergency power where the loss of power would result in very high security or safety risk or very high economic losses. Such applications may include data centers and emergency operations facilities. Even in these cases, storage is used only for short time periods until emergency generators are available.

Battery Storage was a supply-side candidate for this IRP, but it did not appear in any of the IRP's 19 resource plans (please refer to IRP Volume 4, Section 5.2.14 for a description and modeling assumptions).

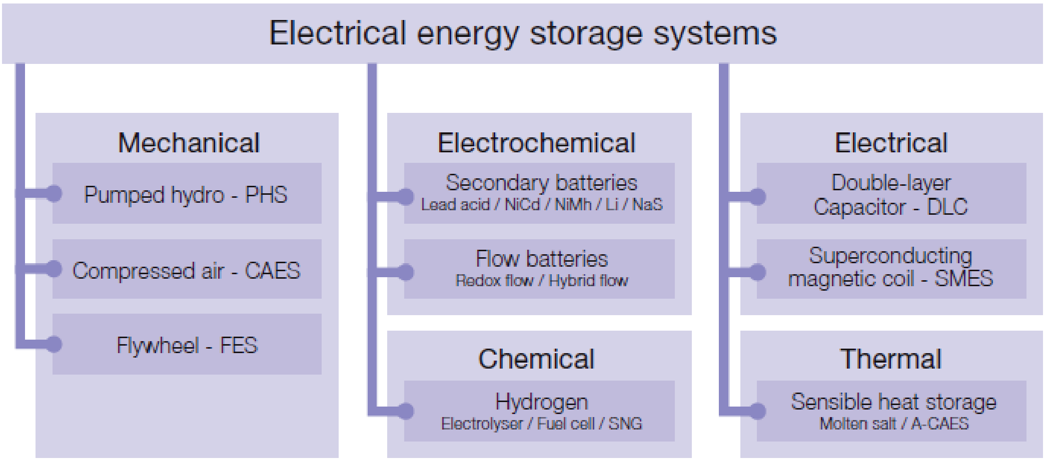

Figure 6-131 – Electric Energy Storage Systems

The most important factors for the broader application of storage technologies are technology maturity and cost. As shown in *Figure 6-132*, only pumped storage hydropower is commercially available today. However, there are a number of technologies in the demonstration and deployment cycle.

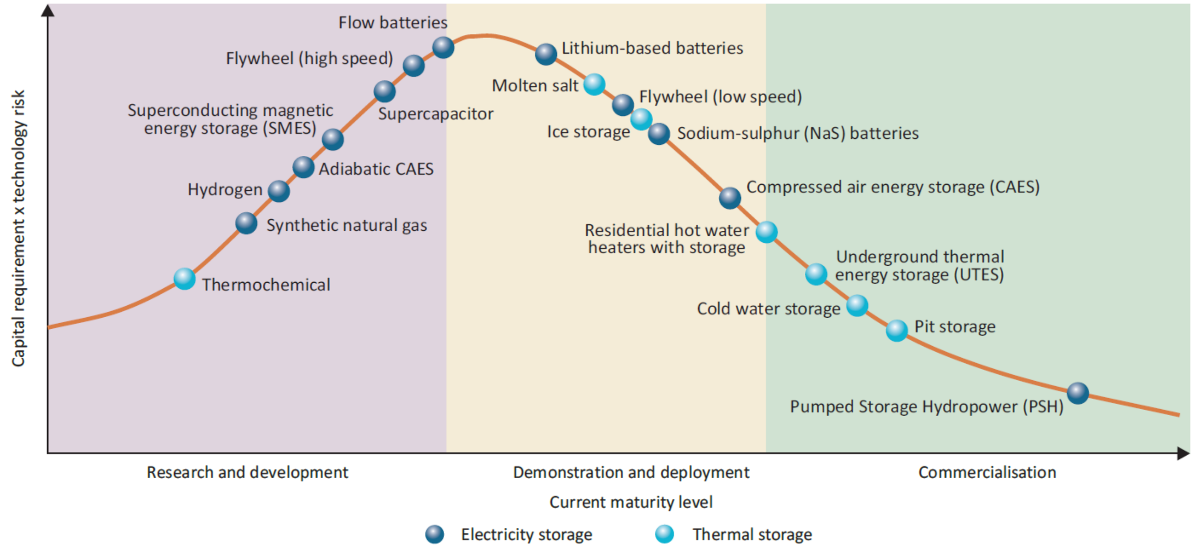

Figure 6-132 – Maturity of Energy Storage Technologies

In recent years, lithium-based batteries have shown rapid decreases in cost, and customer-sited systems are approaching break-even points in regions of the country where electricity costs are the highest (e.g., Hawaii and California). Nonetheless, even these markets still cannot be considered mature, and opportunities in Empire's low-cost service territory are very limited. A potentially important interaction between utilities and customer-owned storage may emerge in the transportation sector with electric vehicles. "Vehicle-to-grid" technologies are currently under development and being tested to understand how electric vehicles may provide accessible storage for utility operations (spinning reserve, renewable energy storage, etc.). However, the introduction of this technology is highly unpredictable due to the effects of oil prices on consumer demand for electric vehicles and consumer acceptance of the technology.

8.1.3 Coal-fired Unit Future Capital and Operating Costs

(c) Analyze and document the future capital and operating costs faced by each Empire coal-fired generating unit in order to comply with the following environmental standards:

> ***(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) Clean Air Interstate Rule;
(6) Mercury and Air Toxics Standards;
(7) Clean Water Act Section 316(b) Cooling Water Intake Standards;
(8) Clean Water Act Steam Electric Effluent Limitation Guidelines;
(9) Coal Combustion Waste rules;
(10) Clean Air Act Section 111(d) Greenhouse Gas standards for existing sources;
(11) Clean Air Act Regional Haze requirements; and
(12) Clean Power Plan.

This is a repeat issue from the 2014 and 2015 Annual Update. In 2014, Empire sought clarification regarding this issue. The issue requires Empire to analyze and document the future capital and operating costs faced by each Empire coal-fired generating unit to comply with several different environmental standards. Empire asked whether the Commission is requiring it to document the cost to comply with each of the environmental standards separately. Empire explained that all of its air quality control system (AQCS) projects are designed to satisfy multiple environmental standards at once. The Commission clarified as follows: "The Commission is interested in the cost associated with compliance by each coal-fired generating unit with the eleven environmental standards in total. Empire does not need to separately breakdown the cost to comply with each of the eleven environmental standards." Based on that guidance, Empire has updated its response from past filings as follows:

In December 2014 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 Empire to comply with the Mercury and Air Toxics Standard (MATS). Final cost of the project was $112.1 million, excluding AFUDC.

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, with the AQCS project operating costs are expected to be approximately **____________** annually in addition to the approximately $1.2 million that will be spent annually to operate and maintain the selective catalytic reduction (SCR) system previously installed. Asbury is also constructing a landfill for its ash and scrubber byproduct at a cost of approximately **_____. _______**. The eventual closure and ongoing post-closure costs of this landfill are expected to be around $9.1 million (2015 dollar value), while operating costs are expected to be **________** (in addition to the **____________** included for ash and byproduct handling included in the Asbury AQCS operating costs above) during active operation. With the addition of the new CCR landfill the existing impoundments will be closed in place. Asbury has budgeted $3.7 million for the impoundment closure. In addition, Asbury has budgeted approximately **_________** for future conversion to a dry bottom ash conveyance system.

Riverton Units 7 and 8 (formerly coal units) were transitioned to natural gas only operation in September 2012 prior to their eventual retirements. Riverton Unit 7 was retired from service in June 2014, and Units 8 and 9 were retired from service June 2015. The decommissioning of the three retired units are tentatively scheduled for the 2017 timeframe, after the completion of the Riverton Unit 12 combined cycle conversion in mid-2016. Although the Riverton Unit 12 combined cycle conversion is a natural gas-fired project, it is included in this discussion because it is being undertaken to replace coal-fired capacity whose retirements were accelerated due to environmental regulations. The conversion of the existing Unit 12 to a combined cycle operation is expected to cost $165 to $175 million (without AFUDC), which includes approximately $12 million for construction of a cooling tower and 316(b)-compliant river water intake. Operating costs for the SCR on the combined cycle unit are expected to be approximately $95,000 annually. Costs associated with the retirement of Riverton Units 7, 8 and 9 include approximately $1.43 million that was spent to close the existing ash landfill and approximately **_________** for the environmental remediation and demolition of the units. Operating costs for the landfill post-closure are forecast to be approximately **________** per year.

On 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 $415,000 in 2015. There is also the infrequent need to construct a new landfill cell – the last cell constructed cost approximately $290,000.

On Empire's 12% ownership share of the two units at the Iatan Station, annual operating costs for the air quality control system were approximately $302,000 for the consumables used, and an O&M cost of approximately $2.57/MWh for compliance with CWA 316(a)/Cooling Towers. There will also be the need to construct additional landfill cells in the future and ash conversion projects to comply with the ELG and CCR rules with an approximate cost to Empire of $9 million. Ongoing capital projects needed for compliance for the CWA 316(a) rules have an estimated cost to Empire of $19 million dollars.

In response to the Clean Power Plan (CPP), Empire is still waiting for the states to submit their implementation plans; due September 2016 (Empire files this IRP on April 1, 2016). Empire has modeled multiple scenarios in the IRP to respond to CPP and other scenarios. At this time there is only speculation on how CPP compliance will be approached by the states, therefore, model results to be submitted are suppositious. Until more information is known, it is impossible to forecast capital and additional O&M expenses associated with CPP. Empire's ultimate compliance approach would be based upon whatever alternative is most economical for customers.

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 the retirement of any existing Empire coal-fired generating unit in the time period established in the IRP process.

This twenty-year IRP covers the period 2016-2035. For this study, Empire had to make retirement assumptions for IRP purposes. It was assumed that the Asbury coal-fired unit would retire in 2035, the final year of the planning horizon, for IRP purposes. One alternate plan (Plan 16) was a "what-if" scenario that examined an earlier retirement date for the Asbury unit in 2022. Since the *assumed* Asbury retirement occurs near the end of the planning horizon, not enough information was available to determine any transmission upgrades as a result of this retirement. No additional transmission upgrade costs were included for the assumed Asbury retirement in this IRP. Empire will continue to consider this issue in its planning models as more details become available.

8.1.5 Impacts of Distributed Generation

> ***(e) Analyze and document the range of potential levels of distributed generation in Empire's service territory for the 20-year planning horizon and the potential impacts of each identified level of distributed generation, and in particular distributed solar generation, on Empire's preferred resource plan. The potential impacts should quantify both the amount of electrical energy the distributed generation is expected to provide to the grid and the amount of electrical energy that the distributed generation customers are expected to consume on site that will offset the amount that the company would normally provide to those customers.***

Empire has made an estimate of the impact of distributed generation, particularly solar, for the 20-year planning horizon (2016-2035) considered in the 2016 IRP. Since the adoption of the Missouri renewable energy standard (RES) until early 2015, Empire had an exemption from the 2% solar requirement of the Missouri RES. On February 10, 2015 the Missouri Supreme Court overruled the solar rebate exemption that was extended to Empire in 2008. Empire's solar rebate tariffs were approved in mid-May 2015 and the first rebates were paid to customers in early June 2015. Prior to the rebate period, Empire had about 37 customer-sited solar photovoltaic (PV) systems in its Missouri service territory and four other solar customers located in other states. At that time, the total installed capacity was about 259.6 kW with an estimated annual energy output of about 340,000 to 387,000 kWh, representing about 0.008 to 0.009% of Missouri retail sales. At the end of 2015, following about six months of paying solar rebates, Empire had about 236 Missouri solar PV customers, representing about 2.6 MW of nameplate capacity with an estimated annual energy output of about 3,400 to 3,870 MWh or about 0.08 to 0.09% of Missouri retail sales. Additionally, at the end of 2015, there were several Missouri solar rebate applicants still in the processing queue. In order to qualify for the rebate level in which they applied, these customers must have their systems operational by June 30, 2016. Therefore, there could be a significant increase in new customer-sited solar PV by the end of June 2016.

When making an estimate of solar's impact on the planning process, the solar incentive levels are a very important factor. In mid-December 2015, the Federal government approved the extension of the 30% solar investment tax credit (ITC) through year 2019. Based on this extension, Empire utilized the solar ITC assumptions of 30% for 2016 through 2019, 26% in 2020, 22% in 2021 and 10% from 2022 through the end of the study period. In addition to the Federal tax incentive, the Empire solar rebate level was an important consideration. Solar rebates are based on a declining rate per watt as shown in the table below. At the time estimates were determined, it was assumed that the declining incentive rate would negatively impact customer participation, which appears to be a valid assumption. Since the time the rebate per watt dropped from $1.00 to $0.50, customer solar applications have slowed considerably.

Application Received on or before December 31st of the Year *	Operation Status Achieved on or before June 30th of the Year	Rebate Rate per Watt
2015	2014	$2.00
2015	2015	$1.50
2015	2016	$1.00
2016-2018	2017-2019	$0.50
2019	2020	$0.25
* Empire started the rebate program in mid-May 2015, but customers may have installed solar PV before that time		

Table 6-77 – Empire Solar Rebate Program

The solar coincident peak and energy impact on the 2016 IRP process was accomplished by a reduction to the demand and energy forecasts. Empire developed the solar forecast through year 2020, the timeframe that Empire's rebate program would be active and Federal incentives are assumed to be decreasing. The period following the rebate program—from 2021 through the end of the study period in 2035—the statistically adjusted end-use (SAE) load forecasting method treated non-incentivized solar PV as an end-use with saturation levels derived from the 2015 EIA Annual Energy Outlook developed by Itron for the West North Central region. Additionally, demand-side solar projects were a demand-side candidate resource screened in the IRP demand-side analysis. However, a customer solar demand-side management (DSM) program was not selected as a cost-effective option by the IRP modeling.

Empire estimated that there would be about 1,000 solar customers by the end of year 2020 as shown in *Table 6-78.*

Year	NEW Customers at End of Period			CUMULATIVE Customers		
	Residential	Non-Res	Total	Residential	Non-Res	Total
2015	255	45	300	255	45	300
2016	184	46	230	439	91	530
2017	135	45	180	574	136	710
2018	84	56	140	658	192	850
2019	50	50	100	708	242	950
2020	22	28	50	730	270	1000
TOTAL	730	270	1000			

Table 6-78 – 2016 IRP Assumed Distributed Generation Solar Customers

The estimated impact on system peak and energy is outlined in *Table 6-79*.

Year	Summer Peak	Winter Peak	Annual NSI (MWh)
2015	3.47	0.37	5442
2016	4.63	0.49	7258
2017	6.76	0.71	10,590
2018	8.62	0.91	13,509
2019	10.22	1.08	16,018
2020	11.30	1.19	17,706

Table 6-79 – 2016 IRP Assumed Solar Impact on Load

Table 6-80 illustrates the current Missouri RES requirement. It is based on a percentage of a utility's Missouri retail sales. The 2% required solar portion, if applied to Empire's Missouri retail sales, would be a 0.1% annual requirement from 2015-2017; a 0.2% annual requirement from 2018-2020; and a 0.3% annual requirement from 2021 onward. In terms of MWh of energy, this would be roughly 4,100 annual MWh from 2015-2017; about 8,300 annual MWh from 2018-2020; and approximately 12,600 annual MWh from 2021 onward adjusted for future growth.

Dates	RES Energy (no less than)
2011-2013	2%
2014-2017	5%
2018-2020	10%
Beginning in 2021	15%
Two (2) percent of the energy requirement from solar	

Table 6-80 – Missouri Renewable Energy Standard

Based on the 2016 IRP assumptions, Empire would meet the 2% RES energy requirement from solar during the entire study period from the rebates paid to customers. It is difficult to estimate the number of customers that will actually install solar PV systems in the future as well as the associated peak and energy impacts of these systems. Estimates will need to be refined as additional information becomes available.

Another type of distributed generation is customer-sited small wind turbines. Currently Empire has only about ten net-metered wind customers. This number has remained relatively static, and no adjustments to the 2016 IRP load forecasts were made for these resources.

8.1.6 Customer Financing for Energy Efficiency Measures

(f) Review the options available to Empire for providing customer financing for energy efficiency measures. Discuss Empire's current, near term (next three years) and long-term activities and plans for providing customer financing for energy efficiency measures.

There are multiple customer financing options for energy efficiency measures/programs. Three common financing options include:

- On-bill financing. The utility provides the customer capital and services the loan. Customer loan payments are collected on the utility bill.
- Utility financing. The utility provides the customer capital and services the loan. Customer loan payments are collected separately from the utility bill.
- Third-party financing. A third-party provides the customer capital and services the loan. The utility may negotiate the customer interest rate or buy-down a portion of the interest rate. Customer loan payments are made directly to the lender. This arrangement eliminates extra costs that the utility would incur from administering the loans.

Empire is currently not offering customer financing to its electric customers, and does not anticipate offering financing for energy efficiency measures for its Missouri electric customers in the near term. The proposed DSM programs did not incorporate financing options for Empire's Missouri electric customers. However, that does not preclude implementation contractors from proposing third-party financing to Empire.

Empire participated in Stakeholder discussions for the creation of the Missouri Comprehensive State Energy Plan ("MCSEP") and submitted comments on drafts. One of the proposed recommendations of the first draft of the MCSEP was:

The Plan could recommend and standardize a process to allow customers to finance energy efficiency and renewable energy improvements through a loan on their utility bill, with appropriate consumer protections.

When asked to comment on the draft version of the MCSEP, Empire submitted the following language:

Utilities are not equipped nor qualified to be a lending institution. Empire does not believe it appropriate for utility shareholders or customers to bear the additional financial burden associated with the new staff, computer infrastructure and paperwork required to process loans, nor the cost of money and loan defaults.

In Arkansas, Empire is a member of the Parties Working Collaboratively ("PWC"), a stakeholder group comprised of energy efficiency personnel from investor-owned utilities, environmental advocates, state agencies, community agencies, and regulators. Order No. 7 in Arkansas Public Service Commission ("APSC") Docket No. 13-002-U directed the PWC, among other things, to submit a proposal:

"for the provision of a financing mechanism or mechanisms by utilities, or the facilitation of a financing mechanism or mechanisms through non-utility parties that allow customers to finance any measures with significant costs that go beyond initial no-cost measures and to thereby implement multiple cost-effective measures, in effect allowing the customer to implement a multiple measure, cost-effective energy plan to substantially reduce whole-house energy use."

During the subsequent discussions, the utilities in the PWC unanimously expressed the preference to avoid an on-bill financing model. The PWC developed a report called "An Assessment of Financing Program Strategies for the Arkansas Residential Market," which was filed on September 30, 2015 in Docket 13-002-U. The study detailed some of the components, options, and challenges of a wide range of financing options that could be or are currently available for financing of energy efficiency measures in Arkansas and nationwide. The Study led to the following conclusions:

- *There are a variety of strategies to deliver energy efficiency financing solutions to residential customers. However few of these programs are offered directly by utilities.*
- *Residential financing programs are complicated to administer and deliver. Therefore, most energy efficiency organizations rely on third-party administrators to offer these programs.*

PWC's first recommendation was that, "The Commission should consider directing the PWC to issue an RFP for development of a self-sustaining financing program."

As a significant party in the stakeholder discussions for MCSEP and the PWC, among other utility stakeholder groups, Empire has been party to many discussions regarding the merits, mechanics, and feasibility of utility on-bill financing. In general, from Empire's experience, many investor-owned utilities are either hesitant toward or opposed to the concept of a utility expanding its current role to include financier, or even being a customer's primary liaison to a financier. In its many discussions with peer utilities and other non-utility stakeholders on the topic, Empire has heard a wide range of arguments against on-bill financing and utility financing. Overall, utilities see the mechanics of such a program as complicated and potentially troublesome. There are many, of which the following list only includes a few of the most common.

- Management of Bad Debt – In a way, by billing customers only after its services have been rendered and its product has been used, a utility is already at risk for customer default and bad debt, and must devote resources to the collection and/or write-off of such debt when customers missed, late, partial, or defaulted payments and arrears. These are inevitable costs of doing business for a utility, but the frequency, severity, and values of customer non-payment could directly or indirectly effect customer rates. If a utility was forced by rule or law to finance energy efficiency measures and/or improvements, it is plausible that it would only increase the risk of bad debt that a utility already has, which could negatively impact utility-customer relations and/or customer rates.
- Collection/Repossession - Most lenders have some recourse for collection of unpaid debt through repossession (i.e., foreclosure of a home or repossession of a car). If a utility finances energy efficiency improvements to the physical structure of a home or business, or finances the purchase of energy-efficient equipment, there is not an obvious solution to how a utility would go about collection or repossession. Even if a solution could be approached, its effect on customer-utility relations and/or a utility's public image and perception is much more likely to be negative than positive.
- Voluntary Disconnection of Service – If a customer moves off of Empire's service, or for any reason voluntarily disconnects its service, it is unclear how or if the on-bill financing of an energy efficiency measure would continue to the original customer or transfer to a new resident/customer.
- Disconnect for Non-Pay – The complicated nature of a utility's atypical means and ability to repossess products/services or collect collateral combines with the complications surrounding disconnection of service—as discussed in the previous two sections—when a customer is disconnected for non-pay ("DNP"). For example, in the event that a customer only paid a portion of its bill in a given month, an on-bill financing mechanism would have to clearly and explicitly define for both parties how and to which debt (usage arrears or financing arrears) a payment would be applied. Partial payments of monthly bills by utility customers are not at all uncommon and under some conditions can result in a DNP if the arrearage grows larger than a utility deems reasonable. If a customer was in arrears on both their monthly on-bill financing item and normal usage-related charges, and made a partial payment that was enough to catch up one of the two in full, but not enough to prevent both from becoming eligible for default, would the financing or the usage take priority? In either case, there would be potential for a complicated situa-

tion in which the utility must either disconnect a customer's service, or proceed to whichever course was in place for default on the financing item. This hypothetical situation is quite plausible, and is one of multiple complicated situations that could arise when a customer defaults on payment of a loan from the utility and/or receives a DNP.

- Utility as Liaison to Financier – Even in a third-party financing situation (described above) in which the utility was neither the lender nor the collector, the utility could very plausibly be thrust into a role as liaison, or even mediator, between its customer and a third-party lender. Empire, like most utilities in some way, has a Mission Statement which includes a commitment to "effectively meet our customers' expectations." A utility's potential to be expected to choose a side or mediate in disputes between customer and lender (both of which a utility would theoretically have a business relationship with and/or an ethical mission/obligation to serve) puts it in an unenviable position. It's also not entirely clear why a utility would need to be involved in third-party financing at all, as there are already many options for third-party lending mechanisms for customers interested in financing home improvements and/or energy efficiency improvements.

8.1.7 Compliance with the Clean Power Plan

(g) Describe how the preferred plan of the Company's last and current annual or triennial Integrated Resource Plans (IRPs) positions the utility for full or partial compliance with the U.S. Environmental Protection Agency's (EPA) Clean Power Plan (CPP) under Section 111(d) of the Clean Air Act, as released in final form on August 3, 2015. Please include in this regard:

> ***(1). An evaluation of how renewable energy, energy efficiency and other demand-side resources (including combined heat and power) deployed by the Company after January 1, 2013 could contribute to compliance;***
> ***(2). An evaluation of how renewable energy and energy efficiency and other demand-side resources (including combined heat and power) deployed by the Company after the submission of a final State Implementation Plan could qualify under EPA's proposed Clean Energy Investment Program (CEIP);***
> ***(3). A description of additional investments (in fiscal, capacity, and energy terms by year) which will be required by the Company to meet the targets in the CPP under scenarios including: a statewide rate-based or mass-based emissions goal; a "trading-ready" approach; and participation in the CEIP;***
> ***(4). The barriers to achieving these additional investments;***
> ***(5). The price of carbon used by the Company in the analyses above; and***
> ***(6). An indication of the Company's preferences regarding various compliance options under a state implementation plan.***

The timing of Empire's 2016 IRP makes it difficult if not impossible to adequately address all aspects of this special contemporary issue related to the U.S. Environmental Protection

Agency's (EPA) Clean Power Plan (CPP) under Section 111(d) of the Clean Air Act. The EPA proposal was introduced in June 2014 and the pre-published final version was unveiled on August 3, 2015 after Empire's IRP process was underway. Empire has attended CPP meetings in each of the states that it serves. However, at this time there are no state approved implementation plans in the states that Empire serves. Environmental uncertainty was discussed during Empire's pre-integration meeting with Missouri Stakeholders on November 20, 2015. During the November 20, 2015 Stakeholder discussions, it was agreed that CPP state and/or regional compliance plans are currently unknown, but to move forward Empire would need to make assumptions about the future to continue with the development of the 2016 IRP in order to meet its April 2016 IRP filing deadline. The annual update process and future triennial compliance filings could then be utilized to update environmental analyses as new information becomes known. Further, following the pre-integration meeting, on February 9, 2016, just months before Empire's 2016 IRP filing date, the U.S. Supreme Court issued a stay of the CPP in a 5-4 decision. Contributing to the uncertainty, the court's decision does not overturn the CPP, nor decide the legal merits of the challenges brought against the U.S. EPA for issuing the CPP. Rather, the court's decision stalls the implementation of the CPP while lawsuits challenging the legality of the plan are adjudicated by the D.C. Circuit Court of Appeals.

While there is much uncertainty surrounding the CPP timing and potential compliance, Empire did address environmental costs in its 2016 IRP filing. Although the CPP is unclear, based upon industry knowledge and where it seems likely states may be headed with respect to each state compliance plan from preliminary meetings, Empire modeled various carbon scenarios with some sensitivity around certain key aspects of the CPP.

As highlighted below, Empire modeled four future carbon cases and one alternate plan related to environmental compliance:

1. No carbon rule during the study period
2. Cap and Trade – Low allowance cost Case
3. Cap and Trade – Mid allowance cost Case

4. Cap and Trade – High allowance cost Case
5. Alternate Environmental Plan: Retire Asbury early in 2022 (Asbury's assumed retirement for other plans is 2035)

Along with a no carbon cost future, carbon allowance costs per ton were studied at three levels based on publicly available data from a CO_2 price forecast published by Synapse Energy Economics, Inc., a research and consulting firm specializing in energy, economic and environmental topics. The annual CO_2 price per ton, which is assumed to begin in year 2022, is shown in the table below.

Year	No Carbon	Low	Mid	High
2022	-	19.84	26.84	33.84
2023	-	21.43	29.16	36.90
2024	-	23.07	31.57	40.07
2025	-	24.77	34.06	43.35
2026	-	26.53	37.77	49.01
2027	-	28.35	41.62	54.89
2028	-	30.23	45.61	60.98
2029	-	32.17	49.74	67.30
2030	-	34.19	54.01	73.84
2031	-	36.26	58.44	80.62
2032	-	38.41	63.02	87.64
2033	-	40.63	67.77	94.90
2034	-	42.92	72.67	102.42
2035	-	45.29	77.75	110.21

Table 6-81 – CO_2 \$/Ton for 2016 IRP Cases

As explained in the IRP technical volumes and as discussed during the Stakeholder process, Environmental cost is a critical uncertain factor and the environmental uncertainty was assigned subjective probabilities to recognize the unknown future as required by the IRP Rule. The Mid CO_2 case shown in *Figure 6-176* represents the IRP base assumption.

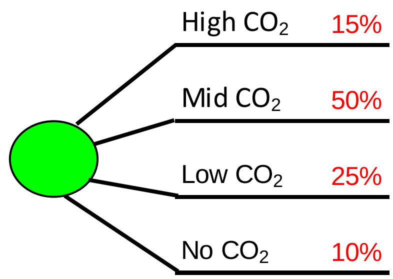

Figure 6-133 – Environmental Uncertainty from the 2016 IRP Decision Tree

Part of this issue asks for a description of how the preferred plan of the Company's last and current annual or triennial Integrated Resource Plans (IRPs) positions the utility for full or partial compliance with the CPP. First, as previously mentioned, the compliance plans are not known at this time and the CPP has been stayed. Secondly, the Company's last triennial IRP was filed in July, 2013 and the last IRP annual update was filed in March 2015, both of which pre-date the EPA CPP. Since the time of the last IRP filing in 2013, Empire has retired three small coal units and a small natural gas turbine and replaced the lost capacity by converting an existing unit to an efficient natural gas-fired combined cycle unit. This unit (Riverton Unit 12) is expected to be commercially available in the first half of 2016. Additionally, of the energy that Empire units produce, more than 15% comes from wind and hydro and only about 50% comes from coal. As a result, Empire appears to be well positioned for future greenhouse gas regulations.

Empire will continue to monitor the status of the CPP and will provide updates in subsequent IRP filings to the extent any material changes have occurred.

8.1.8 Assessment of the Value of Solar (VOS)

(h) Describe any assessment of the value of solar (VOS) performed or used by the Company specifically for its Missouri service territory.

As Empire understands the term VOS to be defined in this question, it is a reference to a tariff and/or a specific rate design. A VOS tariff is a rate design that gives customers with solar installations credit for the electricity generated by a PV system. This is an alternative to the most common form of rate design for customers with solar PV: net metering. Rather than simply running the meter backwards at the same price or rate as consumption, the energy generated by the solar PV system would be valued at a different rate as quantified by the utility. Empire currently has a Net Metering Tariff in place for all customer-sited renewables. Empire began offering its Solar Rebate in May of 2015, and in the short time since, has seen a percentage of customers opt to participate, resulting in a significant amount of new renewable capacity. At this time, Empire has not developed a formal proposal for VOS. With such rapid growth in its customer-sited renewable generation – facilitated and promoted more by the rebate than by the structure of Net Metering – it could be difficult for Empire to develop a formal proposal at this time. As its solar net metering customer base and solar generation capacity continues to grow, Empire continues to analyze and works to better understand the cross-subsidization effects to non-Net-Metering customers. In the future, as information continues to materialize related to Empire's solar customers and generation, and as Empire observes the regulatory approaches to solar generation and net metering rates, Empire will continue to consider useful metrics and options such as VOS.

8.1.9 Transmission Grid Updates for Coal-Fired Unit Retirements

(i) 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 the retirement of any existing Empire coal-fired generating unit.

A similarly-worded special contemporary issue was addressed in the 2014 and 2015 Annual Update. The units addressed in those responses have been retired and are no longer existing coal-fired generating units. Additionally, this special contemporary issue is very similar to special contemporary issue "d" which was addressed earlier.

8.1.10 Utility Scale Wind, Solar and Distributed Generation Resources

(j) 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.

Empire hired Burns & McDonnell to develop the supply-side cost and performance information for the 2016 IRP. Burns & McDonnell is an engineering design firm headquartered in Kansas City, Missouri. Founded in 1898, they are one of the leading design firms in the United States, offering a full-service engineering, architecture, construction, environmental and consulting solutions. Their multi-disciplined staff of 5,300 persons includes engineers, architects, construction professionals, planners, estimators, economists, technicians and scientists, representing virtually all design disciplines. They plan, design, permit, construct and manage facilities all over the world and have experience in all types of power generation technologies.

After reviewing the Missouri IRP Rule and Empire's past IRP filings, Burns & McDonnell met with the Empire IRP supply-side team and suggested a list of candidate resources for the 2016 IRP. According to the IRP Rule, the utility shall evaluate all existing supply-side resources and identify a variety of potential supply-side resource options which the utility can reasonably expect to use, develop, implement, or acquire. Empire's 2016 IRP supply-side candidates include the following:

- Super-Critical Coal (joint-ownership with carbon capture sequestration(CCS))
- Combustion Turbines (CT)
    - Aero-derivative CT, E-Class Frame CT and F-Class Frame CT
- Combined Cycle
    - F-Class unfired and duct fired
- Integrated Gasification Combined Cycle (IGCC) with CCS
- Reciprocating Internal Combustion Engine (RICE)
- Distributed Generation (DG)
- Micro-turbine and Turbine combined heat and power (CHP)
- Small Modular Nuclear (SMN)
- Traditional Nuclear

- Wind (ownership and PPA)
- Biomass
- Landfill Gas
- Utility Scale Solar photovoltaic (PV)
- Battery Storage

The cost and performance parameters for each of these supply-side candidates are documented in IRP Volume 4: Supply-Side Resource Analysis. This information is sufficient to fairly analyze and compare utility scale wind and solar resources, including distributed generation, to other supply-side alternatives. The list of supply-side candidates and the cost and performance parameters were presented to Missouri Stakeholders at the Empire IRP pre-integration meeting in Jefferson City, Missouri on November 20, 2015. An engineer from Burns & McDonnell participated in this meeting by phone, providing a summary of the supply-side inputs and was available for Stakeholder questions.

Once the supply-side candidate costs and parameters were developed and reviewed, they were provided to the engineering and consulting firm ABB for capacity expansion modeling. The goal of this modeling is to determine an optimal set of resources based on the assumptions of each alternate resource plan with the objective function of minimizing present value revenue requirements, the primary selection criterion of the resource planning process. This process indiscriminately looks at all combinations of resources, evaluating renewable resources along with traditional supply-side resources. In the 2016 IRP, all 19 plans satisfied the Missouri renewable energy standard.

The model developer, ABB provides the following documentation of the Capacity Expansion Module (CEM) software:

<u>Capacity Expansion Module</u>

> Capacity Expansion automates screening and evaluation of generation capacity expansion, transmission upgrades, strategic retirement, and other resource alternatives. It is a detailed and fast economic optimization model that simultaneously considers resource expansion investments and external market transactions. With Capacity Expansion, the optimal resource expansion strategy is determined based on an objective

function subject to a set of constraints. The typical criterion for evaluation is the expected present value of revenue requirements (PVRR) subject to meeting load plus reserves, and various resource planning constraints. It develops long-term resource expansion plans with type, size, location, and timing of capital projects over a 30-year horizon.

Decisions to build generating units or expand transmission capacity, purchase or sell contracts, or retire generating units are made based on the expected market value (revenue) less costs including both variable and fixed cost components. The model is a mixed integer linear program (MILP) in which the objective is minimization of the sum of the discounted costs of supplying customer loads in each area with load obligations. The model can be used to also represent areas that provide energy and capacity from power stations or contracts, but have no load obligations. The model includes all existing and proposed plants and transmission lines in a utility system.

Empire recognizes that planning assumptions can change. Empire will continue to evaluate opportunities for resource options between IRP filings as conditions warrant. This may include the evaluation of renewable resources not specifically required for capacity needs. Emerging technology changes; renewable incentives; environmental changes; renewable portfolio changes, pricing changes—particularly for renewable resources; and changing assumptions in general can impact resource planning. For example, near the end of the 2016 IRP process, verbal price quotes from wind developers that differed from the IRP assumptions, created the need for high-level investigation and additional IRP runs. Further, various legislative actions and initiative petitions may pose a need to alter Empire's renewable portfolio in the future.

8.1.11 Impact of Emerging Energy Efficiency Technologies

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

This special contemporary issue is very similar to special contemporary issue "a" that was addressed earlier. Please refer to the response to issue "a" above. In addition to this response, Empire analyzed energy efficiency technologies throughout the planning period in its IRP demand-side analysis. For more information, please refer to IRP Volume 5, which is an entire technical volume dedicated to demand-side analysis.

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 6L	Annual Hours for all Alternative Resource Plans Tables

 Highly Confidential in its Entirety

Avoided Energy Cost and Plan Tables

Table 6A-1 - Avoided Energy Cost – No CO_2

Table 6A-2 – Avoided Energy Cost – Low CO_2

Table 6A-3 – Avoided Energy Cost – Mid CO_2

Table 6A-4 – Avoided Energy Cost – High CO_2

Plan	Plan Description	PVRR ($ Millions)
Plan 1	Base - No RPS	$7,649.28
Plan 2	Base (Meets RPS)	$7,649.28
Plan 3	RAP +	$7,651.01
Plan 4	RAP -	$7,647.98
Plan 5	No DSM	$7,634.16
Plan 6	Fed Renewable Incentives All Yrs	$7,649.28
Plan 7	High CO2	$7,649.88
Plan 8	Low CO2	$7,649.04
Plan 9	No CO2	$7,649.70
Plan 10	Low Load	$7,630.60
Plan 11	High Load	$7,676.29
Plan 12	High-High Load	$7,705.14
Plan 13	Low Fuel & Market Prices	$7,650.54
Plan 14	High Fuel & Market Prices	$7,649.28
Plan 15	Electric Vehicle	$7,683.92
Plan 16	Early Asbury Retirement (1/2022)	$7,865.28
Plan 17	Highly Aggressive DSM	$7,669.88
Plan 18	Aggressive Capacity	$7,669.72
Plan 19	Aggressive Renewable	$7,648.53

Table 6A-5 - PVRR (20 Years) For All Plans

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Table 6A-6 - Annual Rate Increases for All Plans ($ in Millions)

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Table 6A-7 – Plant in Service ($ in Millions)

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

Table 6A-8 – Capacity Margins of All Plans

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

Table 6A-9 – Average Rate Revenue of All Plans

Appendix 6B DSM Impact on Plan Loads Tables

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

Table 6B-1 - DMS Impact on Plan 1, 2, 6, 10-16 Loads

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

Table 6B-2 - DMS Impact on Plan 3 Loads

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

Table 6B-3 - DMS Impact on Plan 4 Loads

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

Table 6B-4 - DMS Impact on Plan 5, 19 Loads

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

Table 6B-5 - DMS Impact on Plan 7 Loads

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

Table 6B-6 - DMS Impact on Plan 8 Loads

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Table 6B-7 - DMS Impact on Plan 9 Loads

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Table 6B-8 - DMS Impact on Plan 17 Loads

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Table 6B-9 - DMS Impact on Plan 18 Loads

Appendix 6C DSM Composition Tables

NOTE: No DSM in Plans 5 and 19, so no table is provided

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.08	0.09	0.01	0.00	0.11	0.00	0.17	0.02	0.00	0.00	0.00
2018	0.02	0.00	0.28	0.26	0.04	0.00	0.33	0.00	0.56	0.07	0.00	0.00	0.00
2019	0.04	0.00	0.52	0.34	0.06	0.00	0.55	0.00	0.96	0.12	0.00	0.00	0.00
2020	0.06	0.00	0.79	0.34	0.09	0.06	0.77	0.00	1.38	0.17	0.00	0.00	0.00
2021	0.07	0.00	1.09	0.34	0.11	0.11	0.98	0.00	1.82	0.22	0.00	0.00	0.00
2022	0.09	0.03	1.39	0.34	0.14	0.11	1.20	0.60	2.28	0.27	0.00	0.00	0.00
2023	0.10	0.08	1.72	0.34	0.17	0.11	1.42	1.47	2.74	0.32	0.00	0.00	0.00
2024	0.11	0.12	2.05	0.34	0.20	0.11	1.64	2.35	3.22	0.37	0.00	0.00	0.00
2025	0.13	0.18	2.39	0.34	0.24	0.11	1.90	3.23	3.67	0.42	0.00	0.00	0.00
2026	0.14	0.24	2.73	0.34	0.28	0.11	2.15	4.24	4.08	0.47	0.00	0.00	0.00
2027	0.14	0.31	3.06	0.34	0.33	0.11	2.41	4.76	4.48	0.52	0.00	0.00	0.00
2028	0.14	0.38	3.37	0.34	0.37	0.11	2.66	5.29	4.87	0.57	0.00	0.00	0.00
2029	0.13	0.46	3.67	0.34	0.42	0.11	2.92	5.83	5.14	0.62	0.00	0.00	1.00
2030	0.13	0.52	3.94	0.34	0.46	0.11	3.17	6.36	5.27	0.67	0.00	0.05	1.99
2031	0.13	0.58	4.19	0.34	0.51	0.11	3.43	6.40	5.39	0.72	0.02	0.10	2.99
2032	0.12	0.63	4.45	0.34	0.55	0.11	3.57	5.85	5.51	0.76	0.04	0.15	2.99
2033	0.12	0.68	4.68	0.34	0.59	0.11	3.61	5.02	5.60	0.76	0.06	0.15	2.99
2034	0.12	0.72	4.89	0.34	0.63	0.11	3.64	4.18	5.67	0.76	0.06	0.15	2.99
2035	0.12	0.76	5.06	0.34	0.66	0.11	3.68	3.34	5.72	0.76	0.06	0.15	2.99

Table 6C-1 - DSM Composition of Plan 1, 2, 6, 10-16 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.10	0.10	0.01	0.00	0.15	0.00	0.20	0.03	0.00	0.00	0.00
2018	0.03	0.00	0.36	0.33	0.04	0.00	0.44	0.00	0.64	0.09	0.00	0.00	0.00
2019	0.05	0.00	0.66	0.46	0.07	0.00	0.73	0.00	1.11	0.16	0.00	0.00	0.00
2020	0.07	0.00	0.99	0.46	0.10	0.09	1.02	0.00	1.64	0.23	0.00	0.00	0.00
2021	0.09	0.00	1.35	0.46	0.14	0.17	1.31	4.46	2.16	0.29	0.00	0.00	0.00
2022	0.11	0.05	1.72	0.46	0.17	0.17	1.60	7.34	2.69	0.36	0.00	0.00	0.00
2023	0.12	0.11	2.11	0.46	0.21	0.17	1.90	10.36	3.22	0.43	0.00	0.00	0.00
2024	0.14	0.17	2.52	0.46	0.25	0.17	2.19	13.40	3.76	0.50	0.00	0.00	0.00
2025	0.15	0.25	2.93	0.46	0.30	0.17	2.50	16.82	4.26	0.57	0.00	0.00	0.00
2026	0.16	0.33	3.35	0.46	0.36	0.17	2.81	18.83	4.72	0.64	0.00	0.00	0.50
2027	0.17	0.41	3.75	0.46	0.41	0.17	3.12	20.59	5.17	0.71	0.00	0.00	1.00
2028	0.16	0.51	4.11	0.46	0.47	0.17	3.43	22.37	5.59	0.78	0.00	0.00	1.50
2029	0.15	0.61	4.46	0.46	0.52	0.17	3.74	24.16	5.91	0.85	0.00	0.00	1.99
2030	0.15	0.68	4.80	0.46	0.58	0.17	4.05	24.48	6.09	0.92	0.00	0.08	2.49
2031	0.14	0.75	5.12	0.46	0.63	0.17	4.36	20.09	6.30	0.98	0.02	0.15	2.99
2032	0.14	0.81	5.43	0.46	0.68	0.17	4.52	17.28	6.47	1.03	0.04	0.23	2.99
2033	0.14	0.87	5.71	0.46	0.73	0.17	4.54	14.34	6.61	1.03	0.06	0.23	2.99
2034	0.14	0.92	5.96	0.46	0.77	0.17	4.56	11.36	6.71	1.03	0.07	0.23	2.99
2035	0.14	0.98	6.17	0.46	0.81	0.17	4.57	8.01	6.77	1.03	0.07	0.23	2.99

Table 6C-2 - DSM Composition of Plan 3 (MW)

NP

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.00	0.00	0.04	0.04	0.01	0.00	0.05	0.00	0.09	0.01	0.00	0.00	0.00
2018	0.01	0.00	0.14	0.13	0.02	0.00	0.16	0.00	0.28	0.03	0.00	0.00	0.00
2019	0.02	0.00	0.26	0.17	0.03	0.00	0.27	0.00	0.48	0.06	0.00	0.00	0.00
2020	0.03	0.00	0.40	0.17	0.04	0.03	0.38	0.00	0.69	0.08	0.00	0.00	0.00
2021	0.04	0.00	0.55	0.17	0.06	0.06	0.49	0.00	0.91	0.11	0.00	0.00	0.00
2022	0.04	0.02	0.70	0.17	0.07	0.06	0.60	0.30	1.14	0.13	0.00	0.00	0.00
2023	0.05	0.04	0.86	0.17	0.09	0.06	0.71	0.73	1.38	0.16	0.00	0.00	0.00
2024	0.06	0.06	1.02	0.17	0.10	0.06	0.82	1.17	1.61	0.19	0.00	0.00	0.00
2025	0.06	0.09	1.19	0.17	0.12	0.06	0.95	1.61	1.84	0.21	0.00	0.00	0.00
2026	0.07	0.12	1.37	0.17	0.14	0.06	1.08	2.12	2.04	0.24	0.00	0.00	0.00
2027	0.07	0.15	1.53	0.17	0.16	0.06	1.20	2.38	2.25	0.26	0.00	0.00	0.00
2028	0.07	0.19	1.69	0.17	0.19	0.06	1.33	2.64	2.44	0.29	0.00	0.00	0.00
2029	0.07	0.23	1.83	0.17	0.21	0.06	1.46	2.91	2.57	0.31	0.00	0.00	0.50
2030	0.07	0.26	1.97	0.17	0.23	0.06	1.59	3.18	2.64	0.34	0.00	0.02	1.00
2031	0.06	0.29	2.10	0.17	0.25	0.06	1.71	3.20	2.70	0.36	0.01	0.05	1.50
2032	0.06	0.32	2.23	0.17	0.28	0.06	1.79	2.92	2.76	0.38	0.02	0.07	1.50
2033	0.06	0.34	2.34	0.17	0.30	0.06	1.80	2.51	2.80	0.38	0.03	0.07	1.50
2034	0.06	0.36	2.45	0.17	0.32	0.06	1.82	2.09	2.84	0.38	0.03	0.07	1.50
2035	0.06	0.38	2.53	0.17	0.33	0.06	1.84	1.67	2.86	0.38	0.03	0.07	1.50

Table 6C-3 - DSM Composition of Plan 4 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.08	0.09	0.01	0.00	0.11	0.00	0.17	0.02	0.00	0.00	0.00
2018	0.02	0.00	0.28	0.26	0.04	0.00	0.40	0.00	0.56	0.07	0.00	0.00	0.00
2019	0.04	0.00	0.52	0.34	0.06	0.00	0.77	0.00	0.96	0.12	0.00	0.00	0.00
2020	0.06	0.02	0.80	0.34	0.09	0.06	1.13	0.00	1.38	0.17	0.00	0.00	0.00
2021	0.07	0.05	1.10	0.34	0.11	0.11	1.49	0.00	1.82	0.22	0.00	0.00	0.00
2022	0.09	0.09	1.41	0.34	0.14	0.11	1.86	0.60	2.28	0.27	0.00	0.00	0.00
2023	0.10	0.13	1.73	0.34	0.17	0.11	2.22	1.47	2.74	0.32	0.00	0.00	0.00
2024	0.11	0.18	2.06	0.34	0.20	0.11	2.59	2.35	3.22	0.37	0.00	0.00	0.00
2025	0.13	0.23	2.40	0.34	0.24	0.11	2.95	3.23	3.67	0.42	0.00	0.00	0.00
2026	0.14	0.29	2.75	0.34	0.28	0.11	3.32	4.24	4.08	0.47	0.00	0.05	0.00
2027	0.14	0.36	3.08	0.34	0.33	0.11	3.68	4.76	4.48	0.52	0.00	0.10	0.00
2028	0.14	0.41	3.39	0.34	0.37	0.11	4.05	5.29	4.87	0.57	0.02	0.15	0.00
2029	0.13	0.46	3.68	0.34	0.42	0.11	4.41	5.83	5.14	0.62	0.04	0.15	1.00
2030	0.13	0.52	3.95	0.34	0.46	0.11	4.77	6.36	5.27	0.67	0.06	0.15	1.99
2031	0.13	0.58	4.21	0.34	0.51	0.11	5.14	6.40	5.39	0.72	0.06	0.15	2.99
2032	0.12	0.63	4.46	0.34	0.55	0.11	5.39	5.85	5.51	0.76	0.06	0.15	2.99
2033	0.12	0.68	4.69	0.34	0.59	0.11	5.47	5.02	5.60	0.76	0.06	0.15	2.99
2034	0.12	0.72	4.90	0.34	0.63	0.11	5.47	4.18	5.67	0.76	0.06	0.15	2.99
2035	0.12	0.76	5.07	0.34	0.66	0.11	5.47	3.34	5.72	0.76	0.06	0.15	2.99

Table 6C-4 - DSM Composition of Plan 7 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.08	0.09	0.01	0.00	0.11	0.00	0.17	0.02	0.00	0.00	0.00
2018	0.02	0.00	0.28	0.26	0.04	0.00	0.40	0.00	0.56	0.07	0.00	0.00	0.00
2019	0.04	0.00	0.52	0.34	0.06	0.00	0.77	0.00	0.96	0.12	0.00	0.00	0.00
2020	0.06	0.00	0.79	0.34	0.09	0.06	1.13	0.00	1.38	0.17	0.00	0.00	0.00
2021	0.07	0.03	1.09	0.34	0.11	0.11	1.49	0.00	1.82	0.22	0.00	0.00	0.00
2022	0.09	0.06	1.39	0.34	0.14	0.11	1.86	0.60	2.28	0.27	0.00	0.00	0.00
2023	0.10	0.10	1.71	0.34	0.17	0.11	2.22	1.47	2.74	0.32	0.00	0.00	0.00
2024	0.11	0.14	2.04	0.34	0.20	0.11	2.59	2.35	3.22	0.37	0.00	0.00	0.00
2025	0.13	0.20	2.38	0.34	0.24	0.11	2.95	3.23	3.67	0.42	0.00	0.00	0.00
2026	0.14	0.26	2.73	0.34	0.28	0.11	3.32	4.24	4.08	0.47	0.00	0.00	0.00
2027	0.14	0.33	3.06	0.34	0.33	0.11	3.68	4.76	4.48	0.52	0.00	0.00	0.00
2028	0.14	0.41	3.37	0.34	0.37	0.11	4.05	5.29	4.87	0.57	0.00	0.00	0.00
2029	0.13	0.46	3.66	0.34	0.42	0.11	4.41	5.83	5.14	0.62	0.00	0.00	1.00
2030	0.13	0.52	3.94	0.34	0.46	0.11	4.77	6.36	5.27	0.67	0.00	0.00	1.99
2031	0.13	0.58	4.19	0.34	0.51	0.11	5.14	6.40	5.39	0.72	0.00	0.00	2.99
2032	0.12	0.63	4.45	0.34	0.55	0.11	5.39	5.85	5.51	0.76	0.00	0.00	2.99
2033	0.12	0.68	4.68	0.34	0.59	0.11	5.47	5.02	5.60	0.76	0.00	0.00	2.99
2034	0.12	0.72	4.88	0.34	0.63	0.11	5.47	4.18	5.67	0.76	0.00	0.00	2.99
2035	0.12	0.76	5.05	0.34	0.66	0.11	5.47	3.34	5.72	0.76	0.00	0.00	2.99

Table 6C-5 - DSM Composition of Plan 8 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.08	0.09	0.01	0.00	0.11	0.00	0.17	0.02	0.00	0.00	0.00
2018	0.02	0.00	0.27	0.26	0.04	0.00	0.40	0.00	0.56	0.07	0.00	0.00	0.00
2019	0.04	0.00	0.50	0.34	0.06	0.00	0.77	0.00	0.96	0.12	0.00	0.00	0.00
2020	0.06	0.00	0.76	0.34	0.09	0.06	1.13	0.00	1.38	0.17	0.00	0.00	0.00
2021	0.07	0.00	1.06	0.34	0.11	0.11	1.49	0.00	1.82	0.22	0.00	0.00	0.00
2022	0.09	0.03	1.35	0.34	0.14	0.11	1.86	0.60	2.28	0.27	0.00	0.00	0.00
2023	0.10	0.08	1.67	0.34	0.17	0.11	2.22	1.47	2.74	0.32	0.00	0.00	0.00
2024	0.11	0.12	2.00	0.34	0.20	0.11	2.59	2.35	3.22	0.37	0.00	0.00	0.00
2025	0.13	0.18	2.34	0.34	0.24	0.11	2.95	3.23	3.67	0.42	0.00	0.00	0.00
2026	0.14	0.24	2.69	0.34	0.28	0.11	3.32	4.24	4.08	0.47	0.00	0.00	0.00
2027	0.14	0.31	3.02	0.34	0.33	0.11	3.68	4.76	4.48	0.52	0.00	0.00	0.00
2028	0.14	0.38	3.33	0.34	0.37	0.11	4.05	5.29	4.87	0.57	0.00	0.00	0.00
2029	0.13	0.46	3.62	0.34	0.42	0.11	4.41	5.83	5.14	0.62	0.00	0.00	1.00
2030	0.13	0.52	3.89	0.34	0.46	0.11	4.77	6.36	5.27	0.67	0.00	0.00	1.99
2031	0.13	0.58	4.15	0.34	0.51	0.11	5.14	6.40	5.39	0.72	0.00	0.00	2.99
2032	0.12	0.63	4.41	0.34	0.55	0.11	5.39	5.85	5.51	0.76	0.00	0.00	2.99
2033	0.12	0.68	4.64	0.34	0.59	0.11	5.47	5.02	5.60	0.76	0.00	0.00	2.99
2034	0.12	0.72	4.85	0.34	0.63	0.11	5.47	4.18	5.67	0.76	0.00	0.00	2.99
2035	0.12	0.76	5.02	0.34	0.66	0.11	5.47	3.34	5.72	0.76	0.00	0.00	2.99

Table 6C-6 - DSM Composition of Plan 9 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.12	0.11	0.01	0.00	0.18	0.00	0.23	0.03	0.00	0.00	0.00
2018	0.04	0.00	0.45	0.40	0.04	0.00	0.55	0.00	0.72	0.11	0.00	0.00	0.00
2019	0.07	0.00	0.80	0.57	0.08	0.00	0.91	0.00	1.27	0.20	0.00	0.00	0.00
2020	0.09	0.00	1.19	0.57	0.12	0.11	1.28	4.14	1.89	0.28	0.00	0.00	0.00
2021	0.11	0.00	1.60	0.57	0.16	0.23	1.64	9.93	2.50	0.37	0.00	0.00	0.00
2022	0.13	0.06	2.04	0.57	0.21	0.23	2.00	15.09	3.09	0.45	0.00	0.00	0.00
2023	0.14	0.14	2.51	0.57	0.25	0.23	2.37	20.26	3.69	0.54	0.00	0.00	0.00
2024	0.16	0.22	2.98	0.57	0.30	0.23	2.73	25.46	4.29	0.63	0.00	0.00	0.00
2025	0.17	0.31	3.47	0.57	0.36	0.23	3.10	31.42	4.84	0.71	0.00	0.00	0.00
2026	0.19	0.41	3.97	0.57	0.43	0.23	3.46	34.42	5.35	0.80	0.00	0.00	1.00
2027	0.19	0.52	4.44	0.57	0.50	0.23	3.83	37.44	5.85	0.88	0.00	0.00	1.99
2028	0.18	0.64	4.84	0.57	0.56	0.23	4.19	40.46	6.30	0.97	0.00	0.00	2.99
2029	0.17	0.76	5.26	0.57	0.63	0.23	4.56	43.50	6.66	1.06	0.00	0.00	2.99
2030	0.16	0.85	5.66	0.57	0.69	0.23	4.92	39.47	6.91	1.14	0.00	0.10	2.99
2031	0.16	0.91	6.05	0.57	0.75	0.23	5.28	33.78	7.18	1.23	0.00	0.20	2.99
2032	0.15	0.98	6.41	0.57	0.81	0.23	5.47	28.72	7.41	1.28	0.02	0.30	2.99
2033	0.15	1.05	6.73	0.57	0.86	0.23	5.47	23.65	7.60	1.29	0.05	0.30	2.99
2034	0.15	1.12	7.03	0.57	0.91	0.23	5.47	18.54	7.74	1.29	0.07	0.30	2.99
2035	0.15	1.19	7.29	0.57	0.96	0.23	5.47	12.67	7.81	1.29	0.07	0.30	2.99

Table 6C-7 - DSM Composition of Plan 17 (MW)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	0.01	0.00	0.08	0.09	0.01	0.00	0.11	0.00	0.17	0.02	0.00	0.00	0.00
2018	0.02	0.00	0.28	0.26	0.04	0.00	0.33	0.00	0.56	0.07	0.00	0.00	0.00
2019	0.04	0.00	0.52	0.34	0.06	0.00	0.55	0.00	0.96	0.12	0.00	0.00	0.00
2020	0.06	0.00	0.79	0.34	0.09	0.06	0.77	0.00	1.38	0.17	0.00	0.00	0.00
2021	0.07	0.00	1.09	0.34	0.11	0.11	0.98	0.00	1.82	0.22	0.00	0.00	0.00
2022	0.09	0.03	1.39	0.34	0.14	0.11	1.20	0.60	2.28	0.27	0.00	0.00	0.00
2023	0.10	0.09	1.79	0.40	0.18	0.14	1.49	3.62	2.82	0.34	0.00	0.00	0.00
2024	0.12	0.16	2.19	0.46	0.22	0.17	1.79	6.66	3.35	0.41	0.00	0.00	0.00
2025	0.13	0.23	2.61	0.46	0.27	0.17	2.10	10.08	3.87	0.48	0.00	0.00	0.00
2026	0.15	0.31	3.03	0.46	0.32	0.17	2.41	12.09	4.34	0.54	0.00	0.00	0.50
2027	0.15	0.40	3.44	0.46	0.38	0.17	2.72	13.86	4.81	0.61	0.00	0.00	1.00
2028	0.15	0.52	3.89	0.52	0.45	0.20	3.08	16.88	5.32	0.70	0.00	0.00	1.99
2029	0.15	0.65	4.34	0.57	0.52	0.23	3.44	19.92	5.71	0.79	0.00	0.00	2.49
2030	0.15	0.76	4.76	0.57	0.58	0.23	3.81	20.03	5.97	0.87	0.00	0.10	2.99
2031	0.15	0.85	5.17	0.57	0.65	0.23	4.17	20.13	6.25	0.96	0.00	0.20	2.99
2032	0.15	0.93	5.58	0.57	0.71	0.23	4.43	19.63	6.51	1.02	0.02	0.30	2.99
2033	0.15	1.02	5.93	0.57	0.77	0.23	4.57	16.71	6.75	1.06	0.05	0.30	2.99
2034	0.15	1.10	6.27	0.57	0.82	0.23	4.72	13.76	6.99	1.10	0.07	0.30	2.99
2035	0.15	1.19	6.57	0.57	0.88	0.23	4.87	10.43	7.20	1.14	0.07	0.30	2.99

Table 6C-8 - DSM Composition of Plan 18 (MW)

Appendix 6D Supply-Side Resource Composition Tables

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1472	1472	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																		100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1439	1439	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC														100	100	100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-3 - Supply-Side Resource Composition of Plan 4

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1439	1439	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC														100	100	100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-4 - Supply-Side Resource Composition of Plan 5

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-5 - Supply-Side Resource Composition of Plan 7

NP

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.76	5804.025	5858.92	5926.614	5925.409	6220.882	6315.257	6387.747	6449.7	6456.827	6454.747	6504.698	6094.338	5973.946	5104.482	4938.663	4809.88	4757.303	3908.106
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429.006	755.374	754.424	747.472	754.559
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	364.29
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6D-7 - Supply-Side Resource Composition of Plan 9

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1472	1472	1539	1539	1445
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																		100	100	200
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-8 - Supply-Side Resource Composition of Plan 10

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	0	0	0	0	0	0	0	0	0	0	200	200	400	400	700	700	700	700	1100
Existing	1422	0	0	0	0	0	0	0	0	0	0	100	100	200	200	350	350	350	350	550
Aero																				
DG																				
LFG																				
CC												100	100	100	100	100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-9 - Supply-Side Resource Composition of Plan 11

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1358	1358	1358	1439	1439	1572	1572	1639	1639	1645
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC											100	100	100	100	100	100	100	200	200	400
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-10 - Supply-Side Resource Composition of Plan 12

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1572	1572	1539	1539	1559
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																100	100	100	100	100
CT																				214
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-11 - Supply-Side Resource Composition of Plan 13

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1572	1572	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																100	100	100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-12 - Supply-Side Resource Composition of Plan 14

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1439	1439	1572	1572	1639	1639	1645
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC														100	100	100	100	200	200	400
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-13 - Supply-Side Resource Composition of Plan 15

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1228	1246	1246	1246	1264	1264	1264	1345	1345	1578	1578	1545	1545	1545
Existing	1422	1422	1422	1422	1422	1422	1228	1146	1146	1146	1064	1064	1064	1045	1045	1028	1028	995	995	995
Aero																				
DG																				
LFG																				
CC								100	100	100	200	200	200	200	200	300	300	300	300	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-14 - Supply-Side Resource Composition of Plan 16

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1339	1339	1472	1472	1539	1539	1545
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																		100	100	300
CT																				
Biomass																				
Wind														100	100	250	250	250	250	250
Solar																				

Table 6D-15 - Supply-Side Resource Composition of Plan 17

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG																				
CC																				
CT																				
Biomass																				
Wind																				
Solar																				

Table 6D-16 - Supply-Side Resource Composition of Plan 18

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1347	1352	1535	1540	1619	1619	1425
Existing	1422	1422	1422	1422	1422	1422	1422	1340	1340	1340	1258	1258	1258	1239	1239	1222	1222	1189	1189	995
Aero																				
DG																				
LFG														2.5	2.5	2.5	2.5	5	5	5
CC																				
CT																				
Biomass																		5	5	5
Wind														100	100	300	300	400	400	400
Solar																	5	10	10	10
Battery														5	10	10	10	10	10	10

Table 6D-17 - Supply-Side Resource Composition of Plan 19

Appendix 6E **Impact of DSM on Annual Energy Requirements Tables**

Table 6E-1 – Table 6E-9
****Highly Confidential in its entirety****

****Table 6E-1 - Impact of DSM on Annual Energy Requirements of Plan 1, 2, 6, 10-16****

****Table 6E-2 - Impact of DSM on Annual Energy Requirements of Plan 3****

****Table 6E-3 - Impact of DSM on Annual Energy Requirements of Plan 4****

****Table 6E-4 - Impact of DSM on Annual Energy Requirements of Plan 5, 19****

****Table 6E-5 - Impact of DSM on Annual Energy Requirements of Plan 7****

****Table 6E-6 - Impact of DSM on Annual Energy Requirements of Plan 8****

****Table 6E-7 - Impact of DSM on Annual Energy Requirements of Plan 9****

****Table 6E-8 - Impact of DSM on Annual Energy Requirements of Plan 17****

****Table 6E-9 - Impact of DSM on Annual Energy Requirements of Plan 18****

Appendix 6F Composition of DSM Energy Provided Tables

NOTE: No DSM in Plans 5 and 19 so no table is provided

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	115.90	0.00	406.80	600.00	47.48	0.00	307.80	0.00	1412.52	111.00	0.00	0.00	0.00
2018	347.70	0.00	1404.01	1800.00	148.34	0.00	923.40	0.00	4559.86	360.75	0.00	0.00	0.00
2019	579.51	0.00	2611.73	2400.00	243.29	0.00	1539.00	0.00	7853.69	638.25	0.00	0.00	0.00
2020	805.61	0.00	3945.02	2400.00	345.41	400.00	2154.60	0.00	11370.29	915.75	0.00	0.00	0.00
2021	1026.02	0.00	5453.43	2400.00	465.32	800.00	2770.20	0.00	15106.59	1193.25	0.00	0.00	0.00
2022	1242.62	294.95	7089.26	2400.00	615.56	800.00	3385.80	9.60	19013.12	1470.75	0.00	0.00	0.00
2023	1426.94	659.72	8773.17	2400.00	768.54	800.00	4001.40	23.49	23081.34	1748.25	0.00	0.00	0.00
2024	1607.46	1038.02	10480.14	2400.00	921.51	800.00	4617.00	37.57	27325.69	2025.75	0.00	0.00	0.00
2025	1784.18	1486.74	12223.90	2400.00	1126.72	800.00	5335.20	51.65	31550.15	2303.25	0.00	0.00	0.00
2026	1955.21	2000.68	13976.78	2400.00	1330.06	800.00	6053.40	67.77	35653.74	2580.75	0.00	0.00	0.00
2027	2010.33	2531.87	15668.85	2400.00	1542.12	800.00	6771.60	76.20	39651.93	2858.25	0.00	0.00	0.00
2028	1949.55	3133.93	17336.49	2400.00	1749.62	800.00	7489.80	84.62	43464.93	3135.75	0.00	0.00	0.00
2029	1888.77	3804.92	18969.82	2400.00	1971.82	800.00	8208.00	93.20	46481.71	3413.25	0.00	0.00	23.93
2030	1835.32	4252.42	20544.01	2400.00	2182.01	800.00	8926.20	101.79	48672.72	3690.75	0.00	243.23	47.85
2031	1789.20	4701.39	22064.68	2400.00	2384.34	800.00	9644.40	102.46	50871.11	3968.25	91.63	486.47	71.78
2032	1746.89	5154.52	23549.12	2400.00	2578.27	800.00	10054.80	93.53	52884.60	4134.75	183.25	729.70	71.78
2033	1736.86	5537.24	24920.37	2400.00	2765.04	800.00	10157.40	80.32	54376.30	4162.50	274.88	729.70	71.78
2034	1730.63	5852.24	26190.50	2400.00	2935.57	800.00	10260.00	66.91	55559.37	4162.50	274.88	729.70	71.78
2035	1728.20	6147.62	27246.40	2400.00	3065.84	800.00	10362.60	53.51	56419.72	4162.50	274.88	729.70	71.78

Table 6F-1 - Composition of DSM Energy Provided in Plan 1, 2 6, 10-16 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	151.18	0.00	516.78	700.00	58.63	0.00	410.40	0.00	1698.28	149.85	0.00	0.00	0.00
2018	452.73	0.00	1770.06	2300.00	183.56	0.00	1231.20	0.00	5710.14	482.85	0.00	0.00	0.00
2019	754.28	0.00	3251.04	3200.00	311.45	0.00	2052.00	0.00	10328.16	860.25	0.00	0.00	0.00
2020	1027.34	0.00	4994.36	3200.00	442.91	600.00	2872.80	0.00	15590.91	1237.65	0.00	0.00	0.00
2021	1272.17	0.00	6897.14	3200.00	625.79	1200.00	3693.60	71.39	21022.80	1615.05	0.00	0.00	0.00
2022	1506.69	401.31	8918.96	3200.00	827.90	1200.00	4514.40	117.42	26605.67	1992.45	0.00	0.00	0.00
2023	1718.41	875.40	10993.53	3200.00	1030.63	1200.00	5335.20	165.78	32483.46	2369.85	0.00	0.00	0.00
2024	1921.59	1394.66	13099.46	3200.00	1233.54	1200.00	6156.00	214.40	38609.43	2747.25	0.00	0.00	0.00
2025	2117.17	1985.69	15257.89	3200.00	1471.52	1200.00	7028.10	269.13	44712.04	3124.65	0.00	0.00	0.00
2026	2306.92	2643.89	17416.09	3200.00	1717.10	1200.00	7900.20	301.21	50665.18	3502.05	0.00	0.00	11.96
2027	2345.49	3348.16	19519.57	3200.00	1970.53	1200.00	8772.30	329.52	56482.20	3879.45	0.00	0.00	23.93
2028	2233.70	4126.86	21544.99	3200.00	2224.40	1200.00	9644.40	357.91	61983.33	4256.85	0.00	0.00	35.89
2029	2122.72	4978.80	23545.92	3200.00	2492.97	1200.00	10516.50	386.54	66796.05	4634.25	0.00	0.00	47.85
2030	2041.86	5507.99	25491.23	3200.00	2750.48	1200.00	11388.60	391.68	70794.70	5011.65	0.00	369.43	59.82
2031	1990.04	5999.15	27383.14	3200.00	2997.98	1200.00	12260.70	321.48	74871.49	5389.05	91.63	738.86	71.78
2032	1948.54	6491.66	29202.78	3200.00	3235.10	1200.00	12722.40	276.55	78553.41	5616.60	198.52	1108.29	71.78
2033	1929.84	6951.04	30808.78	3200.00	3462.03	1200.00	12773.70	229.39	81274.38	5661.00	305.42	1108.29	71.78
2034	1919.67	7376.57	32304.78	3200.00	3649.42	1200.00	12825.00	181.79	83233.14	5661.00	320.69	1108.29	71.78
2035	1917.11	7796.58	33598.66	3200.00	3811.03	1200.00	12876.30	128.09	84528.19	5661.00	320.69	1108.29	71.78

Table 6F-2 - Composition of DSM Energy Provided in Plan 3 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	57.95	0.00	205.78	300.00	25.60	0.00	153.90	0.00	715.23	55.50	0.00	0.00	0.00
2018	173.85	0.00	705.32	900.00	76.03	0.00	461.70	0.00	2293.13	183.15	0.00	0.00	0.00
2019	289.75	0.00	1309.40	1200.00	123.51	0.00	769.50	0.00	3944.51	321.90	0.00	0.00	0.00
2020	402.81	0.00	1976.04	1200.00	174.57	200.00	1077.30	0.00	5703.85	460.65	0.00	0.00	0.00
2021	513.01	0.00	2730.52	1200.00	234.52	400.00	1385.10	0.00	7572.50	599.40	0.00	0.00	0.00
2022	621.31	147.55	3548.38	1200.00	309.64	400.00	1692.90	4.80	9526.69	738.15	0.00	0.00	0.00
2023	713.47	330.01	4390.33	1200.00	386.13	400.00	2000.70	11.74	11561.90	876.90	0.00	0.00	0.00
2024	803.73	519.16	5243.82	1200.00	462.62	400.00	2308.50	18.78	13685.51	1015.65	0.00	0.00	0.00
2025	892.09	743.52	6115.70	1200.00	565.22	400.00	2667.60	25.82	15798.17	1154.40	0.00	0.00	0.00
2026	977.60	1000.41	6992.11	1200.00	666.76	400.00	3026.70	33.89	17850.29	1293.15	0.00	0.00	0.00
2027	1005.16	1265.94	7838.10	1200.00	772.79	400.00	3385.80	38.10	19849.14	1431.90	0.00	0.00	0.00
2028	974.77	1566.96	8671.93	1200.00	876.54	400.00	3744.90	42.31	21755.37	1570.65	0.00	0.00	0.00
2029	944.38	1902.46	9488.59	1200.00	987.58	400.00	4104.00	46.60	23260.44	1709.40	0.00	0.00	11.96
2030	917.66	2126.21	10274.79	1200.00	1091.89	400.00	4463.10	50.89	24356.11	1848.15	0.00	121.62	23.93
2031	894.60	2350.69	11035.13	1200.00	1193.05	400.00	4822.20	51.23	25455.26	1986.90	45.81	243.23	35.89
2032	873.44	2577.26	11777.32	1200.00	1289.80	400.00	5027.40	46.77	26457.57	2070.15	91.63	364.85	35.89
2033	868.43	2768.62	12462.94	1200.00	1383.19	400.00	5078.70	40.16	27198.92	2081.25	137.44	364.85	35.89
2034	865.31	2926.12	13098.01	1200.00	1468.45	400.00	5130.00	33.46	27785.25	2081.25	137.44	364.85	35.89
2035	864.10	3073.81	13625.28	1200.00	1533.58	400.00	5181.30	26.75	28215.55	2081.25	137.44	364.85	35.89

Table 6F-3 - Composition of DSM Energy Provided in Plan 4 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	115.90	0.00	406.80	600.00	47.48	0.00	307.80	0.00	1412.52	111.00	0.00	0.00	0.00
2018	347.70	0.00	1404.01	1800.00	148.34	0.00	1128.60	0.00	4559.86	360.75	0.00	0.00	0.00
2019	579.51	0.00	2615.75	2400.00	243.29	0.00	2154.60	0.00	7853.69	638.25	0.00	0.00	0.00
2020	805.61	215.17	4040.72	2400.00	345.41	400.00	3180.60	0.00	11394.35	915.75	0.00	0.00	0.00
2021	1026.02	444.16	5560.78	2400.00	465.32	800.00	4206.60	0.00	15172.32	1193.25	0.00	0.00	0.00
2022	1242.62	739.10	7204.22	2400.00	615.56	800.00	5232.60	9.60	19140.59	1470.75	0.00	0.00	0.00
2023	1426.94	1103.88	8895.75	2400.00	768.54	800.00	6258.60	23.49	23208.81	1748.25	0.00	0.00	0.00
2024	1607.46	1482.18	10602.72	2400.00	921.51	800.00	7284.60	37.57	27453.15	2025.75	0.00	0.00	0.00
2025	1784.18	1929.57	12346.48	2400.00	1126.72	800.00	8310.60	51.65	31668.98	2303.25	0.00	0.00	0.00
2026	1955.21	2443.51	14099.36	2400.00	1330.06	800.00	9336.60	67.77	35761.79	2580.75	0.00	243.23	0.00
2027	2010.33	2974.71	15791.43	2400.00	1542.12	800.00	10362.60	76.20	39759.97	2858.25	0.00	486.47	0.00
2028	1949.55	3361.59	17459.07	2400.00	1749.62	800.00	11388.60	84.62	43572.97	3135.75	91.63	729.70	0.00
2029	1888.77	3804.92	19092.40	2400.00	1971.82	800.00	12414.60	93.20	46589.75	3413.25	183.25	729.70	23.93
2030	1835.32	4252.42	20662.57	2400.00	2182.01	800.00	13440.60	101.79	48765.33	3690.75	274.88	729.70	47.85
2031	1789.20	4701.39	22179.21	2400.00	2384.34	800.00	14466.60	102.46	50932.85	3968.25	274.88	729.70	71.78
2032	1746.89	5154.52	23652.01	2400.00	2578.27	800.00	15184.80	93.53	52884.60	4134.75	274.88	729.70	71.78
2033	1736.86	5537.24	25015.64	2400.00	2765.04	800.00	15390.00	80.32	54376.30	4162.50	274.88	729.70	71.78
2034	1730.63	5852.24	26278.15	2400.00	2935.57	800.00	15390.00	66.91	55559.37	4162.50	274.88	729.70	71.78
2035	1728.20	6147.62	27326.43	2400.00	3065.84	800.00	15390.00	53.51	56419.72	4162.50	274.88	729.70	71.78

Table 6F-4 - Composition of DSM Energy Provided in Plan 7 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	115.90	0.00	404.12	600.00	47.48	0.00	307.80	0.00	1412.52	111.00	0.00	0.00	0.00
2018	347.70	0.00	1395.95	1800.00	148.34	0.00	1128.60	0.00	4559.86	360.75	0.00	0.00	0.00
2019	579.51	0.00	2598.30	2400.00	243.29	0.00	2154.60	0.00	7853.69	638.25	0.00	0.00	0.00
2020	805.61	0.00	3931.59	2400.00	345.41	400.00	3180.60	0.00	11370.29	915.75	0.00	0.00	0.00
2021	1026.02	227.67	5444.03	2400.00	465.32	800.00	4206.60	0.00	15148.25	1193.25	0.00	0.00	0.00
2022	1242.62	520.11	7087.48	2400.00	615.56	800.00	5232.60	9.60	19116.52	1470.75	0.00	0.00	0.00
2023	1426.94	881.50	8779.01	2400.00	768.54	800.00	6258.60	23.49	23184.74	1748.25	0.00	0.00	0.00
2024	1607.46	1255.39	10485.98	2400.00	921.51	800.00	7284.60	37.57	27429.09	2025.75	0.00	0.00	0.00
2025	1784.18	1704.11	12229.74	2400.00	1126.72	800.00	8310.60	51.65	31653.55	2303.25	0.00	0.00	0.00
2026	1955.21	2220.55	13982.62	2400.00	1330.06	800.00	9336.60	67.77	35746.35	2580.75	0.00	0.00	0.00
2027	2010.33	2755.13	15674.69	2400.00	1542.12	800.00	10362.60	76.20	39744.54	2858.25	0.00	0.00	0.00
2028	1949.55	3361.59	17342.33	2400.00	1749.62	800.00	11388.60	84.62	43557.54	3135.75	0.00	0.00	0.00
2029	1888.77	3804.92	18975.66	2400.00	1971.82	800.00	12414.60	93.20	46574.32	3413.25	0.00	0.00	23.93
2030	1835.32	4252.42	20549.85	2400.00	2182.01	800.00	13440.60	101.79	48765.33	3690.75	0.00	0.00	47.85
2031	1789.20	4701.39	22070.52	2400.00	2384.34	800.00	14466.60	102.46	50932.85	3968.25	0.00	0.00	71.78
2032	1746.89	5154.52	23550.94	2400.00	2578.27	800.00	15184.80	93.53	52884.60	4134.75	0.00	0.00	71.78
2033	1736.86	5537.24	24922.19	2400.00	2765.04	800.00	15390.00	80.32	54376.30	4162.50	0.00	0.00	71.78
2034	1730.63	5852.24	26184.70	2400.00	2935.57	800.00	15390.00	66.91	55559.37	4162.50	0.00	0.00	71.78
2035	1728.20	6147.62	27235.66	2400.00	3065.84	800.00	15390.00	53.51	56419.72	4162.50	0.00	0.00	71.78

Table 6F-5 - Composition of DSM Energy Provided in Plan 8 (MWh)

NP

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	115.90	0.00	360.75	600.00	47.48	0.00	307.80	0.00	1412.52	111.00	0.00	0.00	0.00
2018	347.70	0.00	1263.99	1800.00	148.34	0.00	1128.60	0.00	4559.86	360.75	0.00	0.00	0.00
2019	579.51	0.00	2363.90	2400.00	243.29	0.00	2154.60	0.00	7853.69	638.25	0.00	0.00	0.00
2020	805.61	0.00	3635.62	2400.00	345.41	400.00	3180.60	0.00	11370.29	915.75	0.00	0.00	0.00
2021	1026.02	0.00	5082.46	2400.00	465.32	800.00	4206.60	0.00	15106.59	1193.25	0.00	0.00	0.00
2022	1242.62	294.95	6633.94	2400.00	615.56	800.00	5232.60	9.60	19013.12	1470.75	0.00	0.00	0.00
2023	1426.94	659.72	8313.83	2400.00	768.54	800.00	6258.60	23.49	23004.17	1748.25	0.00	0.00	0.00
2024	1607.46	1038.02	10013.18	2400.00	921.51	800.00	7284.60	37.57	27140.47	2025.75	0.00	0.00	0.00
2025	1784.18	1486.74	11749.32	2400.00	1126.72	800.00	8310.60	51.65	31241.45	2303.25	0.00	0.00	0.00
2026	1955.21	2000.68	13502.20	2400.00	1330.06	800.00	9336.60	67.77	35190.69	2580.75	0.00	0.00	0.00
2027	2010.33	2531.87	15194.27	2400.00	1542.12	800.00	10362.60	76.20	39188.88	2858.25	0.00	0.00	0.00
2028	1949.55	3133.93	16861.91	2400.00	1749.62	800.00	11388.60	84.62	43001.88	3135.75	0.00	0.00	0.00
2029	1888.77	3804.92	18495.24	2400.00	1971.82	800.00	12414.60	93.20	46018.66	3413.25	0.00	0.00	23.93
2030	1835.32	4252.42	20094.06	2400.00	2182.01	800.00	13440.60	101.79	48209.67	3690.75	0.00	0.00	47.85
2031	1789.20	4701.39	21663.98	2400.00	2384.34	800.00	14466.60	102.46	50408.06	3968.25	0.00	0.00	71.78
2032	1746.89	5154.52	23213.38	2400.00	2578.27	800.00	15184.80	93.53	52421.55	4134.75	0.00	0.00	71.78
2033	1736.86	5537.24	24588.66	2400.00	2765.04	800.00	15390.00	80.32	53990.42	4162.50	0.00	0.00	71.78
2034	1730.63	5852.24	25862.81	2400.00	2935.57	800.00	15390.00	66.91	55281.54	4162.50	0.00	0.00	71.78
2035	1728.20	6147.62	26940.13	2400.00	3065.84	800.00	15390.00	53.51	56265.37	4162.50	0.00	0.00	71.78

Table 6F-6 - Composition of DSM Energy Provided in Plan 9 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	186.46	0.00	622.06	800.00	63.59	0.00	513.00	0.00	1976.75	183.15	0.00	0.00	0.00
2018	557.76	0.00	2127.09	2800.00	211.84	0.00	1539.00	0.00	6849.11	599.40	0.00	0.00	0.00
2019	929.05	0.00	3879.47	4000.00	371.89	0.00	2565.00	0.00	12786.72	1071.15	0.00	0.00	0.00
2020	1249.06	0.00	6030.30	4000.00	531.94	800.00	3591.00	66.24	19789.82	1542.90	0.00	0.00	0.00
2021	1518.32	0.00	8327.44	4000.00	777.04	1600.00	4617.00	158.91	26911.45	2014.65	0.00	0.00	0.00
2022	1770.75	507.52	10734.59	4000.00	1030.36	1600.00	5643.00	241.38	34164.92	2486.40	0.00	0.00	0.00
2023	2009.88	1090.94	13199.82	4000.00	1282.06	1600.00	6669.00	324.19	41846.20	2958.15	0.00	0.00	0.00
2024	2235.72	1751.16	15704.72	4000.00	1534.91	1600.00	7695.00	407.36	49848.44	3429.90	0.00	0.00	0.00
2025	2450.17	2484.49	18277.81	4000.00	1805.68	1600.00	8721.00	502.73	57826.78	3901.65	0.00	0.00	0.00
2026	2658.64	3287.10	20841.59	4000.00	2093.75	1600.00	9747.00	550.77	65625.13	4373.40	0.00	0.00	23.93
2027	2680.66	4164.44	23355.65	4000.00	2388.63	1600.00	10773.00	598.96	73259.28	4845.15	0.00	0.00	47.85
2028	2517.84	5119.79	25738.85	4000.00	2687.00	1600.00	11799.00	647.32	80445.07	5316.90	0.00	0.00	71.78
2029	2356.66	6152.67	28106.45	4000.00	3000.45	1600.00	12825.00	696.01	87056.14	5788.65	0.00	0.00	71.78
2030	2248.40	6763.55	30422.89	4000.00	3304.16	1600.00	13851.00	631.47	92856.17	6260.40	0.00	495.63	71.78
2031	2190.89	7296.91	32685.12	4000.00	3595.72	1600.00	14877.00	540.50	98808.19	6732.15	0.00	991.26	71.78
2032	2150.20	7828.79	34839.96	4000.00	3875.41	1600.00	15390.00	459.57	104149.41	7020.75	114.53	1486.88	71.78
2033	2122.81	8364.85	36680.71	4000.00	4141.39	1600.00	15390.00	378.46	108096.84	7076.25	229.07	1486.88	71.78
2034	2108.72	8900.90	38402.58	4000.00	4346.41	1600.00	15390.00	296.67	110837.12	7076.25	343.60	1486.88	71.78
2035	2106.02	9445.53	39938.19	4000.00	4540.55	1600.00	15390.00	202.68	112562.34	7076.25	343.60	1486.88	71.78

Table 6F-7 - Composition of DSM Energy Provided in Plan 17 (MWh)

	Residential Lighting	Appliance Recycling	Whole House Efficiency	Residential Behavior	Low Income Whole House Effic	Low Income Behavior	Low Income Weatherization	Demand Load Control	C&I Prescriptive Rebate	C&I Custom Rebate	Strategic Energy Management	C&I Retrocommissioning	Curtailment Agreement
2017	115.90	0.00	406.80	600.00	47.48	0.00	307.80	0.00	1412.52	111.00	0.00	0.00	0.00
2018	347.70	0.00	1404.01	1800.00	148.34	0.00	923.40	0.00	4559.86	360.75	0.00	0.00	0.00
2019	579.51	0.00	2611.73	2400.00	243.29	0.00	1539.00	0.00	7853.69	638.25	0.00	0.00	0.00
2020	805.61	0.00	3945.02	2400.00	345.41	400.00	2154.60	0.00	11370.29	915.75	0.00	0.00	0.00
2021	1026.02	0.00	5453.43	2400.00	465.32	800.00	2770.20	0.00	15106.59	1193.25	0.00	0.00	0.00
2022	1242.62	294.95	7089.26	2400.00	615.56	800.00	3385.80	9.60	19013.12	1470.75	0.00	0.00	0.00
2023	1454.35	769.04	9168.12	2800.00	818.82	1000.00	4206.60	57.95	24908.50	1848.15	0.00	0.00	0.00
2024	1657.53	1288.30	11277.81	3200.00	1022.27	1200.00	5027.40	106.58	31055.13	2225.55	0.00	0.00	0.00
2025	1853.11	1879.33	13439.99	3200.00	1260.79	1200.00	5899.50	161.30	37239.03	2602.95	0.00	0.00	0.00
2026	2042.86	2540.47	15607.50	3200.00	1507.69	1200.00	6771.60	193.38	43277.82	2980.35	0.00	0.00	11.96
2027	2116.71	3244.74	17736.76	3200.00	1763.60	1200.00	7643.70	221.69	49214.21	3357.75	0.00	0.00	23.93
2028	2093.39	4205.25	20235.28	3600.00	2069.70	1400.00	8669.70	270.05	56850.71	3829.50	0.00	0.00	47.85
2029	2071.70	5242.54	22696.25	4000.00	2390.49	1600.00	9695.70	318.73	63693.33	4301.25	0.00	0.00	59.82
2030	2057.34	6065.41	25104.54	4000.00	2699.81	1600.00	10721.70	320.43	69683.59	4773.00	0.00	495.63	71.78
2031	2048.68	6710.89	27464.31	4000.00	2999.19	1600.00	11747.70	322.14	75824.47	5244.75	0.00	991.26	71.78
2032	2043.82	7378.57	29792.45	4000.00	3289.89	1600.00	12465.90	314.08	81646.73	5605.50	114.53	1486.88	71.78
2033	2043.84	8052.51	31942.53	4000.00	3564.85	1600.00	12876.30	267.43	86979.17	5827.50	229.07	1486.88	71.78
2034	2052.40	8730.62	34022.54	4000.00	3841.41	1600.00	13286.70	220.18	92110.76	6021.75	343.60	1486.88	71.78
2035	2068.57	9445.53	35884.88	4000.00	4077.77	1600.00	13697.10	166.84	96851.90	6216.00	343.60	1486.88	71.78

Table 6F-8 - Composition of DSM Energy Provided in Plan 18 (MWh)

Appendix 6G Composition of Supply-Side Energy Tables

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6455.491	6505.729	6091.926	5976.638	5104.545	4940.003	4812.575	4759.869	3747
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429.003	755.257	754.36	747.522	1582.216
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.075	5802.987	5853.791	5923.716	5919.745	6211.998	6307.638	6378.294	6432.001	6444.638	6443.838	6488.784	6068.475	5962.185	5357.748	5311.763	4924.004	4740.459	3733.858
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	431.585	747.168	1581.155
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5878.51	5803.996	5877.866	5933.216	5930.422	6242.823	6334.003	6401.799	6465.544	6484.302	6471.437	6523.709	5897.42	5616.637	4983.311	4965.516	4838.711	4792.991	3767.912
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	430.064	758.974	756.912	755.587	754.652	747.804	1584.106
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-3 - Composition of Supply-Side Energy for Plan 4

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5878.042	5810.018	5890.528	5937.755	5942.618	6256.995	6342.192	6412.662	6474.07	6497.488	6487.966	6544.549	5917.444	5642.696	5012.86	4997.523	4869.259	4817.29	3799.133
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	430.486	759.184	757.138	755.695	754.735	748.249	1584.436
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-4 - Composition of Supply-Side Energy for Plan 5

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5803.562	5858.78	5927.36	5923.556	6217.869	6313.04	6387.89	6445.423	6457.371	6452.945	6500.317	6092.449	5976.812	5098.971	4936.207	4809.251	4755.739	3744.29
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	428.985	755.344	754.411	747.637	1583.03
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-5 - Composition of Supply-Side Energy for Plan 7

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.163	5802.982	5858.681	5928.521	5924.736	6221.162	6312.576	6386.4	6446.859	6456.313	6451.266	6500.414	6092.047	5975.219	5101.771	4938.916	4808.962	4757.41	3745.007
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	428.989	755.249	754.456	747.474	1582.706
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.76	5804.025	5858.92	5926.614	5925.409	6220.882	6315.257	6387.747	6449.7	6456.827	6454.747	6504.698	6094.338	5973.946	5104.482	4938.663	4809.88	4757.303	3908.106
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429.006	755.374	754.424	747.472	754.559
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	364.29
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-7 - Composition of Supply-Side Energy for Plan 9

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6455.491	6505.729	6091.926	5976.638	5376.065	5325.654	4938.907	4759.869	3941.556
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	431.811	747.522	1176.596
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-8 - Composition of Supply-Side Energy for Plan 10

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6235.01	6079.667	5672.755	5591.264	4958.947	4940.003	4812.575	4759.869	3747
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	432.717	757.358	760.114	758.546	756.515	755.257	754.36	747.522	1582.216
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-9 - Composition of Supply-Side Energy for Plan 11

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6251.411	6028.343	6079.667	5672.755	5591.264	4958.947	4940.003	4596.902	4370.317	3400.835
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	432.992	761.576	757.358	760.114	758.546	756.515	755.257	1174.192	1471.388	2299.477
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-10 - Composition of Supply-Side Energy for Plan 12

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6455.491	6505.729	6091.926	5976.638	5104.545	4940.003	4812.575	4759.869	3912.877
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429.003	755.257	754.36	747.522	754.56
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	364.95
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-11 - Composition of Supply-Side Energy for Plan 13

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6455.491	6505.729	6091.926	5976.638	5104.545	4940.003	4812.575	4759.869	3747
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	429.003	755.257	754.36	747.522	1582.216
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-12 - Composition of Supply-Side Energy for Plan 14

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6313.843	6385.719	6447.362	6458.716	6455.491	6505.729	5872.752	5591.264	4958.947	4940.003	4596.902	4370.317	3400.835
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	429.705	758.546	756.515	755.257	1174.192	1471.388	2299.477
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-13 - Composition of Supply-Side Energy for Plan 15

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6116.876	5955.661	5998.186	5755.004	5519.036	5557.339	5163.899	5140.586	4246.032	4045.924	4014.791	3981.04	3508.739
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	428.508	758.168	760.112	1182.117	1498.856	1497.568	1491.056	1492.732	1885.888	2171.221	2190.829	2166.715	2236.763
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-14 - Composition of Supply-Side Energy for Plan 16

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5878.386	5801.5	5852.871	5920.512	5914.159	6206.85	6295.212	6372.409	6421.521	6431.149	6431.568	6475.129	6043.264	5947.207	5337.307	5295.792	4902.14	4719.541	3716.66
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	431.367	746.353	1580.849
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	943.8	933.935	938.623	942.232	938.86
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-15 - Composition of Supply-Side Energy for Plan 17

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5877.843	5804.351	5862.396	5925.674	5923.946	6222.185	6311.931	6383.199	6441.632	6449.7	6448.821	6495.31	6262.112	6124.549	5654.453	5619.788	5460.141	5439.214	4609.638
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Market	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-16 - Composition of Supply-Side Energy for Plan 18

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Existing	5748.148	5878.042	5810.018	5890.528	5937.755	5942.618	6256.995	6342.192	6412.662	6474.07	6497.488	6487.966	6544.549	6121.225	6011.535	5313.486	5276.442	4950.029	4880.233	4207.313
Aero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LFG	0	0	0	0	0	0	0	0	0	0	0	0	0	8.233	14.812	14.812	14.812	23.045	29.624	29.62
CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12.318	21.108	21.108
Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	375.544	377.509	1132.56	1120.722	1501.796	1507.572	1502.176
Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Battery	0	0	0	0	0	0	0	0	0	0	0	0	0	5.475	10.95	10.95	10.95	10.95	10.95	10.95
Market	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6G-17 - Composition of Supply-Side Energy for Plan 19

Appendix 6H Annual Emissions Tables

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	350
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2016	1976	1974	1896	1804	1749	1696	1656	742
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4194	4187	4131	4033	3998	4026	3943	3892	3245

Table 6H-1 - Annual Emissions of Plan 1, 2, 6

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1657	1598	1588	1606	1605	1594	1591	1592	1558	1554	1479	1452	1374	1321	1283	350
NO_x (Tons)	1974	1971	2027	1973	2063	1994	2008	2025	2024	2016	2010	2015	1974	1971	1894	1855	1771	1688	1654	740
CO_2 (1000 Tons)	3942	3949	3999	3940	4047	3980	4091	4140	4164	4183	4185	4189	4179	4120	4026	3963	3890	3852	3882	3238

Table 6H-2 - Annual Emissions of Plan 3

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1657	1598	1588	1606	1606	1594	1592	1592	1560	1534	1464	1438	1357	1325	1285	351
NO_x (Tons)	1974	1971	2027	1977	2064	1995	2012	2026	2026	2020	2013	2017	1978	1946	1875	1836	1753	1699	1659	745
CO_2 (1000 Tons)	3942	3949	4000	3951	4051	3985	4106	4152	4175	4199	4202	4201	4196	4207	4177	4104	4039	3955	3908	3257

Table 6H-3 - Annual Emissions of Plan 4

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1658	1599	1588	1606	1606	1594	1592	1593	1560	1535	1465	1439	1359	1326	1287	352
NO_x (Tons)	1974	1971	2028	1979	2065	1997	2012	2027	2028	2021	2014	2018	1980	1949	1878	1840	1757	1702	1662	748
CO_2 (1000 Tons)	3942	3949	4004	3957	4054	3991	4112	4156	4180	4203	4209	4209	4205	4217	4190	4117	4055	3969	3920	3274

Table 6H-4 - Annual Emissions of Plan 5

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	350
NO_x (Tons)	1974	1971	2027	1974	2063	1994	2010	2025	2025	2017	2011	2016	1975	1973	1896	1804	1748	1696	1656	742
CO_2 (1000 Tons)	3942	3949	4000	3942	4049	3982	4094	4142	4169	4189	4190	4193	4185	4131	4033	3996	4024	3941	3890	3244

Table 6H-5 - Annual Emissions of Plan 7

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	350
NO_x (Tons)	1974	1971	2027	1974	2063	1994	2009	2026	2025	2017	2011	2016	1975	1973	1896	1804	1749	1696	1656	742
CO_2 (1000 Tons)	3942	3949	3999	3942	4049	3982	4095	4142	4168	4190	4190	4193	4185	4131	4033	3997	4026	3941	3891	3244

Table 6H-6 - Annual Emissions of Plan 8

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	356
NO_x (Tons)	1974	1971	2027	1973	2063	1994	2010	2025	2025	2017	2011	2016	1975	1973	1896	1804	1749	1696	1656	793
CO_2 (1000 Tons)	3942	3949	4000	3942	4048	3983	4095	4143	4169	4191	4190	4194	4187	4132	4032	3998	4025	3942	3891	3193

Table 6H-7 - Annual Emissions of Plan 9

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1452	1375	1322	1284	354
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2016	1976	1974	1896	1857	1772	1690	1656	745
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4194	4187	4131	4033	3972	3897	3859	3892	3166

Table 6H-8 - Annual Emissions of Plan 10

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1538	1533	1462	1437	1356	1323	1284	350
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2009	1947	1944	1871	1834	1749	1696	1656	742
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4276	4302	4246	4165	4092	4026	3943	3892	3245

Table 6H-9 - Annual Emissions of Plan 11

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1594	1577	1538	1533	1462	1437	1356	1297	1257	342
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2002	1993	1947	1944	1871	1834	1749	1666	1627	733
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4279	4314	4302	4246	4165	4092	4026	3998	4000	3376

Table 6H-10 - Annual Emissions of Plan 12

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	356
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2016	1976	1974	1896	1804	1749	1696	1656	795
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4194	4187	4131	4033	3998	4026	3943	3892	3196

Table 6H-11 - Annual Emissions of Plan 13

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1559	1555	1480	1409	1356	1323	1284	350
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2016	1976	1974	1896	1804	1749	1696	1656	742
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4194	4187	4131	4033	3998	4026	3943	3892	3245

Table 6H-12 - Annual Emissions of Plan 14

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1606	1594	1592	1592	1559	1533	1462	1437	1356	1297	1257	342
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2018	2011	2016	1976	1942	1871	1834	1749	1666	1627	733
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4143	4168	4190	4191	4194	4187	4195	4165	4092	4026	3998	4000	3376

Table 6H-13 - Annual Emissions of Plan 15

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1614	1588	1579	1563	1538	1503	1489	1425	1345	1269	1248	1218	343
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2024	1996	1993	1957	1942	1900	1885	1820	1720	1635	1613	1584	738
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4240	4283	4300	4350	4368	4353	4288	4238	4166	4139	4122	4080	3398

Table 6H-14 - Annual Emissions of Plan 16

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1597	1588	1606	1605	1594	1591	1592	1557	1553	1478	1451	1373	1320	1282	350
NO_x (Tons)	1974	1971	2026	1973	2062	1993	2008	2024	2023	2015	2009	2014	1972	1968	1892	1853	1769	1686	1652	739
CO_2 (1000 Tons)	3942	3949	3999	3939	4045	3977	4089	4134	4161	4178	4179	4184	4173	4108	4019	3953	3882	3841	3872	3230

Table 6H-15 - Annual Emissions of Plan 17

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1552	1657	1598	1588	1606	1605	1594	1592	1592	1558	1563	1485	1461	1385	1345	1315	363
NO_x (Tons)	1974	1971	2027	1975	2063	1994	2010	2025	2025	2017	2010	2015	1974	1991	1909	1883	1804	1734	1707	784
CO_2 (1000 Tons)	3942	3949	4000	3944	4048	3982	4096	4142	4167	4187	4187	4191	4182	4211	4102	4104	4039	3933	3910	3008

Table 6H-16 - Annual Emissions of Plan 18

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
SO_2 (Tons)	1608	1599	1634	1553	1658	1599	1588	1606	1606	1594	1592	1593	1560	1556	1480	1449	1371	1329	1291	356
NO_x (Tons)	1974	1971	2028	1979	2065	1997	2012	2027	2028	2021	2014	2018	1980	1977	1900	1854	1769	1706	1675	764
CO_2 (1000 Tons)	3942	3949	4004	3957	4054	3991	4112	4156	4180	4203	4209	4209	4205	4152	4065	3958	3889	3738	3708	2871

Table 6H-17 - Annual Emissions of Plan 19

Appendix 6I Plan Tornado Diagrams Tables

PLAN 1	Low	Range	High	Base	Value
Market	7761.601	77.246	7838.847	7780.982	7794.465
Environmental	7801.609	236.522	7808.562	7748.544	7985.066
Load	7734.541	211.870	7847.011	7788.214	7946.412
Capital Costs	7701.638	309.422	8011.061		
Base Revenues	7531.289	1273.251	8804.540	7794.465	

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

PLAN 2	Low	Range	High	Base	Value
Market	7761.601	77.246	7838.847	7780.982	7794.465
Environmental	7801.609	236.522	7808.562	7748.544	7985.066
Load	7734.541	211.870	7847.011	7788.214	7946.412
Capital Costs	7701.638	309.422	8011.061		
Base Revenues	7531.289	1273.251	8804.540	7794.465	

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

PLAN 3	Low	Range	High	Base	Value
Market	7764.310	76.661	7840.971	7783.391	7796.849
Environmental	7802.643	238.865	7819.165	7749.045	7987.910
Load	7737.004	211.897	7849.323	7790.576	7948.901
Capital Costs	7705.315	305.113	8010.428		
Base Revenues	7538.620	1262.918	8801.537	7796.849	

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

PLAN 4	Low	Range	High	Base	Value
Market	7758.561	78.141	7836.702	7778.365	7791.905
Environmental	7800.655	233.409	7796.102	7748.309	7981.718
Load	7732.395	209.446	7843.535	7786.015	7941.841
Capital Costs	7697.685	314.067	8011.752		
Base Revenues	7522.457	1283.879	8806.336	7791.905	

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

PLAN 5	Low	Range	High	Base	Value
Market	7743.967	79.205	7823.171	7764.270	7777.880
Environmental	7785.577	228.343	7783.225	7735.279	7963.622
Load	7717.579	213.763	7831.470	7771.248	7931.342
Capital Costs	7683.660	314.066	7997.726		
Base Revenues	7497.726	1298.450	8796.176	7777.880	

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

PLAN 6	Low	Range	High	Base	Value
Market	7761.601	77.246	7838.847	7780.982	7794.465
Environmental	7801.609	236.522	7808.562	7748.544	7985.066
Load	7734.541	211.870	7847.011	7788.214	7946.412
Capital Costs	7701.638	309.422	8011.061		
Base Revenues	7531.289	1273.251	8804.540	7794.465	

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

PLAN 7	Low	Range	High	Base	Value
Market	7762.310	77.125	7839.435	7781.632	7795.108
Environmental	7802.375	237.122	7808.971	7749.095	7986.216
Load	7735.479	211.237	7847.244	7788.908	7946.715
Capital Costs	7702.282	309.423	8011.704		
Base Revenues	7533.379	1271.413	8804.791	7795.108	

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

PLAN 8	Low	Range	High	Base	Value
Market	7761.586	77.147	7838.733	7780.908	7794.391
Environmental	7801.623	236.946	7808.315	7748.405	7985.352
Load	7734.794	211.206	7846.792	7788.068	7946.001
Capital Costs	7701.564	309.422	8010.986		
Base Revenues	7532.452	1271.542	8803.994	7794.391	

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

PLAN 9	Low	Range	High	Base	Value
Market	7764.402	77.413	7841.815	7783.851	7797.351
Environmental	7803.703	234.101	7811.982	7752.029	7986.130
Load	7737.998	210.381	7849.842	7790.927	7948.379
Capital Costs	7701.621	319.098	8020.719		
Base Revenues	7528.955	1283.357	8812.312	7797.351	

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

PLAN 10	Low	Range	High	Base	Value
Market	7745.710	77.487	7823.197	7765.185	7778.694
Environmental	7783.126	233.022	7802.556	7732.044	7965.066
Load	7715.540	223.225	7835.205	7771.659	7938.765
Capital Costs	7684.516	313.924	7998.440		
Base Revenues	7505.498	1291.425	8796.923	7778.694	

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

PLAN 11	Low	Range	High	Base	Value
Market	7788.938	77.049	7865.987	7808.241	7821.704
Environmental	7832.547	240.534	7823.218	7776.718	8017.252
Load	7763.120	201.410	7872.195	7816.517	7964.529
Capital Costs	7726.646	316.859	8043.505		
Base Revenues	7563.562	1267.768	8831.329	7821.704	

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

PLAN 12	Low	Range	High	Base	Value
Market	7820.466	76.827	7897.293	7839.673	7853.118
Environmental	7867.280	245.969	7846.042	7807.991	8053.960
Load	7795.483	193.363	7903.341	7848.273	7988.846
Capital Costs	7755.342	325.918	8081.260		
Base Revenues	7599.251	1266.755	8866.006	7853.118	

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

PLAN 13	Low	Range	High	Base	Value
Market	7765.009	77.490	7842.499	7784.505	7798.004
Environmental	7804.286	233.691	7812.728	7752.757	7986.449
Load	7738.341	210.821	7850.631	7791.669	7949.163
Capital Costs	7702.275	319.097	8021.372		
Base Revenues	7528.534	1284.590	8813.125	7798.004	

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

PLAN 14	Low	Range	High	Base	Value
Market	7761.601	77.246	7838.847	7780.982	7794.465
Environmental	7801.609	236.522	7808.562	7748.544	7985.066
Load	7734.541	211.870	7847.011	7788.214	7946.412
Capital Costs	7701.638	309.422	8011.061		
Base Revenues	7531.289	1273.251	8804.540	7794.465	

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

PLAN 15	Low	Range	High	Base	Value
Market	7797.397	76.937	7874.334	7816.648	7830.103
Environmental	7842.788	242.778	7825.118	7785.601	8028.380
Load	7771.975	198.949	7880.696	7824.849	7970.924
Capital Costs	7733.914	320.631	8054.545		
Base Revenues	7574.297	1268.228	8842.525	7830.103	

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

PLAN 16	Low	Range	High	Base	Value
Market	7989.258	76.188	8065.446	8008.292	8021.632
Environmental	8044.819	255.544	7983.604	7978.886	8234.431
Load	7965.541	190.501	8070.399	8016.729	8156.042
Capital Costs	7913.084	361.824	8274.908		
Base Revenues	7772.556	1294.419	9066.975	8021.632	

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

PLAN 17	Low	Range	High	Base	Value
Market	7783.740	75.898	7859.638	7802.465	7815.872
Environmental	7822.522	242.610	7837.221	7767.329	8009.940
Load	7756.865	205.497	7867.260	7810.172	7962.362
Capital Costs	7724.339	305.112	8029.450		
Base Revenues	7565.436	1248.955	8814.391	7815.872	

Table 6I-17 - Plan 17 Tornado Diagram ($ in Millions)

PLAN 18	Low	Range	High	Base	Value
Market	7767.445	86.130	7853.575	7790.880	7805.001
Environmental	7795.567	179.494	7837.981	7770.772	7950.266
Load	7742.914	231.138	7864.126	7795.490	7974.052
Capital Costs	7713.680	304.404	8018.084		
Base Revenues	7447.618	1378.840	8826.458	7805.001	

Table 6I-18 - Plan 18 Tornado Diagram ($ in Millions)

PLAN 19	Low	Range	High	Base	Value
Market	7768.950	75.924	7844.875	7787.720	7801.113
Environmental	7804.614	231.572	7828.566	7754.195	7985.767
Load	7736.755	241.147	7863.567	7790.630	7977.903
Capital Costs	7706.139	316.580	8022.719		
Base Revenues	7532.097	1296.704	8828.801	7801.113	

Table 6I-19 - Plan 19 Tornado Diagram ($ in Millions)

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

	PLN01	PLN02	PLN03	PLN04	PLN05	PLN06	PLN07	PLN8	PLN09	PLN10	PLN11	PLN12	PLN13	PLN14	PLN15	PLN16	PLN17	PLN18	PLN19
EV	7794.465	7794.465	7796.849	7791.905	7777.880	7794.465	7795.108	7794.391	7797.351	7778.694	7821.704	7853.118	7798.004	7794.465	7830.103	8021.632	7815.872	7805.001	7801.113
Deterministic	7649.276	7649.276	7651.008	7647.979	7634.155	7649.276	7649.883	7649.045	7649.696	7630.596	7676.290	7705.137	7650.542	7649.276	7683.921	7865.282	7669.876	7669.719	7648.528
Difference	145.189	145.189	145.841	143.926	143.724	145.189	145.226	145.346	147.655	148.098	145.414	147.981	147.462	145.189	146.183	156.349	145.996	135.282	152.585

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

Appendix 6K Cumulative Probability Tables

PLAN 1	Cumulative	Probability	PLAN 2	Cumulative	Probability	PLAN 3	Cumulative	Probability	PLAN 4	Cumulative	Probability
7531.2893	0.0035	0.0035	7531.2893	0.0035	0.0035	7538.6199	0.0035	0.0035	7522.4569	0.0035	0.0035
7559.5815	0.0105	0.0070	7559.5815	0.0105	0.0070	7566.9584	0.0105	0.0070	7550.3638	0.0105	0.0070
7591.9799	0.0133	0.0028	7591.9799	0.0133	0.0028	7594.7440	0.0980	0.0875	7581.3555	0.0133	0.0028
7592.8282	0.1008	0.0875	7592.8282	0.1008	0.0875	7599.4667	0.1008	0.0028	7591.7432	0.1008	0.0875
7649.2757	0.2758	0.1750	7649.2757	0.2758	0.1750	7651.0082	0.2758	0.1750	7638.7550	0.1271	0.0263
7651.7265	0.2765	0.0007	7651.7265	0.2765	0.0007	7654.5833	0.3196	0.0438	7639.7734	0.1278	0.0007
7652.1546	0.3203	0.0438	7652.1546	0.3203	0.0438	7659.2168	0.3203	0.0007	7647.9794	0.3028	0.1750
7652.5200	0.3465	0.0263	7652.5200	0.3465	0.0263	7664.4270	0.3465	0.0263	7650.0765	0.3465	0.0438
7702.6837	0.4340	0.0875	7702.6837	0.4340	0.0875	7704.8965	0.4340	0.0875	7695.7213	0.3990	0.0525
7709.3045	0.4865	0.0525	7709.3045	0.4865	0.0525	7712.5831	0.5040	0.0700	7700.8325	0.4865	0.0875
7710.7747	0.5565	0.0700	7710.7747	0.5565	0.0700	7715.3105	0.5128	0.0088	7706.3051	0.4953	0.0088
7710.9561	0.5653	0.0088	7710.9561	0.5653	0.0088	7721.4268	0.5653	0.0525	7708.1687	0.5653	0.0700
7752.1776	0.5828	0.0175	7752.1776	0.5828	0.0175	7756.5908	0.5828	0.0175	7747.1669	0.5828	0.0175
7758.6516	0.6178	0.0350	7758.6516	0.6178	0.0350	7761.1135	0.6178	0.0350	7755.2254	0.6178	0.0350
7771.0361	0.6388	0.0210	7771.0361	0.6388	0.0210	7782.1815	0.6388	0.0210	7756.7721	0.6388	0.0210
7798.2375	0.6458	0.0070	7798.2375	0.6458	0.0070	7802.5597	0.6458	0.0070	7791.9282	0.6458	0.0070
7814.3481	0.6633	0.0175	7814.3481	0.6633	0.0175	7816.0870	0.6633	0.0175	7810.6005	0.6633	0.0175
7840.7128	0.6648	0.0015	7840.7128	0.6648	0.0015	7843.7297	0.6648	0.0015	7836.5223	0.6648	0.0015
7853.4273	0.6735	0.0088	7853.4273	0.6735	0.0088	7855.8463	0.6735	0.0088	7849.0880	0.6735	0.0088
7869.0025	0.6765	0.0030	7869.0025	0.6765	0.0030	7872.0682	0.6765	0.0030	7859.5555	0.6788	0.0053
7874.9089	0.6818	0.0053	7874.9089	0.6818	0.0053	7883.2562	0.6783	0.0018	7864.4285	0.6818	0.0030
7878.5993	0.6835	0.0018	7878.5993	0.6835	0.0018	7887.4851	0.6835	0.0053	7871.0484	0.6835	0.0018
7901.4020	0.6847	0.0012	7901.4020	0.6847	0.0012	7899.8571	0.7210	0.0375	7895.4208	0.6847	0.0012
7902.2506	0.7222	0.0375	7902.2506	0.7222	0.0375	7904.5770	0.7222	0.0012	7905.8106	0.7222	0.0375
7958.6977	0.7972	0.0750	7958.6977	0.7972	0.0750	7956.1224	0.7972	0.0750	7952.8223	0.7335	0.0113
7961.1496	0.7975	0.0003	7961.1496	0.7975	0.0003	7959.6963	0.8160	0.0188	7953.8388	0.7338	0.0003
7961.5776	0.8163	0.0188	7961.5776	0.8163	0.0188	7964.3283	0.8163	0.0003	7962.0462	0.8088	0.0750
7961.9428	0.8275	0.0113	7961.9428	0.8275	0.0113	7969.5398	0.8275	0.0113	7964.1438	0.8275	0.0188
8012.1060	0.8650	0.0375	8012.1060	0.8650	0.0375	8010.0093	0.8650	0.0375	8009.7876	0.8500	0.0225
8018.7275	0.8875	0.0225	8018.7275	0.8875	0.0225	8017.6933	0.8950	0.0300	8014.8988	0.8875	0.0375
8020.1977	0.9175	0.0300	8020.1977	0.9175	0.0300	8020.4233	0.8988	0.0038	8020.3716	0.8913	0.0038
8020.3779	0.9213	0.0038	8020.3779	0.9213	0.0038	8026.5412	0.9213	0.0225	8022.2350	0.9213	0.0300
8061.5985	0.9288	0.0075	8061.5985	0.9288	0.0075	8061.7036	0.9288	0.0075	8061.2331	0.9288	0.0075
8068.0736	0.9438	0.0150	8068.0736	0.9438	0.0150	8066.2251	0.9438	0.0150	8069.2927	0.9438	0.0150
8080.4580	0.9528	0.0090	8080.4580	0.9528	0.0090	8087.2932	0.9528	0.0090	8070.8395	0.9528	0.0090
8107.6612	0.9558	0.0030	8107.6612	0.9558	0.0030	8107.6719	0.9558	0.0030	8105.9954	0.9558	0.0030
8123.7696	0.9633	0.0075	8123.7696	0.9633	0.0075	8121.1987	0.9633	0.0075	8124.6669	0.9633	0.0075
8162.8494	0.9670	0.0038	8162.8494	0.9670	0.0038	8160.9576	0.9670	0.0038	8163.1541	0.9670	0.0038
8184.3316	0.9693	0.0023	8184.3316	0.9693	0.0023	8188.3672	0.9678	0.0008	8173.6202	0.9693	0.0023
8188.0225	0.9700	0.0008	8188.0225	0.9700	0.0008	8192.5977	0.9700	0.0023	8185.1136	0.9700	0.0008
8273.6795	0.9753	0.0053	8273.6795	0.9753	0.0053	8275.0186	0.9753	0.0053	8273.5503	0.9753	0.0053
8329.4115	0.9858	0.0105	8329.4115	0.9858	0.0105	8331.0453	0.9858	0.0105	8329.1193	0.9858	0.0105
8390.8929	0.9900	0.0042	8390.8929	0.9900	0.0042	8392.5050	0.9900	0.0042	8389.4997	0.9900	0.0042
8495.1165	0.9910	0.0011	8495.1165	0.9910	0.0011	8496.4263	0.9910	0.0011	8492.2705	0.9910	0.0011
8583.1023	0.9933	0.0023	8583.1023	0.9933	0.0023	8580.1312	0.9933	0.0023	8587.6161	0.9933	0.0023
8638.8320	0.9978	0.0045	8638.8320	0.9978	0.0045	8636.1553	0.9978	0.0045	8643.1851	0.9978	0.0045
8700.3139	0.9996	0.0018	8700.3139	0.9996	0.0018	8697.6171	0.9996	0.0018	8703.5663	0.9996	0.0018
8804.5399	1.0000	0.0005	8804.5399	1.0000	0.0005	8801.5374	1.0000	0.0005	8806.3362	1.0000	0.0005

Table 6K-1 - Cumulative Probability Plans 1, 2, 3, and 4 ($ in Millions)

PLAN 5	Cumulative	Probability	PLAN 6	Cumulative	Probability	PLAN 7	Cumulative	Probability	PLAN 8	Cumulative	Probability
7497.7264	0.0035	0.0035	7531.2893	0.0035	0.0035	7533.3786	0.0035	0.0035	7532.4520	0.0035	0.0035
7525.8970	0.0105	0.0070	7559.5815	0.0105	0.0070	7561.4256	0.0105	0.0070	7560.4496	0.0105	0.0070
7559.6124	0.0133	0.0028	7591.9799	0.0133	0.0028	7593.4520	0.0133	0.0028	7592.6349	0.0133	0.0028
7577.9694	0.1008	0.0875	7592.8282	0.1008	0.0875	7593.6958	0.1008	0.0875	7593.0904	0.1008	0.0875
7619.3348	0.1015	0.0007	7649.2757	0.2758	0.1750	7649.8827	0.2758	0.1750	7649.0445	0.2758	0.1750
7625.0991	0.1278	0.0263	7651.7265	0.2765	0.0007	7653.1077	0.2765	0.0007	7652.1840	0.2765	0.0007
7634.1554	0.3028	0.1750	7652.1546	0.3203	0.0438	7653.2027	0.3203	0.0438	7652.4316	0.3203	0.0438
7634.1600	0.3465	0.0438	7652.5200	0.3465	0.0263	7653.2055	0.3465	0.0263	7652.5614	0.3465	0.0263
7681.9442	0.3990	0.0525	7702.6837	0.4340	0.0875	7703.5204	0.4340	0.0875	7702.6780	0.4340	0.0875
7685.1604	0.4865	0.0875	7709.3045	0.4865	0.0525	7709.6913	0.4865	0.0525	7708.9046	0.4865	0.0525
7686.6136	0.4953	0.0088	7710.7747	0.5565	0.0700	7710.8784	0.5565	0.0700	7710.4551	0.5565	0.0700
7697.1644	0.5653	0.0700	7710.9561	0.5653	0.0088	7712.4327	0.5653	0.0088	7711.4811	0.5653	0.0088
7727.7561	0.5828	0.0175	7752.1776	0.5828	0.0175	7753.4837	0.5828	0.0175	7752.4600	0.5828	0.0175
7741.8498	0.6178	0.0350	7758.6516	0.6178	0.0350	7758.9571	0.6178	0.0350	7758.4697	0.6178	0.0350
7746.1366	0.6388	0.0210	7771.0361	0.6388	0.0210	7771.2544	0.6388	0.0210	7770.8874	0.6388	0.0210
7774.9861	0.6458	0.0070	7798.2375	0.6458	0.0070	7798.9866	0.6458	0.0070	7798.3109	0.6458	0.0070
7801.1297	0.6633	0.0175	7814.3481	0.6633	0.0175	7814.5385	0.6633	0.0175	7813.8581	0.6633	0.0175
7811.7909	0.6648	0.0015	7840.7128	0.6648	0.0015	7842.8006	0.6648	0.0015	7841.8730	0.6648	0.0015
7837.3435	0.6735	0.0088	7853.4273	0.6735	0.0088	7853.9159	0.6735	0.0088	7853.1216	0.6735	0.0088
7839.9636	0.6765	0.0030	7869.0025	0.6765	0.0030	7870.8451	0.6765	0.0030	7869.8719	0.6765	0.0030
7850.6317	0.6818	0.0053	7874.9089	0.6818	0.0053	7874.9176	0.6818	0.0053	7874.3600	0.6818	0.0053
7855.5509	0.6835	0.0018	7878.5993	0.6835	0.0018	7879.5872	0.6835	0.0018	7878.5938	0.6835	0.0018
7873.6788	0.6847	0.0012	7901.4020	0.6847	0.0012	7902.8736	0.6847	0.0012	7902.0570	0.6847	0.0012
7892.0361	0.7222	0.0375	7902.2506	0.7222	0.0375	7903.1188	0.7222	0.0375	7902.5119	0.7222	0.0375
7933.4009	0.7225	0.0003	7958.6977	0.7972	0.0750	7959.3047	0.7972	0.0750	7958.4664	0.7972	0.0750
7939.1665	0.7338	0.0113	7961.1496	0.7975	0.0003	7962.5307	0.7975	0.0003	7961.6077	0.7975	0.0003
7948.2205	0.8088	0.0750	7961.5776	0.8163	0.0188	7962.6252	0.8163	0.0188	7961.8533	0.8163	0.0188
7948.2278	0.8275	0.0188	7961.9428	0.8275	0.0113	7962.6296	0.8275	0.0113	7961.9832	0.8275	0.0113
7996.0087	0.8500	0.0225	8012.1060	0.8650	0.0375	8012.9432	0.8650	0.0375	8012.0995	0.8650	0.0375
7999.2268	0.8875	0.0375	8018.7275	0.8875	0.0225	8019.1145	0.8875	0.0225	8018.3251	0.8875	0.0225
8000.6802	0.8913	0.0038	8020.1977	0.9175	0.0300	8020.3013	0.9175	0.0300	8019.8769	0.9175	0.0300
8011.2308	0.9213	0.0300	8020.3779	0.9213	0.0038	8021.8579	0.9213	0.0038	8020.9027	0.9213	0.0038
8041.8227	0.9288	0.0075	8061.5985	0.9288	0.0075	8062.9071	0.9288	0.0075	8061.8854	0.9288	0.0075
8055.9161	0.9438	0.0150	8068.0736	0.9438	0.0150	8068.3808	0.9438	0.0150	8067.8925	0.9438	0.0150
8060.2032	0.9528	0.0090	8080.4580	0.9528	0.0090	8080.6784	0.9528	0.0090	8080.3098	0.9528	0.0090
8089.0531	0.9558	0.0030	8107.6612	0.9558	0.0030	8108.4095	0.9558	0.0030	8107.7350	0.9558	0.0030
8115.1937	0.9633	0.0075	8123.7696	0.9633	0.0075	8123.9607	0.9633	0.0075	8123.2802	0.9633	0.0075
8151.4068	0.9670	0.0038	8162.8494	0.9670	0.0038	8163.3399	0.9670	0.0038	8162.5437	0.9670	0.0038
8164.6965	0.9693	0.0023	8184.3316	0.9693	0.0023	8184.3397	0.9693	0.0023	8183.7828	0.9693	0.0023
8169.6186	0.9700	0.0008	8188.0225	0.9700	0.0008	8189.0095	0.9700	0.0008	8188.0166	0.9700	0.0008
8259.4808	0.9753	0.0053	8273.6795	0.9753	0.0053	8274.4331	0.9753	0.0053	8273.5794	0.9753	0.0053
8315.4383	0.9858	0.0105	8329.4115	0.9858	0.0105	8330.1192	0.9858	0.0105	8329.3879	0.9858	0.0105
8378.1148	0.9900	0.0042	8390.8929	0.9900	0.0042	8391.0795	0.9900	0.0042	8390.6412	0.9900	0.0042
8482.1079	0.9910	0.0011	8495.1165	0.9910	0.0011	8495.3701	0.9910	0.0011	8494.5714	0.9910	0.0011
8573.5465	0.9933	0.0023	8583.1023	0.9933	0.0023	8583.8557	0.9933	0.0023	8583.0008	0.9933	0.0023
8629.5028	0.9978	0.0045	8638.8320	0.9978	0.0045	8639.5411	0.9978	0.0045	8638.8123	0.9978	0.0045
8692.1802	0.9996	0.0018	8700.3139	0.9996	0.0018	8700.5028	0.9996	0.0018	8700.0609	0.9996	0.0018
8796.1765	1.0000	0.0005	8804.5399	1.0000	0.0005	8804.7913	1.0000	0.0005	8803.9940	1.0000	0.0005

Table 6K-2 - Cumulative Probability Plans 5, 6, 7, and 8 ($ in Millions)

PLAN 9	Cumulative	Probability	PLAN 10	Cumulative	Probability	PLAN 11	Cumulative	Probability	PLAN 12	Cumulative	Probability
7528.9553	0.0035	0.0035	7505.4975	0.0035	0.0035	7563.5615	0.0035	0.0035	7599.2509	0.0035	0.0035
7556.9460	0.0105	0.0070	7536.1498	0.0105	0.0070	7591.5433	0.0105	0.0070	7627.0838	0.0105	0.0070
7588.9489	0.0133	0.0028	7571.6963	0.0980	0.0875	7620.2216	0.0980	0.0875	7649.8554	0.0980	0.0875
7594.0098	0.1008	0.0875	7573.6001	0.1008	0.0028	7620.9673	0.1008	0.0028	7656.0579	0.1008	0.0028
7648.2365	0.1015	0.0007	7628.9803	0.1446	0.0438	7666.0556	0.1271	0.0263	7686.9918	0.1271	0.0263
7649.6960	0.2765	0.1750	7630.5957	0.3196	0.1750	7673.5702	0.1278	0.0007	7702.0612	0.1278	0.0007
7651.8819	0.3203	0.0438	7637.6761	0.3203	0.0007	7676.2897	0.3028	0.1750	7705.1367	0.3028	0.1750
7653.6285	0.3465	0.0263	7642.3666	0.3465	0.0263	7682.1232	0.3465	0.0438	7714.9665	0.3465	0.0438
7701.8012	0.4340	0.0875	7682.0904	0.4340	0.0875	7722.6766	0.3990	0.0525	7743.2371	0.3990	0.0525
7709.3458	0.4865	0.0525	7686.0063	0.4428	0.0088	7732.5093	0.4865	0.0875	7762.9059	0.4690	0.0700
7709.4826	0.4953	0.0088	7697.0715	0.5128	0.0700	7734.5880	0.5565	0.0700	7764.8727	0.5565	0.0875
7711.2613	0.5653	0.0700	7701.3179	0.5653	0.0525	7742.4715	0.5653	0.0088	7777.3952	0.5653	0.0088
7750.1369	0.5828	0.0175	7729.6998	0.5828	0.0175	7781.6195	0.5863	0.0210	7801.2119	0.5863	0.0210
7757.5275	0.6178	0.0350	7742.9320	0.6178	0.0350	7783.3973	0.6038	0.0175	7817.1399	0.6213	0.0350
7772.3001	0.6388	0.0210	7766.6439	0.6388	0.0210	7785.3092	0.6388	0.0350	7817.9789	0.6388	0.0175
7795.8774	0.6458	0.0070	7780.8457	0.6458	0.0070	7826.3579	0.6458	0.0070	7852.0481	0.6563	0.0175
7813.9398	0.6633	0.0175	7804.6160	0.6633	0.0175	7830.8582	0.6633	0.0175	7860.3042	0.6633	0.0070
7848.0533	0.6648	0.0015	7819.4237	0.6648	0.0015	7872.8419	0.6720	0.0088	7893.1576	0.6685	0.0053
7851.9472	0.6735	0.0088	7841.4385	0.6735	0.0088	7879.6883	0.6773	0.0053	7897.9671	0.6773	0.0088
7874.2450	0.6788	0.0053	7850.0727	0.6765	0.0030	7880.4209	0.6788	0.0015	7925.1687	0.6788	0.0015
7875.9122	0.6805	0.0018	7865.5774	0.6783	0.0018	7899.4649	0.6805	0.0018	7926.7457	0.6805	0.0018
7876.0429	0.6835	0.0030	7875.9829	0.6835	0.0053	7908.4020	0.6835	0.0030	7953.0010	0.6835	0.0030
7908.0461	0.6847	0.0012	7885.6198	0.7210	0.0375	7937.0815	0.7210	0.0375	7975.7731	0.7210	0.0375
7913.1060	0.7222	0.0375	7887.5247	0.7222	0.0012	7937.8275	0.7222	0.0012	7981.9753	0.7222	0.0012
7967.3348	0.7225	0.0003	7942.9044	0.7410	0.0188	7982.9157	0.7335	0.0113	8012.9094	0.7335	0.0113
7968.7935	0.7975	0.0750	7944.5192	0.8160	0.0750	7990.4305	0.7338	0.0003	8027.9785	0.7338	0.0003
7970.9794	0.8163	0.0188	7951.6011	0.8163	0.0003	7993.1476	0.8088	0.0750	8031.0531	0.8088	0.0750
7972.7258	0.8275	0.0113	7956.2911	0.8275	0.0113	7998.9844	0.8275	0.0188	8040.8862	0.8275	0.0188
8020.8989	0.8650	0.0375	7996.0145	0.8650	0.0375	8039.5365	0.8500	0.0225	8069.1568	0.8500	0.0225
8028.4437	0.8875	0.0225	7999.9299	0.8688	0.0038	8049.3673	0.8875	0.0375	8088.8252	0.8800	0.0300
8028.5815	0.8913	0.0038	8010.9971	0.8988	0.0300	8051.4479	0.9175	0.0300	8090.7904	0.9175	0.0375
8030.3602	0.9213	0.0300	8015.2420	0.9213	0.0225	8059.3307	0.9213	0.0038	8103.3142	0.9213	0.0038
8069.2343	0.9288	0.0075	8043.6236	0.9288	0.0075	8098.4789	0.9303	0.0090	8127.1302	0.9303	0.0090
8076.6266	0.9438	0.0150	8056.8559	0.9438	0.0150	8100.2560	0.9378	0.0075	8143.0587	0.9453	0.0150
8091.3997	0.9528	0.0090	8080.5685	0.9528	0.0090	8102.1688	0.9528	0.0150	8143.8946	0.9528	0.0075
8114.9731	0.9558	0.0030	8094.7699	0.9558	0.0030	8143.2187	0.9558	0.0030	8177.9656	0.9603	0.0075
8133.0350	0.9633	0.0075	8118.5398	0.9633	0.0075	8147.7168	0.9633	0.0075	8186.2218	0.9633	0.0030
8171.0433	0.9670	0.0038	8155.3622	0.9670	0.0038	8189.7009	0.9670	0.0038	8219.0750	0.9655	0.0023
8193.3416	0.9693	0.0023	8179.5020	0.9678	0.0008	8196.5473	0.9693	0.0023	8223.8836	0.9693	0.0038
8195.0082	0.9700	0.0008	8189.9069	0.9700	0.0023	8216.3244	0.9700	0.0008	8252.6644	0.9700	0.0008
8273.2071	0.9753	0.0053	8250.1462	0.9753	0.0053	8303.8898	0.9753	0.0053	8337.8097	0.9753	0.0053
8328.4053	0.9858	0.0105	8308.5163	0.9858	0.0105	8359.5122	0.9858	0.0105	8392.8485	0.9858	0.0105
8389.3887	0.9900	0.0042	8374.9158	0.9900	0.0042	8417.8535	0.9900	0.0042	8450.3011	0.9900	0.0042
8493.2147	0.9910	0.0011	8482.9978	0.9910	0.0011	8514.4685	0.9910	0.0011	8540.0864	0.9910	0.0011
8592.3054	0.9933	0.0023	8564.0707	0.9933	0.0023	8620.7503	0.9933	0.0023	8663.7276	0.9933	0.0023
8647.5026	0.9978	0.0045	8622.4386	0.9978	0.0045	8676.3707	0.9978	0.0045	8718.7656	0.9978	0.0045
8708.4868	0.9996	0.0018	8688.8389	0.9996	0.0018	8734.7110	0.9996	0.0018	8776.2179	0.9996	0.0018
8812.3120	1.0000	0.0005	8796.9230	1.0000	0.0005	8831.3293	1.0000	0.0005	8866.0060	1.0000	0.0005

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

PLAN 13	Cumulative	Probability	PLAN 14	Cumulative	Probability	PLAN 15	Cumulative	Probability	PLAN 16	Cumulative	Probability
7528.5345	0.0035	0.0035	7531.2893	0.0035	0.0035	7574.2972	0.0035	0.0035	7772.5561	0.0035	0.0035
7556.8142	0.0105	0.0070	7559.5815	0.0105	0.0070	7602.2192	0.0105	0.0070	7799.5358	0.0105	0.0070
7589.0596	0.0133	0.0028	7591.9799	0.0133	0.0028	7628.5602	0.0980	0.0875	7811.5494	0.0980	0.0875
7594.3781	0.1008	0.0875	7592.8282	0.1008	0.0875	7631.6625	0.1008	0.0028	7815.8293	0.1243	0.0263
7648.3383	0.1015	0.0007	7649.2757	0.2758	0.1750	7666.9640	0.1271	0.0263	7827.6895	0.1271	0.0028
7650.5419	0.2765	0.1750	7651.7265	0.2765	0.0007	7682.1741	0.1278	0.0007	7865.2822	0.3021	0.1750
7652.1804	0.3203	0.0438	7652.1546	0.3203	0.0438	7683.9207	0.3028	0.1750	7869.4500	0.3546	0.0525
7654.1820	0.3465	0.0263	7652.5200	0.3465	0.0263	7691.6548	0.3465	0.0438	7874.0701	0.3553	0.0007
7702.4208	0.4340	0.0875	7702.6837	0.4340	0.0875	7723.5338	0.3990	0.0525	7883.0896	0.3990	0.0438
7709.4497	0.4428	0.0088	7709.3045	0.4865	0.0525	7741.5244	0.4865	0.0875	7921.3831	0.4690	0.0700
7710.1991	0.4953	0.0525	7710.7747	0.5565	0.0700	7742.4672	0.5565	0.0700	7927.1224	0.4900	0.0210
7712.1076	0.5653	0.0700	7710.9561	0.5653	0.0088	7752.8860	0.5653	0.0088	7931.7221	0.5775	0.0875
7750.5250	0.5828	0.0175	7752.1776	0.5828	0.0175	7782.3560	0.5863	0.0210	7949.4115	0.5863	0.0088
7758.3479	0.6178	0.0350	7758.6516	0.6178	0.0350	7793.5059	0.6038	0.0175	7982.3426	0.6213	0.0350
7772.9897	0.6388	0.0210	7771.0361	0.6388	0.0210	7794.5955	0.6388	0.0350	7988.6763	0.6388	0.0175
7796.4533	0.6458	0.0070	7798.2375	0.6458	0.0070	7836.3705	0.6563	0.0175	8010.6849	0.6563	0.0175
7814.8189	0.6633	0.0175	7814.3481	0.6633	0.0175	7836.3929	0.6633	0.0070	8018.9932	0.6615	0.0053
7847.6330	0.6648	0.0015	7840.7128	0.6648	0.0015	7878.9826	0.6685	0.0053	8029.9168	0.6685	0.0070
7852.6239	0.6735	0.0088	7853.4273	0.6735	0.0088	7880.0844	0.6773	0.0088	8063.4021	0.6773	0.0088
7875.1109	0.6788	0.0053	7869.0025	0.6765	0.0030	7894.9291	0.6788	0.0015	8096.3405	0.6790	0.0018
7875.9101	0.6818	0.0030	7874.9089	0.6818	0.0053	7907.6103	0.6805	0.0018	8134.3814	0.6805	0.0015
7876.2815	0.6835	0.0018	7878.5993	0.6835	0.0018	7922.8480	0.6835	0.0030	8161.3586	0.6835	0.0030
7908.1569	0.6847	0.0012	7901.4020	0.6847	0.0012	7949.1905	0.7210	0.0375	8173.3738	0.7210	0.0375
7913.4757	0.7222	0.0375	7902.2506	0.7222	0.0375	7952.2929	0.7222	0.0012	8177.6536	0.7323	0.0113
7967.4367	0.7225	0.0003	7958.6977	0.7972	0.0750	7987.5950	0.7335	0.0113	8189.5148	0.7335	0.0012
7969.6388	0.7975	0.0750	7961.1496	0.7975	0.0003	8002.8054	0.7338	0.0003	8227.1053	0.8085	0.0750
7971.2786	0.8163	0.0188	7961.5776	0.8163	0.0188	8004.5505	0.8088	0.0750	8231.2743	0.8310	0.0225
7973.2799	0.8275	0.0113	7961.9428	0.8275	0.0113	8012.2853	0.8275	0.0188	8235.8938	0.8313	0.0003
8021.5183	0.8650	0.0375	8012.1060	0.8650	0.0375	8044.1646	0.8500	0.0225	8244.9125	0.8500	0.0188
8028.5468	0.8688	0.0038	8018.7275	0.8875	0.0225	8062.1552	0.8875	0.0375	8283.2077	0.8800	0.0300
8029.2969	0.8913	0.0225	8020.1977	0.9175	0.0300	8063.0985	0.9175	0.0300	8288.9485	0.8890	0.0090
8031.2055	0.9213	0.0300	8020.3779	0.9213	0.0038	8073.5173	0.9213	0.0038	8293.5448	0.9265	0.0375
8069.6212	0.9288	0.0075	8061.5985	0.9288	0.0075	8102.9880	0.9303	0.0090	8311.2354	0.9303	0.0038
8077.4452	0.9438	0.0150	8068.0736	0.9438	0.0150	8114.1347	0.9378	0.0075	8344.1682	0.9453	0.0150
8092.0868	0.9528	0.0090	8080.4580	0.9528	0.0090	8115.2272	0.9528	0.0150	8350.5000	0.9528	0.0075
8115.5518	0.9558	0.0030	8107.6612	0.9558	0.0030	8157.0004	0.9603	0.0075	8372.5081	0.9603	0.0075
8133.9153	0.9633	0.0075	8123.7696	0.9633	0.0075	8157.0231	0.9633	0.0030	8380.8148	0.9625	0.0023
8171.7209	0.9670	0.0038	8162.8494	0.9670	0.0038	8199.6148	0.9655	0.0023	8391.7419	0.9655	0.0030
8194.2079	0.9693	0.0023	8184.3316	0.9693	0.0023	8200.7145	0.9693	0.0038	8425.2252	0.9693	0.0038
8195.3796	0.9700	0.0008	8188.0225	0.9700	0.0008	8228.2416	0.9700	0.0008	8458.1632	0.9700	0.0008
8273.5835	0.9753	0.0053	8273.6795	0.9753	0.0053	8313.9110	0.9753	0.0053	8505.0240	0.9753	0.0053
8329.0302	0.9858	0.0105	8329.4115	0.9858	0.0105	8368.9434	0.9858	0.0105	8558.9371	0.9858	0.0105
8390.2846	0.9900	0.0042	8390.8929	0.9900	0.0042	8427.2628	0.9900	0.0042	8615.2240	0.9900	0.0042
8494.0259	0.9910	0.0011	8495.1165	0.9910	0.0011	8521.8935	0.9910	0.0011	8705.1509	0.9910	0.0011
8592.6817	0.9933	0.0023	8583.1023	0.9933	0.0023	8634.5433	0.9933	0.0023	8866.8484	0.9933	0.0023
8648.1259	0.9978	0.0045	8638.8320	0.9978	0.0045	8689.5721	0.9978	0.0045	8920.7593	0.9978	0.0045
8709.3804	0.9996	0.0018	8700.3139	0.9996	0.0018	8747.8917	0.9996	0.0018	8977.0478	0.9996	0.0018
8813.1246	1.0000	0.0005	8804.5399	1.0000	0.0005	8842.5255	1.0000	0.0005	9066.9750	1.0000	0.0005

Table 6K-4 - Cumulative Probability Plans 13, 14, 15, and 16 ($ in Millions)

PLAN 17	Cumulative	Probability	PLAN 18	Cumulative	Probability	PLAN 19	Cumulative	Probability
7565.4357	0.0035	0.0035	7447.6179	0.0035	0.0035	7532.0965	0.0035	0.0035
7593.7362	0.0105	0.0070	7475.8924	0.0105	0.0070	7560.8789	0.0105	0.0070
7613.8501	0.0980	0.0875	7519.6264	0.0133	0.0028	7591.9718	0.0980	0.0875
7624.3851	0.1008	0.0028	7592.1122	0.0140	0.0007	7607.7762	0.1008	0.0028
7669.8761	0.2758	0.1750	7614.1385	0.1015	0.0875	7648.2572	0.1446	0.0438
7675.3373	0.3196	0.0438	7644.9635	0.1453	0.0438	7648.5276	0.3196	0.1750
7679.6483	0.3203	0.0007	7668.0427	0.1540	0.0088	7666.4680	0.3458	0.0263
7683.3341	0.3465	0.0263	7669.7190	0.3290	0.1750	7682.9968	0.3465	0.0007
7725.3879	0.4340	0.0875	7683.6925	0.3553	0.0263	7699.4859	0.4340	0.0875
7729.7677	0.5040	0.0700	7694.7181	0.4428	0.0875	7705.6315	0.4428	0.0088
7738.6920	0.5128	0.0088	7709.0151	0.4603	0.0175	7722.6965	0.4953	0.0525
7739.9122	0.5653	0.0525	7737.4505	0.5128	0.0525	7724.1684	0.5653	0.0700
7779.7334	0.5828	0.0175	7741.3044	0.5828	0.0700	7747.3757	0.5828	0.0175
7779.7695	0.6178	0.0350	7752.0235	0.5843	0.0015	7769.2821	0.6178	0.0350
7799.4795	0.6388	0.0210	7761.3946	0.6193	0.0350	7798.9217	0.6388	0.0210
7823.9696	0.6458	0.0070	7766.3293	0.6263	0.0070	7807.9346	0.6458	0.0070
7828.8346	0.6633	0.0175	7780.2950	0.6293	0.0030	7842.6119	0.6633	0.0175
7870.1243	0.6720	0.0088	7805.9067	0.6503	0.0210	7848.6750	0.6648	0.0015
7870.5473	0.6735	0.0015	7824.0295	0.6515	0.0012	7877.4599	0.6678	0.0030
7898.8464	0.6765	0.0030	7855.9171	0.6690	0.0175	7879.5339	0.6765	0.0088
7900.0344	0.6818	0.0053	7858.9167	0.6707	0.0018	7903.7555	0.6783	0.0018
7900.0729	0.6835	0.0018	7867.3332	0.6795	0.0088	7908.5517	0.7158	0.0375
7918.9615	0.7210	0.0375	7896.5163	0.6798	0.0003	7916.8385	0.7210	0.0053
7929.4956	0.7222	0.0012	7916.5936	0.6850	0.0053	7924.3563	0.7222	0.0012
7974.9884	0.7972	0.0750	7918.5419	0.7225	0.0375	7964.8383	0.7410	0.0188
7980.4502	0.8160	0.0188	7949.3678	0.7413	0.0188	7965.1069	0.8160	0.0750
7984.7622	0.8163	0.0003	7972.4474	0.7450	0.0038	7983.0498	0.8272	0.0113
7988.4470	0.8275	0.0113	7974.1225	0.8200	0.0750	7999.5773	0.8275	0.0003
8030.5000	0.8650	0.0375	7988.0977	0.8313	0.0113	8016.0660	0.8650	0.0375
8034.8772	0.8950	0.0300	7999.1217	0.8688	0.0375	8022.2119	0.8688	0.0038
8043.8036	0.8988	0.0038	8013.4175	0.8763	0.0075	8039.2763	0.8913	0.0225
8045.0242	0.9213	0.0225	8041.8547	0.8988	0.0225	8040.7486	0.9213	0.0300
8084.8443	0.9288	0.0075	8045.7092	0.9288	0.0300	8063.9571	0.9288	0.0075
8084.8816	0.9438	0.0150	8065.7973	0.9438	0.0150	8085.8629	0.9438	0.0150
8104.5905	0.9528	0.0090	8070.7338	0.9468	0.0030	8115.5024	0.9528	0.0090
8129.0837	0.9558	0.0030	8110.3110	0.9558	0.0090	8124.5148	0.9558	0.0030
8133.9453	0.9633	0.0075	8160.3214	0.9633	0.0075	8159.1899	0.9633	0.0075
8175.2359	0.9670	0.0038	8163.3203	0.9640	0.0008	8196.1108	0.9670	0.0038
8205.1453	0.9693	0.0023	8171.7366	0.9678	0.0038	8220.3371	0.9678	0.0008
8205.1848	0.9700	0.0008	8220.9974	0.9700	0.0023	8233.4169	0.9700	0.0023
8294.2722	0.9753	0.0053	8279.1402	0.9753	0.0053	8261.2450	0.9753	0.0053
8350.1662	0.9858	0.0105	8334.7983	0.9858	0.0105	8317.6810	0.9858	0.0105
8409.7606	0.9900	0.0042	8406.9588	0.9900	0.0042	8393.2568	0.9900	0.0042
8509.2776	0.9910	0.0011	8522.0515	0.9910	0.0011	8512.2177	0.9910	0.0011
8599.3855	0.9933	0.0023	8583.5441	0.9933	0.0023	8577.8254	0.9933	0.0023
8655.2768	0.9978	0.0045	8639.2009	0.9978	0.0045	8634.2586	0.9978	0.0045
8714.8727	0.9996	0.0018	8711.3615	0.9996	0.0018	8709.8364	0.9996	0.0018
8814.3906	1.0000	0.0005	8826.4578	1.0000	0.0005	8828.8006	1.0000	0.0005

Table 6K-5 - Cumulative Probability Plans 17, 18, and 19 ($ in Millions)

Appendix 6L Annual Unserved Hours for all Alternative Resource Plans Table

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Plan 1	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 2	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 3	0	0	0	0	0	0	0	0	0	30.6	0	178.9	0	0	0	0	0	229.7	0	0
Plan 4	0	0	0	39.8	0	0	0	0	0	45.7	0	252.4	0	0	0	0	0	265	0	0
Plan 5	0	0	0	44.4	0	0	0	0	0	68.3	0	307	0	0	0	5.2	0	297.7	0	0
Plan 6	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 7	0	0	0	0	0	0	0	0	0	35.9	0	198.5	0	0	0	0	0	229.8	0	0
Plan 8	0	0	0	0	0	0	0	0	0	36	0	199.4	0	0	0	0	0	230.5	0	0
Plan 9	0	0	0	0	0	0	0	0	0	36.3	0	200.5	0	0	0	0	0	230.7	0	0
Plan 10	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	251.2	0	0
Plan 11	0	0	0	0	0	0	0	0	0	38	0	34.9	0	0	0	0	0	233.7	0	0
Plan 12	0	0	0	0	0	0	0	0	0	38	0	0	0	0	0	0	0	233.7	0	0
Plan 13	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 14	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 15	0	0	0	0	0	0	0	0	0	38	0	204.9	0	0	0	0	0	233.7	0	0
Plan 16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plan 17	0	0	0	0	0	0	0	0	0	23.6	0	180.4	0	0	0	0	0	208.6	0	0
Plan 18	0	0	0	0	0	0	0	0	0	34.8	0	190	0	0	0	5.1	0	2026.6	1029.5	4647
Plan 19	0	0	0	44.4	0	0	0	0	0	68.3	0	307	0	0	0	12	0	99.5	20.9	1977.7

Table 6L-1 - Annual Unserved Hours By Alternative Resource Plan