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VOLUME 6

INTEGRATED RESOURCE PLAN AND RISK ANALYSIS

THE EMPIRE DISTRICT ELECTRIC COMPANY

4 CSR 240-22.060

CASE NO. EO-2013-0547

JULY 2013

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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 which were critical to meeting the fundamental resource planning objective, but which 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.

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*. It is based on a percentage of a utility's sales. Two percent of this requirement must be solar. However, Empire has an exemption from the solar requirement. 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 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, Ventyx, developed, considered, and analyzed the present worth of long-run utility costs for 18 alternative resource supply plans by calculating the net present value revenue requirements (PVRR) for each plan. Minimization of PVRR was the determining 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 Ventyx 2013 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 ratebase. Capital expenditures for investments in plant increase the ratebase while depreciation and amortization of assets reduce the ratebase.

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 - 10 percent CO_2 regulation by 2015; Base - 50 percent no CO_2 regulations throughout the 20-year planning period; and Moderate - 40 percent CO_2 regulation by 2021. *Figure 6-1* provides a risk tree illustration of the risk distribution that was applied.

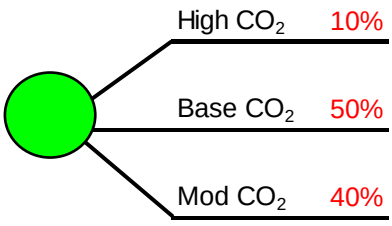

Figure 6-1 - Environmental Probabilities

Empire surveyed subject matter experts within the Company, at Ventyx, and at Sega, Inc. and reviewed the results with Empire Management before their use.

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 6.84 percent for all analyses of alternative resource plans. All PVRR dollar amounts were discounted back to 2012 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 18 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.

No.	Description	Type	DSM Portfolio	RES Requirement	Carbon Costs for DSM Screening
1	Base Case	Base Plan	Base Portfolio (RAP)	None	None
2	Base Case (meets RPS)	Base Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
3	Moderate Environmental	Other Contingency Plan	Moderate Env Portfolio (higher avoided costs)	15 to 25% by 2021	Begin 2021
4	High Environmental	Other Contingency Plan	High Env Portfolio (highest avoided costs)	15 to 25% by 2021	Begin 2015
5	RAP + DSM	Base Plan	Participation 1/3 between RAP & MAP	15 to 20% by 2021	None
6	RAP ++ DSM	Base Plan	Participation 2/3 between RAP & MAP	15 to 20% by 2021	None
7	Moderate DSM	Required Plan	Moderate (1% savings by 2015)	15 to 20% by 2021	Weighted
8	Aggressive DSM	Required Plan	Aggressive (2% savings by 2020)	15 to 20% by 2021	Weighted
9	MEEIA Level DSM	Required Plan	Designed to meet MEEIA savings goals	15 to 20% by 2021	Weighted
10	Aggressive Capacity DSM	Required Plan	Only DSM utilized to meet future capacity needs	15 to 20% by 2021	Weighted
11	No DSM	Base/Contingency Plan	None	15 to 20% by 2021	None
12	RAP - DSM	Base/Contingency Plan	55% of RAP participation	15 to 20% by 2021	None
13	High Fuel	Other Contingency Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
14	Low Fuel	Other Contingency Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
15	High Load	Other Contingency Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
16	Low Load	Other Contingency Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
17	High Fuel (No Future Coal)	Other Contingency Plan	Base Portfolio (RAP)	15 to 20% by 2021	None
18	Aggressive Renewable	Required Plan	None	Only Renewables Utilized	None

Abbreviations:
RES – Renewable Energy Standard
DSM – Demand-Side Management (energy efficiency and demand response programs)
RAP – Realistically Achievable Potential DSM
MAP – Maximum Achievable Potential DSM
MEEIA – Missouri Energy Efficiency Investment Act of 2009

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 developed first without RES requirements. Plan 11 included RES compliance resources, but no DSM resources. All the other plans were developed to comply with the RES mandates of 4 CSR 240-20.100 and the DSM requirements of 4 CSR 240-20.094 and 4 CSR 240-22.060. Plan 2 became the base case plan with realistically achievable potential (RAP) DSM and meets the minimum 15-percent RES by 2021. It is the compliance benchmark plan for planning purposes.

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 18 (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 10 (Aggressive Capacity DSM) was developed using only DSM to meet future capacity needs, but also includes sufficient renewable resources for compliance with RESs (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

Plan 7 (Moderate DSM) and Plan 8 (Aggressive DSM) were required by the stipulation and agreement in Empire's last IRP case (File No. EO-2011-0066). Empire is not aware of any other legal mandates that identified energy resources other than renewable energy or demand-side resources such that no aggressive, legally-mandated other energy resource plan was modeled. However, while not mandated, Plan 9 (MEEIA-level DSM) was designed to meet the savings goals specified by the Missouri Energy Efficiency Act of 2009 (MEEIA).

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

Plan 1 (Base Case) included realistically achievable potential DSM but contained no renewable resources. Plan 11 (No DSM) included compliance level renewables but did not include DSM. These plans were run to determine the best capacity expansion plan under those planning assumptions. All other plans, 2 through 10 and 12 through 18, included sufficient DSM and renewables for compliance with RES requirements.

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

The Commission's Order establishing special contemporary resource planning issues in this case, dated October 31, 2012, did not require special contemporary cases to be run. However, the three special resource planning issues contained in the Commission's order are addressed in Section 8 at the end of this volume.

Empire will be filing a separate application in relation to MEEIA and the Commission's rules implementing that act. However, for the purposes of this integrated resource plan filing, Plan 9 (MEEIA) was designed to demonstrate the relative costs of attaining the savings goals required under MEEIA for demonstration purposes.

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

Empire developed several plans using combinations of various resources and variables to determine the potential impacts of such occurrences. Plans 3 (Moderate Environmental) and 4 (High Environmental) were run to determine the effects of different levels of carbon costs for DSM screening. Plans 5 through 8 were developed to analyze the effects of DSM participation relative to varied carbon cost levels. Plan 12 was developed to model the case where only 55 percent of realistically achievable potential DSM was implemented, which is the current and historic level that Empire has experienced. Additionally, the DSM portfolio in Plan 12 was developed to help address the uncertainty associated with the load impact estimates of DSM. Plans 13 (High Fuel) and 14 (Low Fuel) were run to determine the likely impacts of different fuel cost scenarios on the Base Plan with compliant levels of DSM and renewables. Plans 15 (High Load) and 16 (Low Load) were run to gage the potential impacts of higher and lower loads on potential resource plan selection.

> *(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, Asbury 1 is in the midst of an environmental retrofit and steam turbine project. Asbury 2 is planned to be retired in early 2014. Riverton 7 and 8 previously transitioned from coal to natural gas in September 2012. Riverton 7, 8, and 9

and are scheduled to be retired in mid-2016 in conjunction with the conversion of Riverton 12 to combined cycle. All Empire resource plans assume the scheduled retirement of Energy Center 1 in 2032 for the purposes of this IRP.

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 the resource plans account for the on-going environmental retrofit project at Asbury Generating Station, which includes a flue gas desulfurization scrubber and a fabric filter, in addition to the recently added selective catalytic converter (SCR). All Empire resource plans incorporated the ongoing conversion of the Riverton 12 gas turbine from simple cycle to combined cycle arrangement which includes an SCR and a CO oxidation catalyst in the heat recovery steam generator. Iatan 1 was retrofitted with new emission controls equipment in 2010. Iatan 2 and Plum Point were recently 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.

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

3.1.12 Conclusion of Any DSM Programs

Empire currently participates in the following DSM programs.

Missouri

- High Efficiency Central Air Conditioner Rebate Program
- ENERGY STAR® New Homes
- Home Performance with ENERGY STAR®
- Low-Income New Homes
- Low-Income Weatherization
- Get Energy Active
- Commercial and Industrial Rebate Program
- Building Operator Certificate
- Energize Missouri

Kansas (Pilot Program - Ended June 30, 2013)

- High Efficiency Central Air Conditioner Rebate Program
- AC Tune-Up Program
- Low-Income Weatherization
- Commercial and Industrial Rebate Program

Oklahoma

- High Efficiency Central Air Conditioner Rebate Program
- AC Tune-Up Program
- Low-Income Weatherization
- Commercial and Industrial Rebate Program

Arkansas

- Arkansas Weatherization
- High Efficiency Central Air Conditioner Rebate Program
- Small Appliance Rebate program
- Commercial and Industrial Rebate Program

- CFL Promotion
- School Energy Education Program
- On-line Tools and Resources

All of the Kansas DSM programs are three-year pilot programs that ended on June 30, 2013. All other DSM programs listed above are current as of this filing.

(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 primary 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 Ventyx. The DSM alternatives that passed the AEG screening tests were input into the Ventyx 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.

Ventyx created nine forward views of the SPP-KSMO regional electricity market; three environmental scenarios with base, high, and low fuel price uncertainty for each. The base fuel market prices for the three environmental scenarios were used as the avoided costs. Three avoided costs cases were specified with two 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. The following figures show the avoided energy costs for the base environmental, moderate environmental, and high environmental cases.

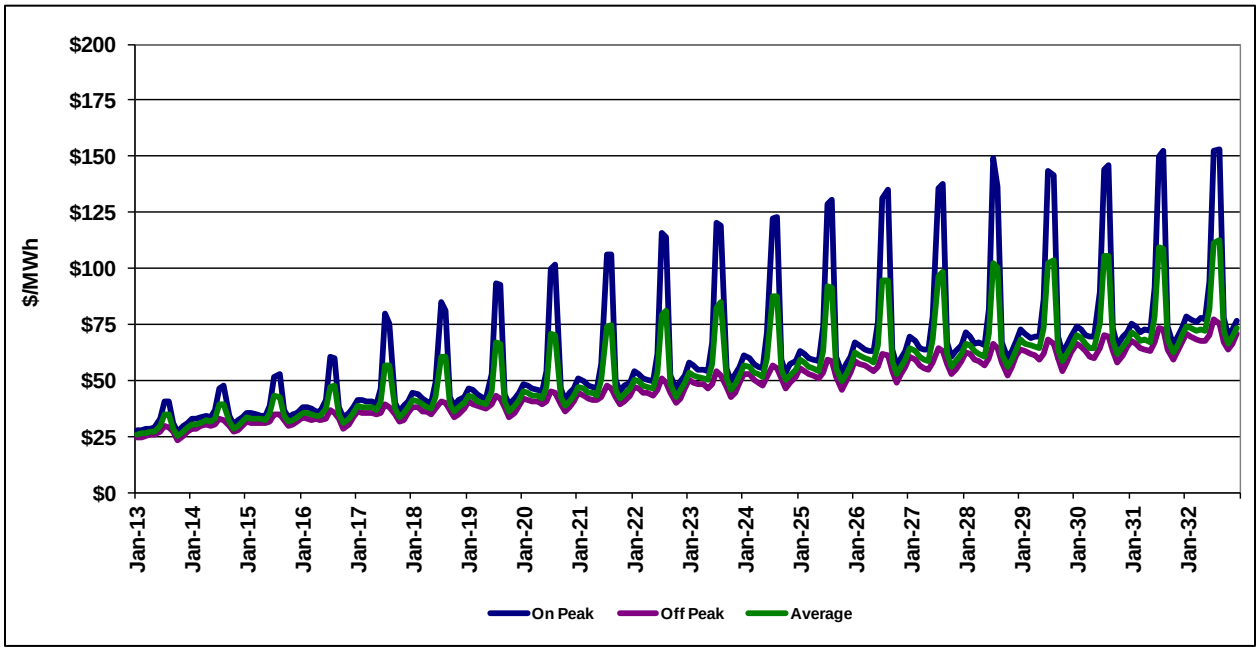

Figure 6-2 - Avoided Energy Cost - Zero Pollutant Case

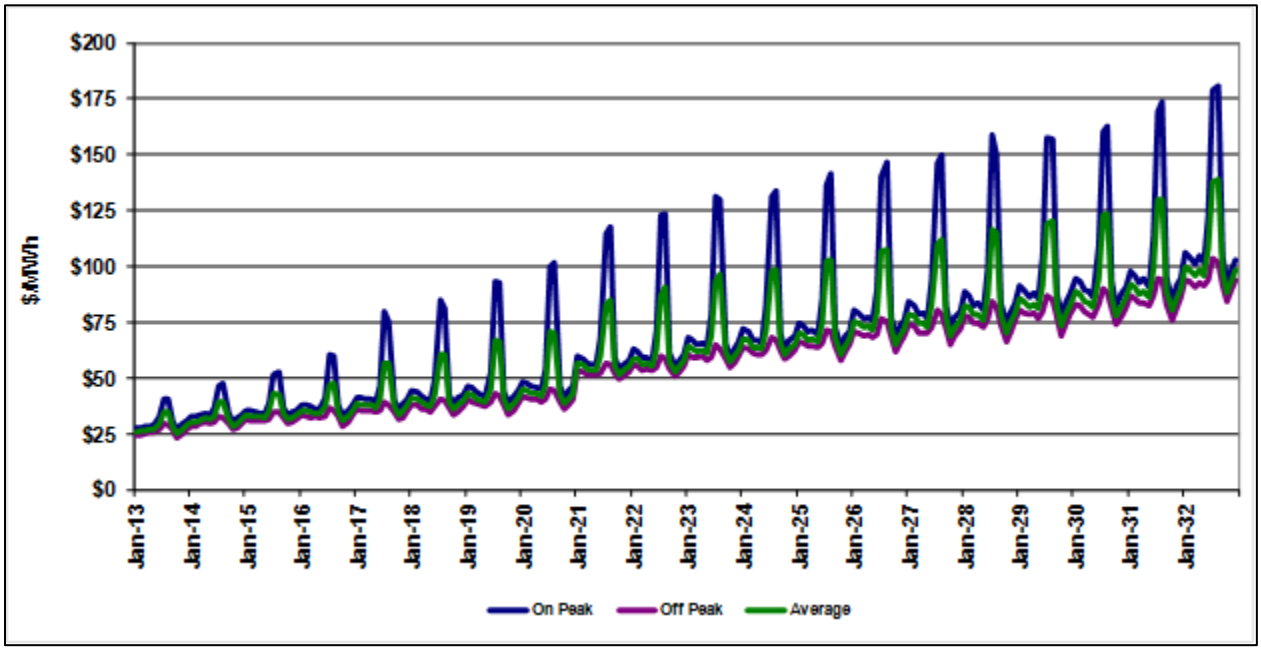

Figure 6-3 - Avoided Energy Cost - Moderate Pollutant Case

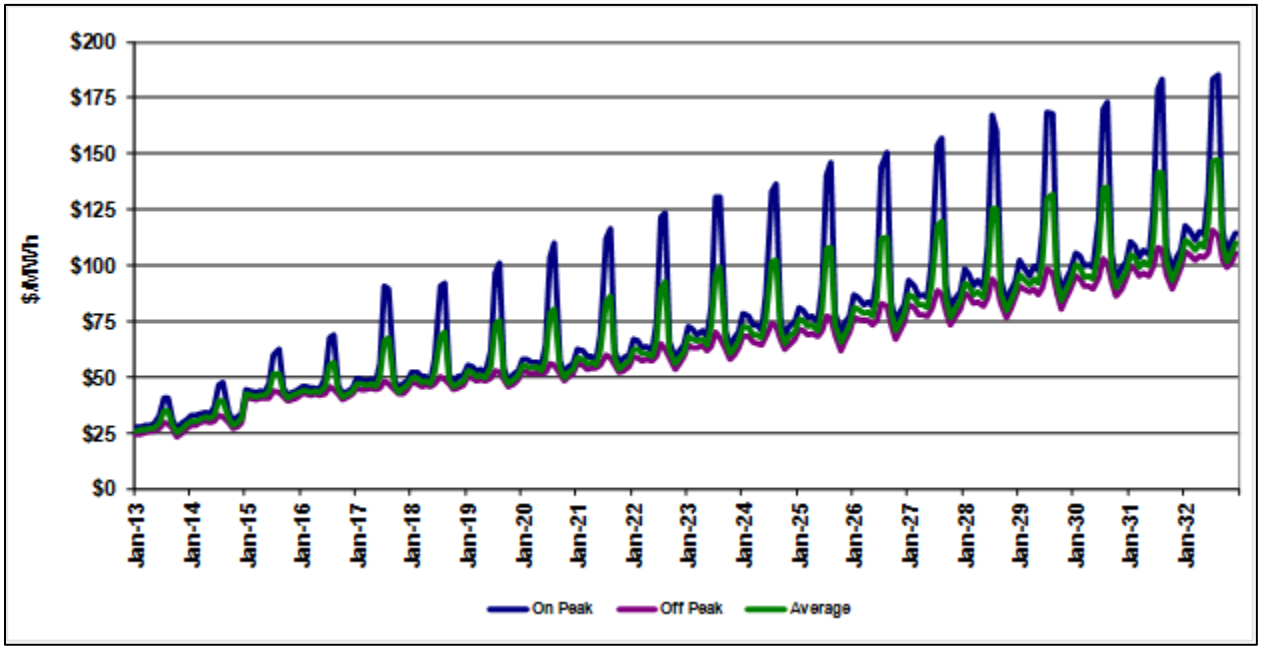

Figure 6-4 - Avoided Energy Cost - High Pollutant Case

3.1.13.2 DSM Alternatives after Avoided Cost Screening

The DSM programs that passed AEG's screening tests for all levels for the environmental scenarios and were passed on to Ventyx's CEM were as follows:

For Residential:

- Residential Products
- Residential Appliance Recycling
- Residential High Efficiency HVAC
- Whole House
- Home Energy Comparison Reports
- Low Income Weatherization
- Low Income New Homes
- School Kits
- Direct Load Control
- Peak Time Rebate

- Critical Peak Pricing
- Photovoltaics
- Wind Turbine

For Commercial and Industrial:

- Small Business Lighting
- C&I Custom Rebate
- C&I Prescriptive
- Building Operator Certificate
- Interruptible Service Rider
- Direct Load Control
- Critical Peak Pricing
- Photovoltaics
- Wind Turbine

The schedules for DSM programs that passed AEG screening tests for each of the environmental portfolios are provided in *Table 6-3*.

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DSM Portfolio	Base	Moderate Environmental	High Environmental	RAP+	RAP++	Moderate	Aggressive	Aggressive Capacity	MEEIA
Residential Products	2013	2013	2013	2013	2013	2013	2013	2013	2013
Residential Appliance Recycling	2013	2013	2013	2013	2013	2013	2013	2013	2013
Residential High Efficiency HVAC	2013	2013	2013	2013	2013	2013	2013	2013	2013
Whole House	2013	2013	2013	2013	2013	2013	2013	2013	2013
Home Energy Comparison Reports	No	No	No	2021	2021	2021	2021	2025	2021
Low Income Weatherization	2013	2013	2013	2013	2013	2013	2013	2013	2013
Low Income New Homes	2013	2013	2013	2013	2013	2013	2013	2013	2013
School Kits	2013	2013	2013	2013	2013	2013	2013	2013	2013
Direct Load Control	No	No	No	2021	2021	2021	2021	2024	2021
Peak Time Rebate	No	No	No	2020	2020	2020	2020	2024	2020
Critical Peak Pricing	No	No	No	2019	2019	2019	2019	2024	2019
Residential Photovoltaic	No	No	No	2030	2030	2030	2030	2030	2030
Residential Wind Turbine	No	No	No	2023	2023	2023	2023	2025	2023
Small Business Lighting	2013	2013	2013	2013	2013	2013	2013	2013	2013
C&I Custom Rebate	2013	2013	2013	2013	2013	2013	2013	2013	2013
C&I Prescriptive	2013	2013	2013	2013	2013	2013	2013	2013	2013
Building Operator Certificate	2013	2013	2013	2013	2013	2013	2013	2013	2013
Interruptible Service Rider	2013	2013	2013	2013	2013	2013	2013	2013	2013
Direct Load Control	No	No	No	No	2018	2018	2018	2024	2017
Critical Peak Pricing	No	No	No	No	2017	2017	2017	2024	2016
Commercial Photovoltaic	No	No	No	2028	2028	2028	2028	2028	2028
Commercial Wind Turbine	No	No	No	2022	2022	2022	2022	2025	2022

Abbreviations:
DSM - Demand-Side Management
RAP - Realistically Achievable Potential
MAP - Maximum Achievable Potential
MEEIA - Missouri Energy Efficiency Investment Act of 2009

Table 6-3 - 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 6-4 provides Empire's base capacity resources over the 20-year planning period. The only scheduled change in the existing base capacity resources is a 9-MW net reduction in the capacity of the Asbury plant resulting from the air emission control equipment retrofit and turbine projects (+ 5 MW) on Unit 1 in 2015 and the retirement of Unit 2 (-14 MW) in early 2014.

Plant	Asbury	Iatan	Iatan	Plum Point [2]	Ozark Beach	Total Capacity, MW
Unit	1 & 2 [1]	1	2		-	
Fuel	Coal	Coal	Coal	Coal	Water	
Type	Steam	Steam	Steam	Steam	Hydro	
2013	203	85	102	50	16	456
2014	189	85	102	50	16	456
2015	194	85	102	50	16	447
2016	194	85	102	50	16	447
2017	194	85	102	50	16	447
2018	194	85	102	50	16	447
2019	194	85	102	50	16	447
2020	194	85	102	50	16	447
2021	194	85	102	50	16	447
2022	194	85	102	50	16	447
2023	194	85	102	50	16	447
2024	194	85	102	50	16	447
2025	194	85	102	50	16	447
2026	194	85	102	50	16	447
2027	194	85	102	50	16	447
2028	194	85	102	50	16	447
2029	194	85	102	50	16	447
2030	194	85	102	50	16	447
2031	194	85	102	50	16	447
2032	194	85	102	50	16	447

Note: (1) Asbury Unit 2 is scheduled to be retired in early 2014.
(2) Does not include Empire's 50 MW Plum Point PPA that extends throughout the planning period.

Table 6-4 - Empire Base Capacity Resources for All Plans

Table 6-5 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.

Plant	State Line	Riverton	Total Capacity, MW
Fuel	Natural Gas		
Type	Combined Cycle		
2013	297	-	297
2014	297	-	297
2015	297	-	297
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

Table 6-5 - Empire Intermediate Capacity Supply-Side Resources

Table 6-6 provides the sequence and schedule for the end of life of Empire's peaking capacity resources. Riverton 7 and 8 previously transitioned from coal to natural gas in September 2012. Riverton 7, 8, and 9 and are scheduled to be retired in mid-2016 after Riverton 12 has been converted to combined cycle.

Plant	Riverton						Energy Center				State Line	Total Capacity, MW
Unit	7	8	9	10	11	12	1	2	3	4	1	
Type	Steam	Steam	GT	GT	GT	GT	GT	GT	Aero	Aero	GT	
2013	38	54	12	16	17	142	82	82	49	49	94	635
2014	38	54	12	16	17	142	82	82	49	49	94	635
2015	38	54	12	16	17	142	82	82	49	49	94	635
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	82	49	49	94	389
2024	-	-	-	16	17	-	82	82	49	49	94	389
2025	-	-	-	16	17	-	82	82	49	49	94	389
2026	-	-	-	16	17	-	82	82	49	49	94	389
2027	-	-	-	16	17	-	82	82	49	49	94	389
2028	-	-	-	16	17	-	82	82	49	49	94	389
2029	-	-	-	16	17	-	82	82	49	49	94	389
2030	-	-	-	16	17	-	82	82	49	49	94	389
2031	-	-	-	16	17	-	82	82	49	49	94	389
2032	-	-	-	16	17	-	-	82	49	49	94	295

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

Table 6-7 provides the sequence and schedule for the expiration of Empire's wind PPA energy resources which are intermittent resources for capacity. The accredited intermediate capacity from these wind resources is limited to 5 percent. The Elk River wind resource PPA is now scheduled to end in 2030. The Meridian Way wind resource PPA is scheduled to end in December 2028.

Project	Elk River	Meridian Way	Total Capacity, MW	Accredited Capacity, MW
Location	Kansas	Kansas		
2013	150	105	255	13
2014	150	105	255	13
2015	150	105	255	13
2016	150	105	255	13
2017	150	105	255	13
2018	150	105	255	13
2019	150	105	255	13
2020	150	105	255	13
2021	150	105	255	13
2022	150	105	255	13
2023	150	105	255	13
2024	150	105	255	13
2025	150	105	255	13
2026	150	105	255	13
2027	150	105	255	13
2028	150	105	255	13
2029	150	-	150	8
2030	150	-	150	8
2031	-	-	0	0
2032	-	-	0	0

Table 6-7 - Empire Renewable Intermittent Resources

3.1.14 Alternative Resource Plan Descriptions

Tables 6-8 and *6-9* highlight the supply-side resource expansion components for each of Empire's alternative resource plans.

YEAR	Plan 1	Plan 2	Plan 3	Plan 4	Plan 5	Plan 6	Plan 7	Plan 8	Plan 9
2021									
2022									
2023									
2024									
2025									
2026			100 MW Wind	100 MW Wind					
2027	50 MW Aero	50 MW Aero							
2028			50 MW Aero	50 MW Aero					
2029		100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind	100 MW Wind
2030			50 MW Aero 100 MW Wind	100 MW Wind					
2031	50 MW Aero	50 MW Aero 200 MW Wind 5 MW DG	100 MW Wind	100 MW Wind 100 MW Aero	200 MW Wind	200 MW Wind	200 MW Wind	200 MW Wind	200 MW Wind
2032	50 MW Aero 20 MW DG	50 MW Aero	50 MW Aero						

Table 6-8 - Supply-Side Expansion Plans

YEAR	Plan 10	Plan 11	Plan 12	Plan 13	Plan 14	Plan 15	Plan 16	Plan 17	Plan 18
2021						50 MW Aero			
2022									
2023									
2024		50 MW Aero		50 MW Coal		100 MW Wind			10 MW Biomass 2.5 MW Landfill Gas
2025			50 MW Aero	50 MW Coal		50 MW Aero			10 MW Biomass
2026				100 MW Coal					10 MW Biomass 100 MW Wind
2027					50 MW Aero			50 MW Aero 2.5 MW Landfill Gas	10 MW Biomass
2028		50 MW Aero				50 MW Aero			15 MW Solar
2029	100 MW Wind	100 MW Wind	50 MW Aero 100 MW Wind	100 MW Wind	100 MW Wind	200 MW Wind	100 MW Wind	100 MW Wind	200 MW Wind 15 MW Solar
2030						50 MW Aero	100 MW Wind	100 MW Aero	20 MW Biomass 20 MW Solar 100 MW Wind
2031	200 MW Wind	200 MW Wind 50 MW Aero	200 MW Wind	200 MW Wind	200 MW Wind 10 MW DG		100 MW Wind	200 MW Wind	20 MW Biomass 20 MW Solar 100 MW Wind
2032		50 MW Aero 2.5 MW Landfill Gas	100 MW Aero		100 MW Aero	87 MW Simple Cycle	50 MW Aero	2.5 MW Landfill Gas	20 MW Biomass 20 MW Solar 2.5 MW Landfill Gas

Table 6-9 - Supply-Side Expansion Plans Continued

Each of the alternative resource plans are further described below and in the capacity balance tables that follow. In compliance with 4 CSR 240-22.080(2)(D), the forecast of capacity balance table for each of the alternative resource plans is included. Due to likely rerates in the future, a generic 5 percent was utilized to calculate wind capacity for the 20-year planning horizon.

1. Plan 1 (Base Case): The Base Plan applied the existing Empire resources as described above and realistically achievable potential (RAP) DSM, but included no new renewables beyond Empire's current wind resources. Carbon costs for DSM screening were not included.

   The model satisfied future capacity needs by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2027, adding a second in 2031, and a third in 2032. Distributed generation capacity of 20 MW was added in 2032. Empire's existing wind PPAs were allowed to expire in 2029 and 2031. The Base portfolio of RAP DSM beginning at 6 MW in 2013 was employed throughout the planning period, increasing to 47.6 MW by 2032.

2. Plan 2 (Base Case Meets RPS): This plan utilized all Base plan assumptions and RAP DSM as described above, but added sufficient renewable energy resources for compliance with existing state (and potential federal) 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 not included. The model satisfied future capacity needs by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2027, adding a second in 2031, and a third in 2032. Distributed generating capacity of 5 MW was added in 2031. Future RES requirements were satisfied by adding wind PPAs totaling 100 MW in 2029, and increasing to 300 MW in 2031.

3. Plan 3 (Moderate Environmental): Plan 3 was a contingency plan that started with the Base plan to which Ventyx moderate forecasts were applied for a moderate environmental portfolio DSM based on higher avoided costs, natural gas, and electric market prices. Carbon costs were included for DSM modeling beginning in 2021. Renewable energy was allowed to reach a maximum of 25 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2026, increased to 200 MW in 2029, and increased to a total of 300 MW in 2030 for the remainder of the planning period. Capacity needs also resulted in the installation of a 50-MW aero peaking turbine in 2028, adding one more in 2030, and a third in 2032.

4. Plan 4 (High Environmental): Plan 4 was a similar contingency plan which started with the Base plan to which the Ventyx high forecasts were applied for a high environmental portfolio DSM based on higher avoided costs, natural gas, and electric market prices. Carbon costs were included for DSM modeling beginning earlier in 2015. Renewable energy was allowed to reach a maximum of 25 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning with 100 MW in 2026, added a second increment in 2029, a third increment in 2030, and increased to a total of 400 MW in 2031 for the remainder of the planning period. Capacity needs also resulted in the installation of a 50-MW aero peaking turbine in 2028 and added two more in 2031.

5. Plan 5 (RAP + DSM): Plan 5 was run from the Base plan to demonstrate the impacts of increased DSM participation. An assumed increment of one-third more DSM participation between RAP and maximum achievable participation (MAP) DSM was used. Renewable energy requirements reached a maximum of 20 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, and increased to a total of 300 MW in 2031 for the remainder of the planning period. With increased participation levels, DSM began at approximately 6.8 MW in 2013 and grew to approximately 205 MW by 2032.

6. Plan 6 (RAP++ DSM): Similarly, Plan 6 demonstrated the effects of further increased DSM participation from Plan 5. An increment of two-thirds more DSM participation between RAP and MAP levels of DSM was used. Renewable

energy requirements reached a maximum of 20 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through the end of the planning period. With the further increased "RAP++" participation levels, DSM began at approximately 7.5 MW in 2013 and grew to approximately 352 MW by 2032.

7. Plan 7 (Moderate DSM): The effects of a moderate DSM portfolio that would obtain a 1-percent savings by 2015 were modeled in this required plan. Carbon costs for DSM screening were weighted. Renewable energy requirements reached a maximum of 20 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through 2032. DSM began at approximately 10 MW in 2013 and grew to approximately 227 MW by 2032.

8. Plan 8 (Aggressive DSM): More aggressive DSM portfolio that would result in a 2-percent savings by 2020 were modeled in this required plan. Carbon costs for DSM screening were weighted. Renewable energy requirements reached a maximum of 20 percent by 2021. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through 2032. DSM began at approximately 10 MW in 2013 and grew to approximately 362 MW by 2032.

9. Plan 9 (MEEIA Level DSM): This required plan was designed to determine the cost impacts of meeting the savings goals of the Missouri Energy Efficiency Act of 2009 and simultaneously complying with renewable energy requirements (20 percent by 2021). Carbon costs for DSM screening were weighted. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through 2032. DSM began at approximately 7.8 MW in 2013 and grew to approximately 377 MW by 2032.

10. Plan 10 (Aggressive Capacity DSM): This required plan modeled the use of only DSM to meet all future capacity needs. No supply-side resources were added except for wind PPAs as required to meet renewable energy requirements (20 percent by 2021). Carbon costs for DSM screening were weighted. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 317 MW by 2032.

11. Plan 11 (No DSM): This contingency plan demonstrated meeting all future capacity needs without future DSM additions. Only conventional supply-side resources were added along with wind PPAs to meet RES requirements

(20 percent by 2021). Future capacity needs were satisfied by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2024, adding a second in 2028, a third in 2031, and a fourth in 2032. Landfill gas capacity of 2.5 MW was added in 2032. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029, added two increments in 2031, and remained at 300 MW through 2032.

12. Plan 12 (RAP - DSM): This contingency plan utilized the Base model with the addition of DSM at a 55-percent participation rate which has been the typical experience level on Empire's system. Sufficient renewable energy resources were used to meet renewable energy requirements (20 percent by 2021). Future capacity needs were satisfied by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2025, adding a second in 2029, and two more in 2032. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029. Two more increments were added in 2031, and then remained at 300 MW through 2032. DSM at the 55-percent level began at approximately 3.3 MW in 2013 and grew to approximately 26.2 MW by 2032.

13. Plan 13 (High Fuel): The impact of high fuel and electric market prices on the Base plan was modeled in this contingency plan including RAP-level DSM and compliance with renewable energy requirements (20 percent by 2021). Future capacity needs were satisfied by participating in coal-fired generating projects in 50-MW increments beginning in 2024, adding 50 MW in 2025, 100 MW more in 2026, and remaining at the 200-MW level through the end of the period. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029. Two more increments were added in 2031, and then remained at 300 MW through 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 47.6 MW by 2032.

14. Plan 14 (Low Fuel): This contingency plan demonstrated the impact of low fuel and electric market prices on the Base plan including RAP-level DSM and compliance with renewable energy requirements (20 percent by 2021). Future capacity needs were satisfied by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2027, and by adding two more in 2032. Distributed generation capacity of 10 MW was added in 2031. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029. Two more increments were added in 2031, and remained at 300 MW through 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 47.6 MW by 2032.

15. Plan 15 (High Load): The impact of higher than expected load growth on the Base plan was modeled for contingency with RAP-level DSM and compliance with renewable energy requirements (20 percent by 2021). Future capacity

needs were satisfied by earlier installation of natural gas-fired, aeroderivative combustion turbines in 50-MW increments, beginning in 2021, adding another in 2025, adding a third in 2028, and a fourth in 2030. Combined cycle capacity of 87 MW was added in 2032. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2024. Two more increments were added in 2029, and remained at 300 MW through 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 47.6 MW by 2032.

16. Plan 16 (Low Load): This contingency plan modeled the impact of less than expected load growth on the Base plan with RAP-level DSM and compliance with renewable energy requirements (20 percent by 2021). Future capacity needs were satisfied by installing one natural gas-fired, 50-MW aeroderivative combustion turbine in 2032. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029. Another increment was added in 2031, and a third was added in 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 47.6 MW by 2032.

17. Plan 17 (High Fuel - No Future Coal): This plan modeled the impact that the lack of availability of any coal-fired projects in which Empire could participate would have for the high fuel cost scenario as a contingency plan. Plan 17 utilized the Base model with RAP-level DSM and compliance with renewable energy requirements (20 percent by 2021). Future capacity needs were satisfied by installing natural gas-fired, aeroderivative combustion turbines in 50-MW increments beginning in 2027, and by adding two more in 2029. Landfill Gas capacity of 2.5 was added in 2027 and remained throughout the period. Renewable resources were added in the form of 100-MW wind PPA increments beginning in 2029. Two more increments were added in 2031, and remained at 300 MW through 2032. DSM began at approximately 6 MW in 2013 and grew to approximately 47.6 MW by 2032.

18. Plan 18 (Aggressive Renewable): This required plan demonstrated the impact of meeting all future capacity requirements exclusively by renewable resources. Plan 18 utilized the Base model with no DSM. Therefore, future capacity needs were satisfied by installing biomass generation in 10-MW increments beginning in 2024, adding another increment annually for three years, then adding two more in 2030, two more in 2031, and two more ending with a total of 100 MW in 2032. Landfill Gas generation of 2.5 was added in 2024 doubled in 2032. Wind PPAs in 100-MW increments were added beginning in 2026. Two more increments were added in 2029, then a fourth in 2030 and a fifth in 2031 and remained at 500 MW through 2032.

Tables 6-10 through 6-27 provide the sequence and schedule for all demand-side and supply-side resources for each of the alternative resource plans.

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Table 6-10 - Forecast of Capacity Balance for the Base Scenario - Plan 1 (BASE)

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Table 6-11 - Forecast of Capacity Balance for Plan 2 (BRPS) Base Case

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Table 6-12 - Forecast of Capacity Balance for Moderate Environmental DSM Scenario - Plan 3 (MOENV)

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Table 6-13 - Forecast of Capacity Balance for High Environmental DSM Scenario - Plan 4 (HIENV)

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Table 6-14 - Forecast of Capacity Balance for RAP + DSM Scenario - Plan 5 (RAP1)

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Table 6-15 - Forecast of Capacity Balance for RAP ++ DSM Scenario - Plan 6 (RAP11)

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Table 6-16 - Forecast of Capacity Balance for Moderate DSM Scenario - Plan 7 (MODPF)

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Table 6-17 - Forecast of Capacity Balance for Aggressive DSM Scenario - Plan 8 (AGDPF)

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Table 6-18 - Forecast of Capacity Balance for MEEIA Level DSM Scenario - Plan 9 (MEEIA)

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Table 6-19 - Forecast of Capacity Balance for Aggressive Capacity DSM Scenario - Plan 10 (AGCAP)

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Table 6-20 - Forecast of Capacity Balance for No DSM Scenario - Plan 11 (IRPDN)

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

Table 6-21 - Forecast of Capacity Balance for RAP - DSM Scenario - Plan 12 (RAPL)

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Table 6-22 - Forecast of Capacity Balance for High Fuel Scenario - Plan 13 (HFUEL)

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Table 6-23 - Forecast of Capacity Balance for Low Fuel Scenario - Plan 14 (LFUEL)

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Table 6-24 - Forecast of Capacity Balance for High Load Scenario - Plan 15 (HLOAD)

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Table 6-25 - Forecast of Capacity Balance for Low Load Scenario - Plan 16 (LLOAD)

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Table 6-26 - Forecast of Capacity Balance for High Fuel – No Coal Options Scenario - Plan 17 (HFNCL)

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Table 6-27 - Forecast of Capacity Balance for Aggressive Renewable Scenario - Plan 18 (AGREN)

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 6-28*.

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Table 6-28 - Alternative Resource Plan Performance

Table 6-29 provides a reference listing for each alternative resource plan.

Plan No.	Plan Description
1	Base Case
2	Base Case (meet RES)
3	Moderate Environmental
4	High Environmental
5	RAP + DSM
6	RAP ++ DSM
7	Moderate DSM
8	Aggressive DSM
9	MEEIA Level DSM
10	Aggressive Capacity DSM
11	No DSM
12	RAP – DSM
13	High Fuel
14	Low Fuel
15	High Load
16	Low Load
17	High Fuel (No Future Coal)
18	Aggressive Renewable

Table 6-29 - Plan Legend

The deterministic PVRR for each of Empire's alternative resource plans is shown in *Figure 6-5.*

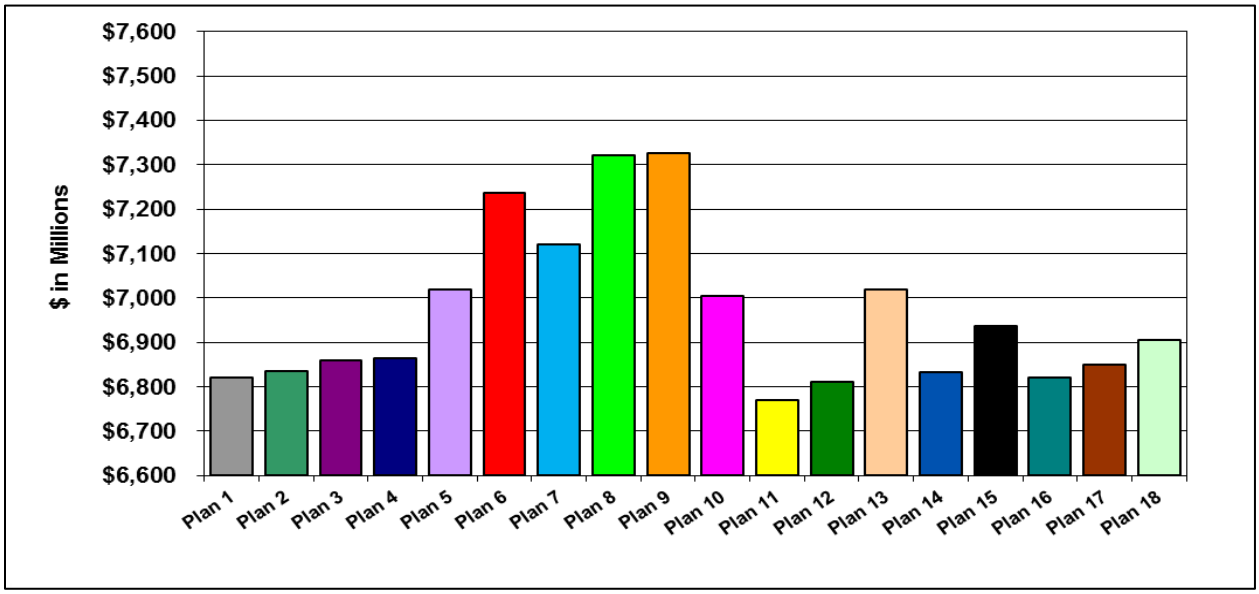

Figure 6-5 - Deterministic 20-Year NPVRR of All Plans

Plans 1, 2, 5, 6, 11, and 12 are Base plans. However, Plans 7 through 10 and 18 were developed to comply with rules and are not directly comparable to other plans. Plans 3, 4, and 13 through 17 are plans developed to analyze contingency options. *Figures 6-6* through *6-8* illustrate the 20-year PVRR based upon these groupings. *Figure 6-9* indicates the annual rate increase as a percentage of average rate revenue for each of the alternative resource plans. *Figures 6-10* through *6-12* provide the deterministic results of all the plans, including capital cost of plant in service, capacity margins, and average rate revenues (cents per kWh).

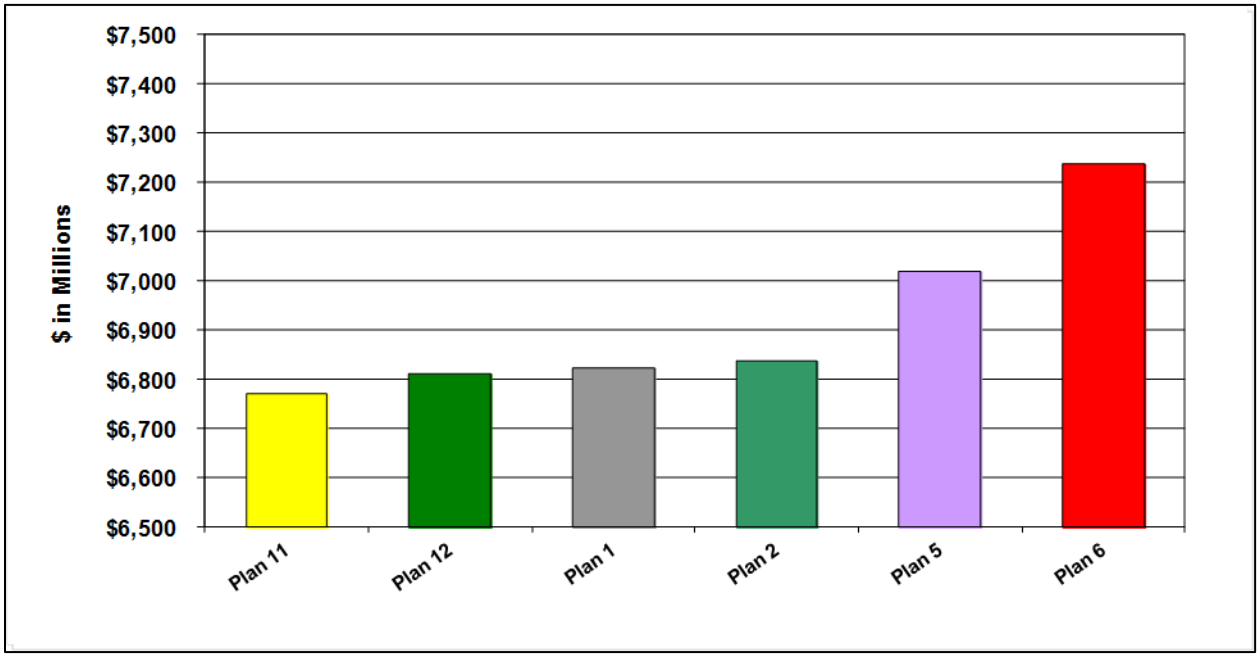

Figure 6-6 - 20-Year NPVRR of Base Plans

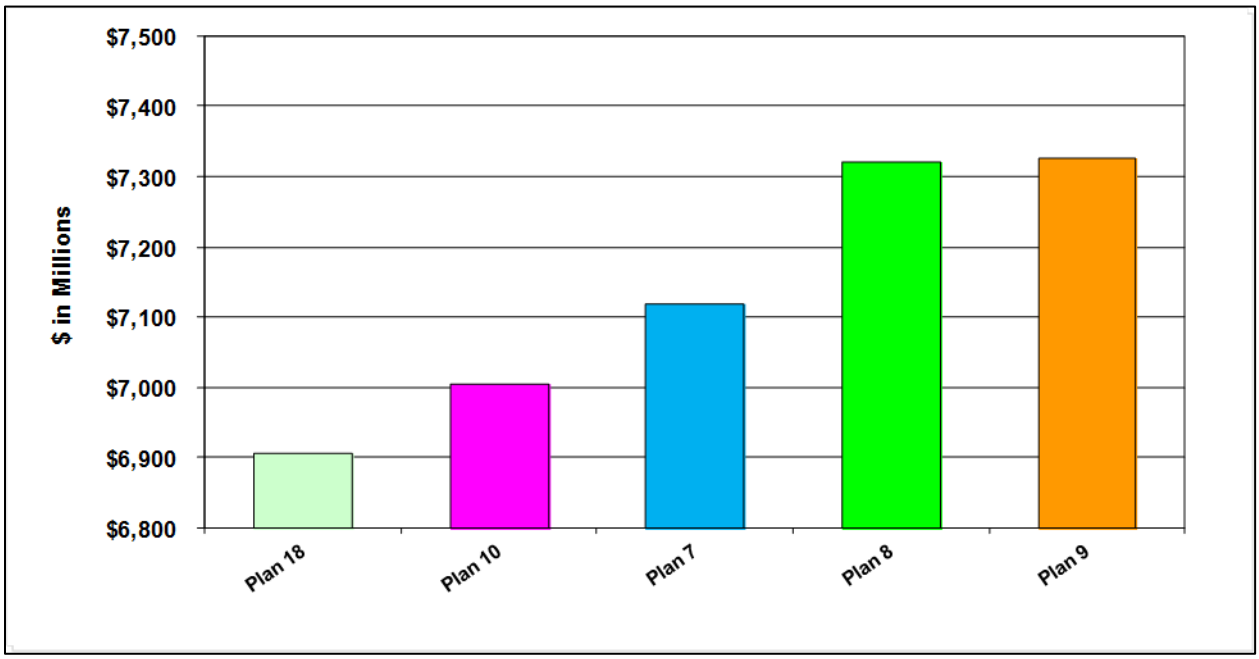

Figure 6-7 - 20-Year NPVRR of the Rule-Required Plans

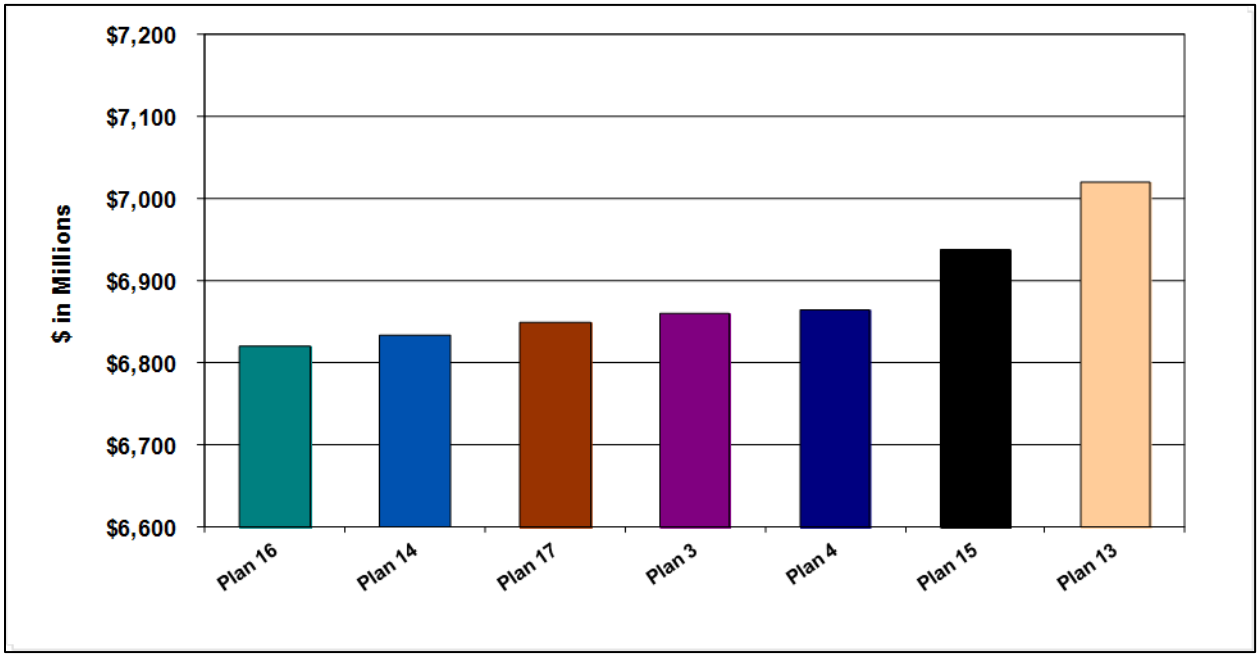

Figure 6-8 - 20-Year NPVRR of Contingency Plans

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Figure 6-9 - Annual Rate Increases for All Plans

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Figure 6-10 - Plant in Service

****Highly Confidential in its Entirety****
Figure 6-11 - Capacity Margins of All Plans

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Figure 6-12 - 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 each resource plan is shown in *Figures 6-13* through *6-30*. The corresponding tables of values for all these figures are provided in Appendix 6B.

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Figure 6-13 - DSM Impact on Plan 1 Loads

****Highly Confidential in its Entirety****
Figure 6-14 - DSM Impact on Plan 2 Loads

****Highly Confidential in its Entirety****
Figure 6-15 - DSM Impact on Plan 3 Loads

****Highly Confidential in its Entirety****
Figure 6-16 - DSM Impact on Plan 4 Loads

****Highly Confidential in its Entirety****
Figure 6-17 - DSM Impact on Plan 5 Loads

****Highly Confidential in its Entirety****
Figure 6-18 - DSM Impact on Plan 6 Loads

****Highly Confidential in its Entirety****
Figure 6-19 - DSM Impact on Plan 7 Loads

****Highly Confidential in its Entirety****
Figure 6-20 - DSM Impact on Plan 8 Loads

****Highly Confidential in its Entirety****
Figure 6-21 - DSM Impact on Plan 9 Loads

****Highly Confidential in its Entirety****
Figure 6-22 - DSM Impact on Plan 10 Loads

****Highly Confidential in its Entirety****
Figure 6-23 - DSM Impact on Plan 11 Loads

****Highly Confidential in its Entirety****
Figure 6-24 - DSM Impact on Plan 12 Loads

****Highly Confidential in its Entirety****
Figure 6-25 - DSM Impact on Plan 13 Loads

****Highly Confidential in its Entirety****
Figure 6-26 - DSM Impact on Plan 14 Loads

****Highly Confidential in its Entirety****
Figure 6-27 - DSM Impact on Plan 15 Loads

****Highly Confidential in its Entirety****
Figure 6-28 - DSM Impact on Plan 16 Loads

****Highly Confidential in its Entirety****
Figure 6-29 - DSM Impact on Plan 17 Loads

****Highly Confidential in its Entirety****
Figure 6-30 - 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 6-31* through *6-48*. The corresponding tables of values for all these figures are provided in Appendix 6C. Since plans 11 and 18 did not use any DSM to meet future capacity needs, *Figures 6-41* and *6-48* are blank.

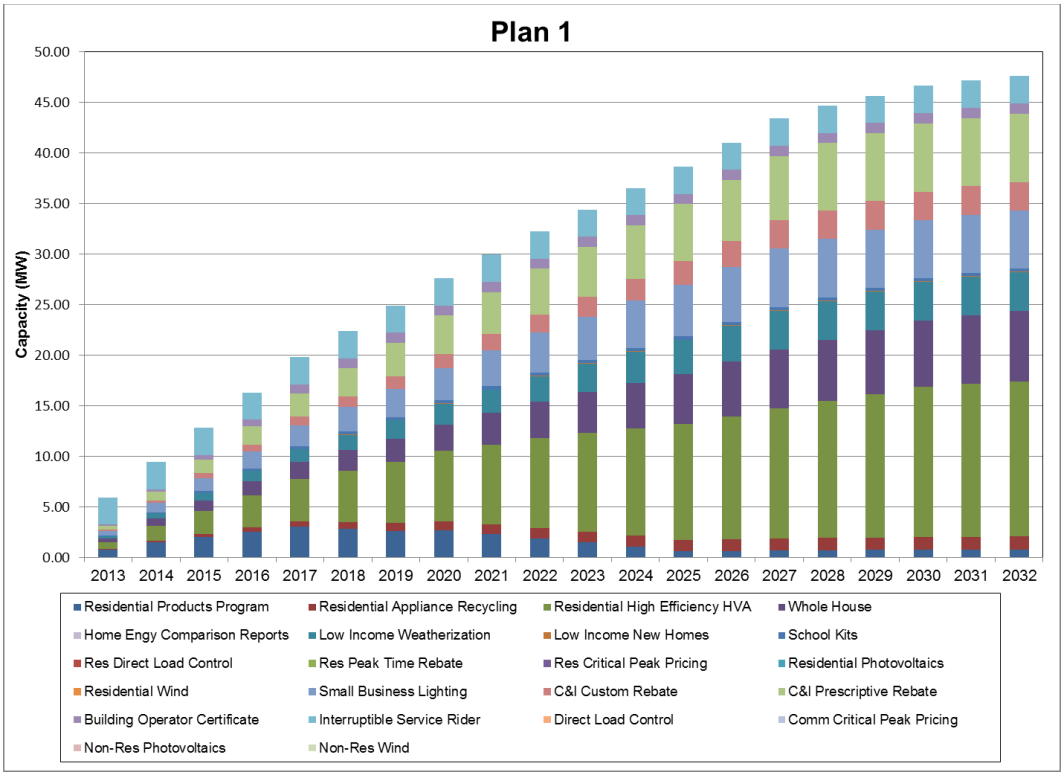


Figure 6-31 - DSM Composition of Plan 1

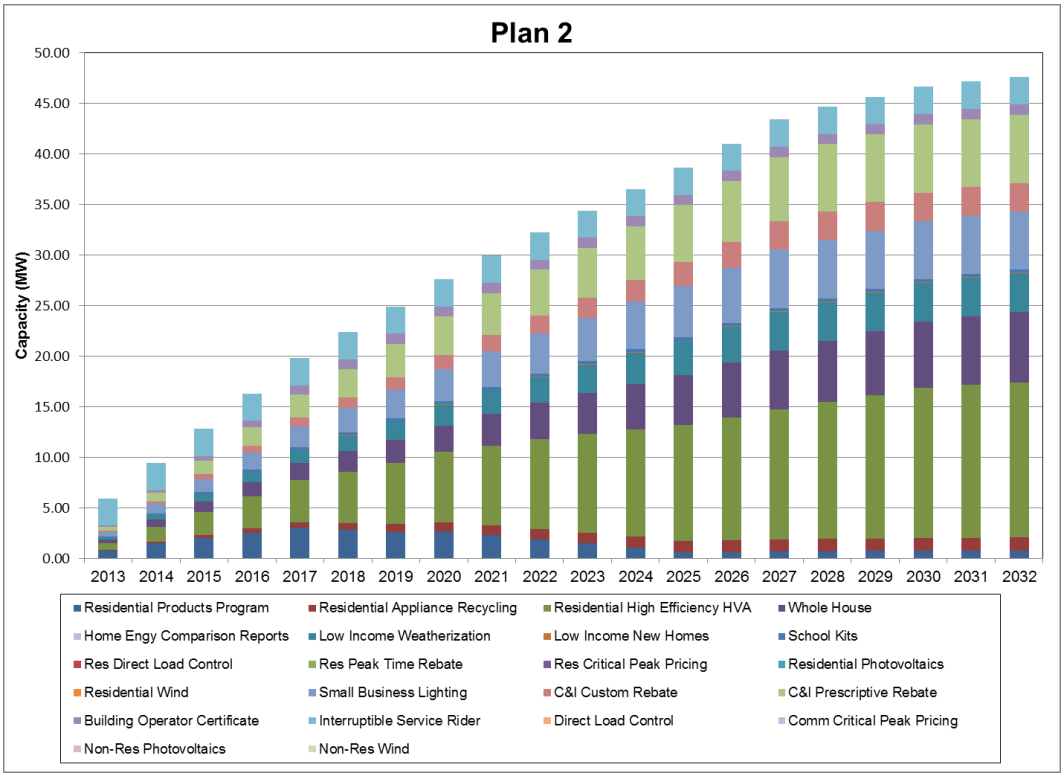


Figure 6-32 - DSM Composition of Plan 2

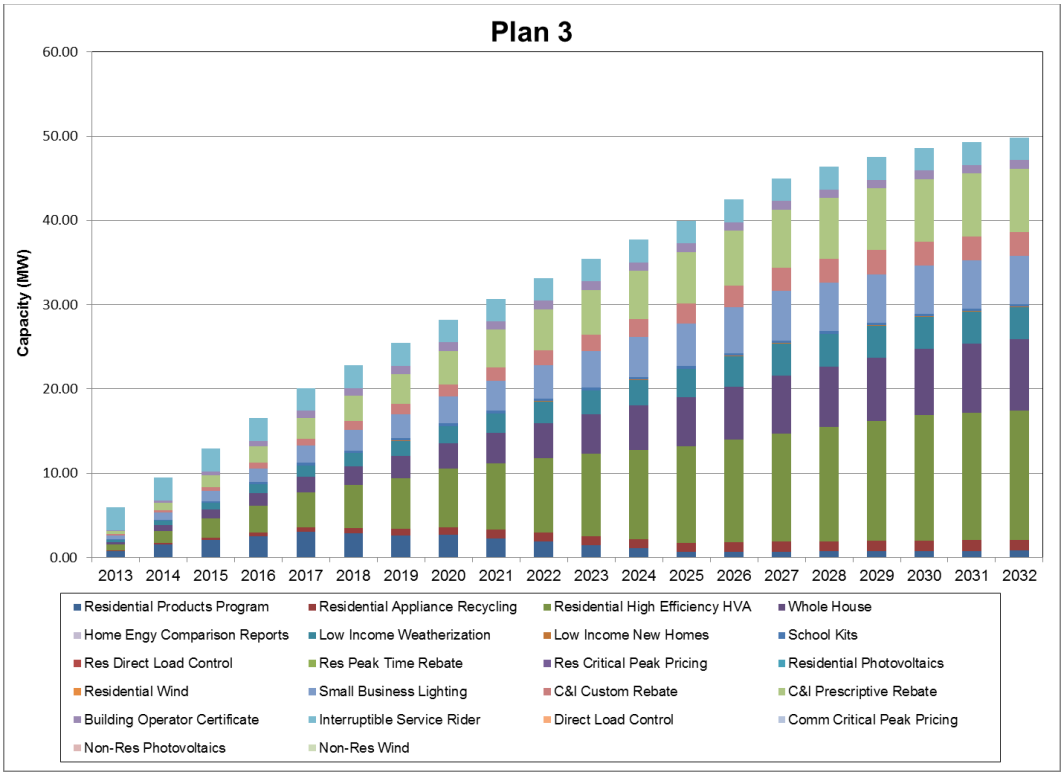


Figure 6-33 - DSM Composition of Plan 3

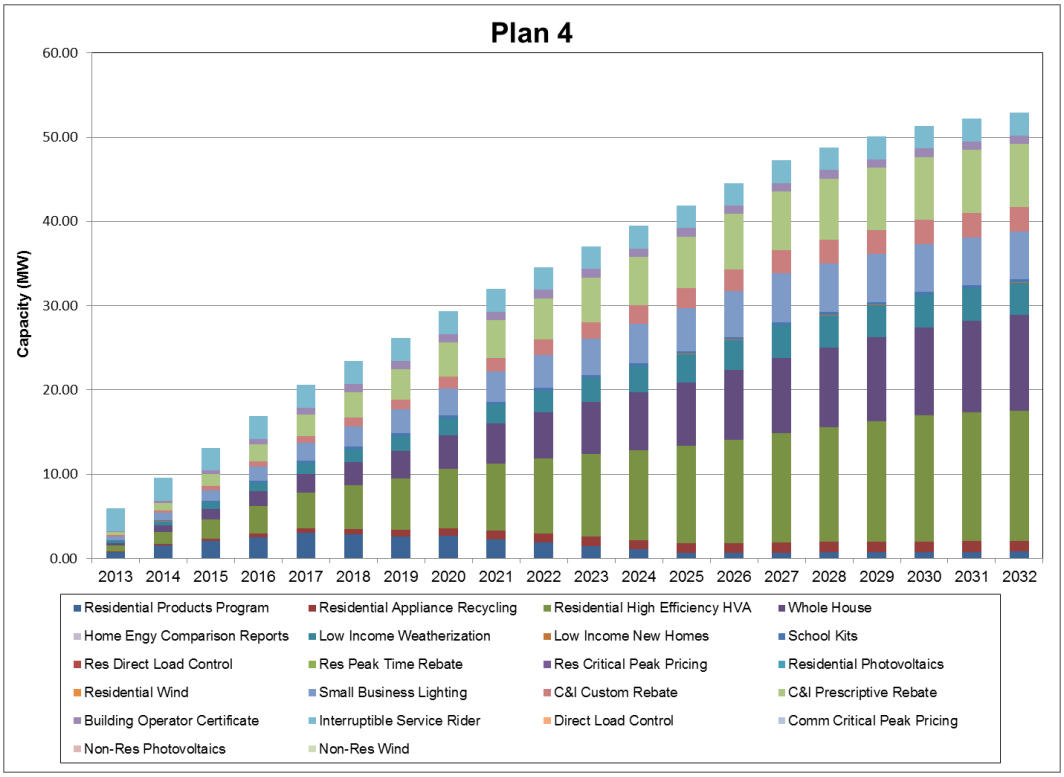


Figure 6-34 - DSM Composition of Plan 4

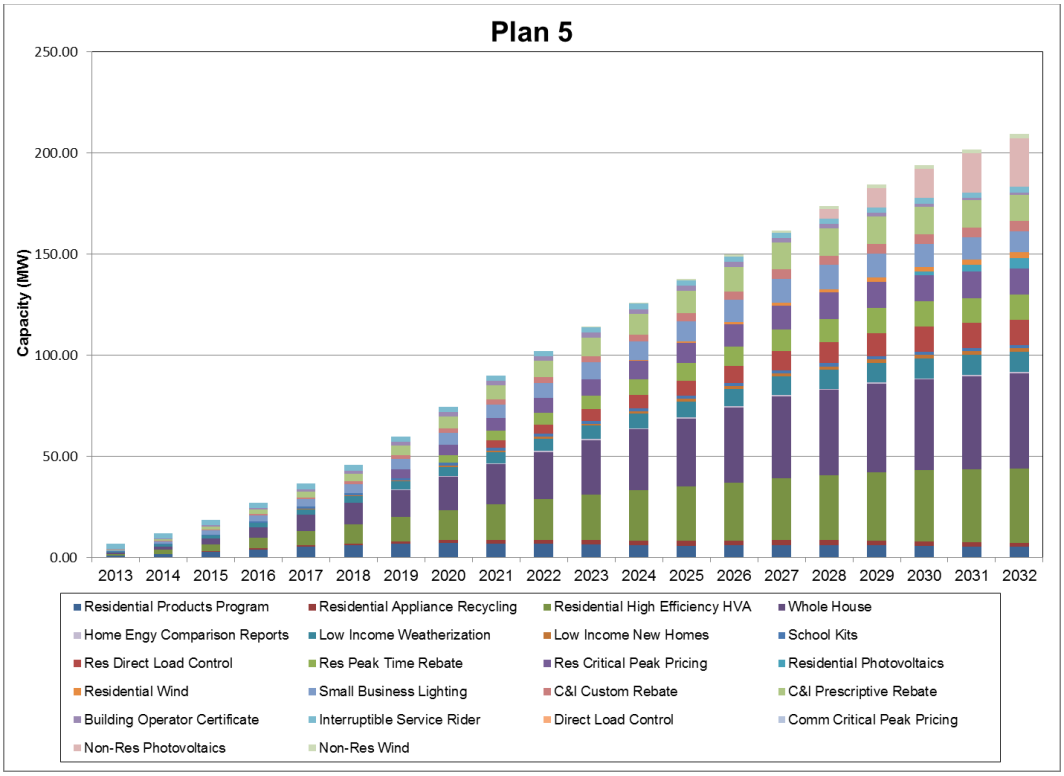


Figure 6-35 - DSM Composition of Plan 5

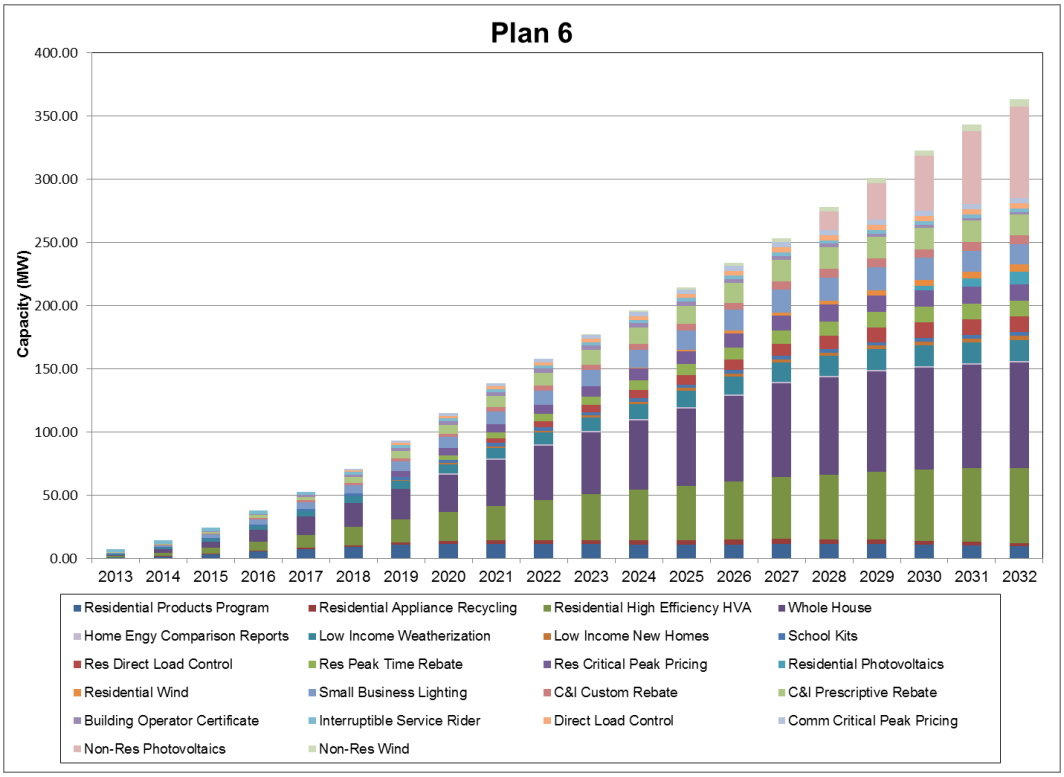


Figure 6-36 - DSM Composition of Plan 6

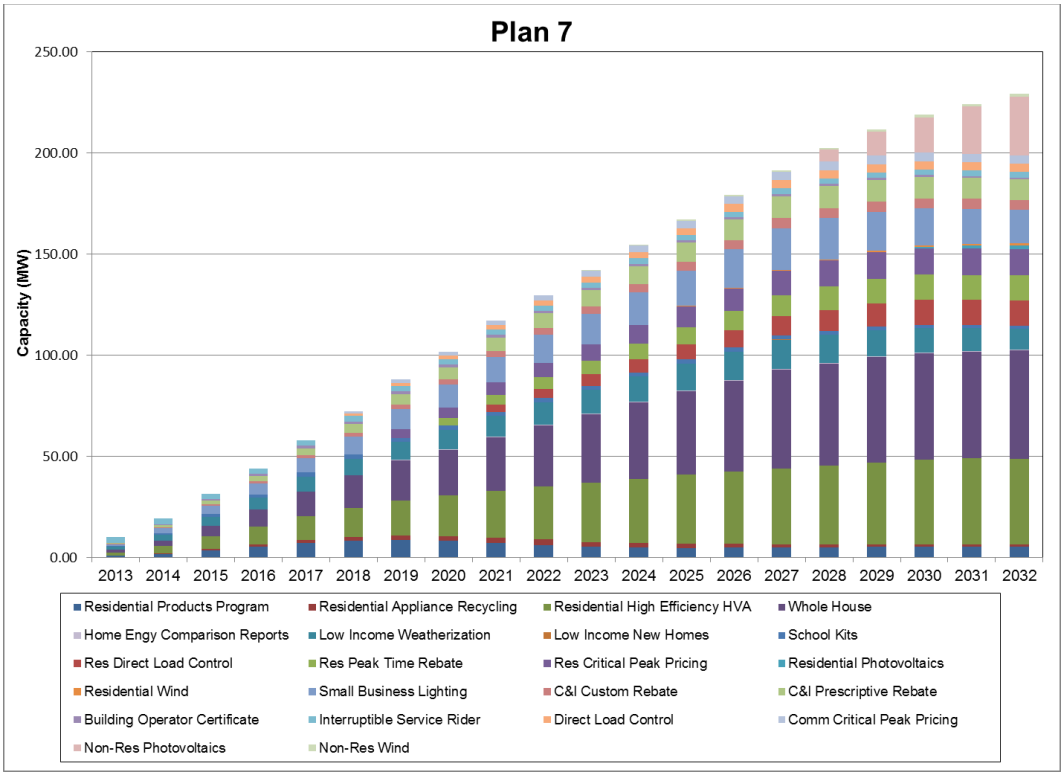


Figure 6-37 - DSM Composition of Plan 7

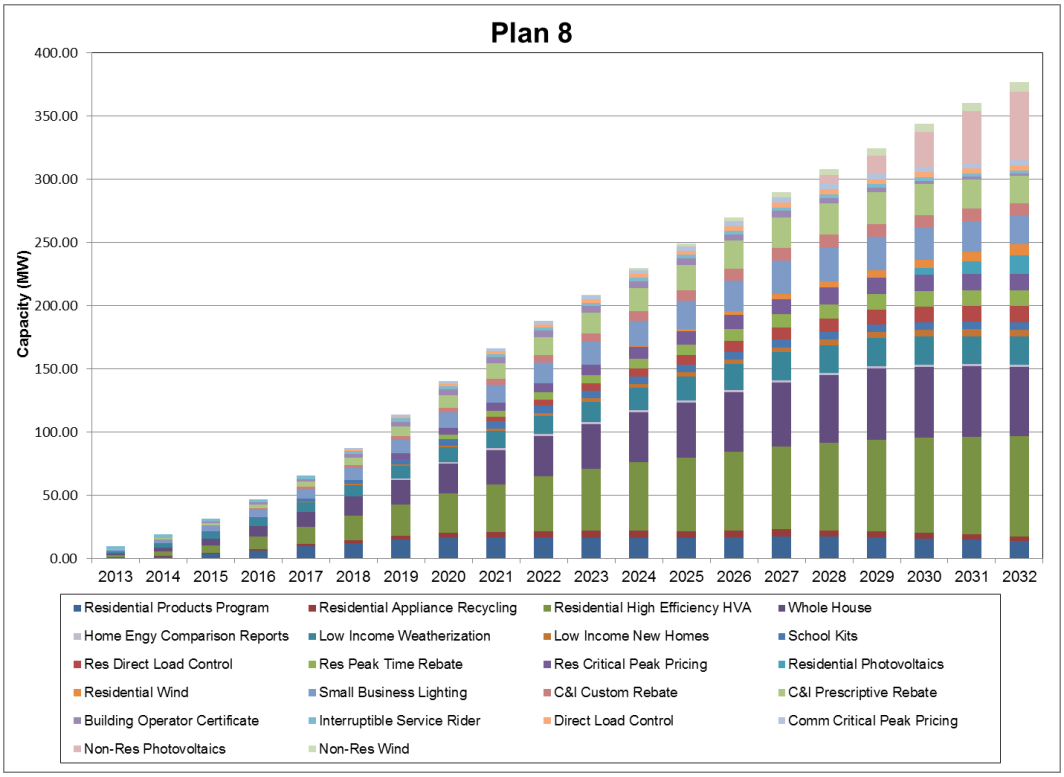


Figure 6-38 - DSM Composition of Plan 8

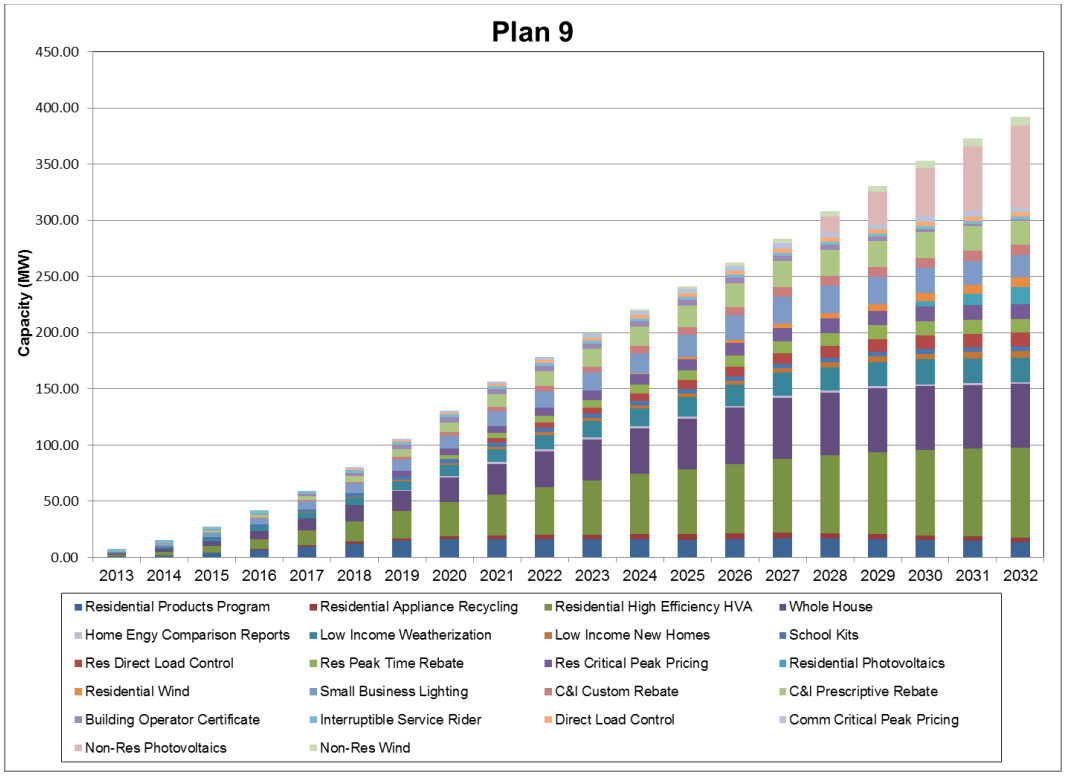


Figure 6-39 - DSM Composition of Plan 9

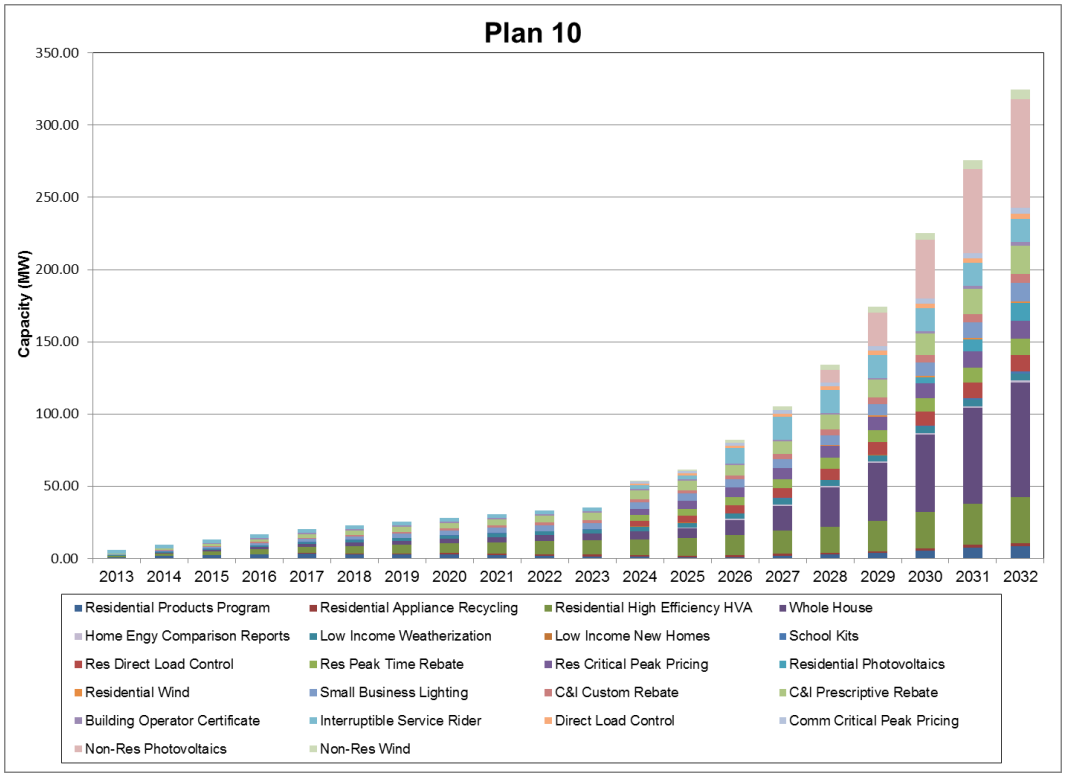


Figure 6-40 - DSM Composition of Plan 10

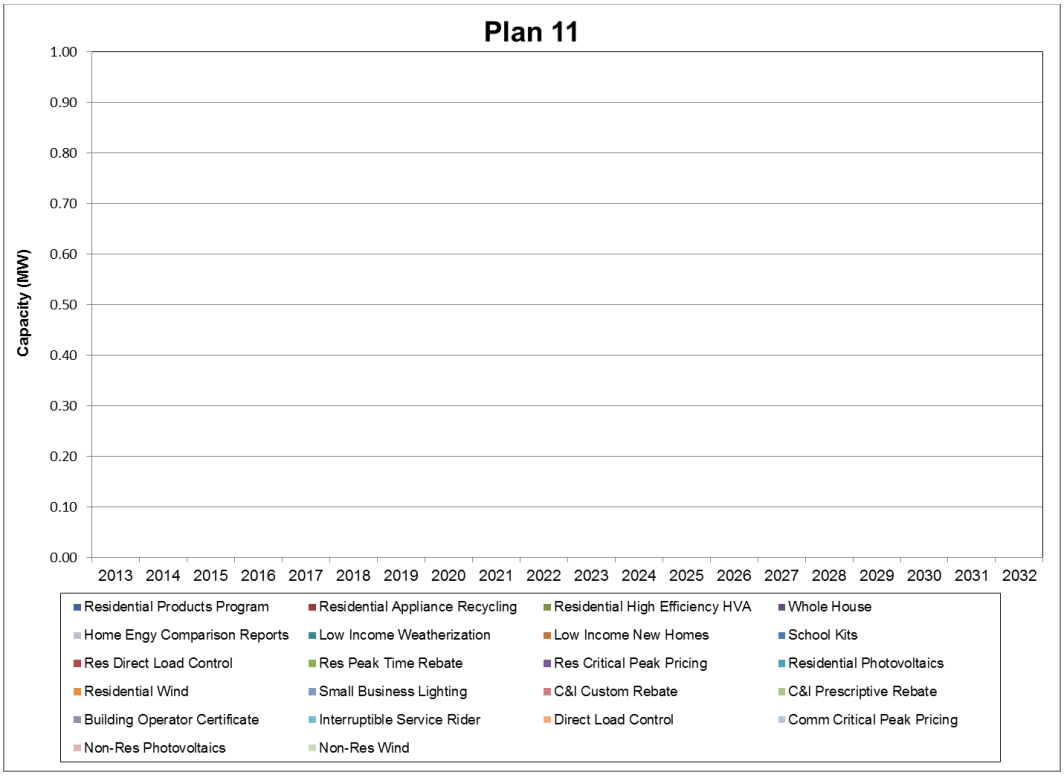


Figure 6-41 - DSM Composition of Plan 11

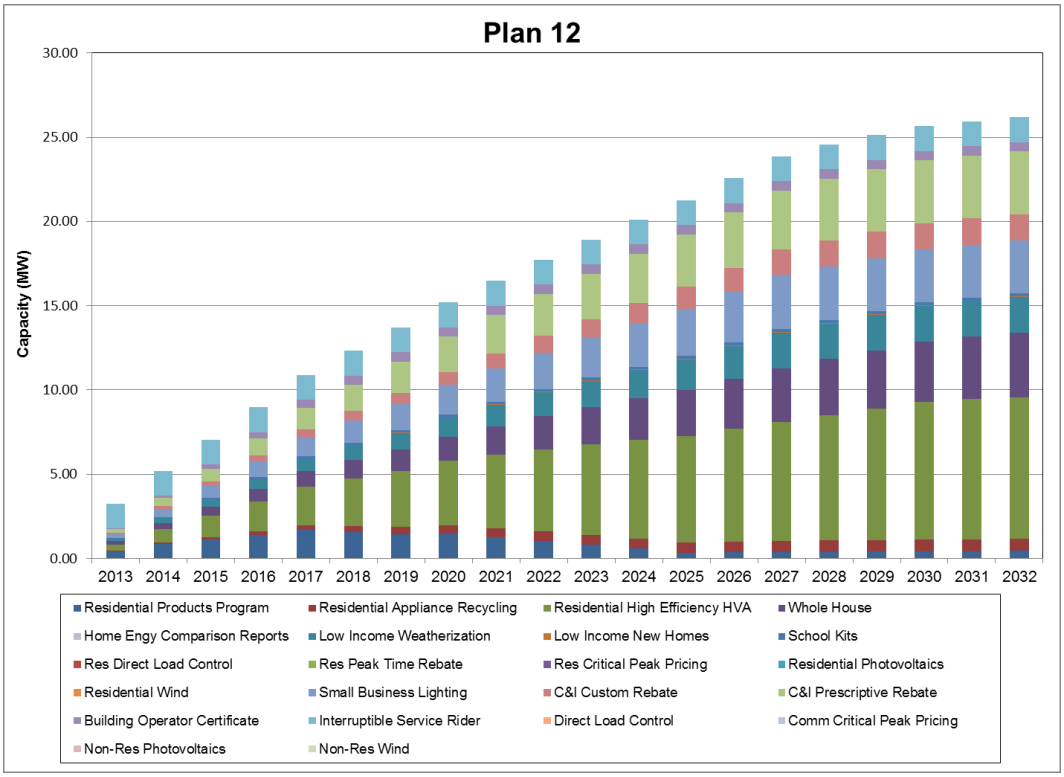


Figure 6-42 - DSM Composition of Plan 12

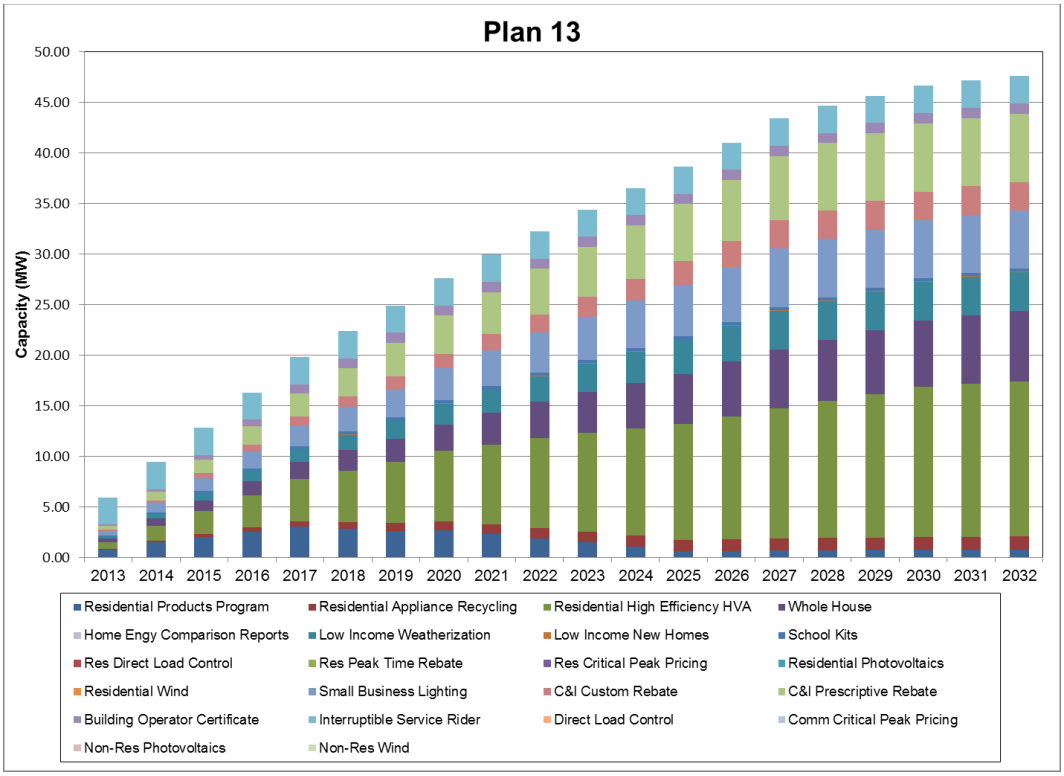


Figure 6-43 - DSM Composition of Plan 13

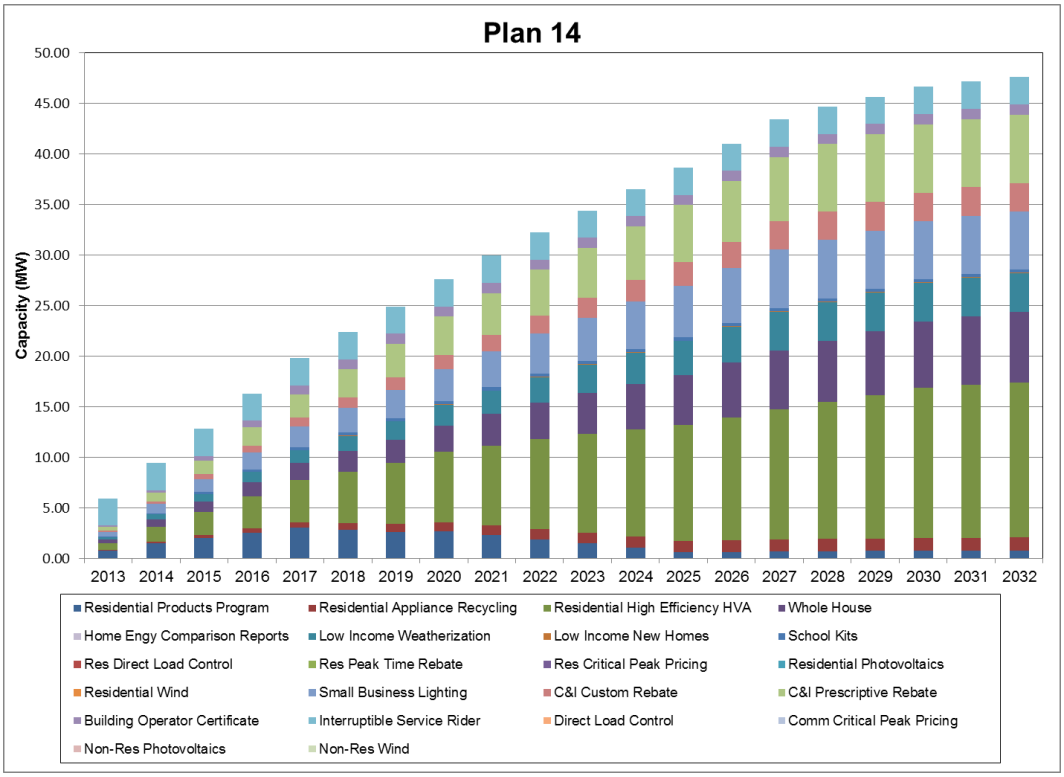


Figure 6-44 - DSM Composition of Plan 14

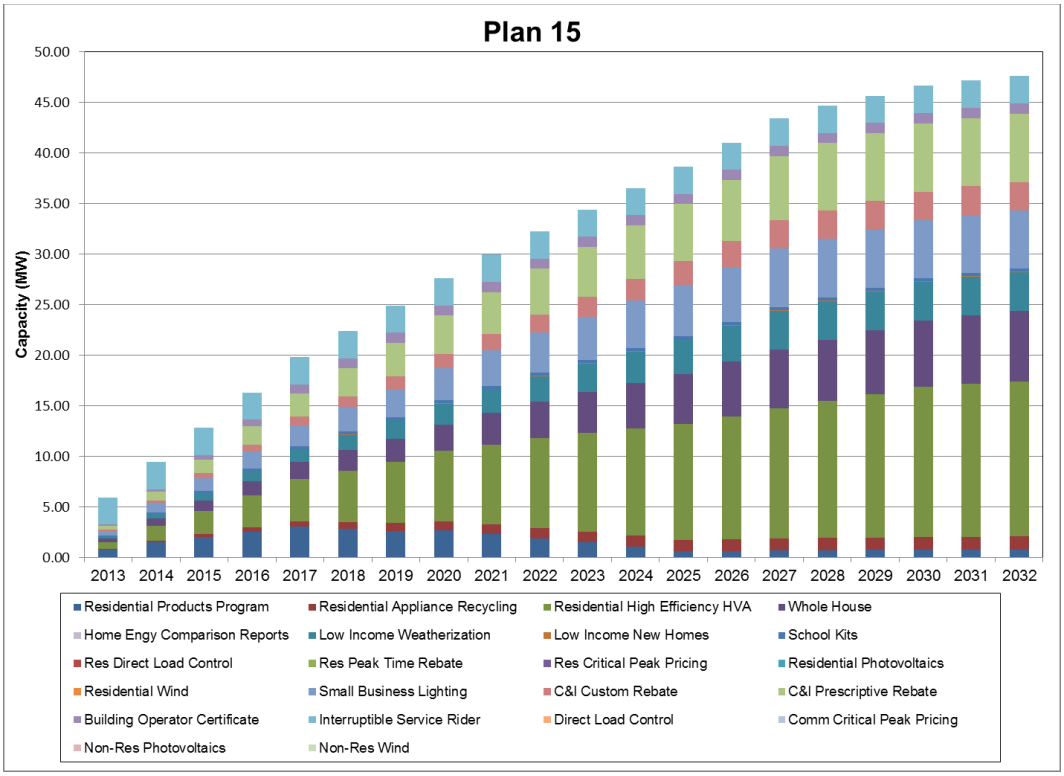


Figure 6-45 - DSM Composition of Plan 15

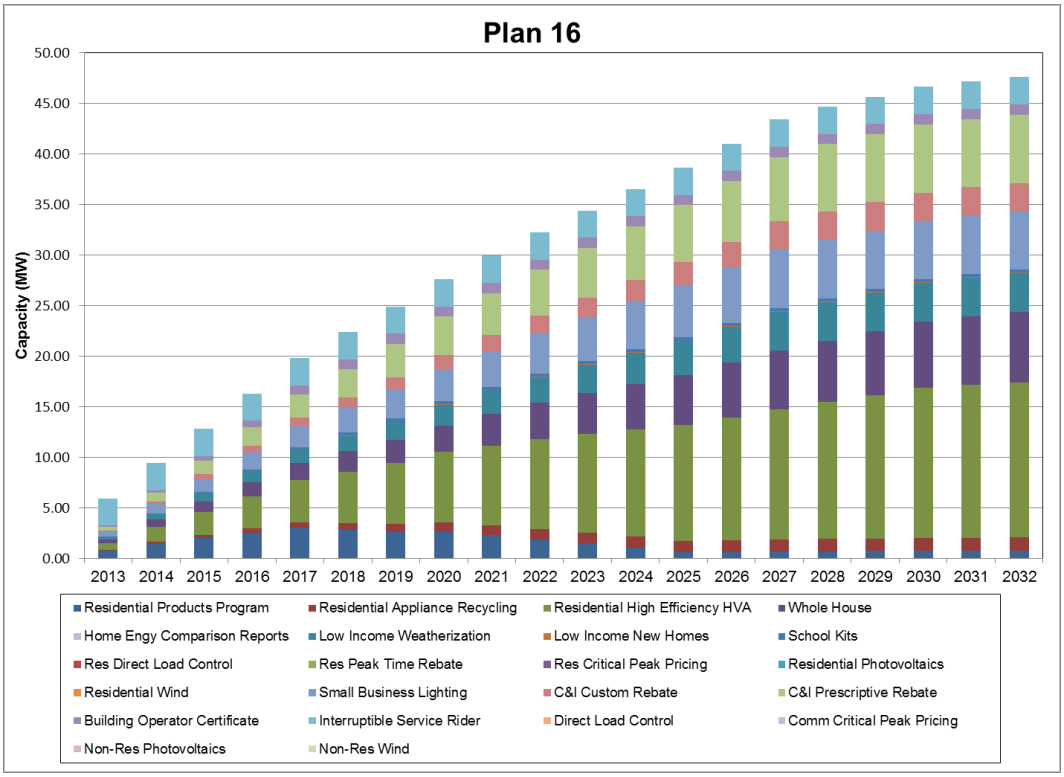


Figure 6-46 - DSM Composition of Plan 16

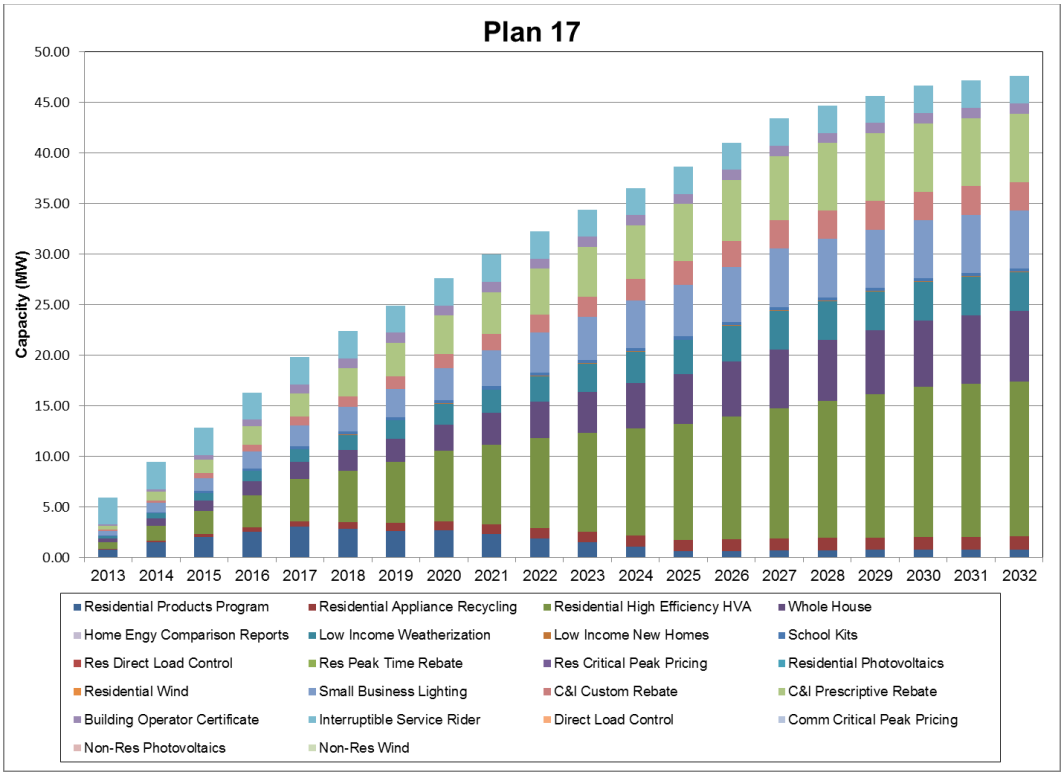


Figure 6-47 - DSM Composition of Plan 17

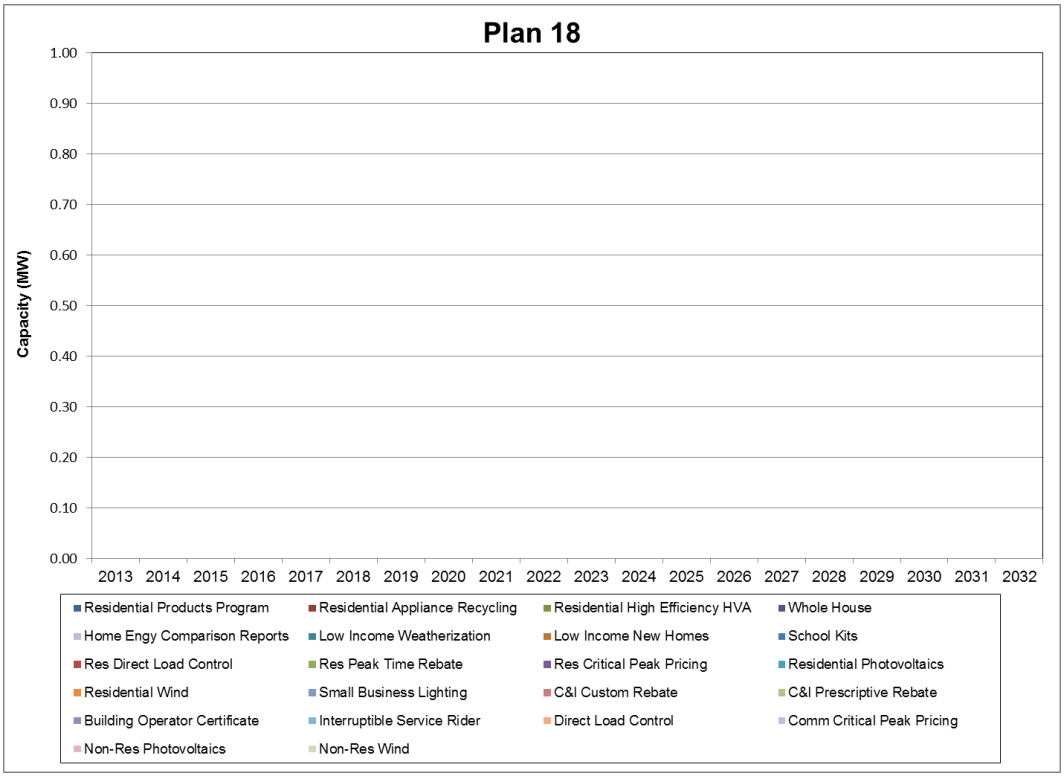


Figure 6-48 - DSM Composition of Plan 18

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 6-49* through *6-66*. The corresponding tables of values for all these figures are provided in Appendix 6D.

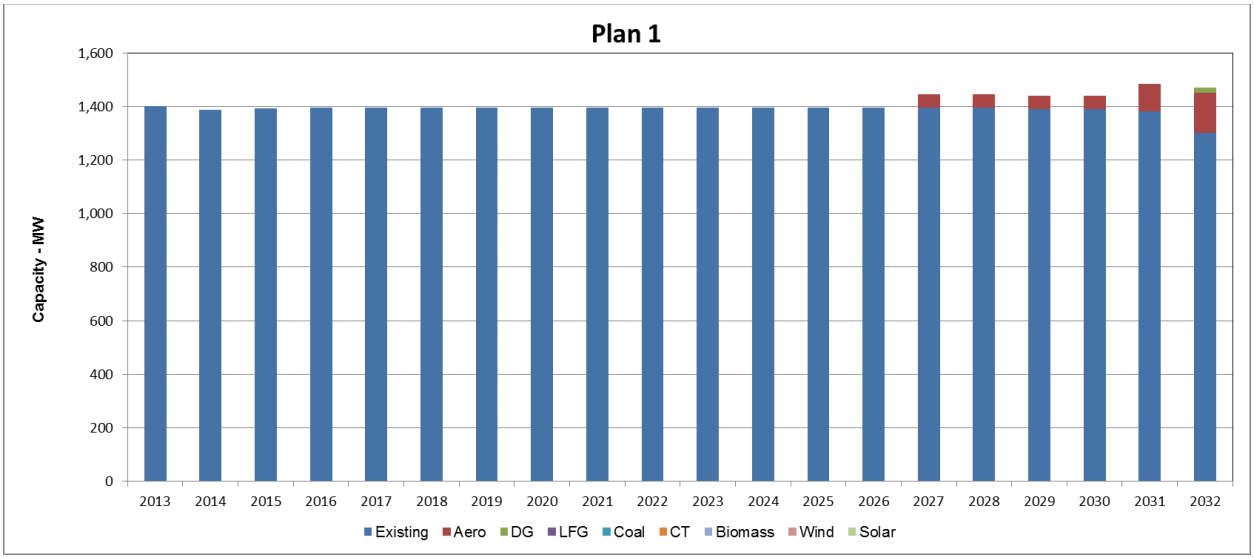


Figure 6-49 - Supply-Side Resource Composition of Plan 1

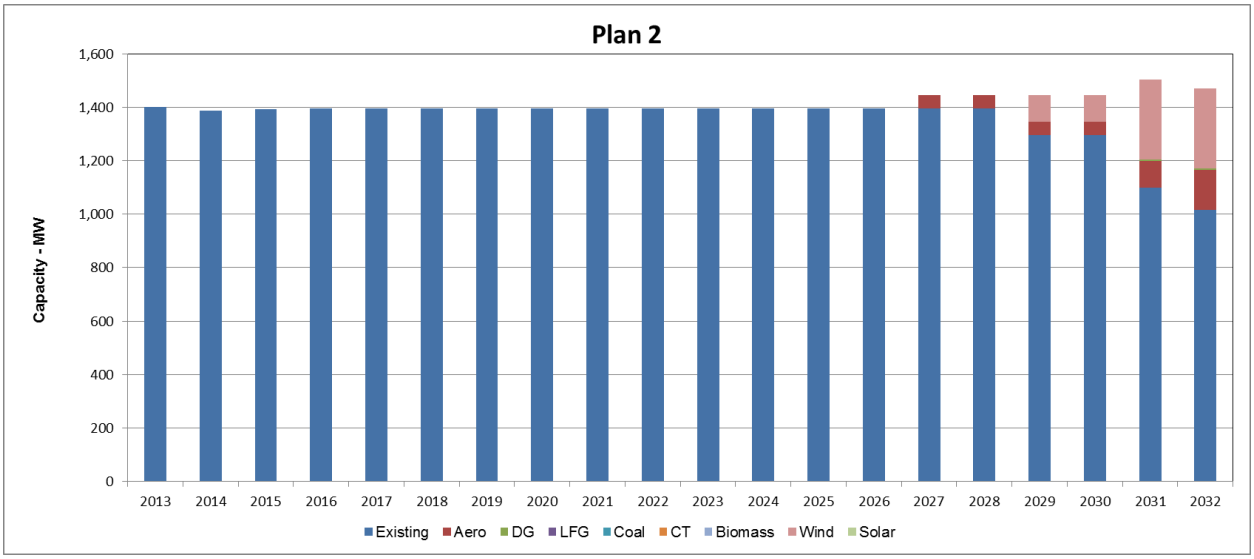


Figure 6-50 - Supply-Side Resource Composition of Plan 2

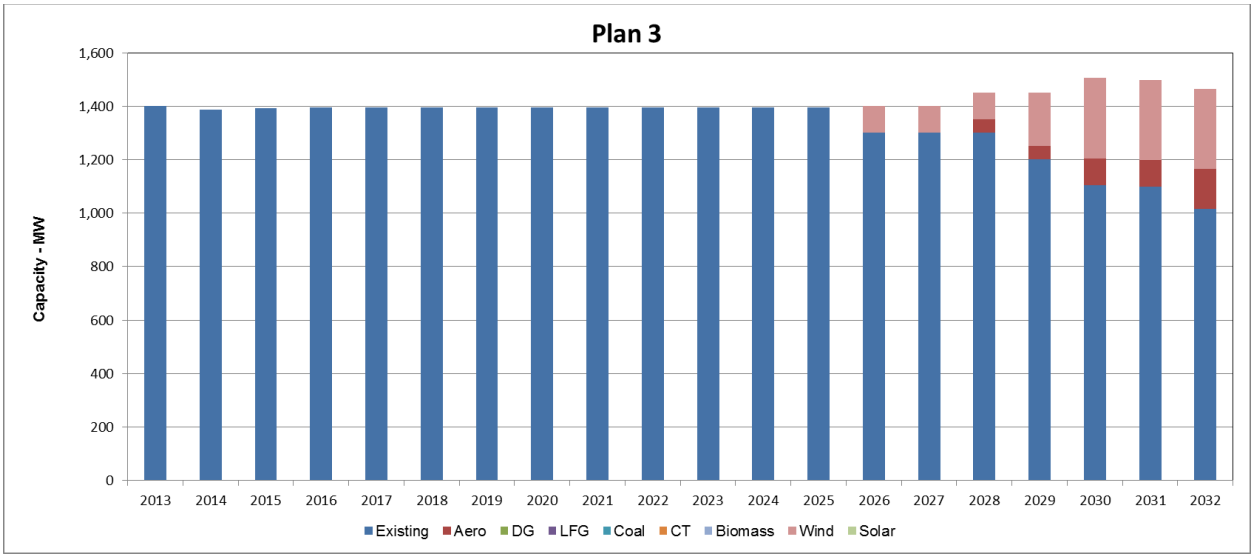


Figure 6-51 - Supply-Side Resource Composition of Plan 3

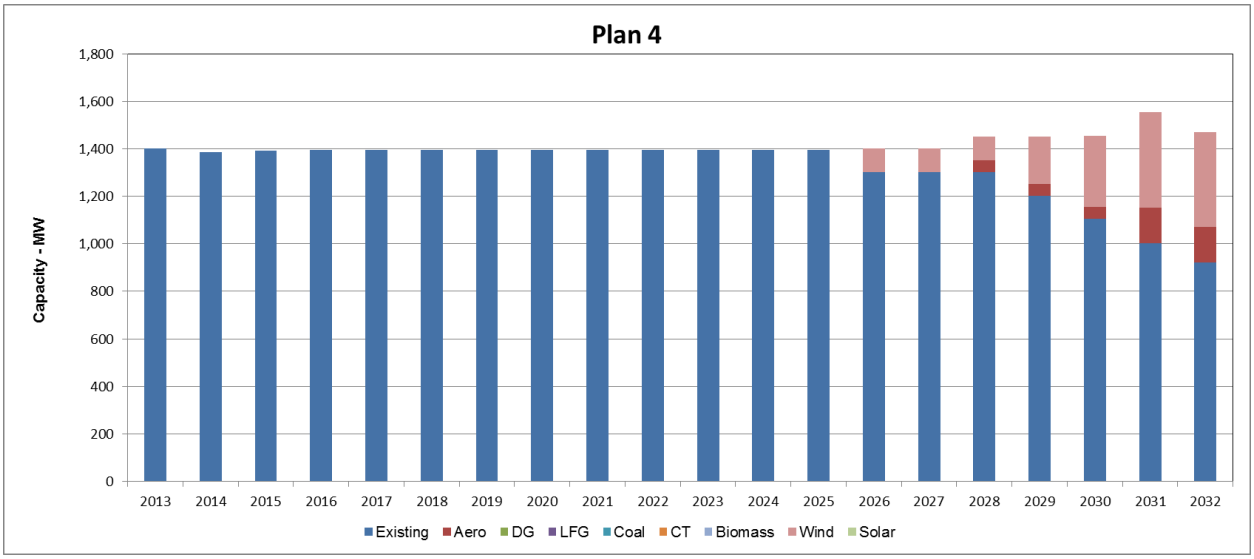


Figure 6-52 - Supply-Side Resource Composition of Plan 4

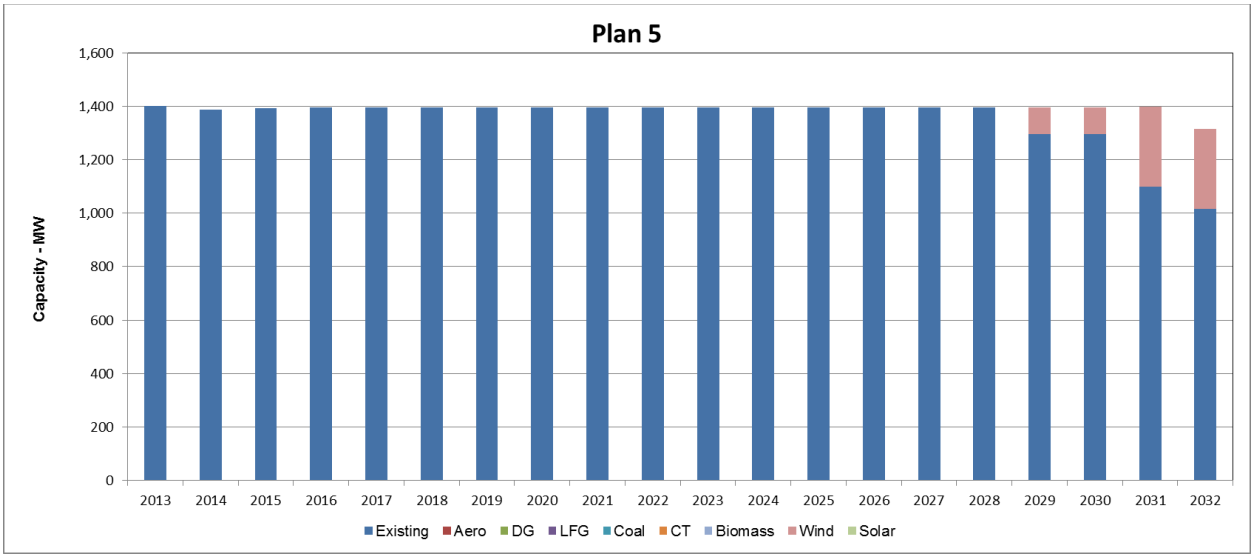


Figure 6-53 - Supply-Side Resource Composition of Plan 5

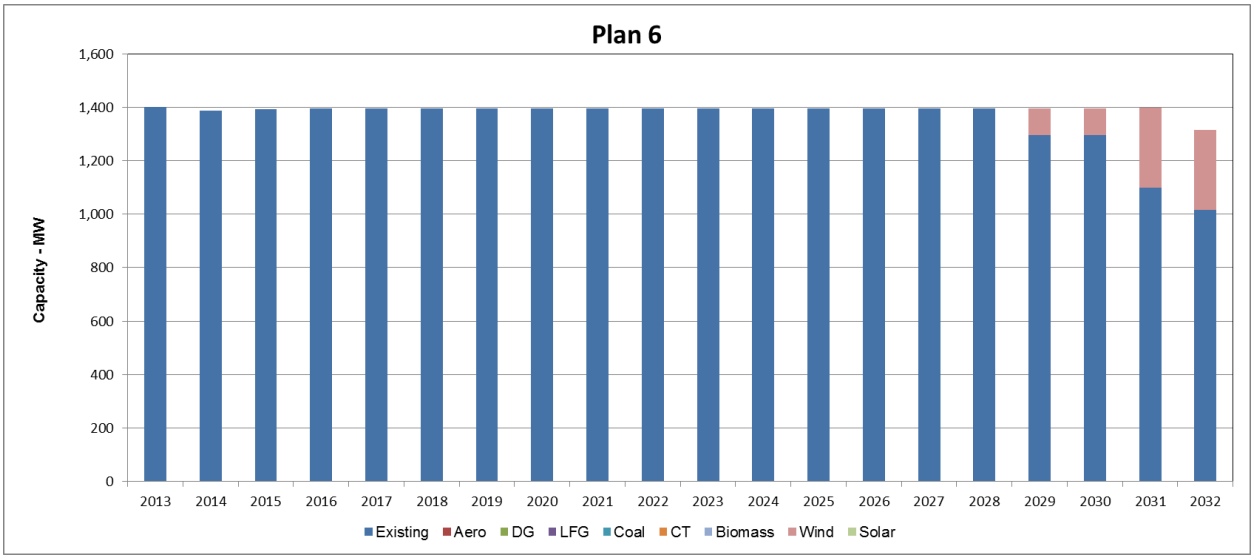


Figure 6-54 - Supply-Side Resource Composition of Plan 6

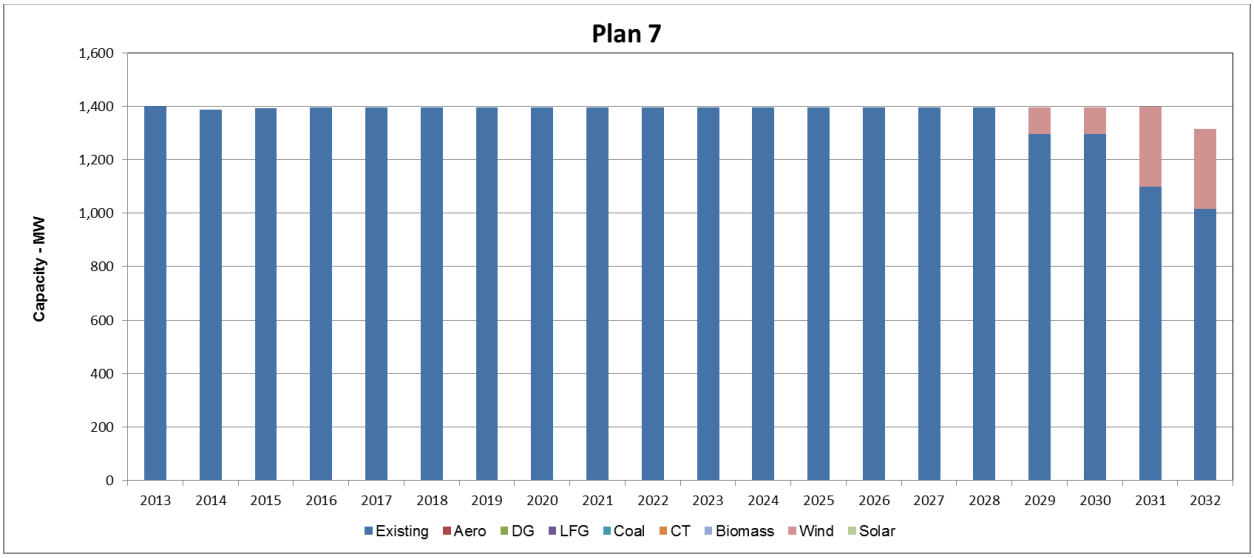


Figure 6-55 - Supply-Side Resource Composition of Plan 7

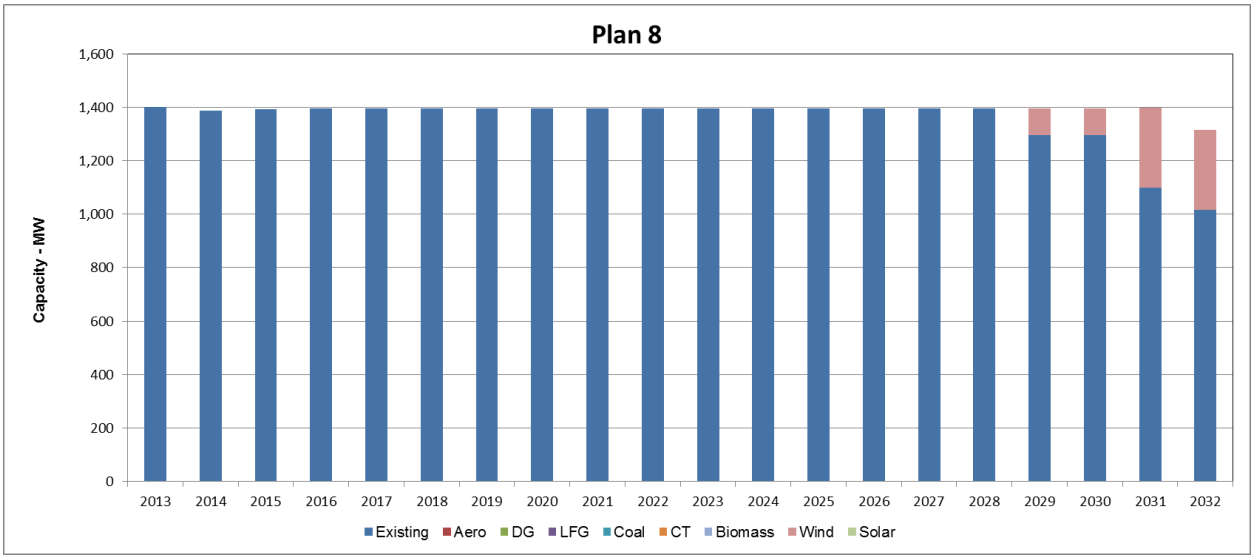


Figure 6-56 - Supply-Side Resource Composition of Plan 8

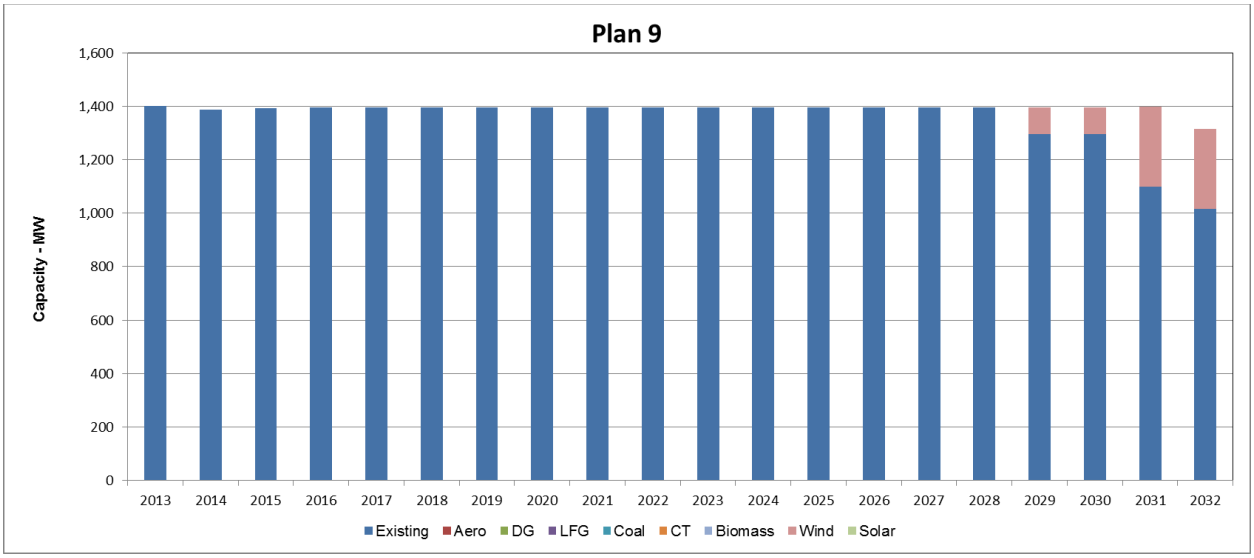


Figure 6-57 - Supply-Side Resource Composition of Plan 9

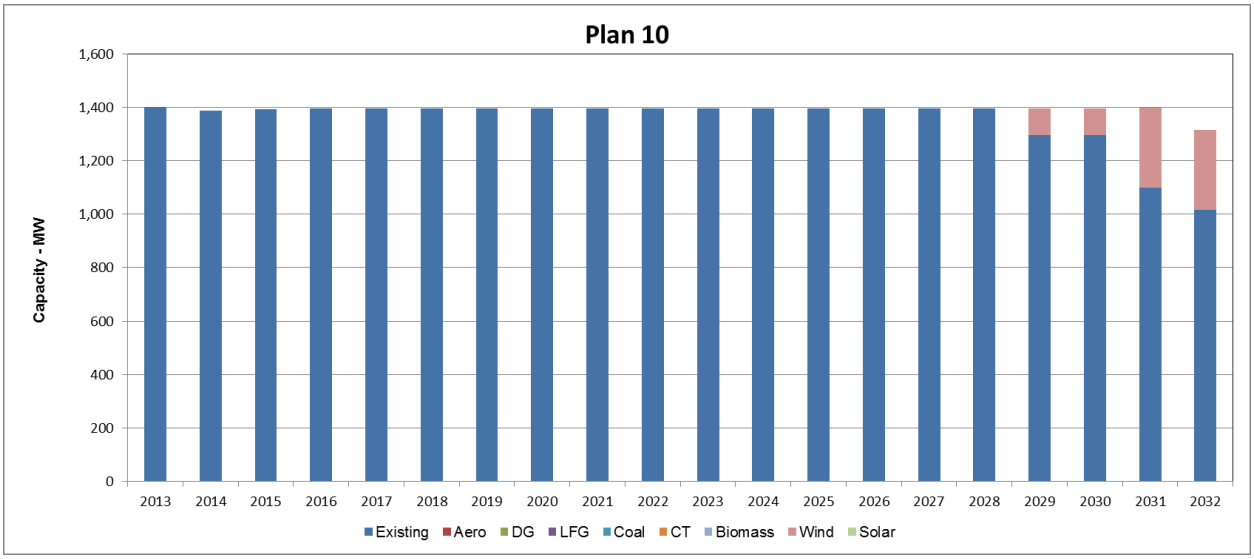


Figure 6-58 - Supply-Side Resource Composition of Plan 10

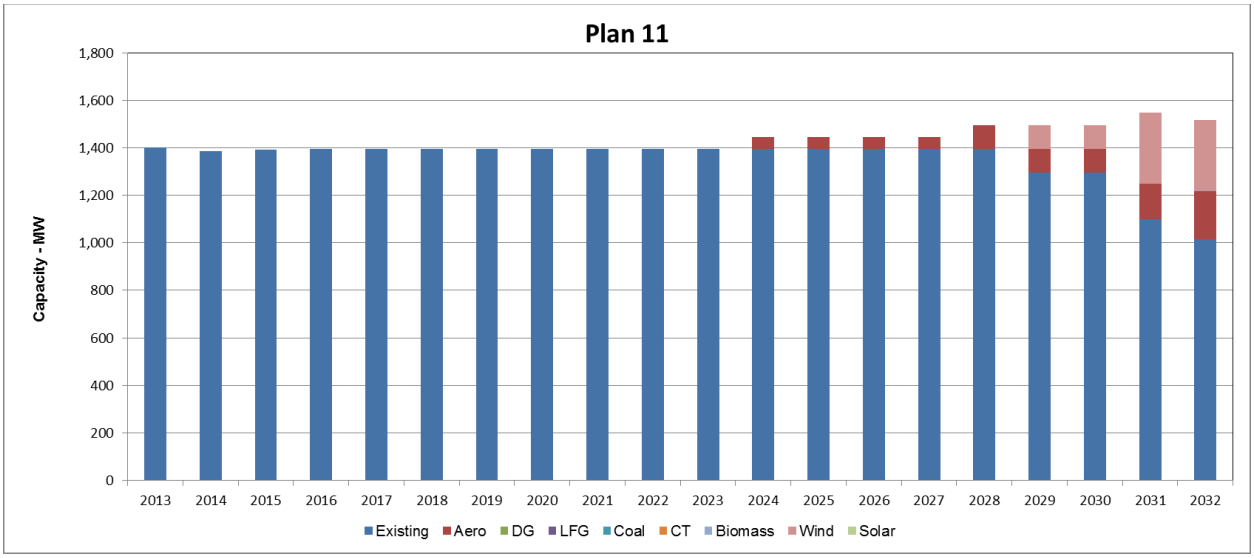


Figure 6-59 - Supply-Side Resource Composition of Plan 11

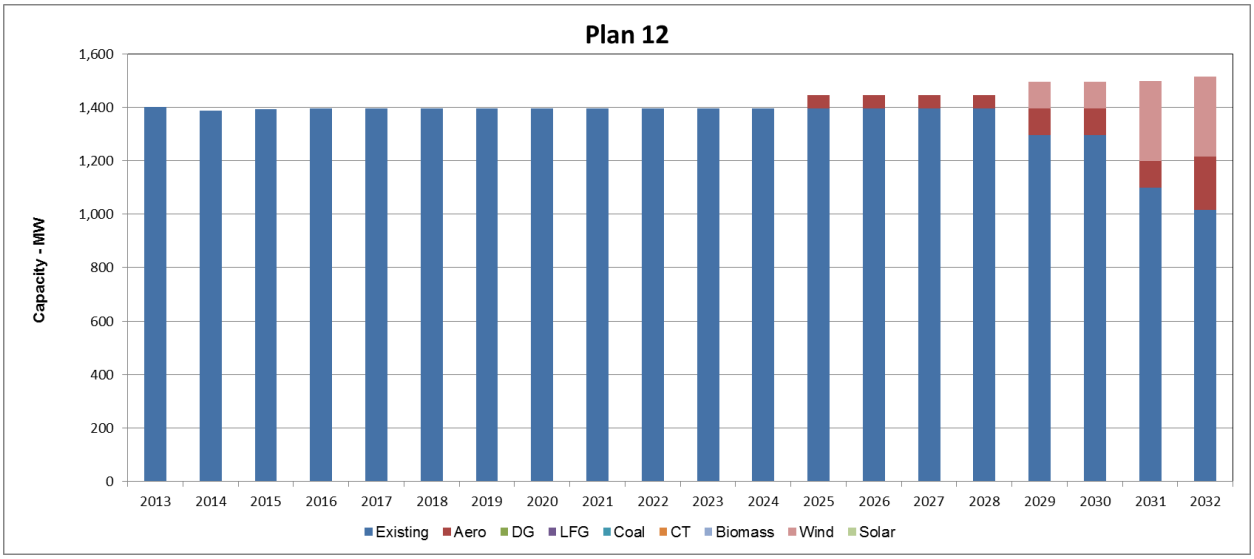


Figure 6-60 - Supply-Side Resource Composition of Plan 12

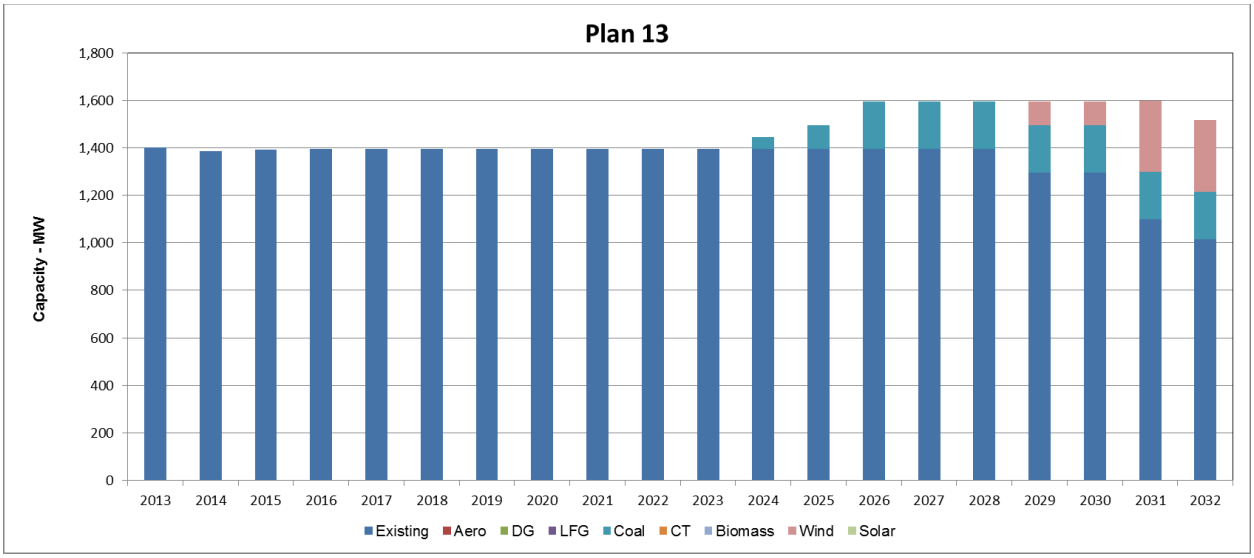


Figure 6-61 - Supply-Side Resource Composition of Plan 13

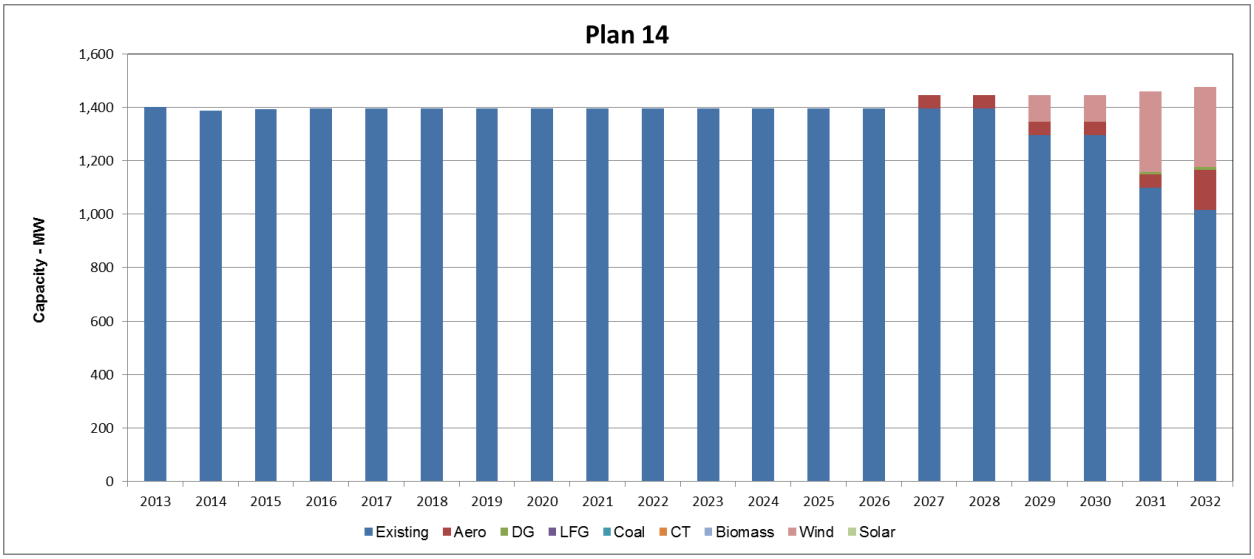


Figure 6-62 - Supply-Side Resource Composition of Plan 14

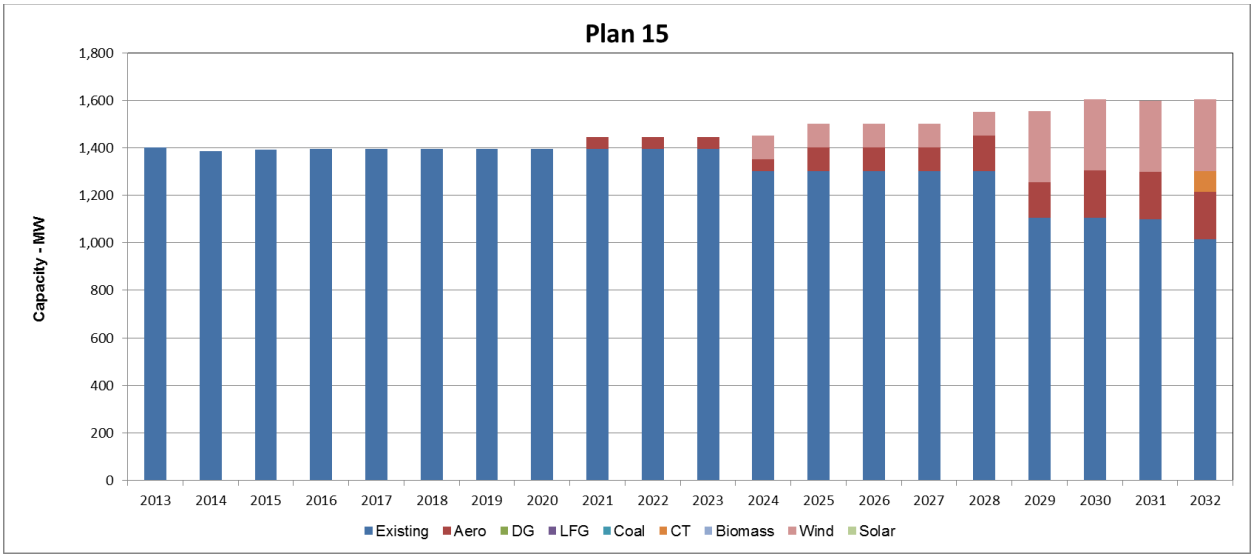


Figure 6-63 - Supply-Side Resource Composition of Plan 15

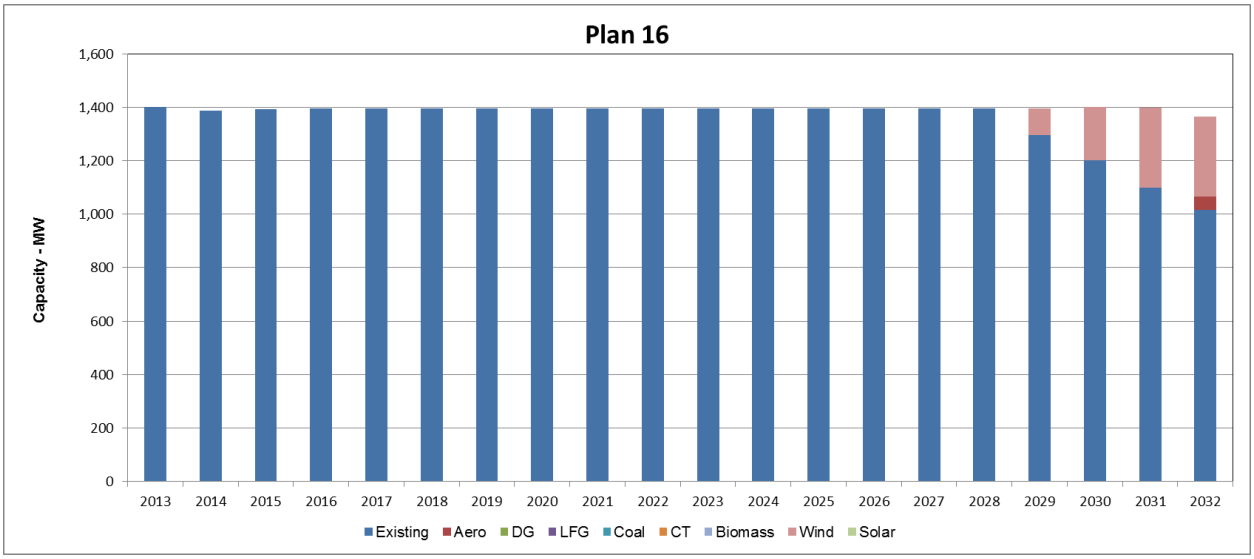


Figure 6-64 - Supply-Side Resource Composition of Plan 16

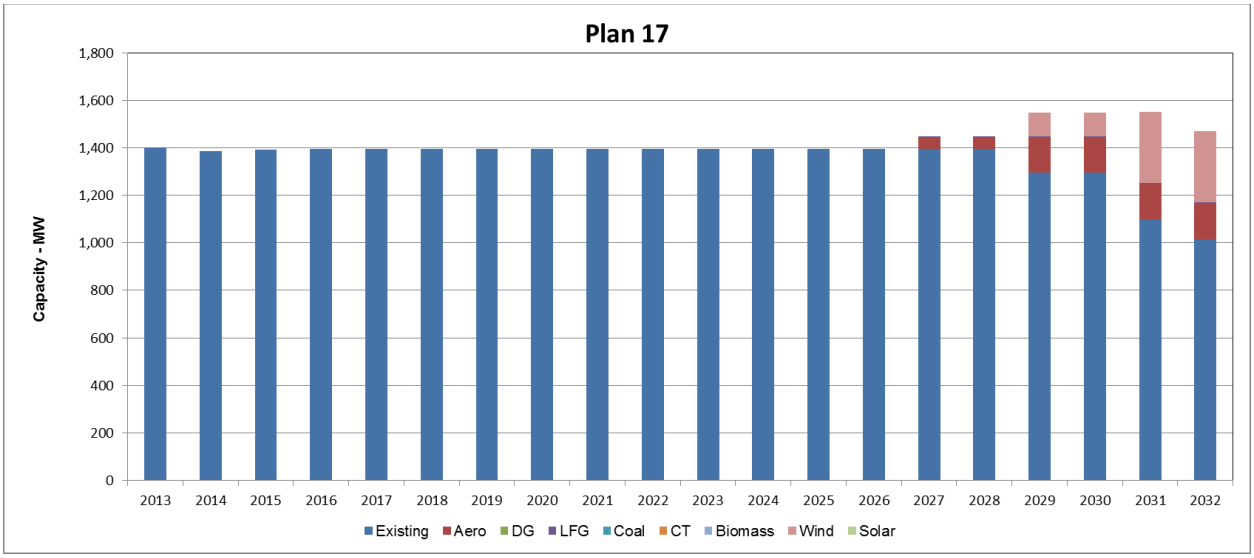


Figure 6-65 - Supply-Side Resource Composition of Plan 17

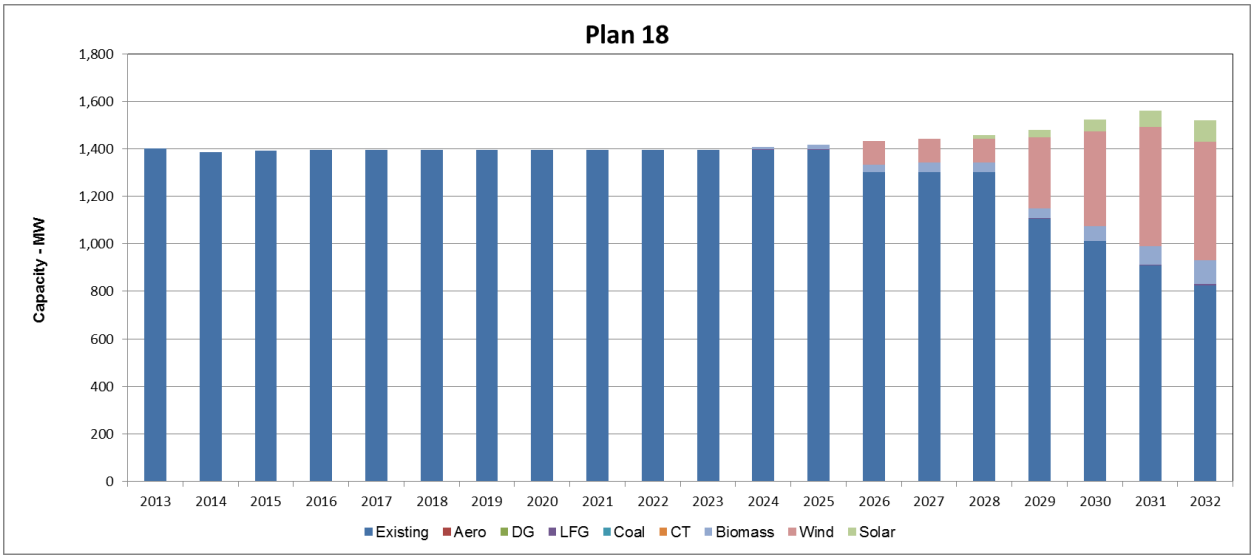


Figure 6-66 - Supply-Side Resource Composition of Plan 18

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 6-67* through *6-84*. The corresponding tables of values for all these figures are provided in Appendix 6E.

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

Figure 6-67 - Impact of DSM on Annual Energy Requirements of Plan 1

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

Figure 6-68 - Impact of DSM on Annual Energy Requirements of Plan 2

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

Figure 6-69 - Impact of DSM on Annual Energy Requirements of Plan 3

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

Figure 6-70 - Impact of DSM on Annual Energy Requirements of Plan 4

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

Figure 6-71 - Impact of DSM on Annual Energy Requirements of Plan 5

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

Figure 6-72 - Impact of DSM on Annual Energy Requirements of Plan 6

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

Figure 6-73 - Impact of DSM on Annual Energy Requirements of Plan 7

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

Figure 6-74 - Impact of DSM on Annual Energy Requirements of Plan 8

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

Figure 6-75 - Impact of DSM on Annual Energy Requirements of Plan 9

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

Figure 6-76 - Impact of DSM on Annual Energy Requirements of Plan 10

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

Figure 6-77 - Impact of DSM on Annual Energy Requirements of Plan 11

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

Figure 6-78 - Impact of DSM on Annual Energy Requirements of Plan 12

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

Figure 6-79 - Impact of DSM on Annual Energy Requirements of Plan 13

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

Figure 6-80 - Impact of DSM on Annual Energy Requirements of Plan 14

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

Figure 6-81 - Impact of DSM on Annual Energy Requirements of Plan 15

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

Figure 6-82 - Impact of DSM on Annual Energy Requirements of Plan 16

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

Figure 6-83 - Impact of DSM on Annual Energy Requirements of Plan 17

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

Figure 6-84 - 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 6-85 through 6-102. The corresponding tables of values for all these figures are provided in Appendix 6F. Since plans 11 and 18 were configured without using DSM to meet future energy needs, *Figures 6-95* and *6-102* are blank.

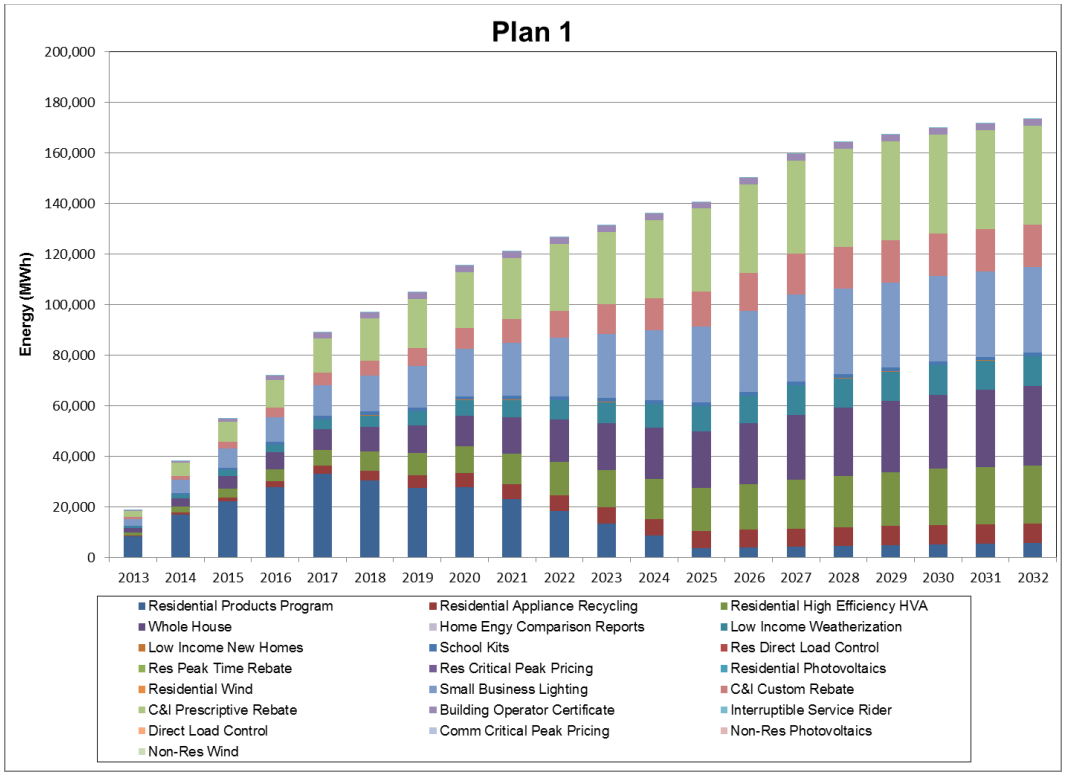


Figure 6-85 - Composition of DSM Energy Provided in Plan 1

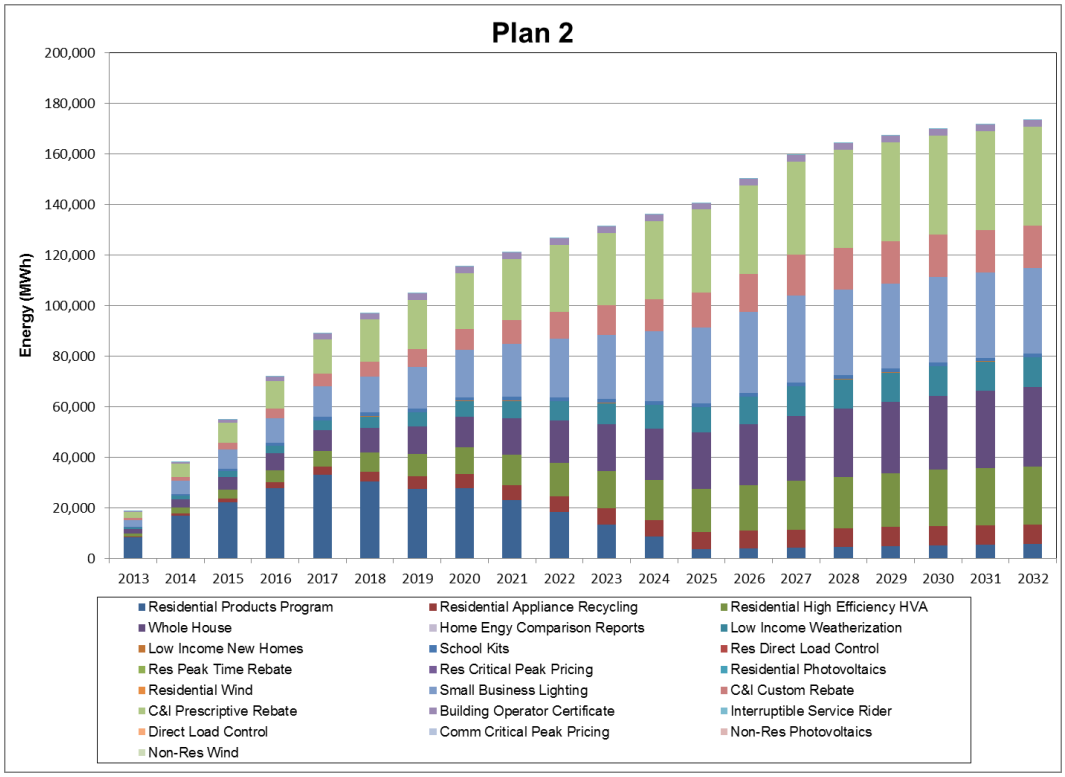


Figure 6-86 - Composition of DSM Energy Provided in Plan 2

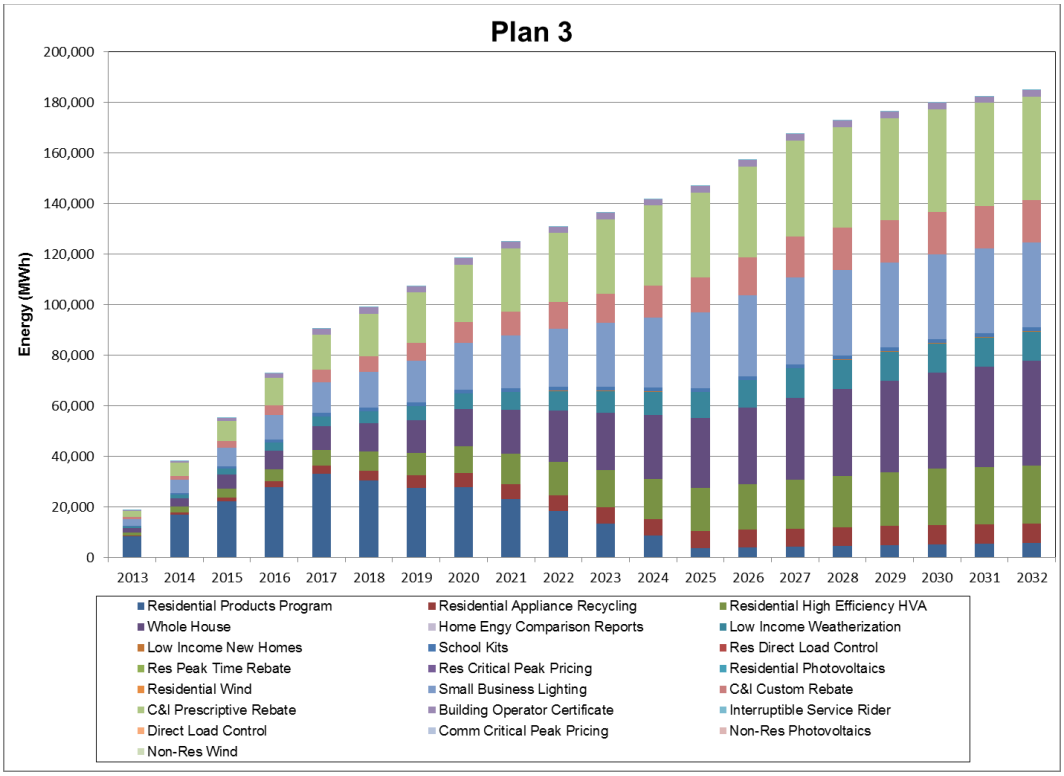


Figure 6-87 - Composition of DSM Energy Provided in Plan 3

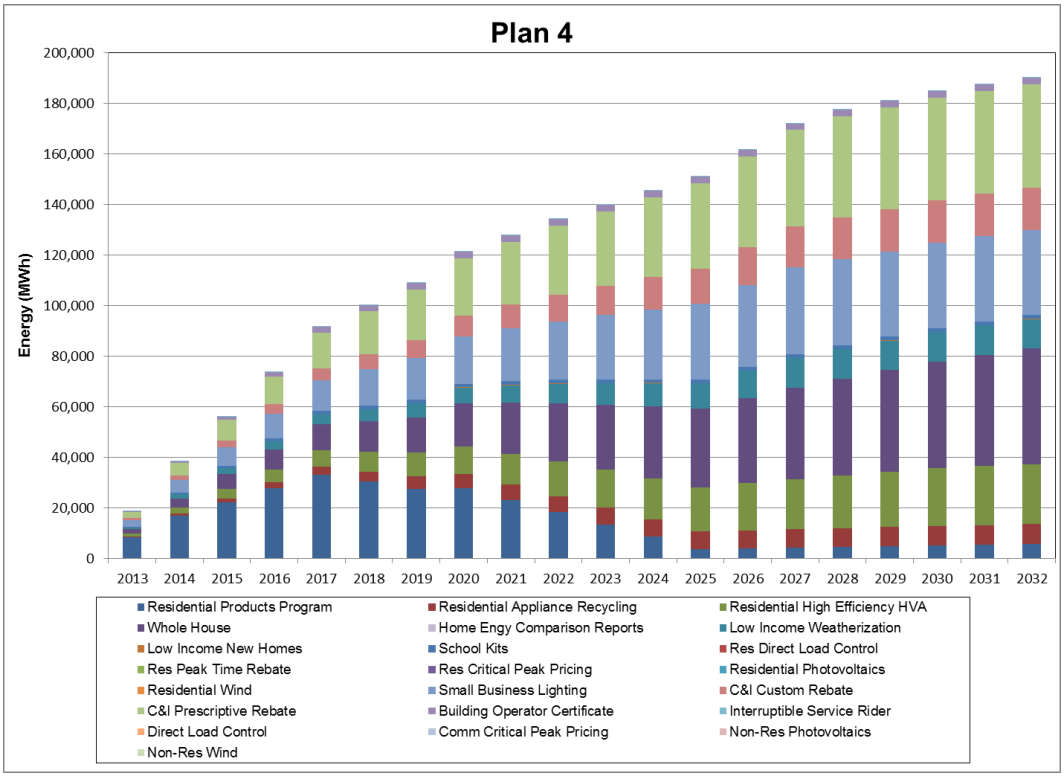


Figure 6-88 - Composition of DSM Energy Provided in Plan 4

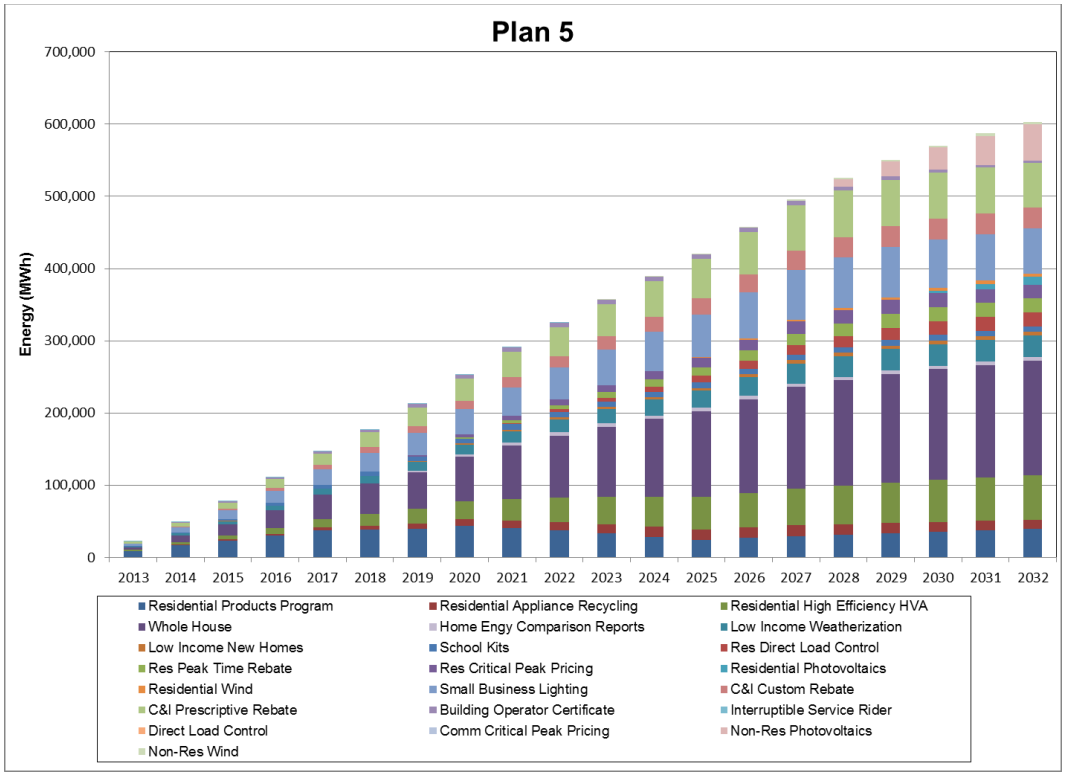


Figure 6-89 - Composition of DSM Energy Provided in Plan 5

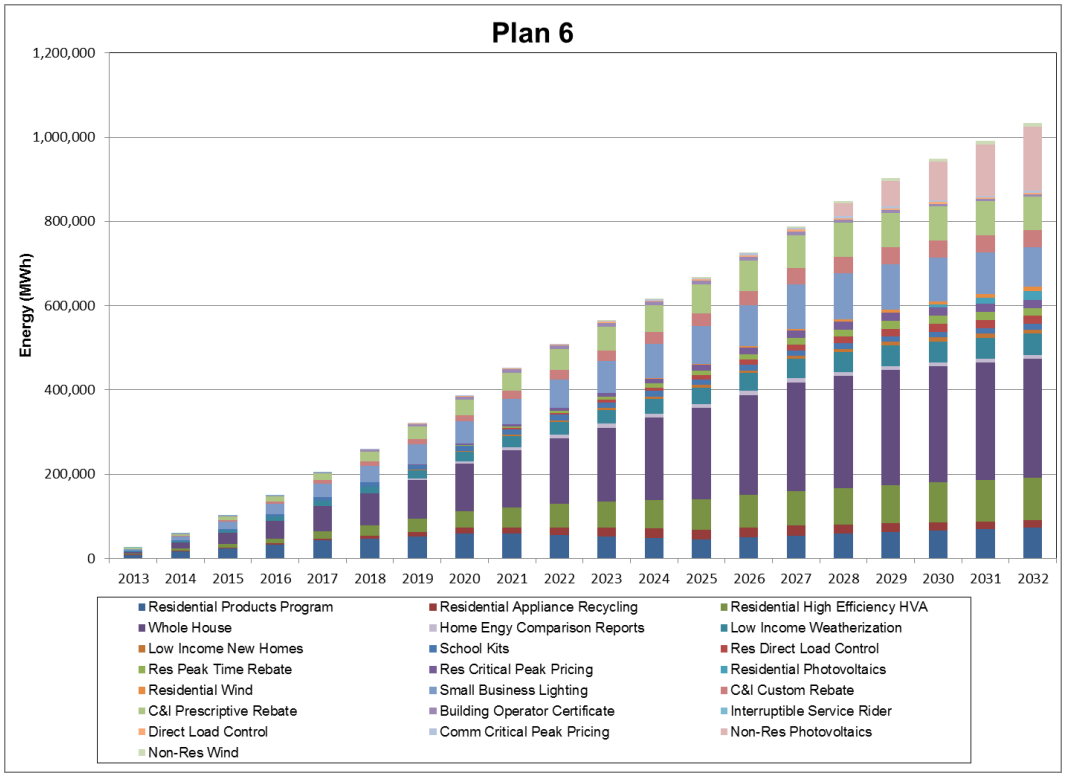


Figure 6-90 - Composition of DSM Energy Provided in Plan 6

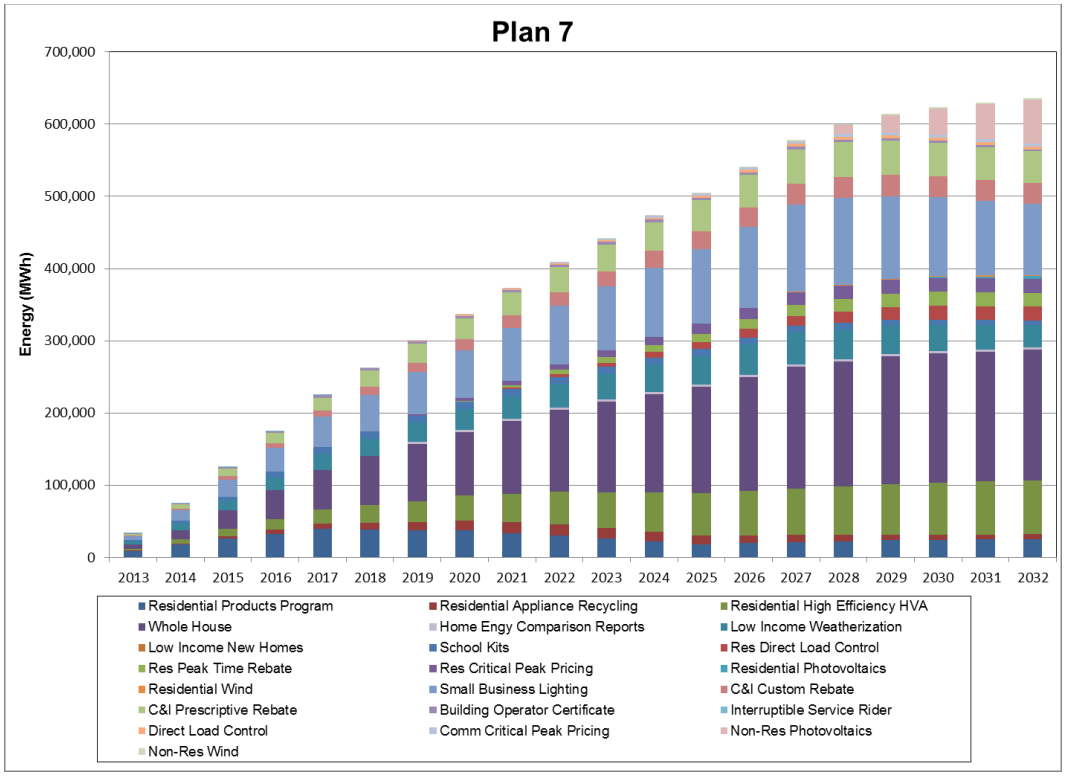


Figure 6-91 - Composition of DSM Energy Provided in Plan 7

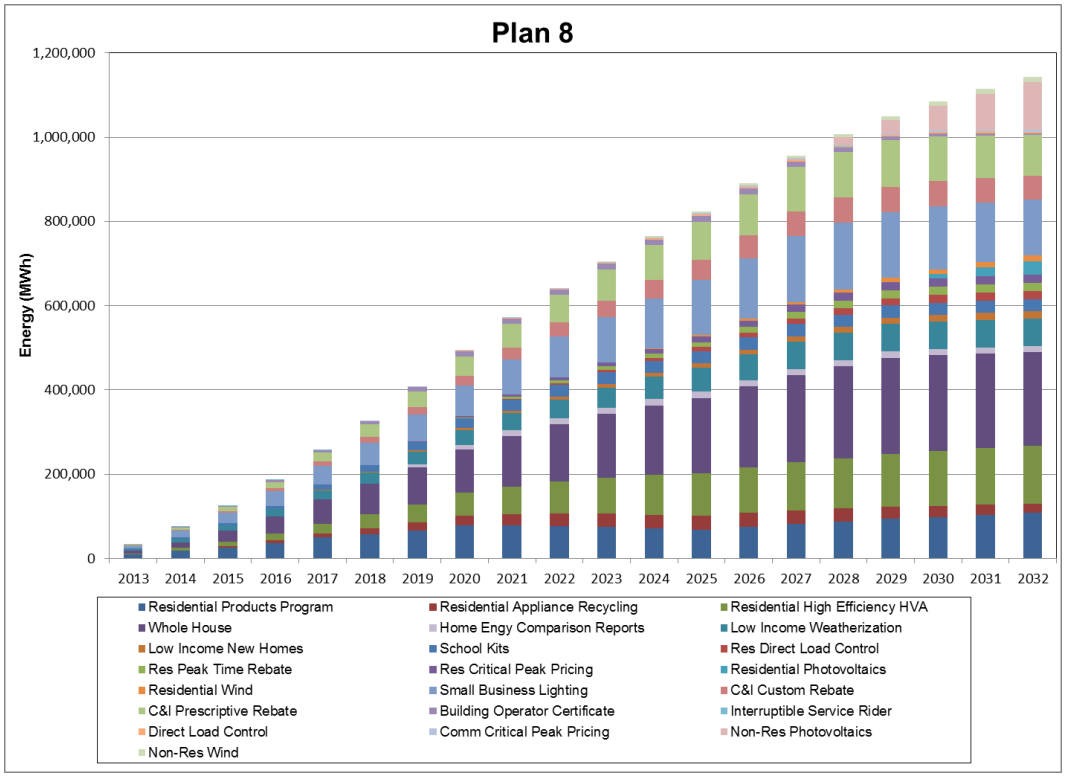


Figure 6-92 - Composition of DSM Energy Provided in Plan 8

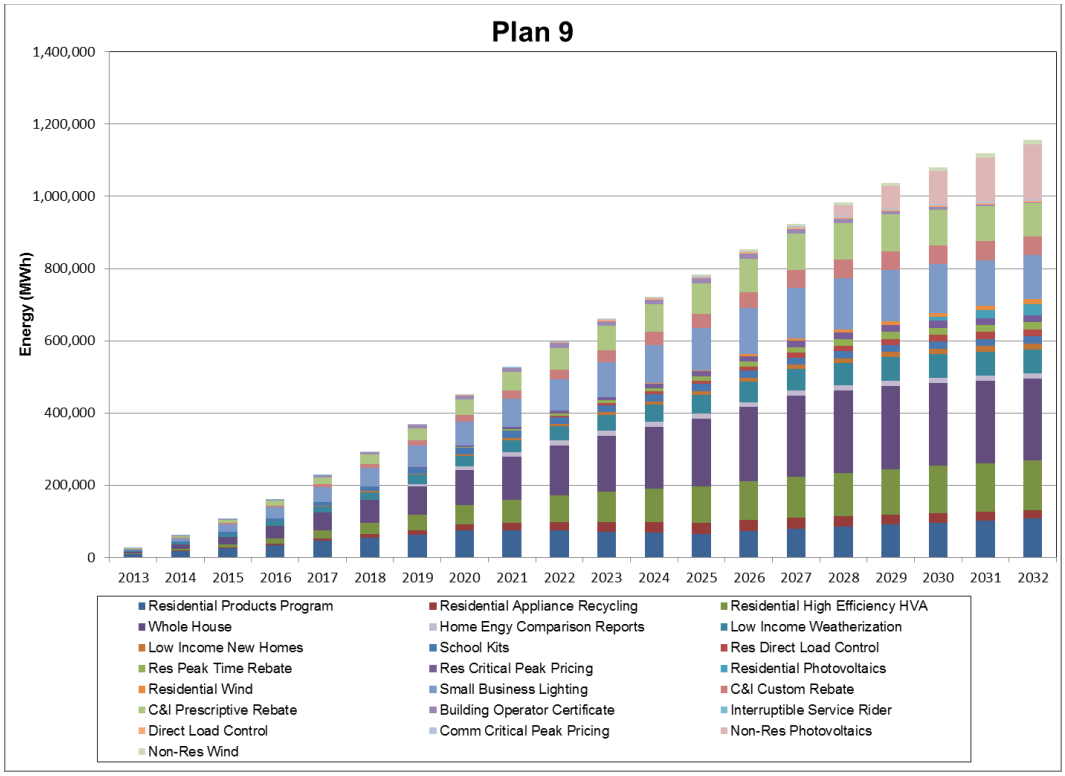


Figure 6-93 - Composition of DSM Energy Provided in Plan 9

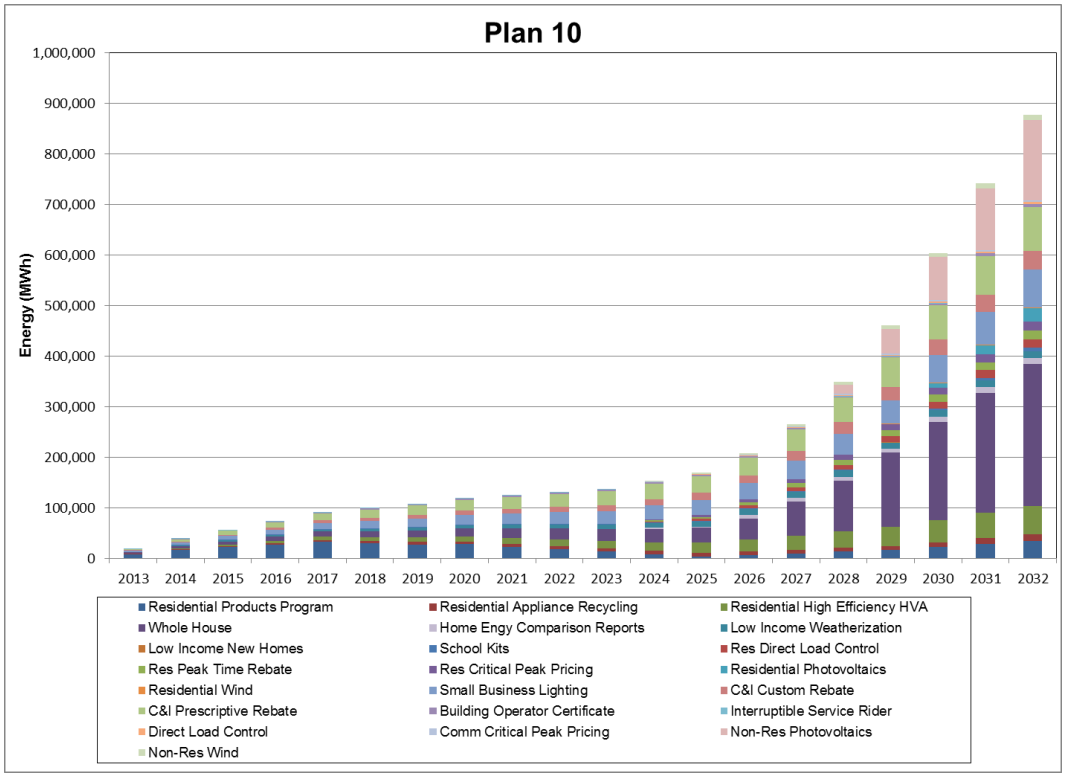


Figure 6-94 - Composition of DSM Energy Provided in Plan 10

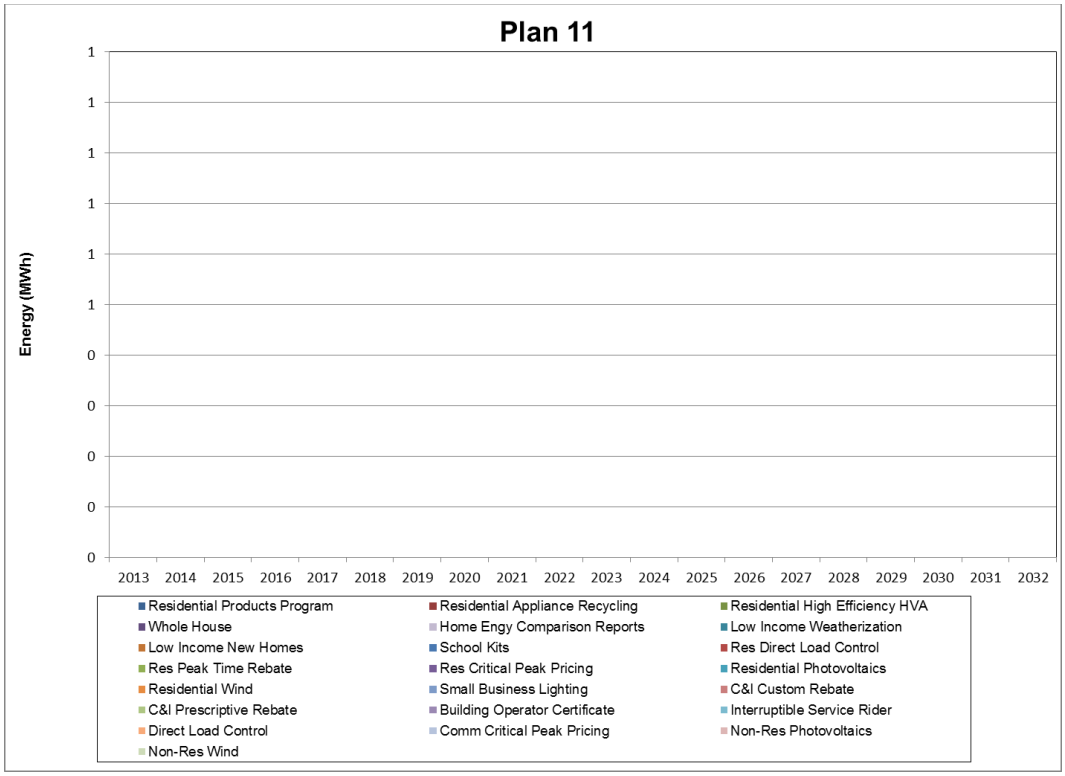


Figure 6-95 - Composition of DSM Energy Provided in Plan 11

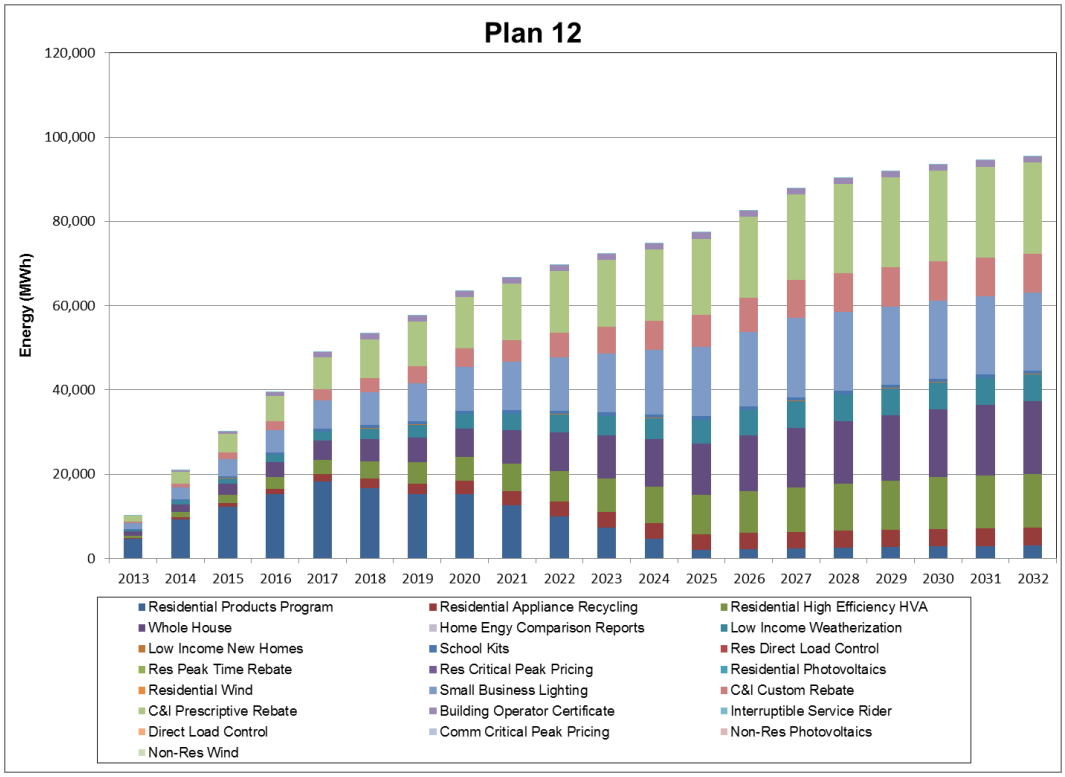


Figure 6-96 - Composition of DSM Energy Provided in Plan 12

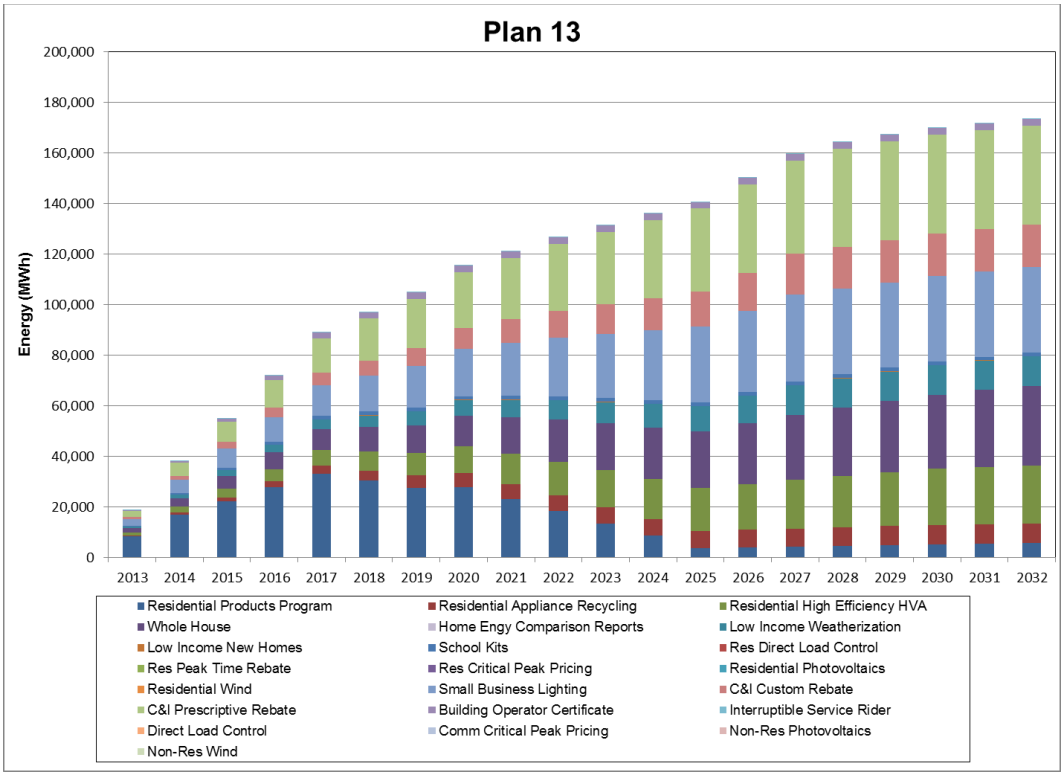


Figure 6-97 - Composition of DSM Energy Provided in Plan 13

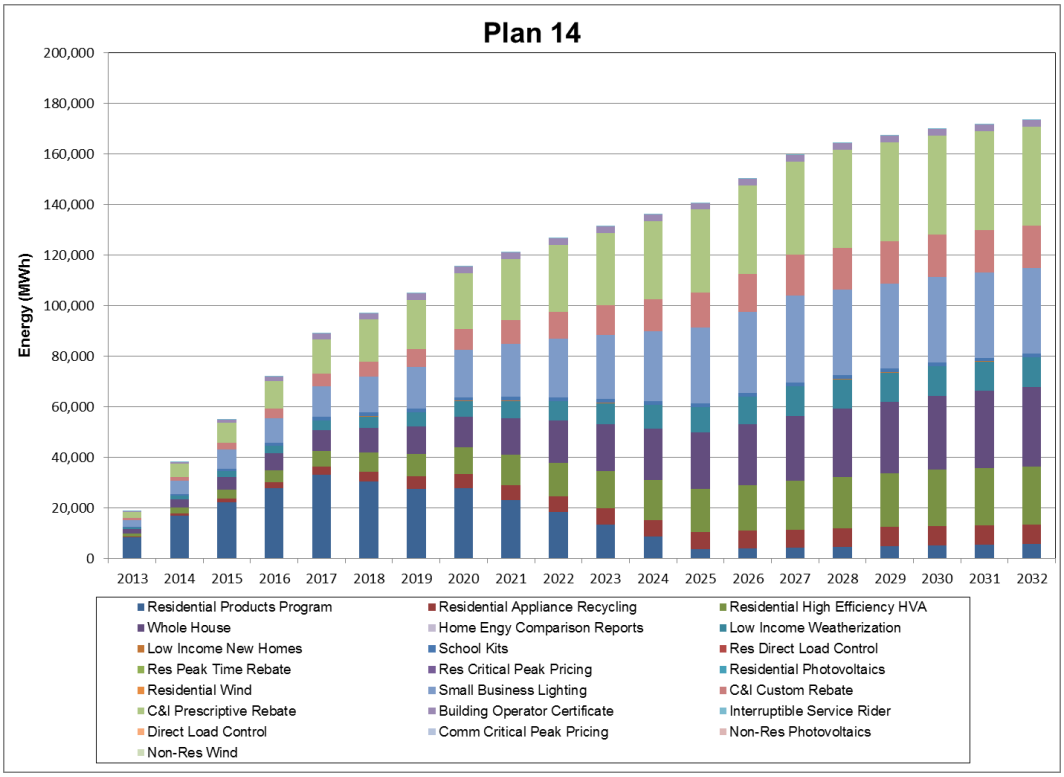


Figure 6-98 - Composition of DSM Energy Provided in Plan 14

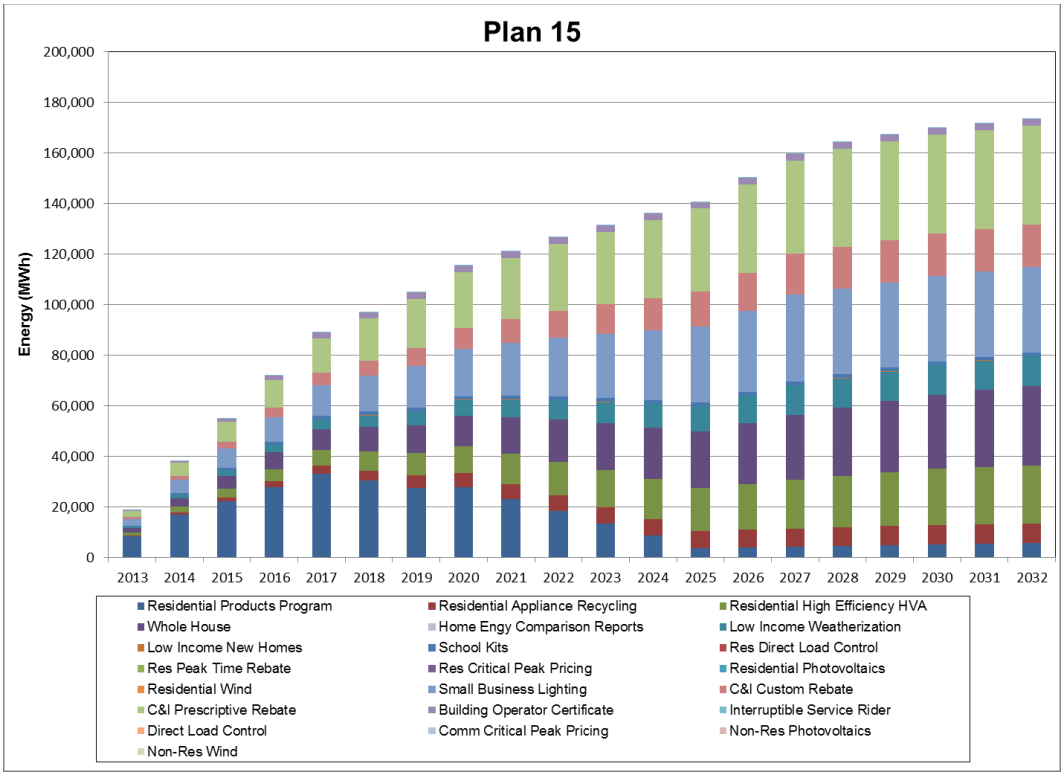


Figure 6-99 - Composition of DSM Energy Provided in Plan 15

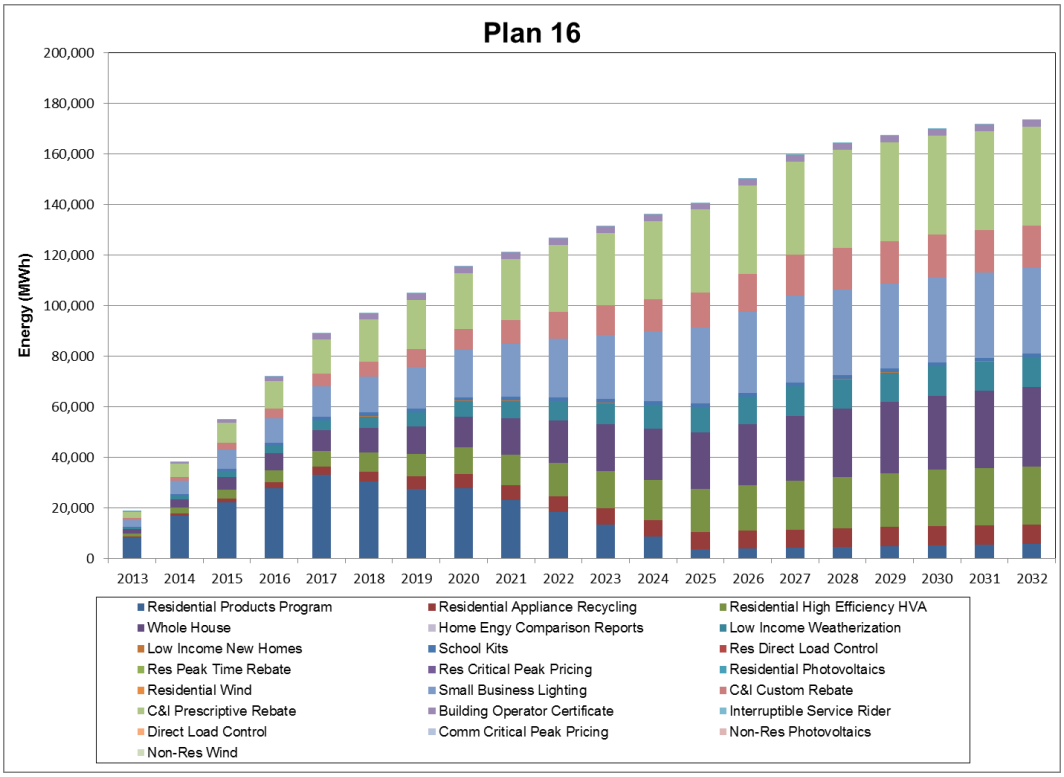


Figure 6-100 - Composition of DSM Energy Provided in Plan 16

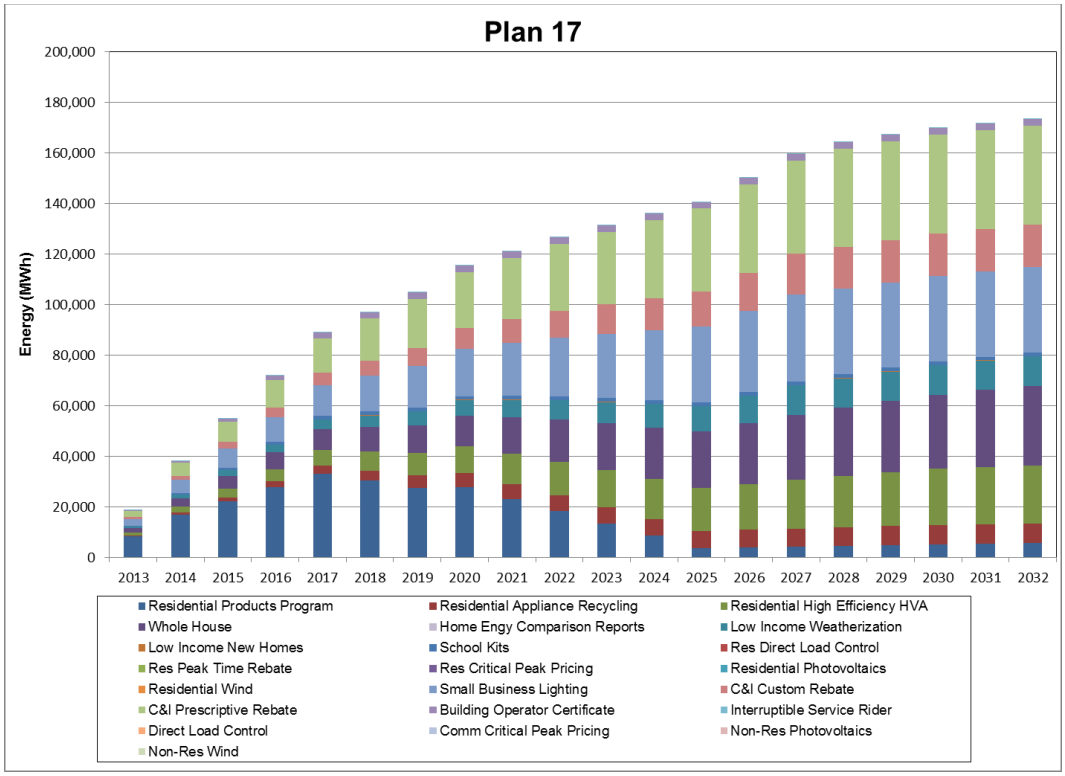


Figure 6-101 - Composition of DSM Energy Provided in Plan 17

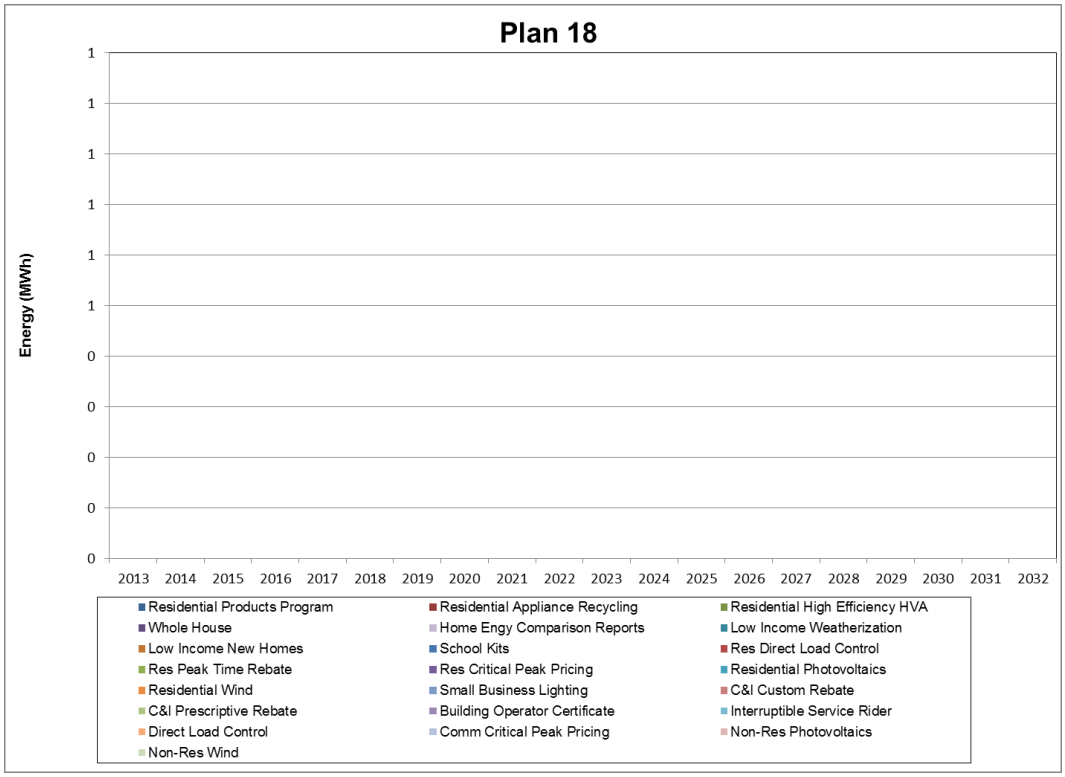


Figure 6-102 - Composition of DSM Energy Provided in Plan 18

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 6-103* through *6-120*. 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.

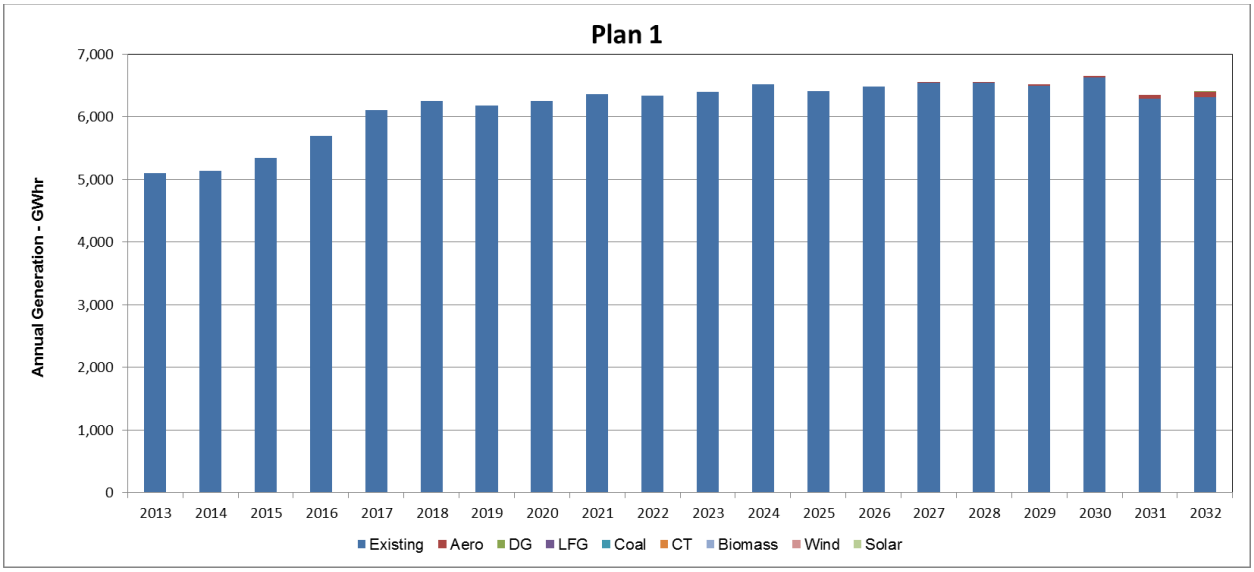


Figure 6-103 - Composition of Supply-Side Energy for Plan 1

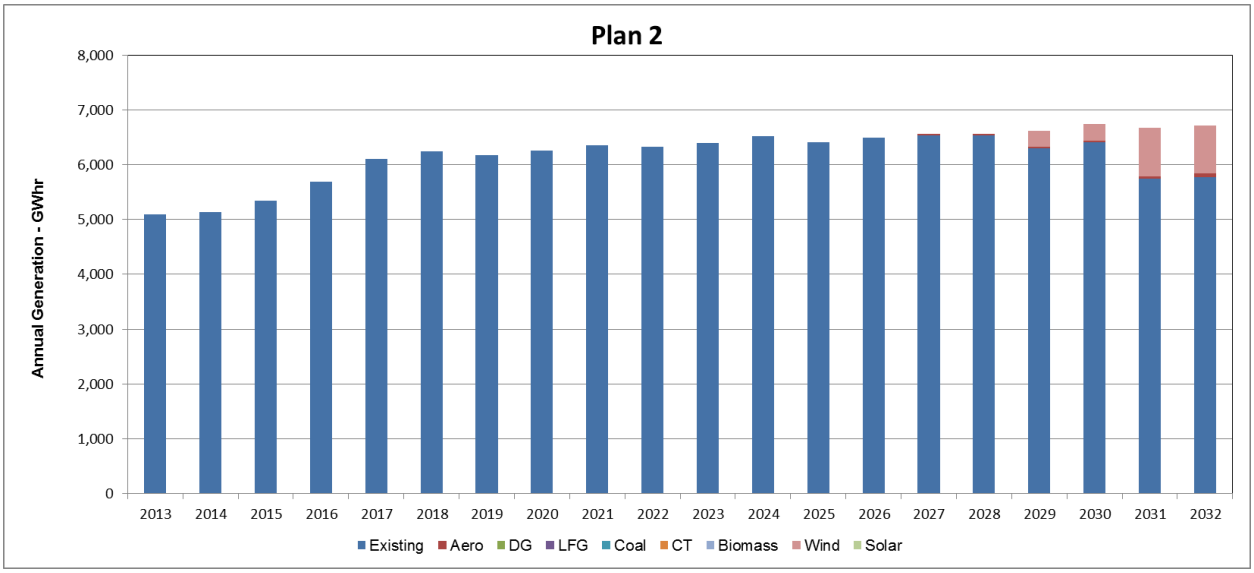


Figure 6-104 - Composition of Supply-Side Energy for Plan 2

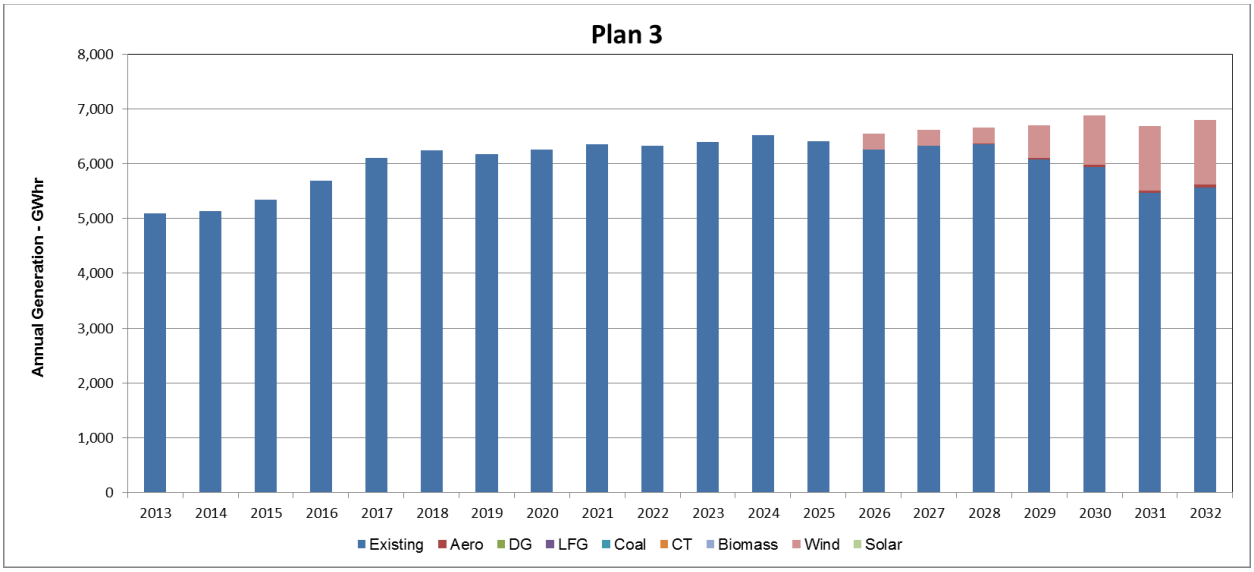


Figure 6-105 - Composition of Supply-Side Energy for Plan 3

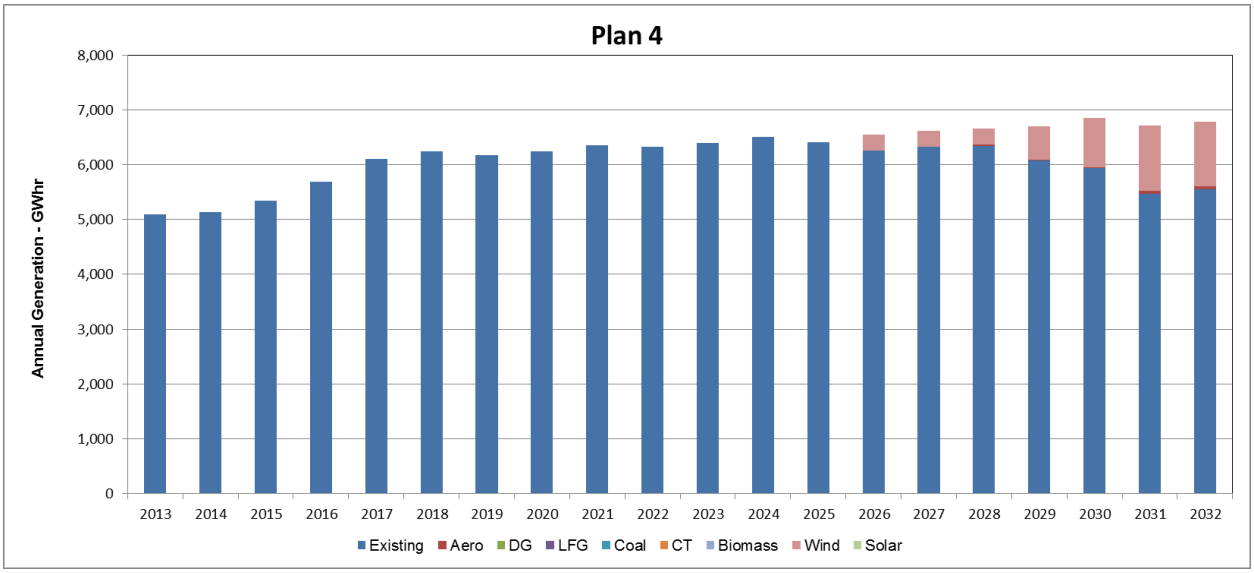


Figure 6-106 - Composition of Supply-Side Energy for Plan 4

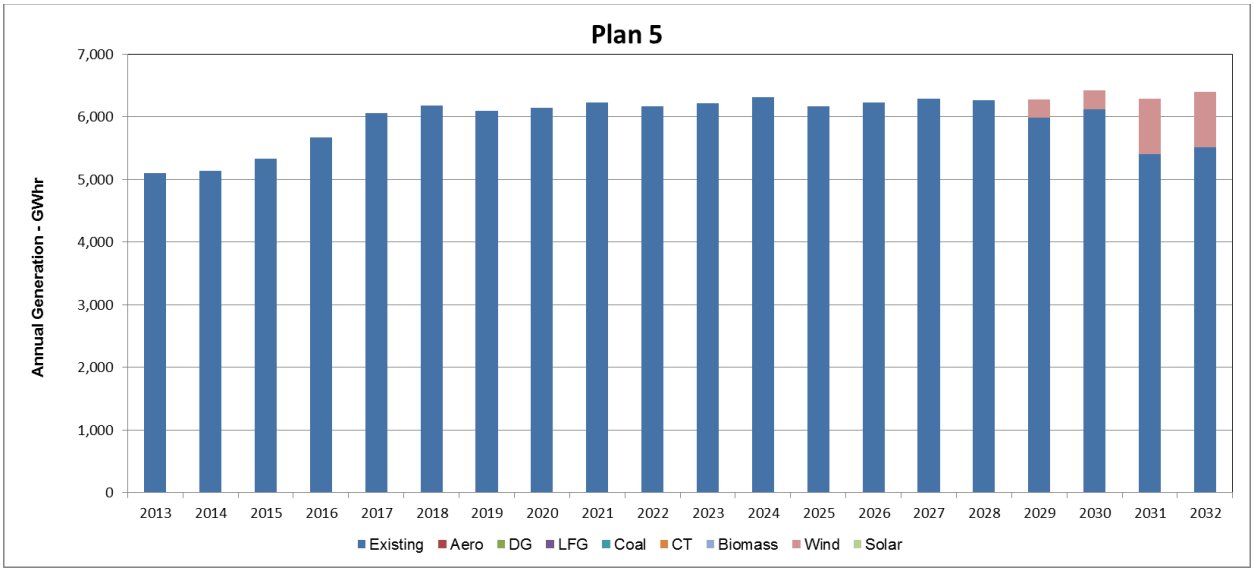


Figure 6-107 - Composition of Supply-Side Energy for Plan 5

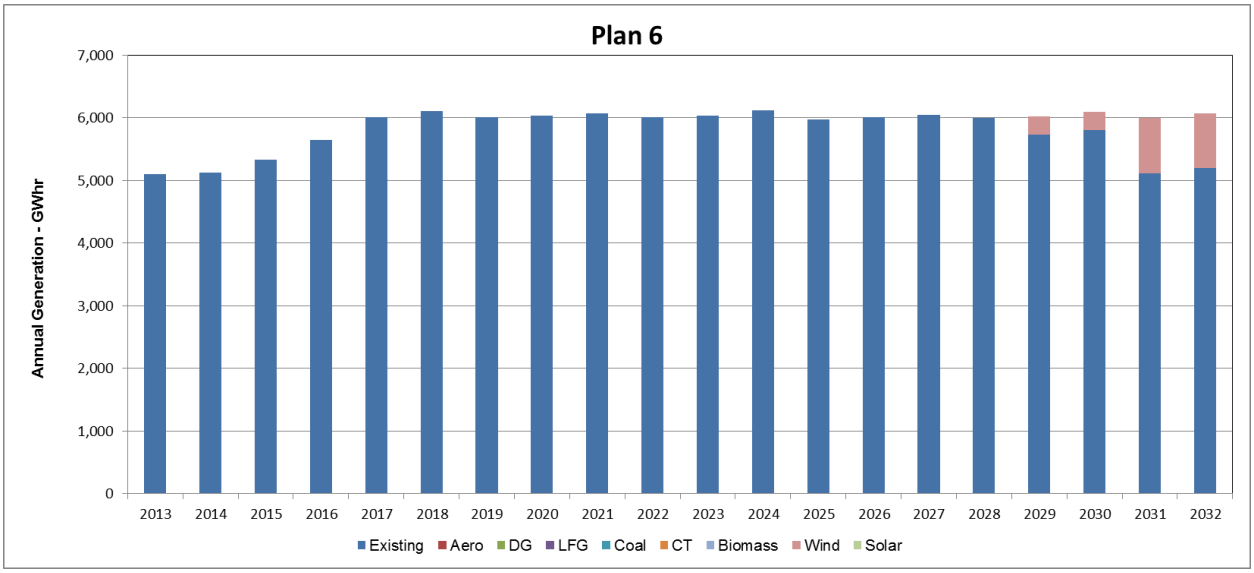


Figure 6-108 - Composition of Supply-Side Energy for Plan 6

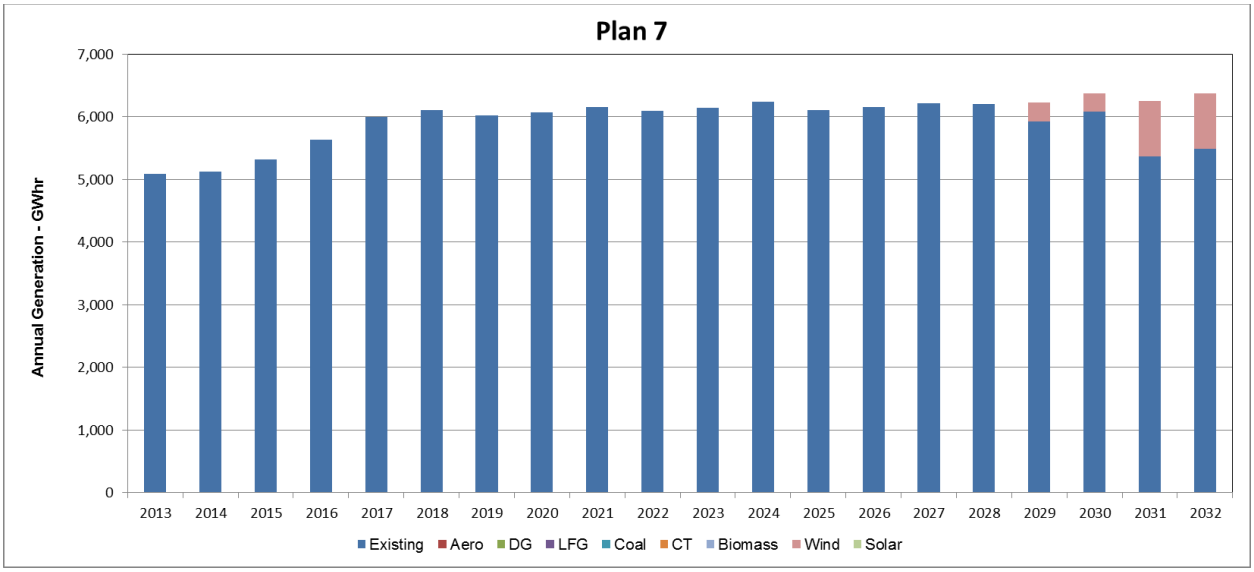


Figure 6-109 - Composition of Supply-Side Energy for Plan 7

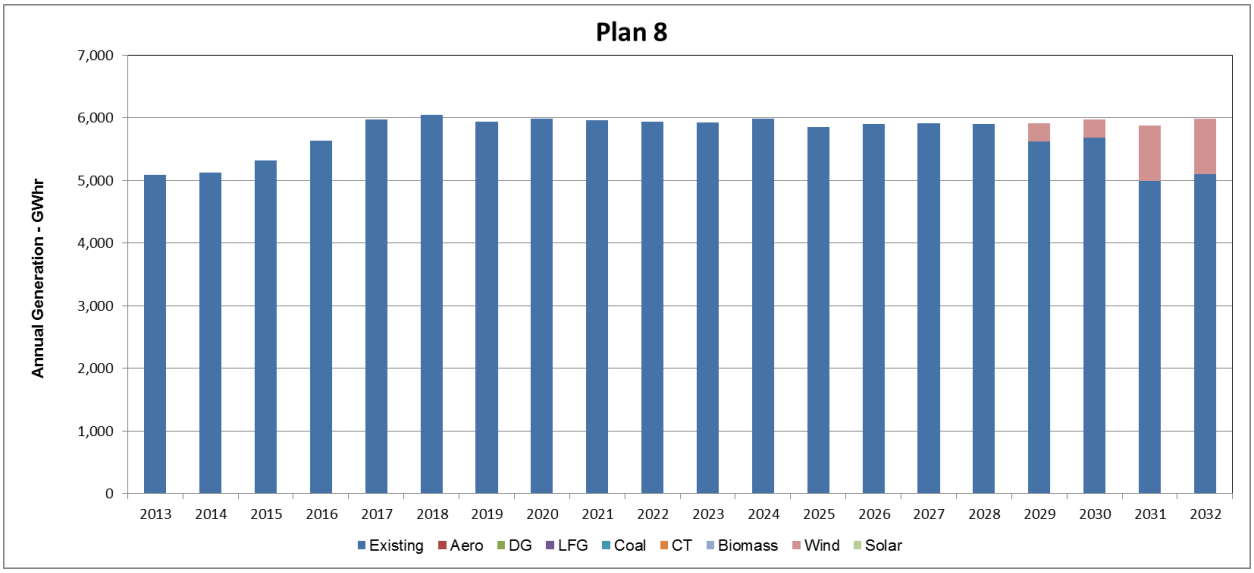


Figure 6-110 - Composition of Supply-Side Energy for Plan 8

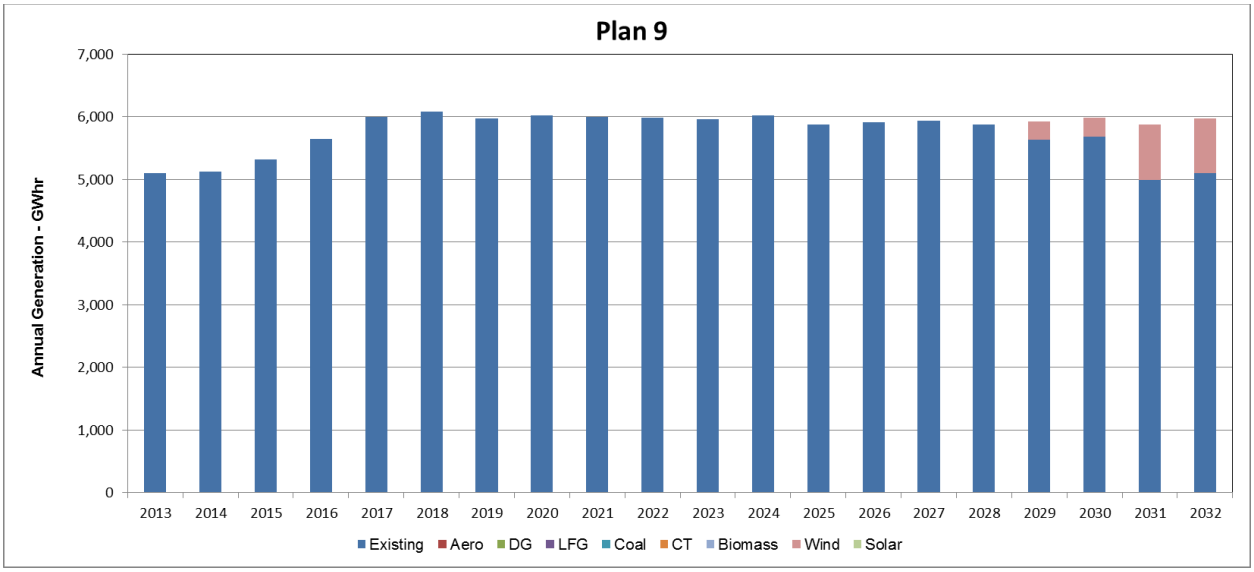


Figure 6-111 - Composition of Supply-Side Energy for Plan 9

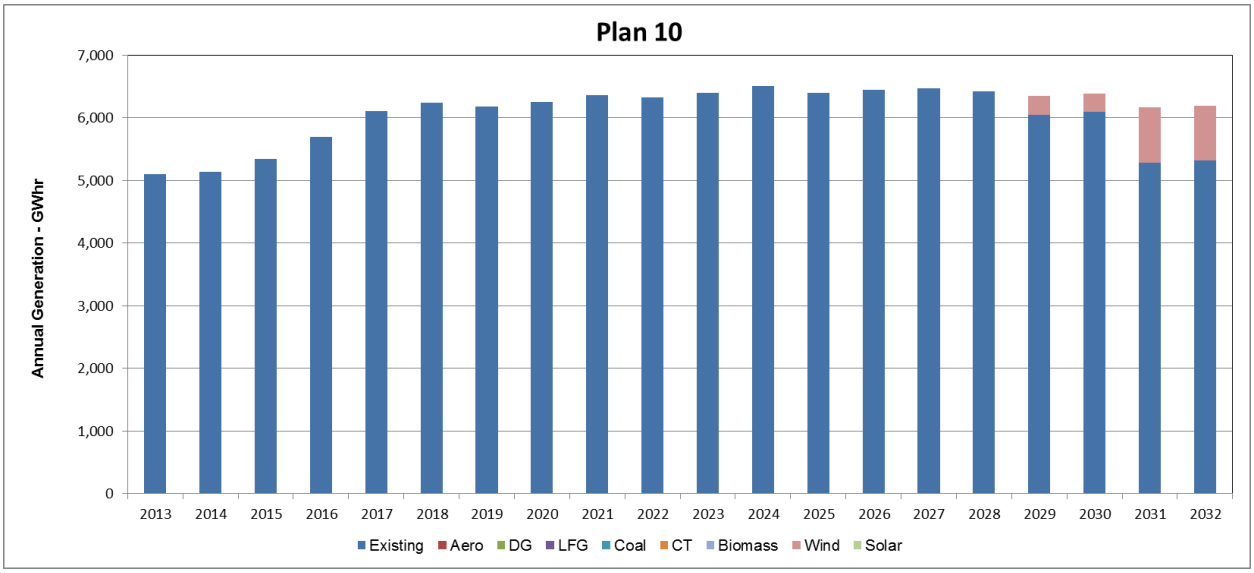


Figure 6-112 - Composition of Supply-Side Energy for Plan 10

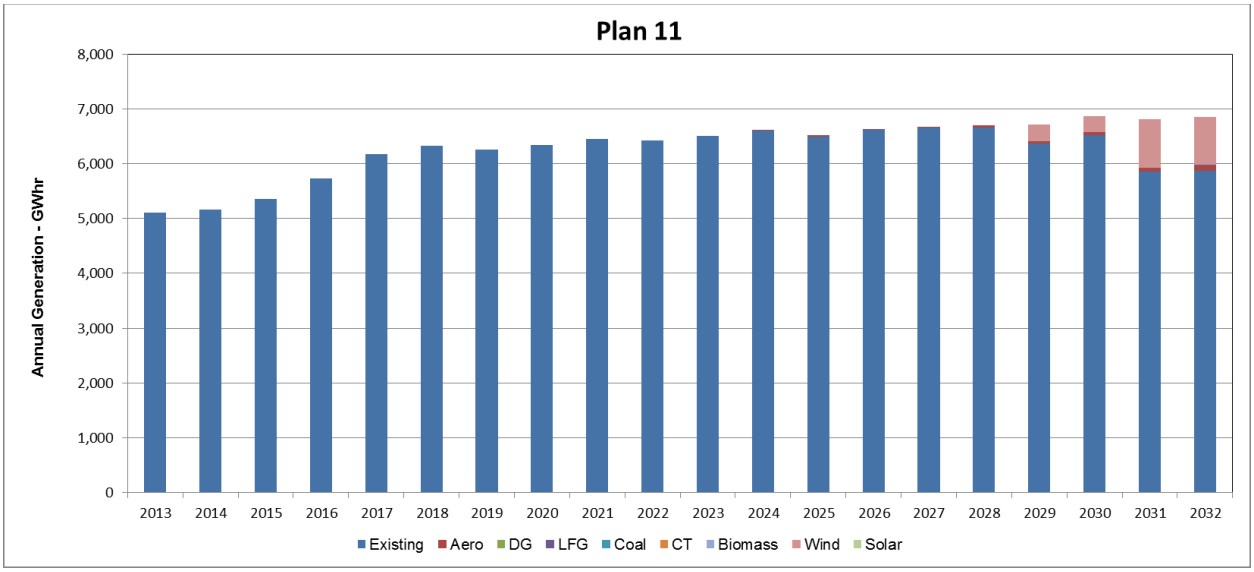


Figure 6-113 - Composition of Supply-Side Energy for Plan 11

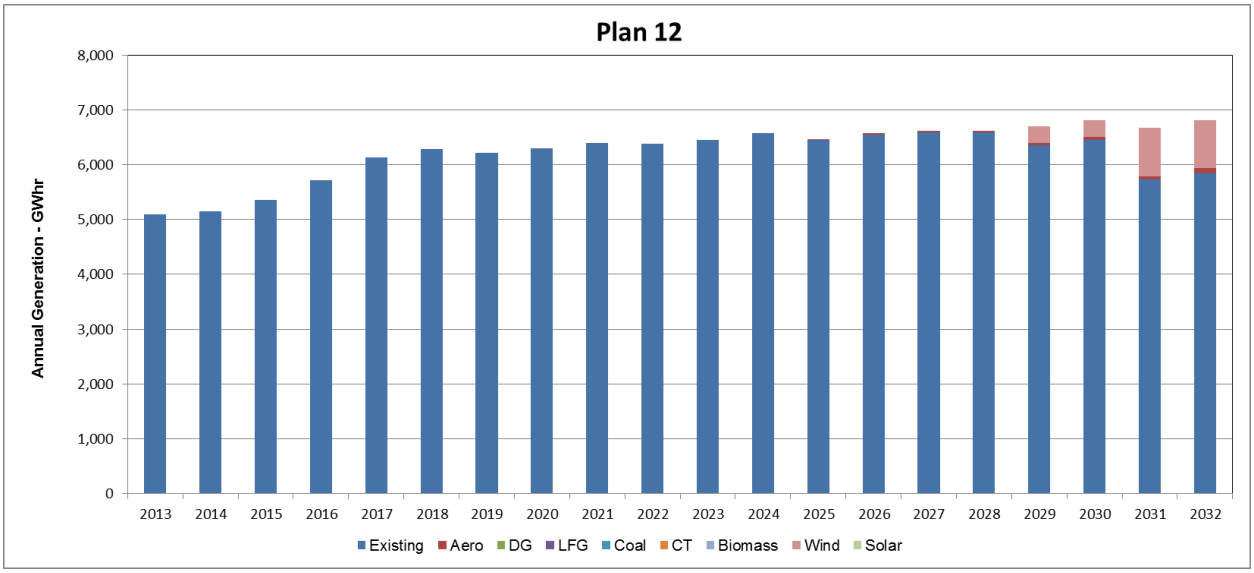


Figure 6-114 - Composition of Supply-Side Energy for Plan 12

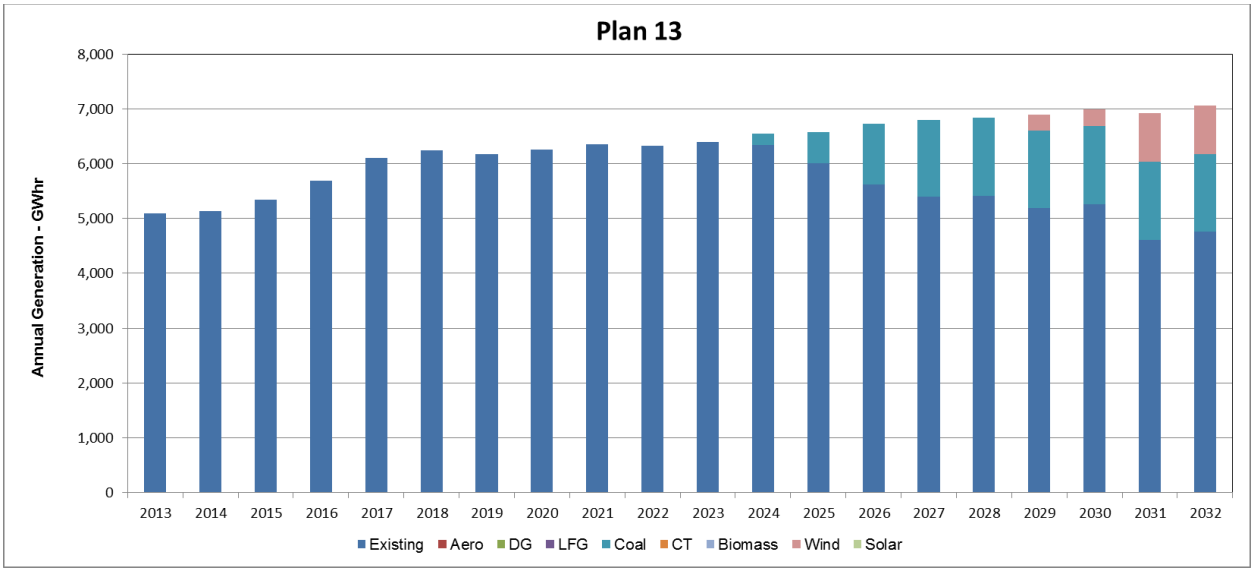


Figure 6-115 - Composition of Supply-Side Energy for Plan 13

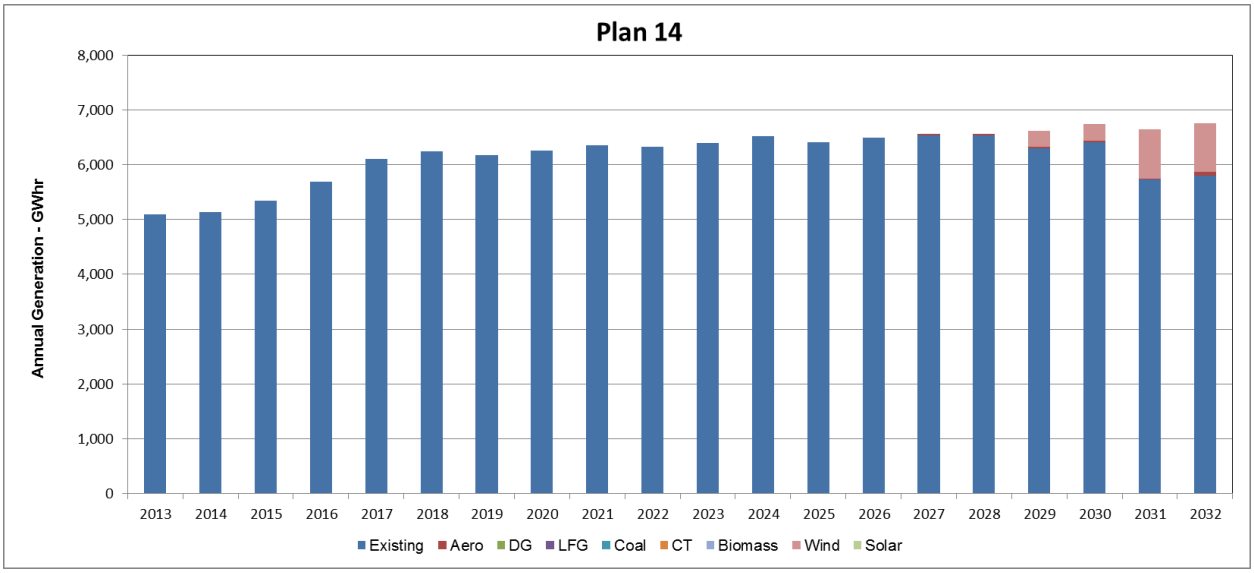


Figure 6-116 - Composition of Supply-Side Energy for Plan 14

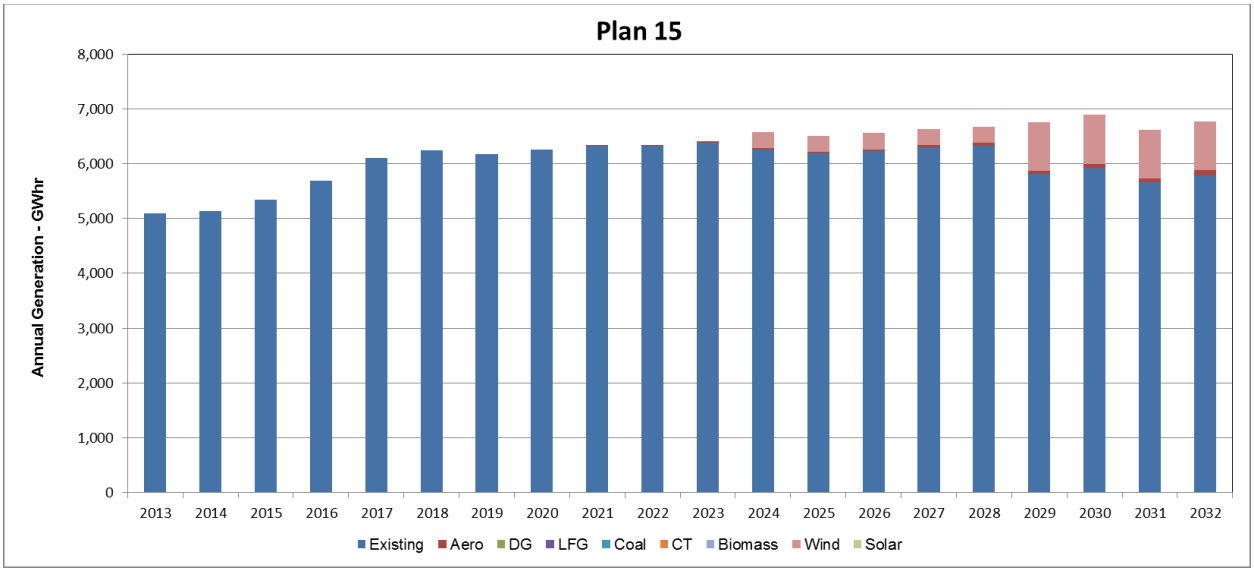


Figure 6-117 - Composition of Supply-Side Energy for Plan 15

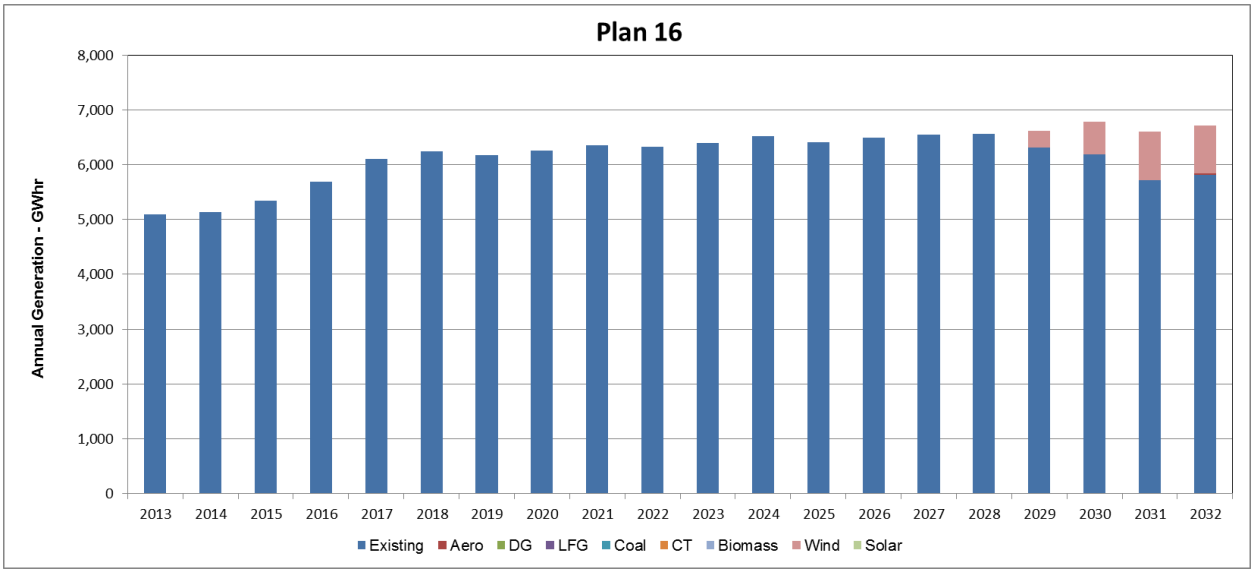


Figure 6-118 - Composition of Supply-Side Energy for Plan 16

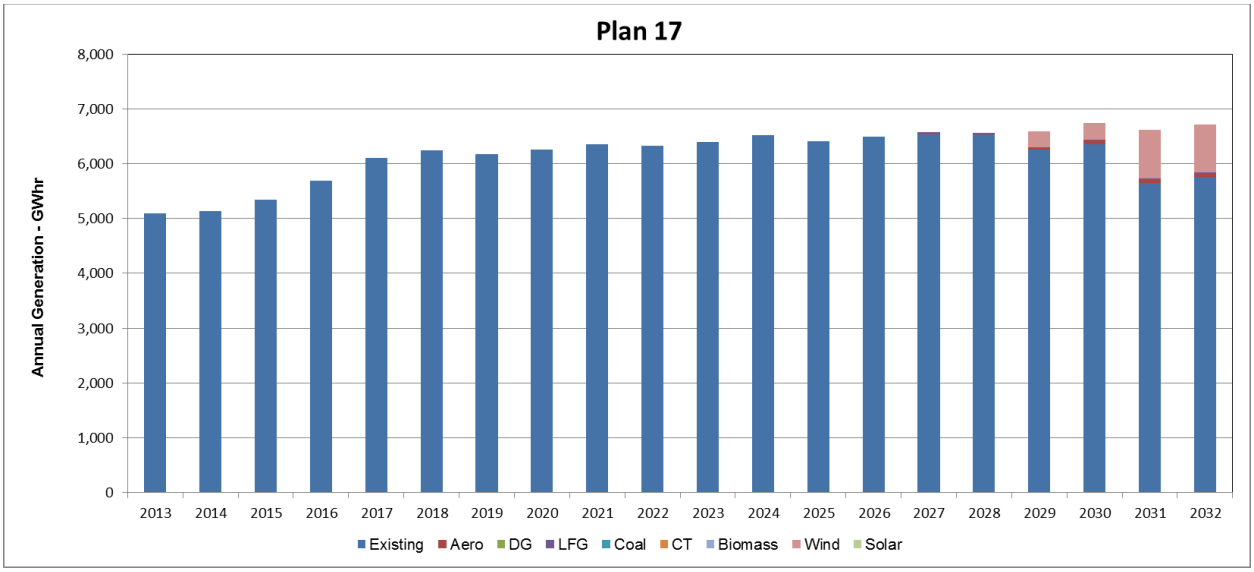


Figure 6-119 - Composition of Supply-Side Energy for Plan 17

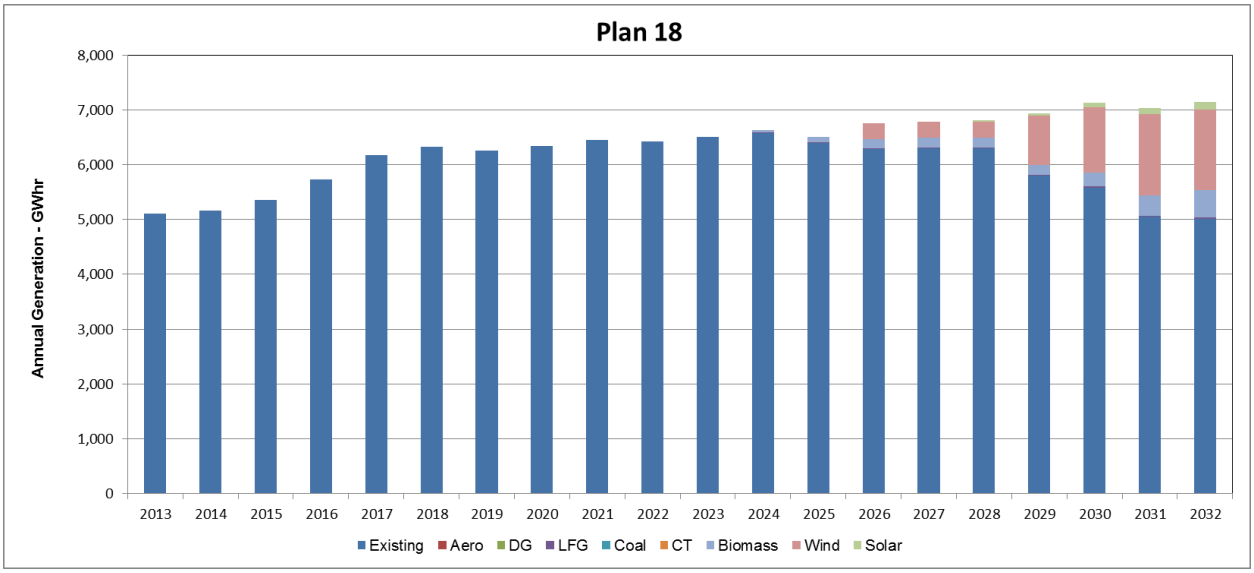


Figure 6-120 - Composition of Supply-Side Energy for Plan 18

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 6-120* through *6-138*. The corresponding tables of values for all these figures are provided in Appendix 6H.

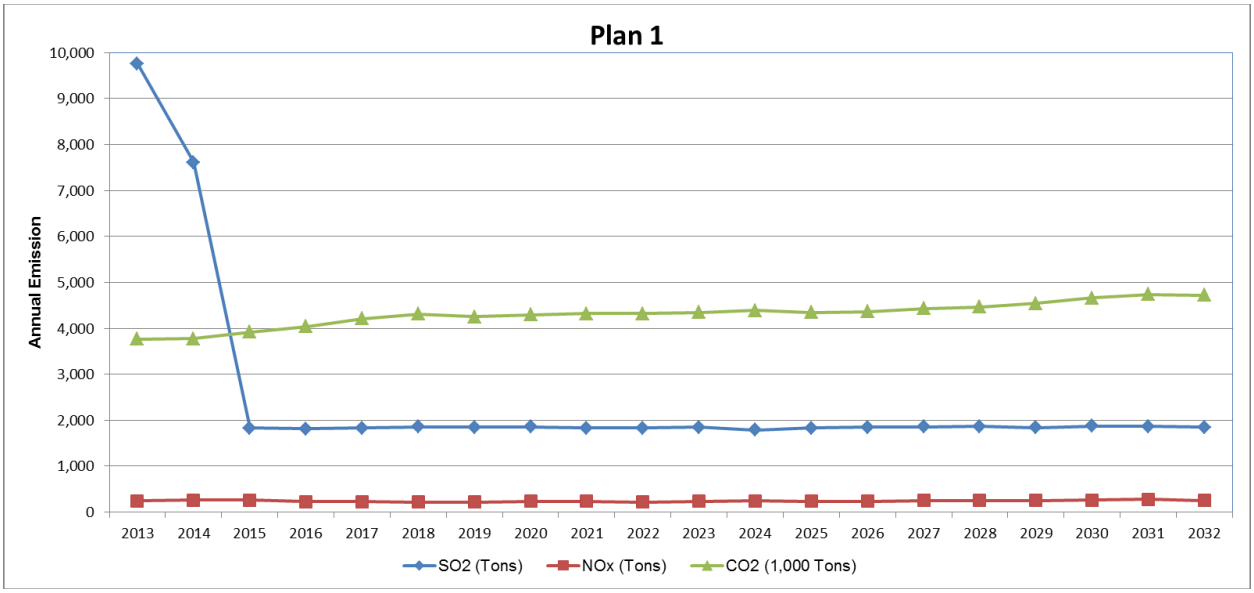


Figure 6-121 - Annual Emissions of Plan 1

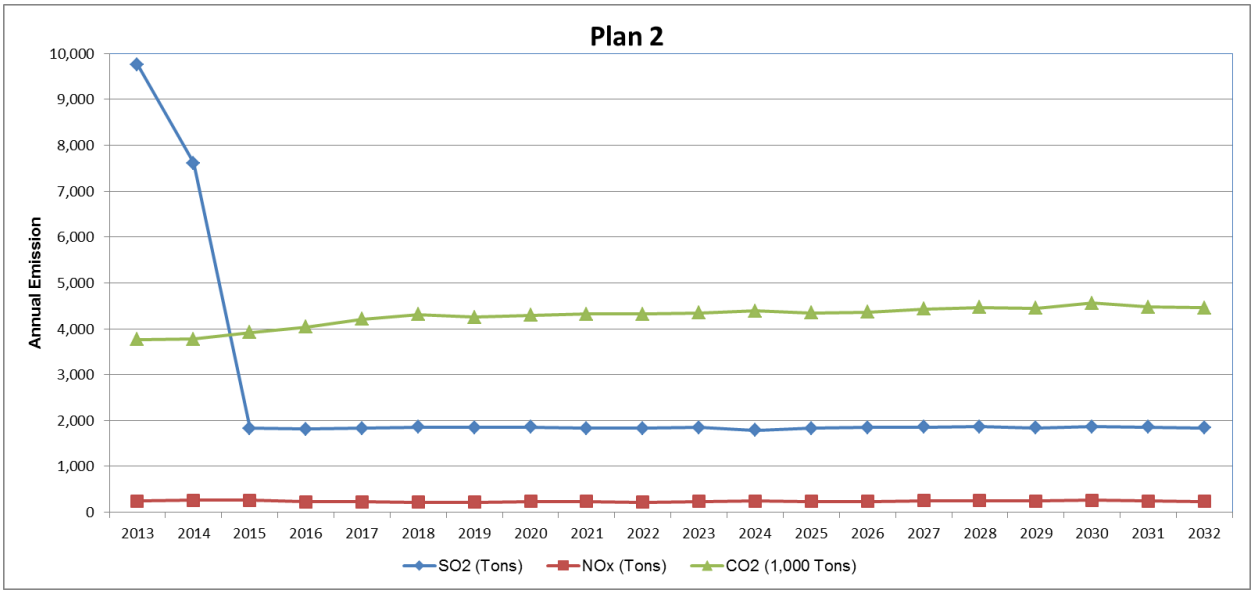


Figure 6-122 - Annual Emissions of Plan 2

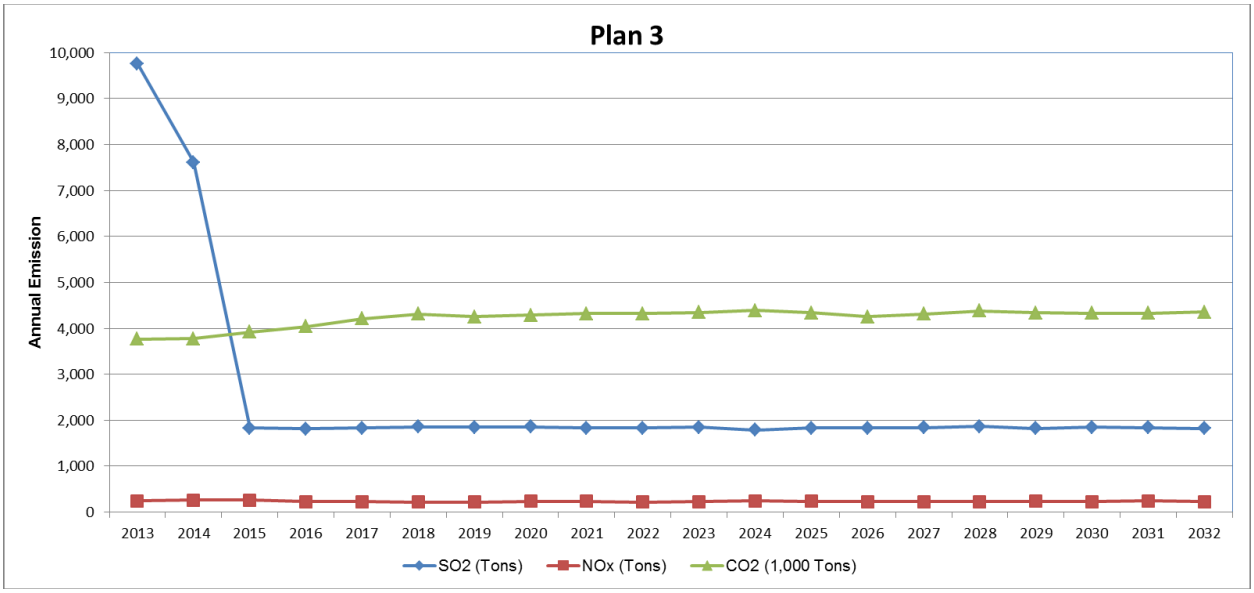


Figure 6-123 - Annual Emissions of Plan 3

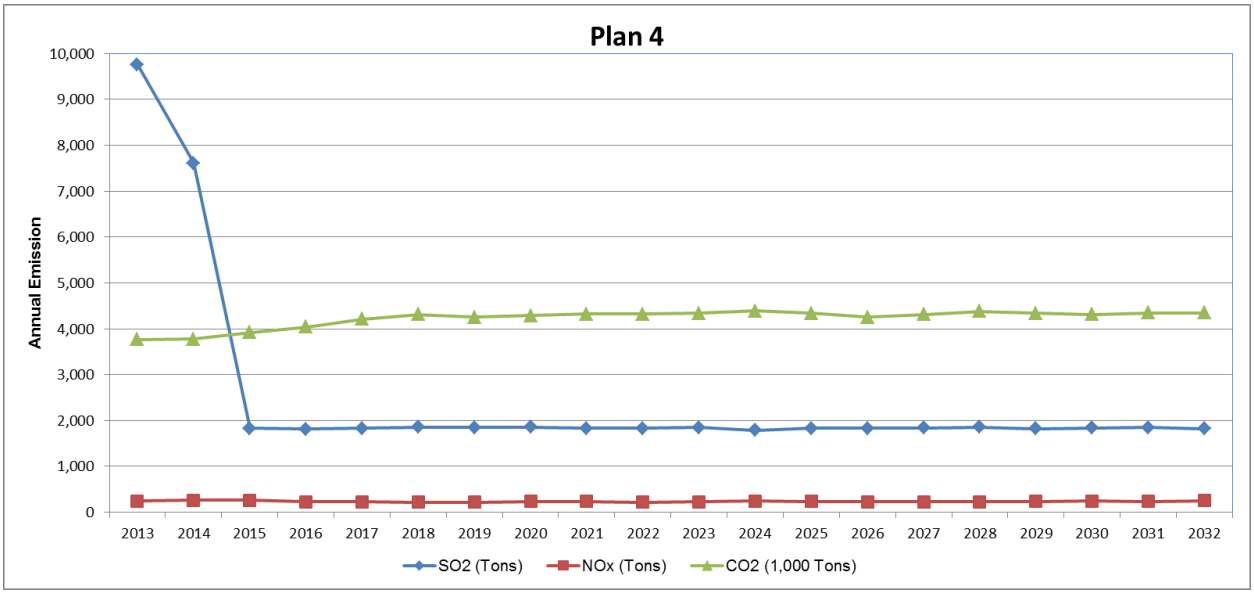


Figure 6-124 - Annual Emissions of Plan 4

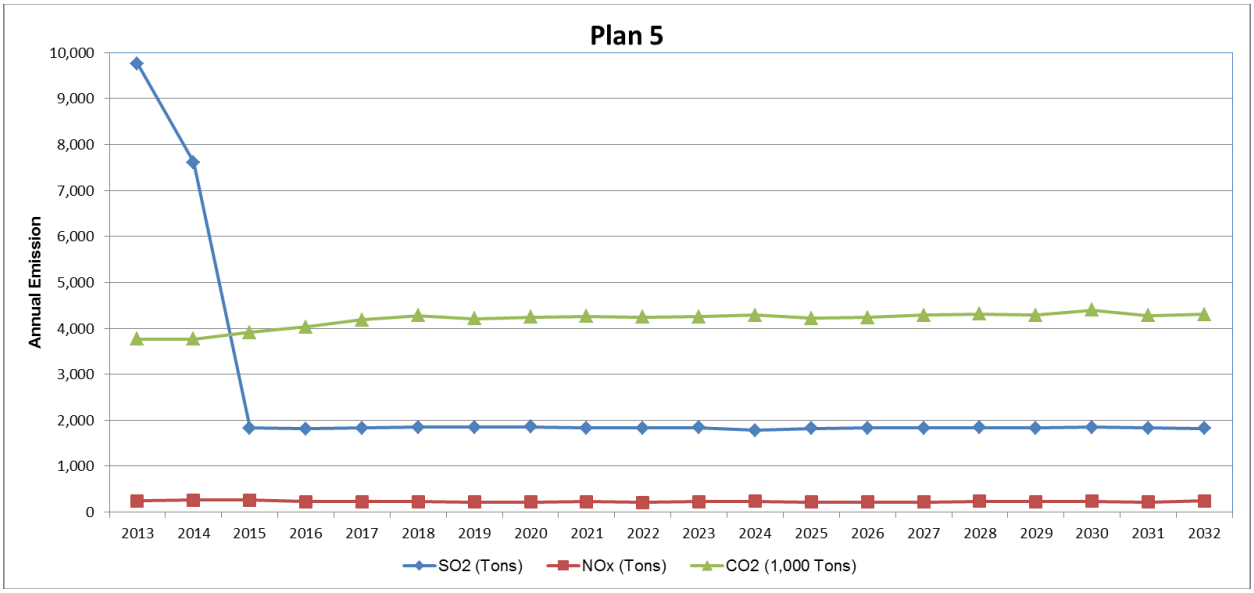


Figure 6-125 - Annual Emissions of Plan 5

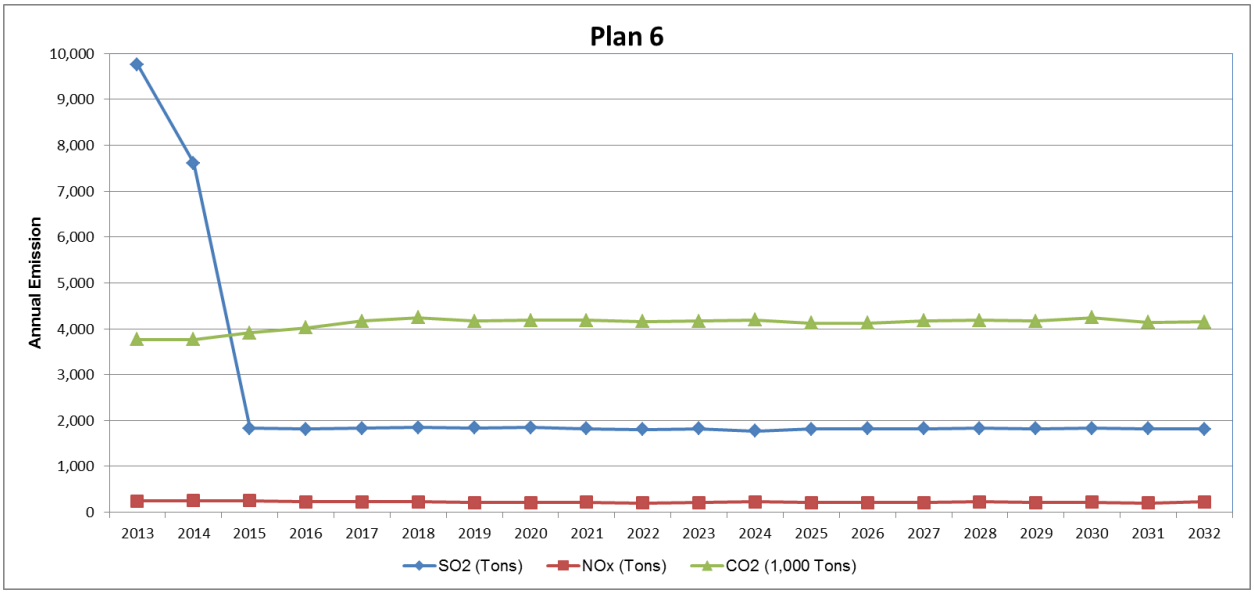


Figure 6-126 - Annual Emissions of Plan 6

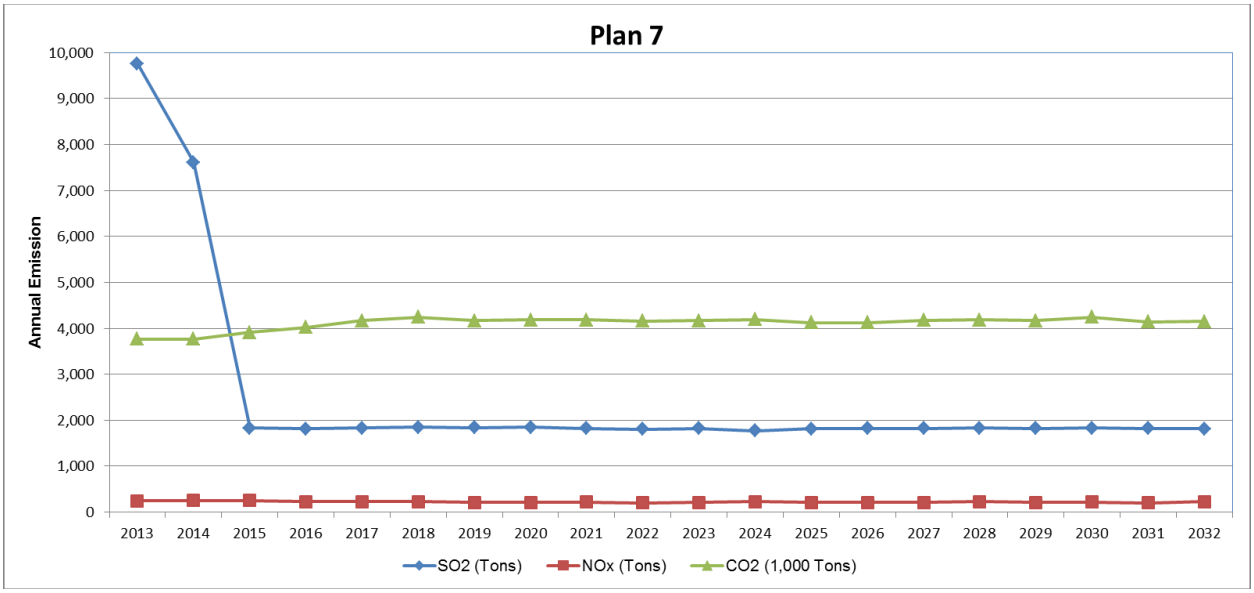


Figure 6-127 - Annual Emissions of Plan 7

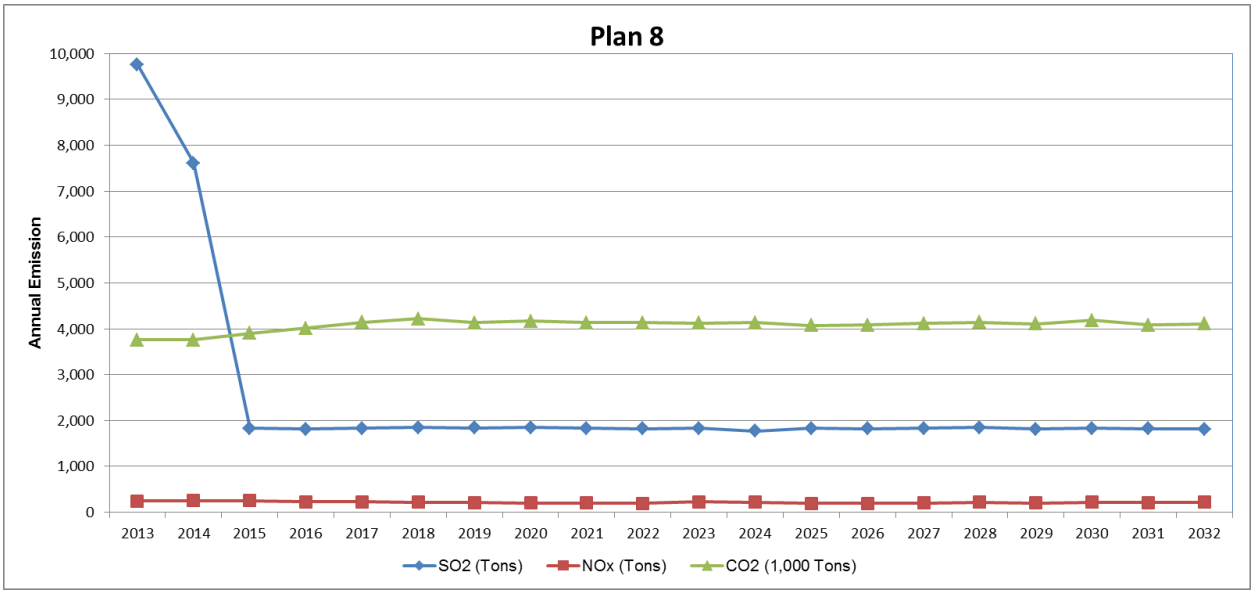


Figure 6-128 - Annual Emissions of Plan 8

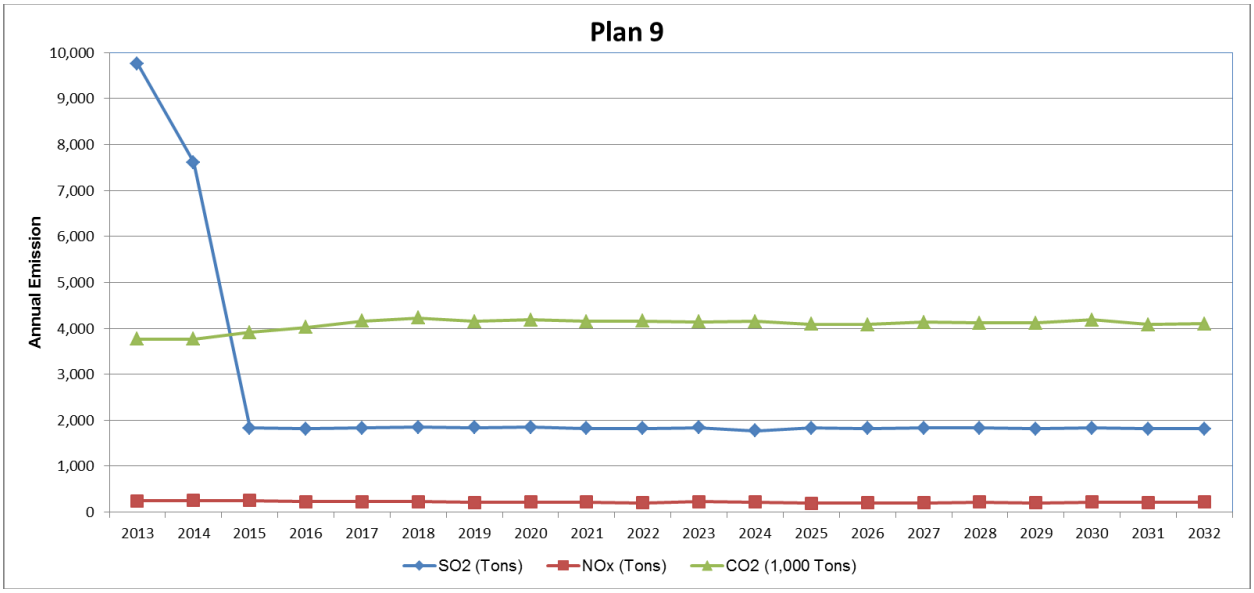


Figure 6-129 - Annual Emissions of Plan 9

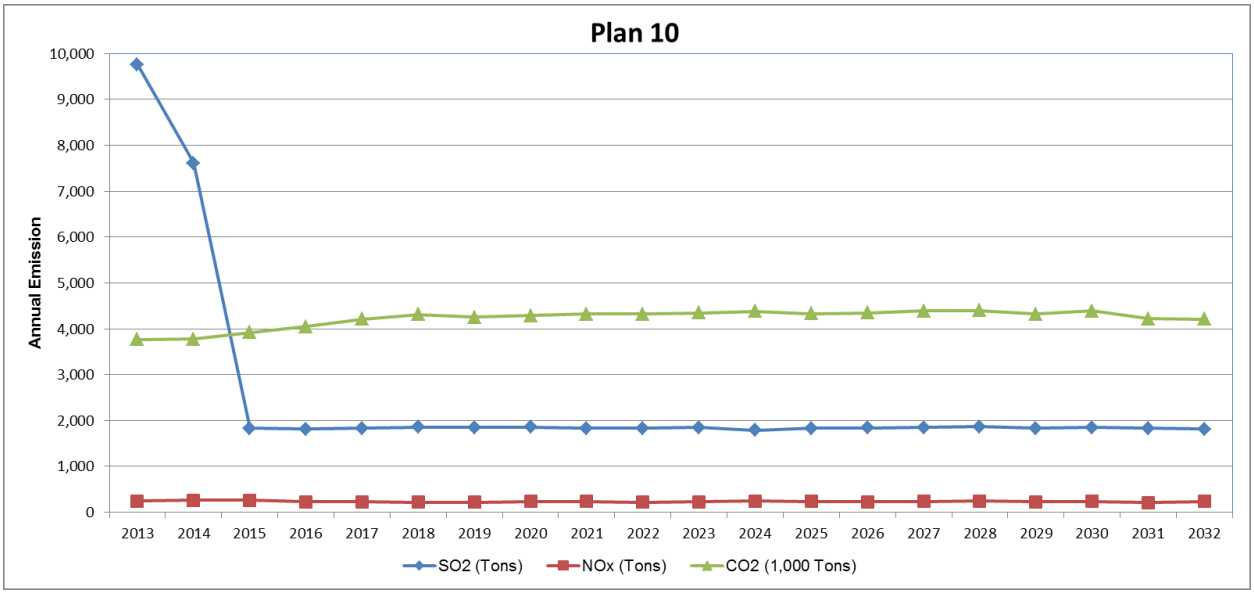


Figure 6-130 - Annual Emissions of Plan 10

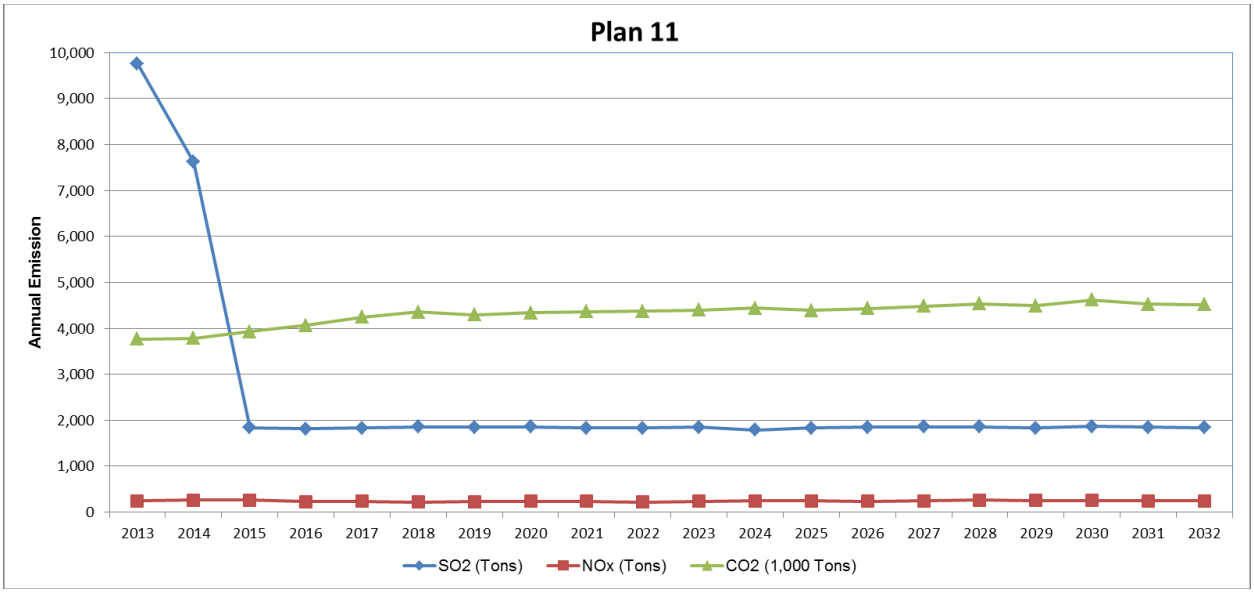


Figure 6-131 - Annual Emissions of Plan 11

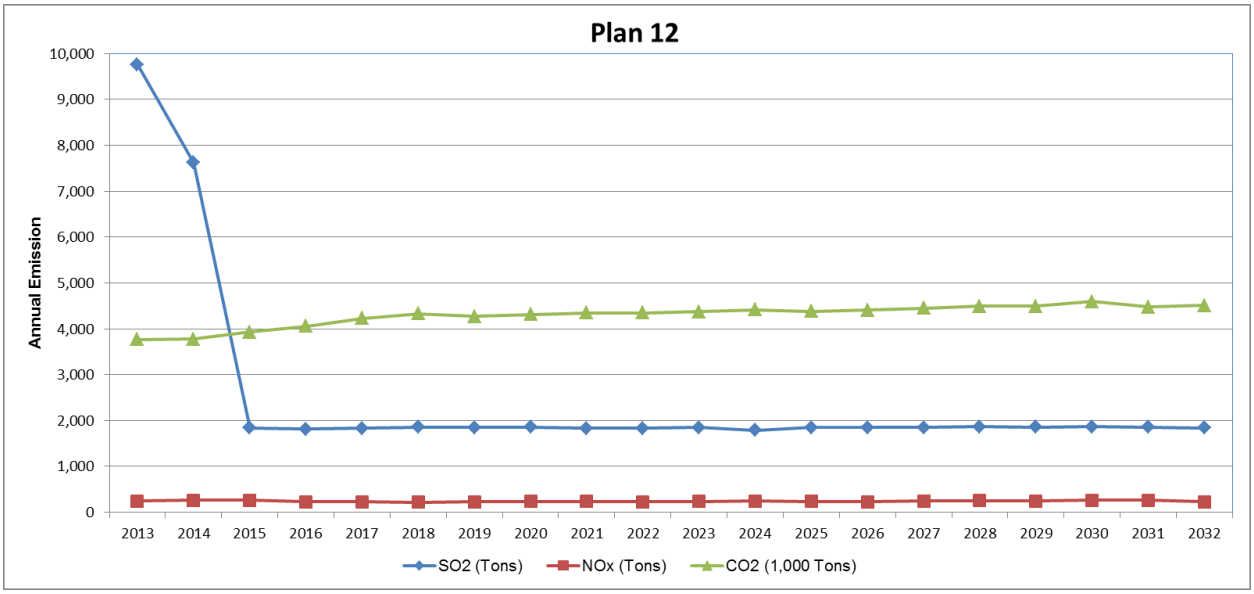


Figure 6-132 - Annual Emissions of Plan 12

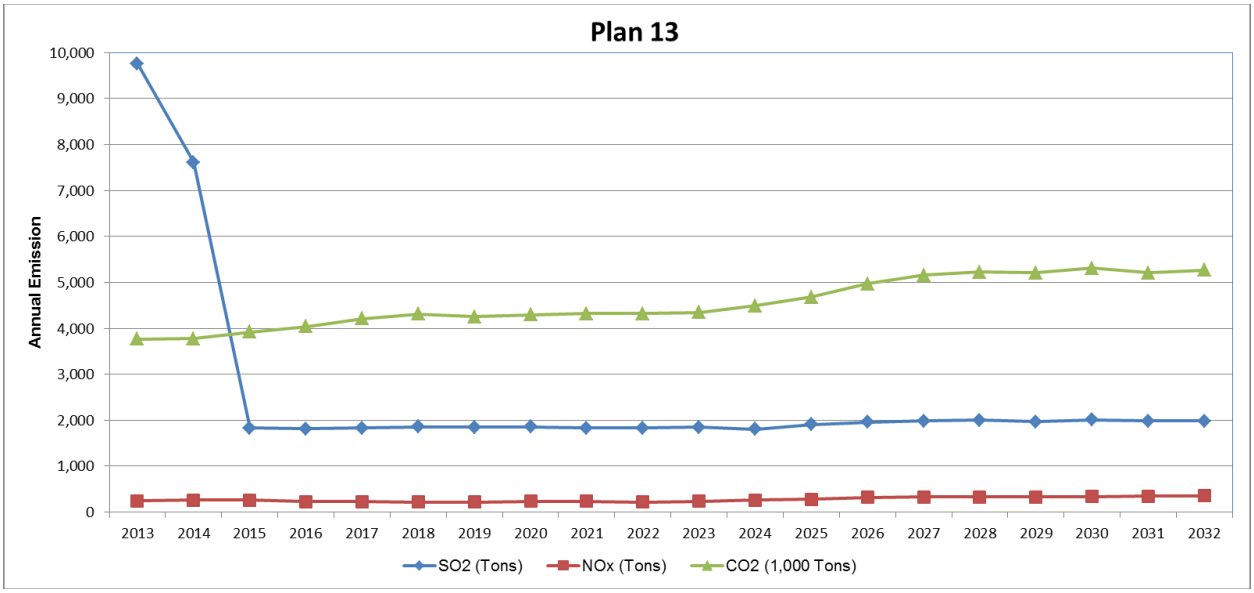


Figure 6-133 - Annual Emissions of Plan 13

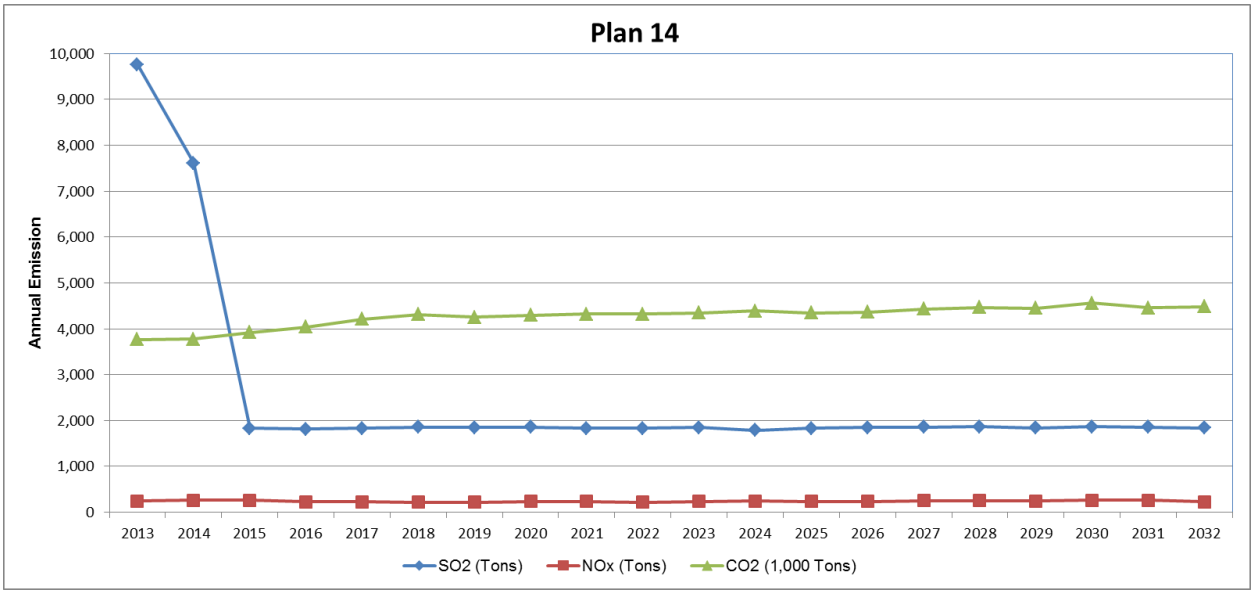


Figure 6-134 - Annual Emissions of Plan 14

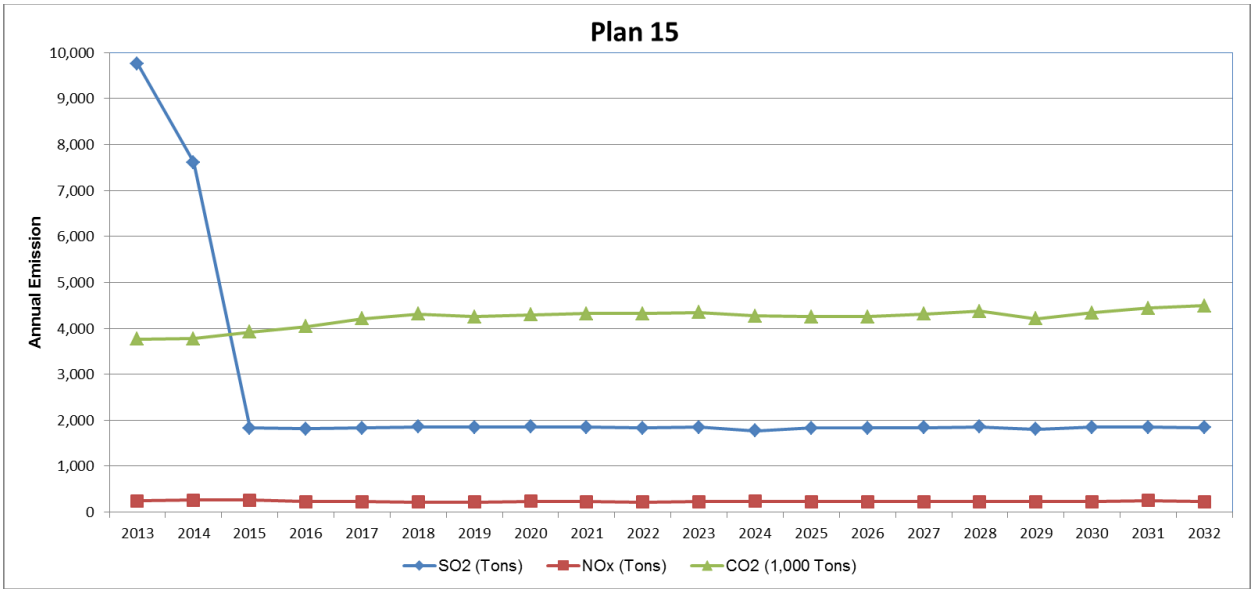


Figure 6-135 - Annual Emissions of Plan 15

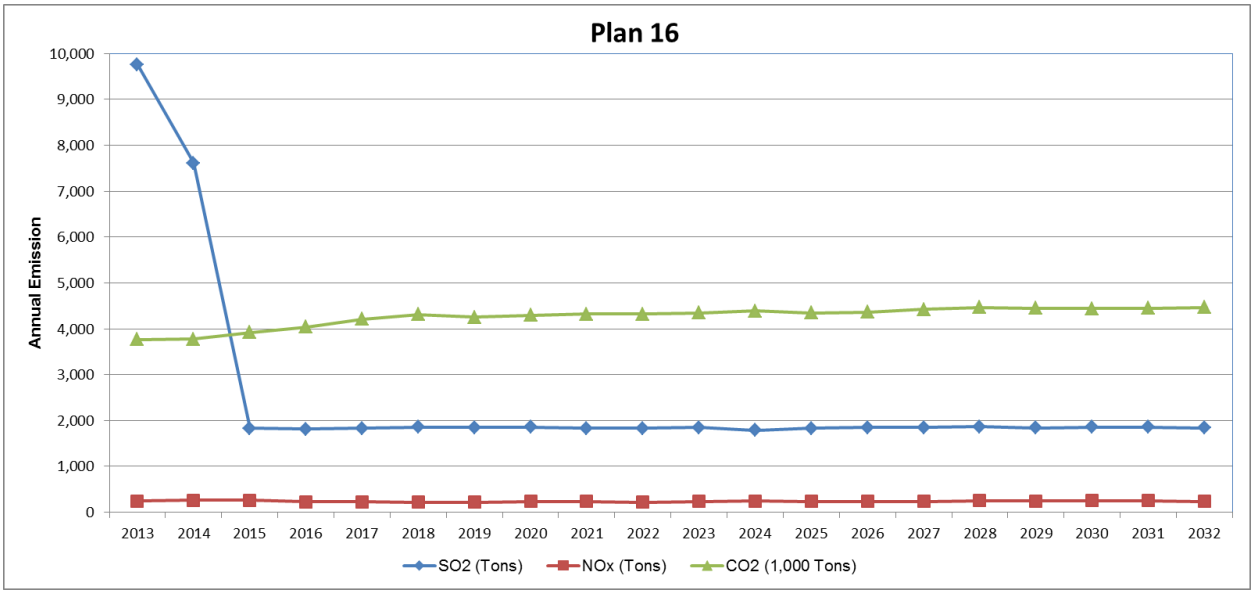


Figure 6-136 - Annual Emissions of Plan 16

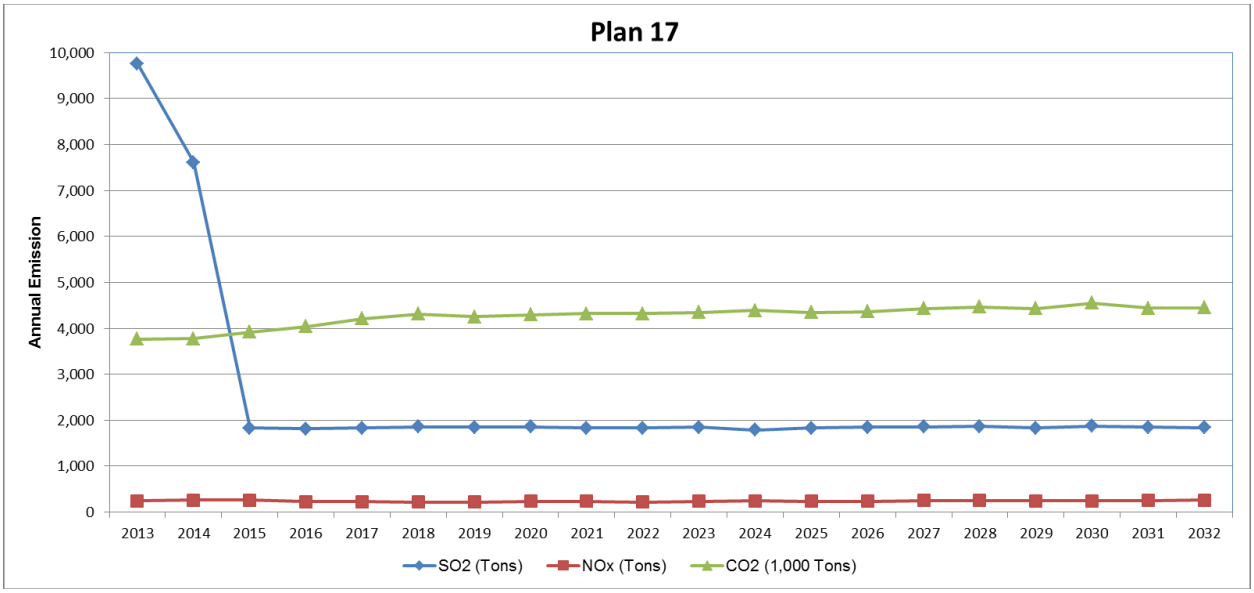


Figure 6-137 - Annual Emissions of Plan 17

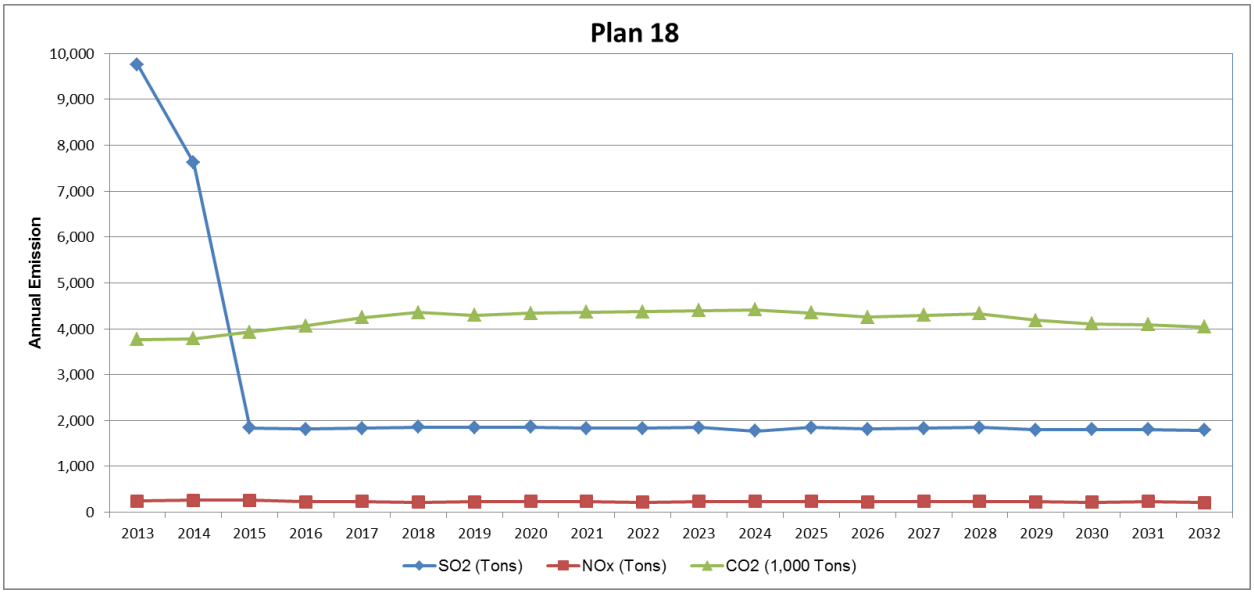


Figure 6-138 - Annual Emissions of Plan 18

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 6-139*. The corresponding tables of values for all these figures are provided in Appendix 6I.

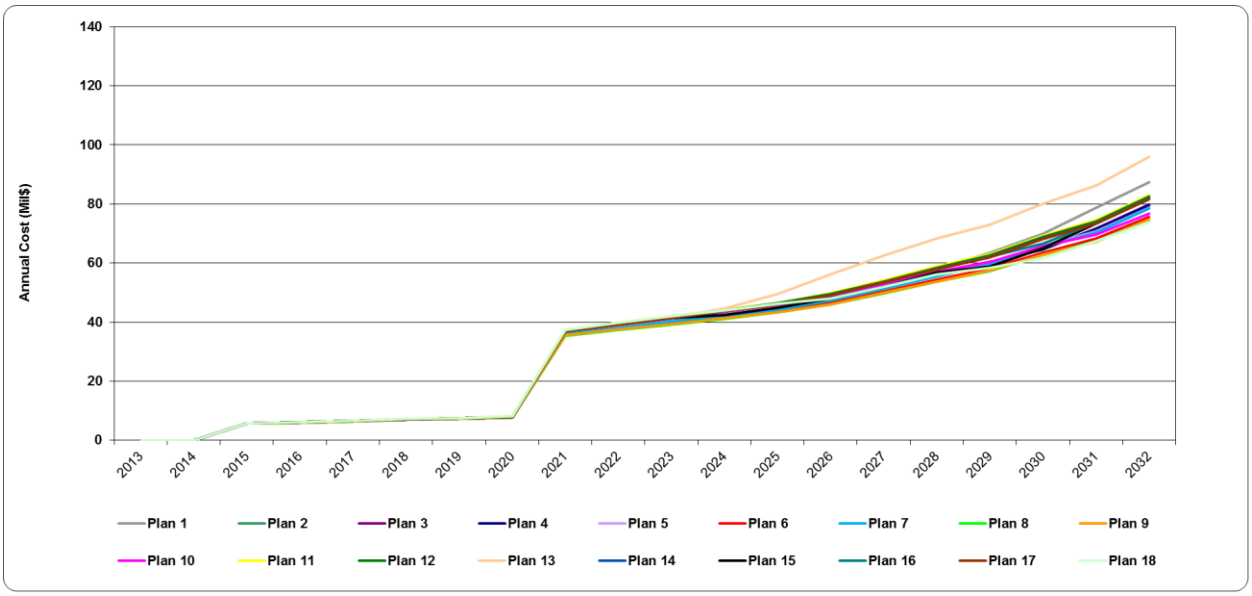


Figure 6-139 - Annual Probable Environmental Costs for Each Alternative Resource Plan

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 are provided in *Tables 6-30* through *6-47*. Due to likely rerates in the future, a generic 5 percent was utilized to calculate wind capacity for the 20-year planning horizon.

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

Table 6-30 - Forecast of Capacity Balance for Plan 1

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

Table 6-31 - Forecast of Capacity Balance for Plan 2

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

Table 6-32 - Forecast of Capacity Balance for Plan 3

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

Table 6-33 - Forecast of Capacity Balance for Plan 4

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

Table 6-34 - Forecast of Capacity Balance for Plan 5

Highly Confidential in its Entirety

Table 6-35 - Forecast of Capacity Balance for Plan 6

Highly Confidential in its Entirety

Table 6-36 - Forecast of Capacity Balance for Plan 7

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

Table 6-37 - Forecast of Capacity Balance for Plan 8

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

Table 6-38 - Forecast of Capacity Balance for Plan 9

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

Table 6-39 - Forecast of Capacity Balance for Plan 10

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

Table 6-40 - Forecast of Capacity Balance for Plan 11

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

Table 6-41 - Forecast of Capacity Balance for Plan 12

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

Table 6-42 - Forecast of Capacity Balance for Plan 13

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

Table 6-43 - Forecast of Capacity Balance for Plan 14

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

Table 6-44 - Forecast of Capacity Balance for Plan 15

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

Table 6-45 - Forecast of Capacity Balance for Plan 16

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

Table 6-46 - Forecast of Capacity Balance for Plan 17

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

Table 6-47 - Forecast of Capacity Balance for Plan 18

(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 revenues, also referred to as shared savings; and 3) incentive costs. Incentive costs would include payments to customers as inducement to implement a program or in the event Empire meets its goals for that program. However, 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 6-48* through *6-65.*

Highly Confidential in its Entirety
Table 6-48 - Plan 1 Performance

Highly Confidential in its Entirety
Table 6-49 - Plan 2 Performance

Highly Confidential in its Entirety
Table 6-50 - Plan 3 Performance

Highly Confidential in its Entirety
Table 6-51 - Plan 4 Performance

Highly Confidential in its Entirety
Table 6-52 - Plan 5 Performance

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

Highly Confidential in its Entirety
Table 6-54 - Plan 7 Performance

Highly Confidential in its Entirety
Table 6-55 - Plan 8 Performance

Highly Confidential in its Entirety
Table 6-56 - Plan 9 Performance

Highly Confidential in its Entirety
Table 6-57 - Plan 10 Performance

Highly Confidential in its Entirety
Table 6-58 - Plan 12 Performance

Highly Confidential in its Entirety
Table 6-59 - Plan 12 Performance

Highly Confidential in its Entirety
Table 6-60 - Plan 13 Performance

Highly Confidential in its Entirety
Table 6-61 - Plan 14 Performance

Highly Confidential in its Entirety
Table 6-62 - Plan 15 Performance

Highly Confidential in its Entirety
Table 6-63 - Plan 16 Performance

Highly Confidential in its Entirety
Table 6-64 - Plan 17 Performance

Highly Confidential in its Entirety
Table 6-65 - Plan 18 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;

Plan 1 - Base Case did not include renewable energy resources for meeting future loads, while Plan 18 - 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. All of the other 16 plans included Missouri RES-compliant levels of renewable resources (MO-RES, i.e., at least 15 percent by 2021). 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 10 - Aggressive Capacity DSM. Also, Plans 5 through 9 were developed with varying levels of DSM utilization for meeting future needs for the purposes of planning. Each produced a higher PVRR than Plan 2, the lowest cost plan meeting the RES with the base portfolio and the AEG developed realistically achievable potential (RAP) levels of 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 Ventyx 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, portfolios, and business unit profitability.

Markets Module

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.

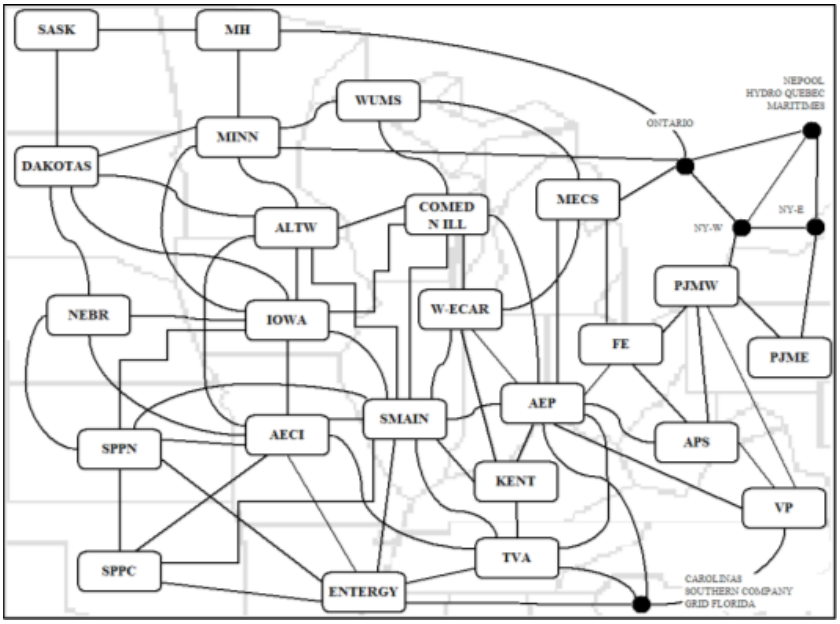


Figure 6-140 - Sample Topology

The database is populated with Ventyx Intelligence - Market Ops information:

1. Operational information provided for over 10,000 generating units.
2. Load forecasts by zone (where zone may be best defined as utility level) and historical hourly load profiles.
3. Transmission capabilities.
4. Coal price forecast by plant with delivery adders from basin.
5. Gas price forecast from Henry Hub with basis and delivery adders.

When running the simulation in markets module, the main process of the simulation is to determine hourly market prices. Plant outages are based on a unit derate, and maintenance outages may be specified as a number of weeks per year or scheduled.

The market-based resource expansion algorithm builds resources by planning region based on user-defined profitability and/or minimum and maximum reserve margin requirements in determining prices. In addition, strategic retirements are made of non-profitable units based on user-defined parameters.

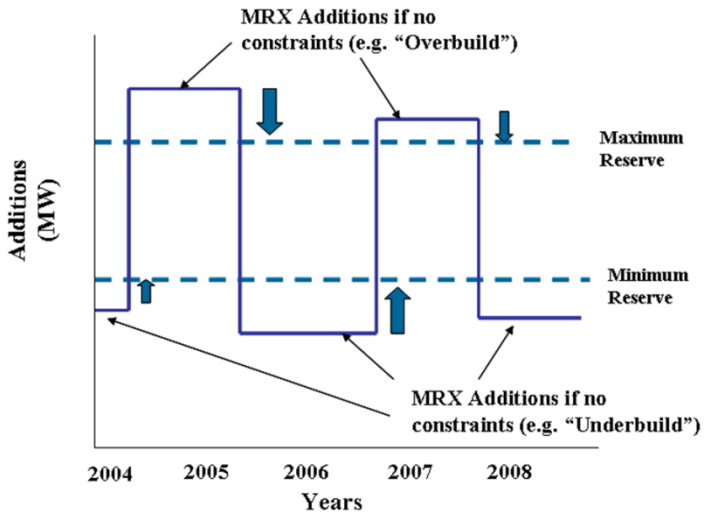


Figure 6-141 - MRX Decision Basis

The markets module simulation process performs the following steps to determine price:

1. Hourly loads are summed for all customers within each transaction group.

2. For each transaction group in each hour, all available hydro power is used to meet firm power sales commitments.

3. For each transaction group and day type, the model calculates production cost data for each dispatchable thermal unit and develops a dispatch order.

4. The model calculates a probabilistic supply curve for each transaction group considering forced and planned outages.

5. Depending on the relative sum of marginal energy cost + transmission cost + scarcity cost between regions, the model determines the hourly transactions that would likely occur among transaction groups.

6. The model records and reports details about the generation, emissions, costs, revenues, etc. associated with these hourly transactions.

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

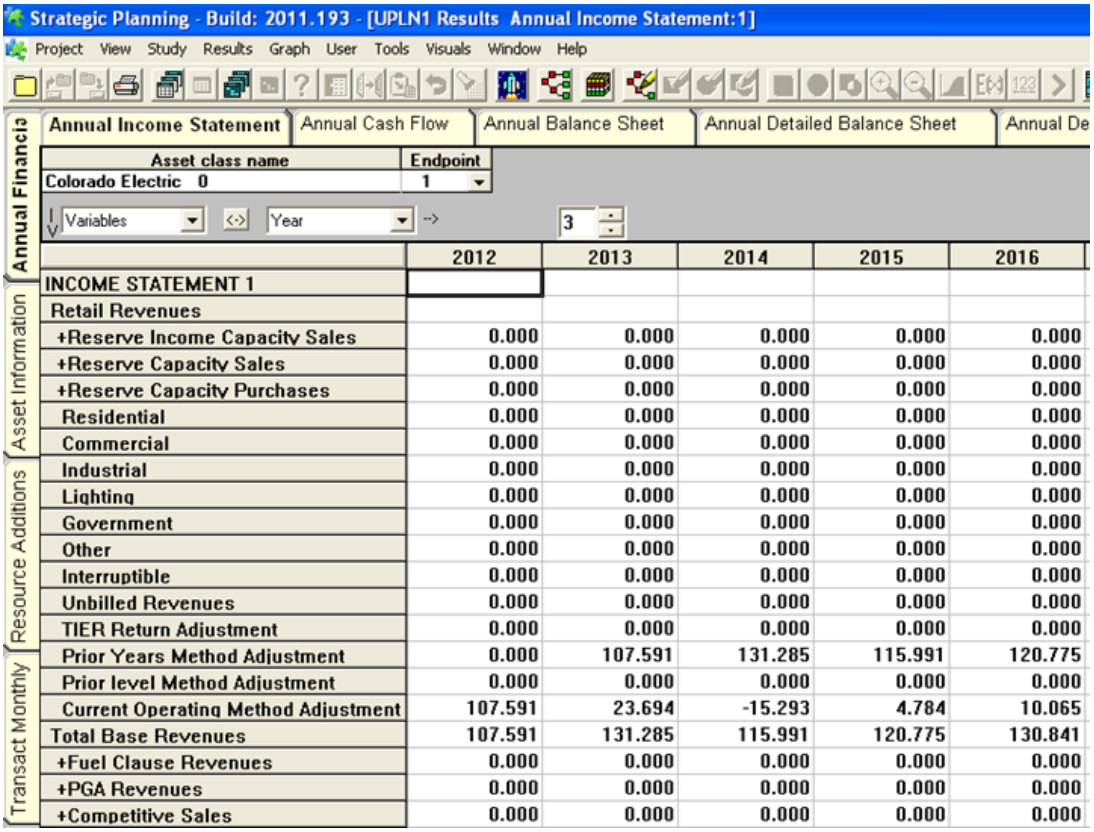
Capacity Expansion automates screening and evaluation of generation capacity expansion, transmission upgrades, strategic retirement, and other resource alternatives. It is a detailed

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.



	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 6-142 - 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.

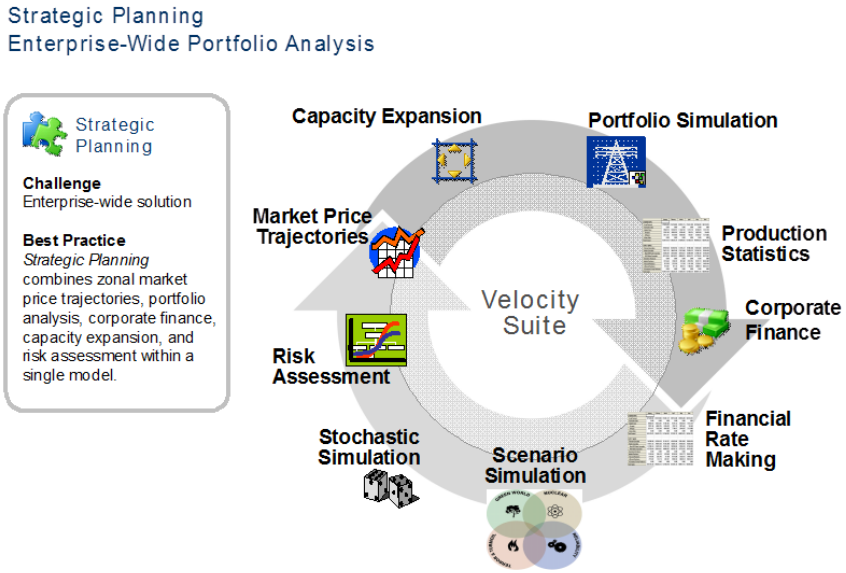


Figure 6-143 - Overview of Process

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, high and low scenarios were also assigned a subjective probability by the subject matter experts. *Table 6-66* 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
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.
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
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.
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.
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.
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 Ventyx used the Capacity Expansion Module which optimizes the in-service date of a resource.
Purchase Power	Yes	Purchase power costs are deemed to be a critical uncertain factor and are captured in the market price for power.
Prices for Emission allowances	Yes	SO_2, NO_x and coal prices are outputs for the carbon scenarios discussed in Chapter 3 section titled CO_2 Tax Probabilities.
Fixed O&M	No	High and Low fixed O&M costs were analyzed for the 15 different plans. 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.
Equivalent or full- and partial Forced Outage Rates	No	High and Low forced outage rates were analyzed for the 15 different plans. 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.
DSM Load Impacts/ Rates	No	In addition to the seven levels of DSM (Base, Moderate Avoided Costs, High Avoided Costs, Moderate Portfolio, Aggressive Portfolio, MEEIA Goal and Aggressive Capacity), Empire modeled a RAP+, RAP++ and a RAP-. Uncertainty around DSM was captured by modeling these additional plans.
Variable O&M	No	High and Low variable O&M costs were analyzed for the 15 different plans. 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 6-66 - Uncertain Factors

Table 6-67 contains the uncertain factor ranges for the candidate factors that were not screened out or considered critical.

Uncertain Factor	Value	Coal NO CCS	Aero CT	Frame Type CT	CC No CCS	RICE	DG	Wind Own
Project Cost	Low	$123.893	$ 41.132	$ 70.703	$ 212.707	$ 71.524	$ 6.248	$ 149.269
($MM)	Base	$145.756	$ 48.390	$ 83.180	$ 250.244	$ 84.146	$ 7.351	$ 175.610
	High	$174.907	$ 58.068	$ 99.816	$ 300.293	$100.975	$ 8.821	$ 210.732
Fixed O&M	Low	$25.85	$10.34	$10.12	$12.54	$12.08	$14.62	$0.00
($/kW-yr)	Base	$30.41	$12.17	$11.90	$14.75	$14.21	$17.20	$0.00
	High	$34.97	$14.00	$13.69	$16.96	$16.34	$19.78	$0.00
Variable O&M	Low	$3.49	$2.48	$1.66	$2.81	$2.48	$6.12	$9.37
($/MWh)	Base	$4.36	$3.10	$2.07	$3.51	$3.10	$7.65	$11.71
	High	$5.23	$3.72	$2.48	$4.21	$3.72	$9.18	$14.05
EFOR	Low	2%	1.1%	1.1%	3%	1%		
(%)	Base	6%	3.6%	3.6%	5.5%	2%	0%	0%
	High	10%	6.1%	6.1%	8%	3%		

Table 6-67 - Uncertain Factor Ranges

Ventyx used their Capacity Expansion Module to test the uncertain factors above. Each of the 15 preliminary candidate resource plans were analyzed using the varying value levels (low/base/high) in the Capacity Expansion Module to see if a different expansion plan would be selected from the base.

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 6-68* 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	5.94	8.94
Return on Ratebase	7.94	9.38

Table 6-68 - 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, fuel prices, siting and permitting costs and schedules for transmission, project construction costs/schedule, purchased power costs, prices for emission allowances. 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 Ventyx 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 gas price forecasts developed by the Ventyx Power and Fuels Module. Multipliers were used to change coal and oil prices to correlate with 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 developed for high and base probabilities. Capital and transmission costs for all alternative resource plans were 1.2 times that of the base plan. Nuclear expansion units were 1.5 times higher than base. Interest rates were increased three basis points for the high scenario and the corresponding higher return on ratebase was applied.

SO_2 and NO_X emission price forecasts were developed by using public resources from the U.S. Department of Energy and proprietary forecasts from Ventyx.

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. As with each of the alternative plans, *Figure 6-162* indicates that the major driver of PVRR uncertainty is market price/fuel price uncertainty followed by environmental costs. The top two drivers of uncertainty remain the same for all of the plans. *Figures 6-144* through *6-161* are Tornado Diagrams that illustrate the influence that uncertain factors have on each of the alternate resource plans.

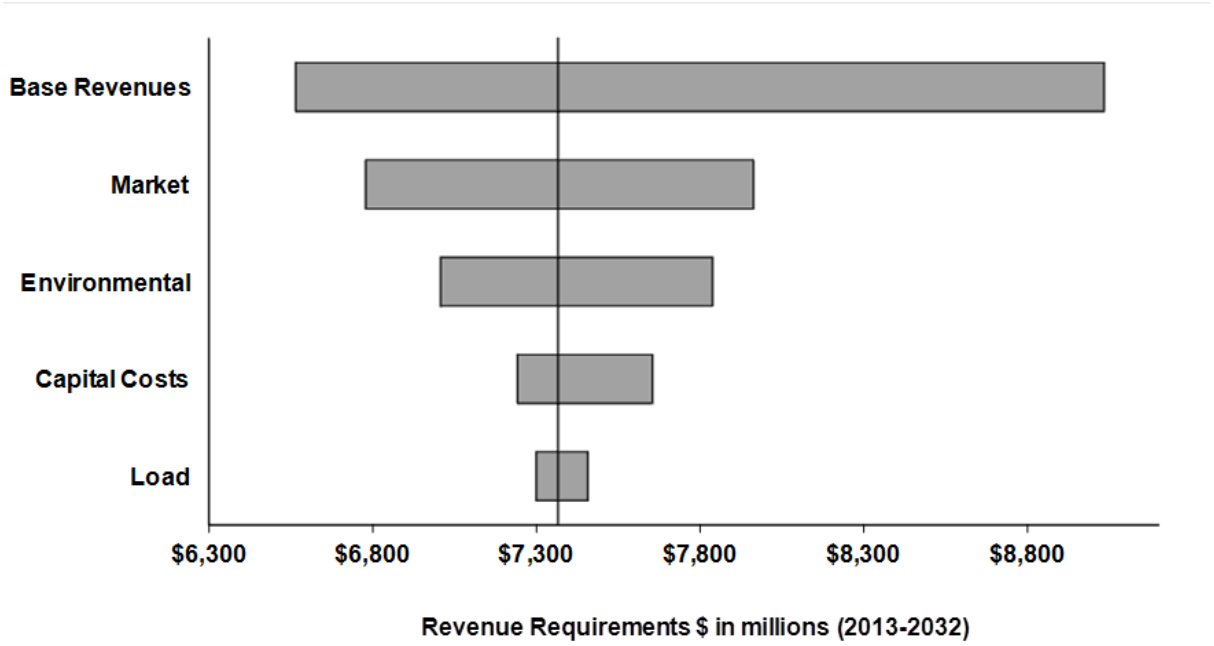


Figure 6-144 - Plan 1 (Base Case) Tornado Diagram

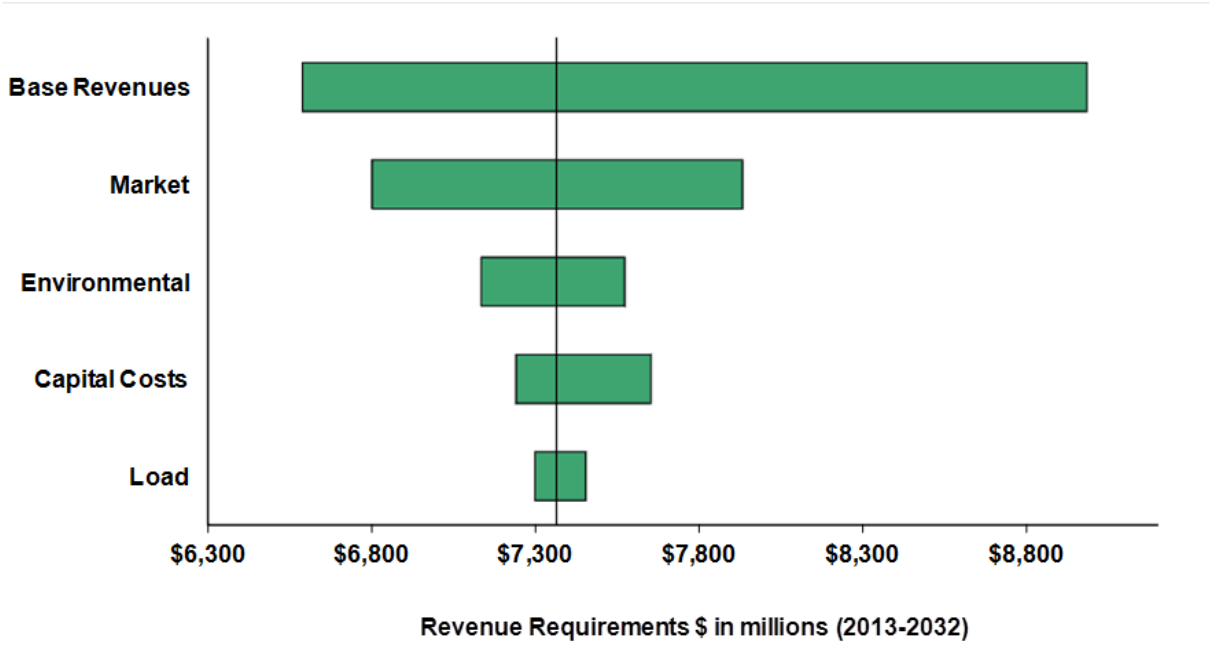


Figure 6-145 - Plan 2 (Base Case meet RPS) Tornado Diagram

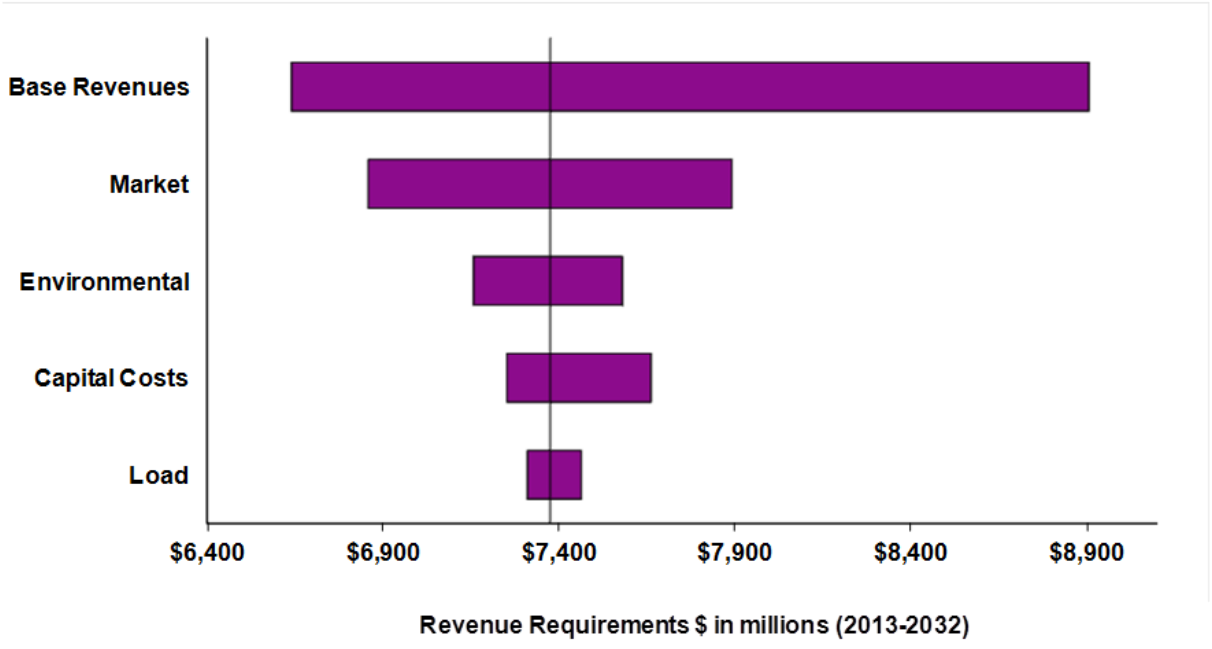


Figure 6-146 - Plan 3 (Moderate Environmental) Tornado Diagram

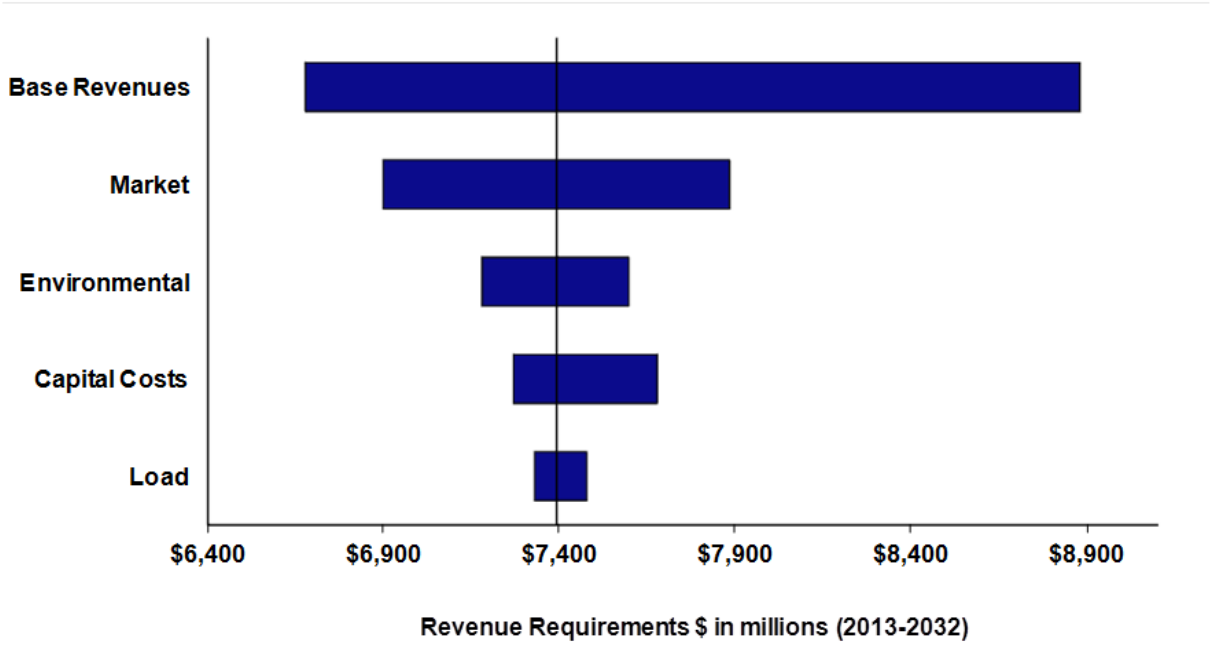


Figure 6-147 - Plan 4 (High Environmental) Tornado Diagram

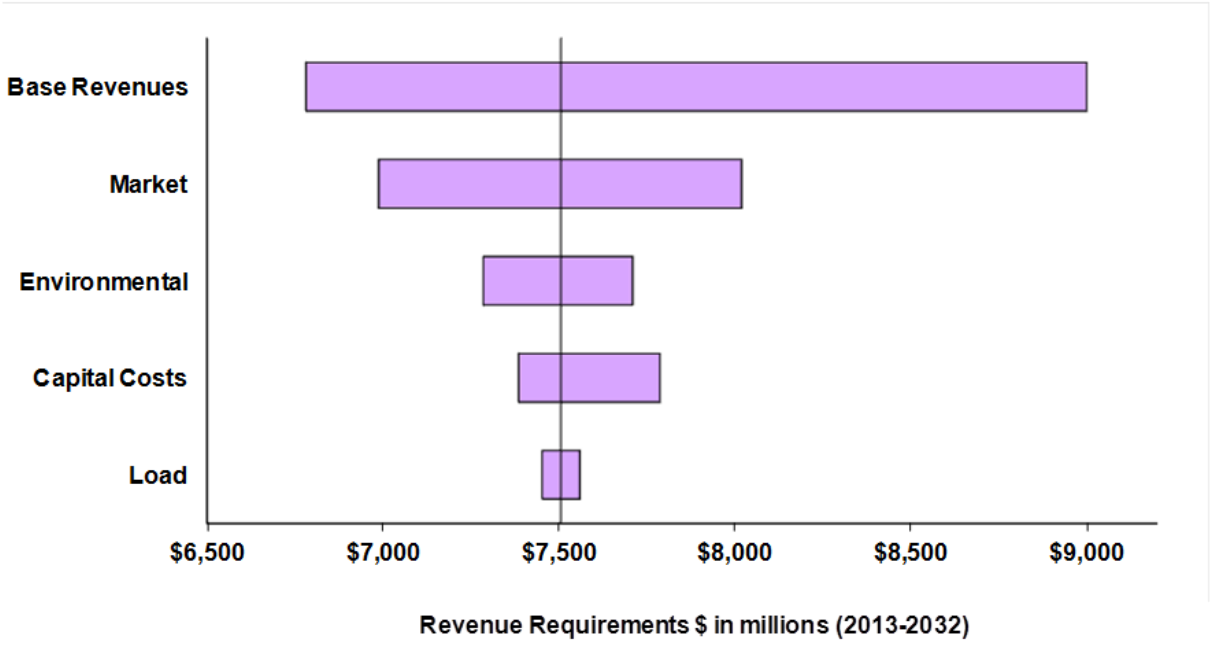


Figure 6-148 - Plan 5 (RAP + DSM) Tornado Diagram

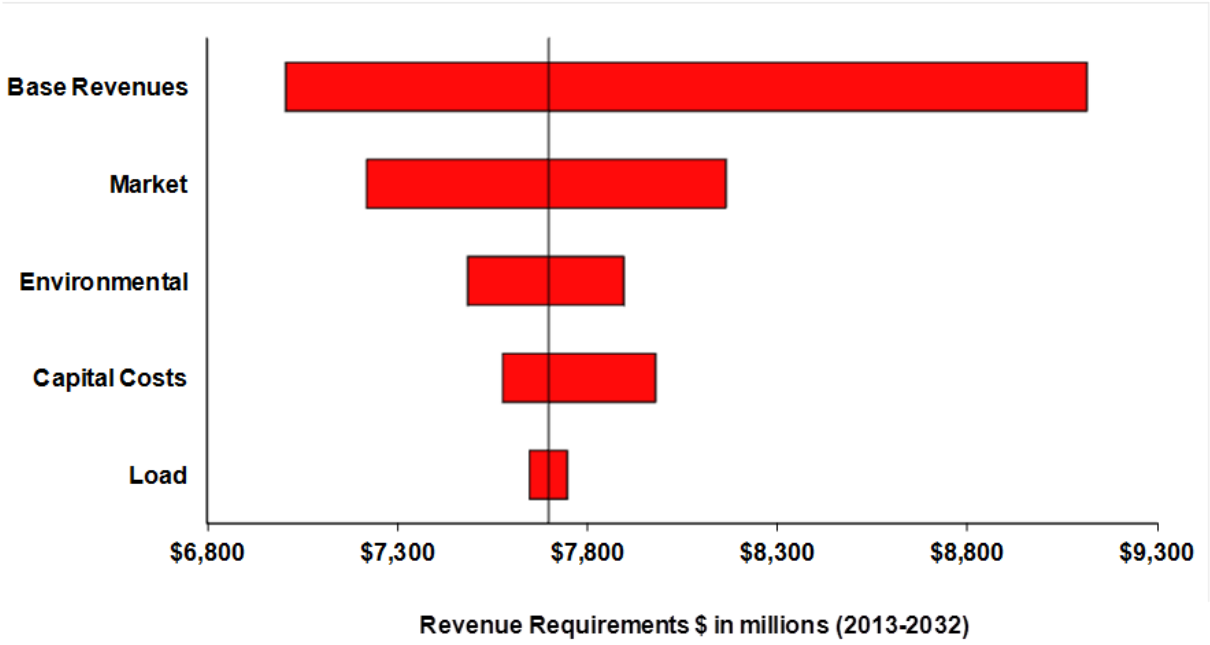


Figure 6-149 - Plan 6 (RAP + + DSM) Tornado Diagram

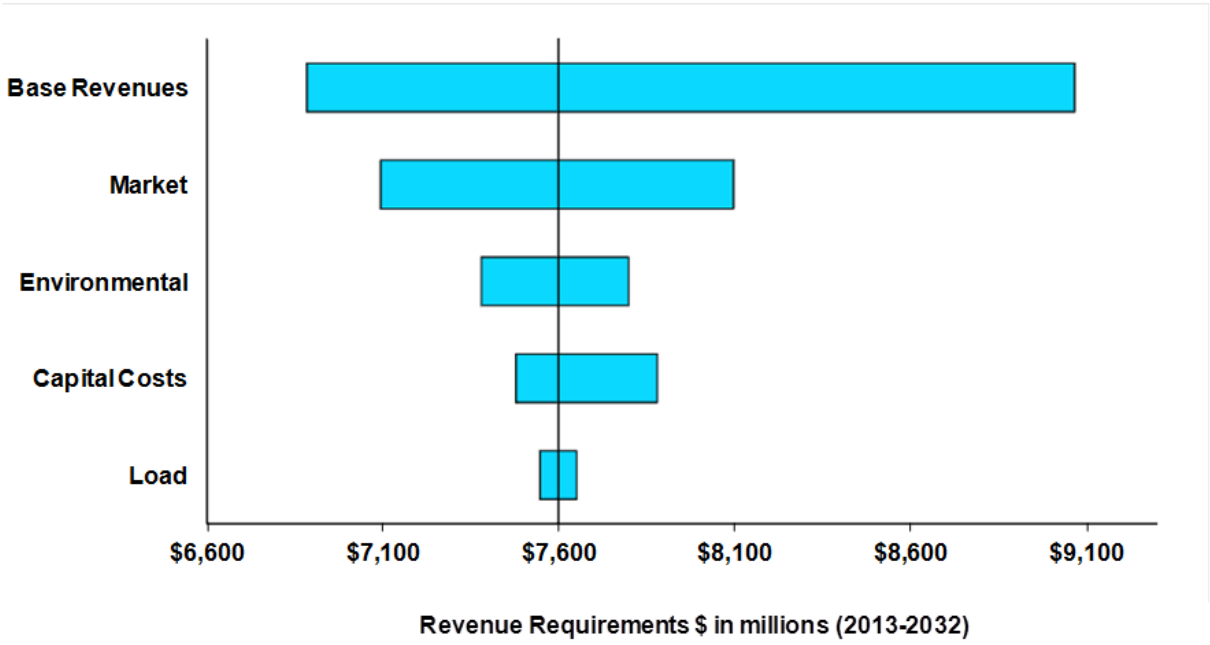


Figure 6-150 - Plan 7 (Moderate DSM) Tornado Diagram

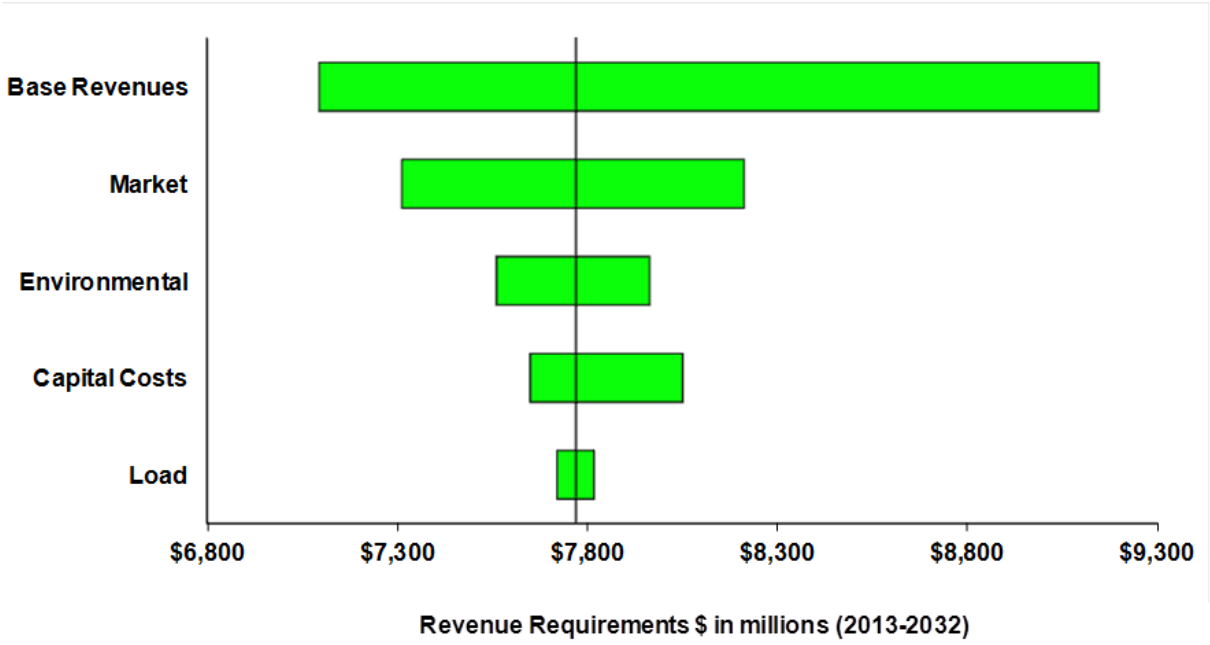


Figure 6-151 - Plan 8 (Aggressive DSM) Tornado Diagram

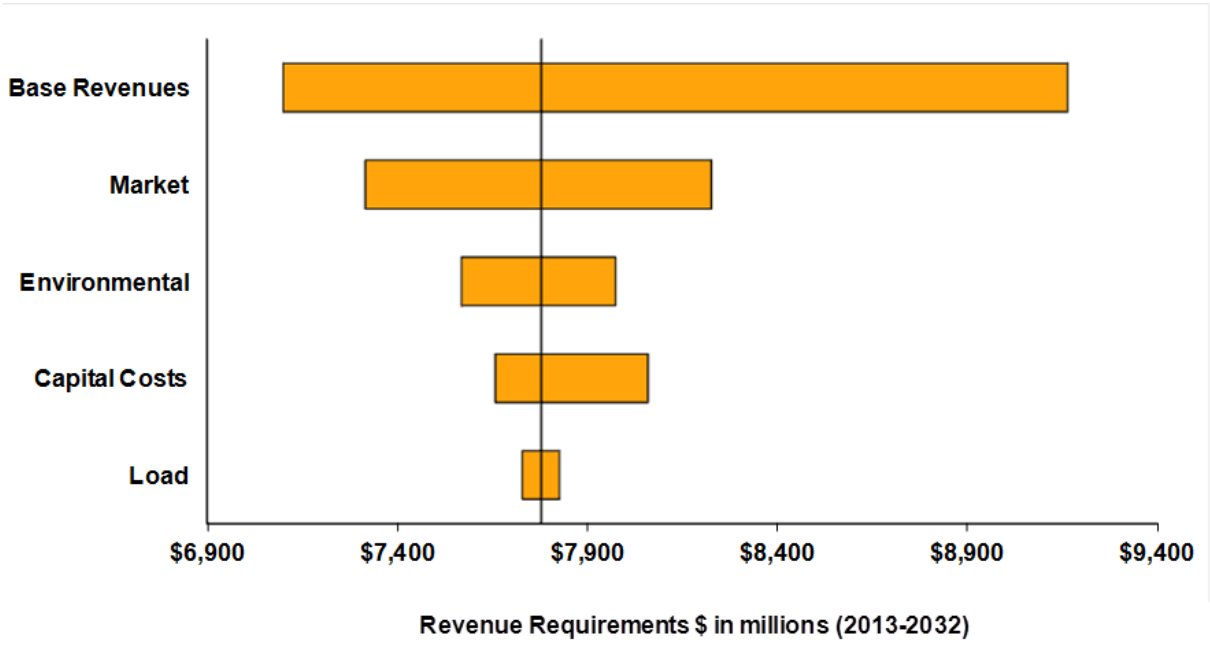


Figure 6-152 - Plan 9 (MEEIA Level DSM) Tornado Diagram

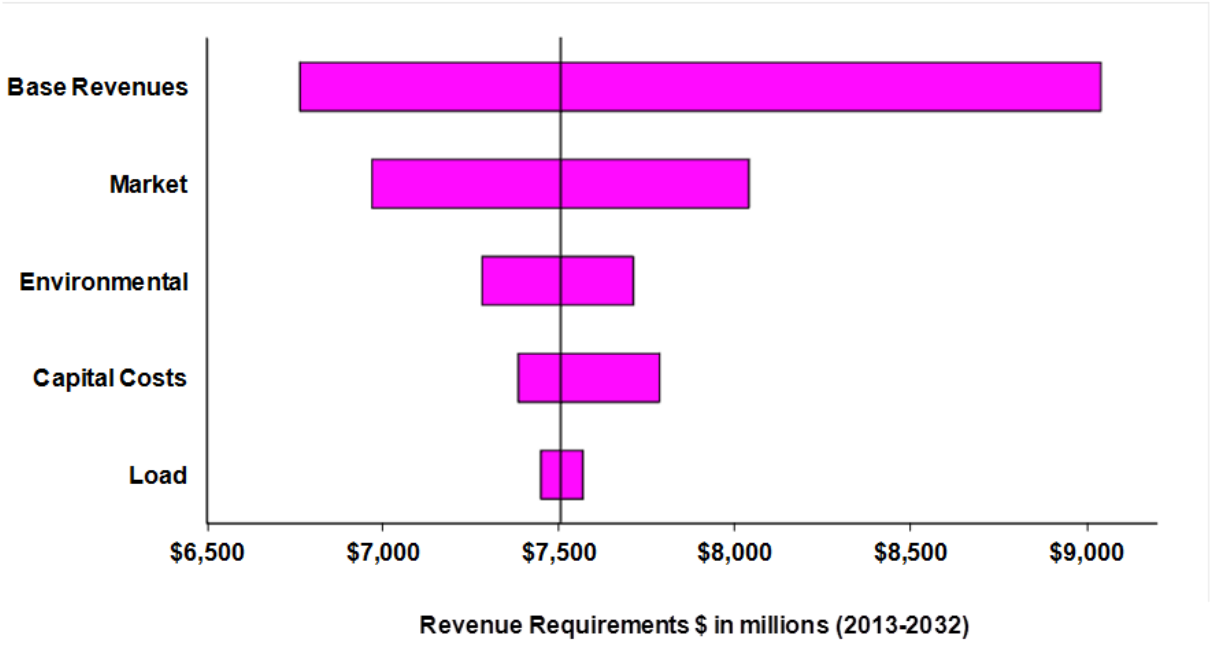


Figure 6-153 - Plan 10 (Aggressive Capacity DSM) Tornado Diagram

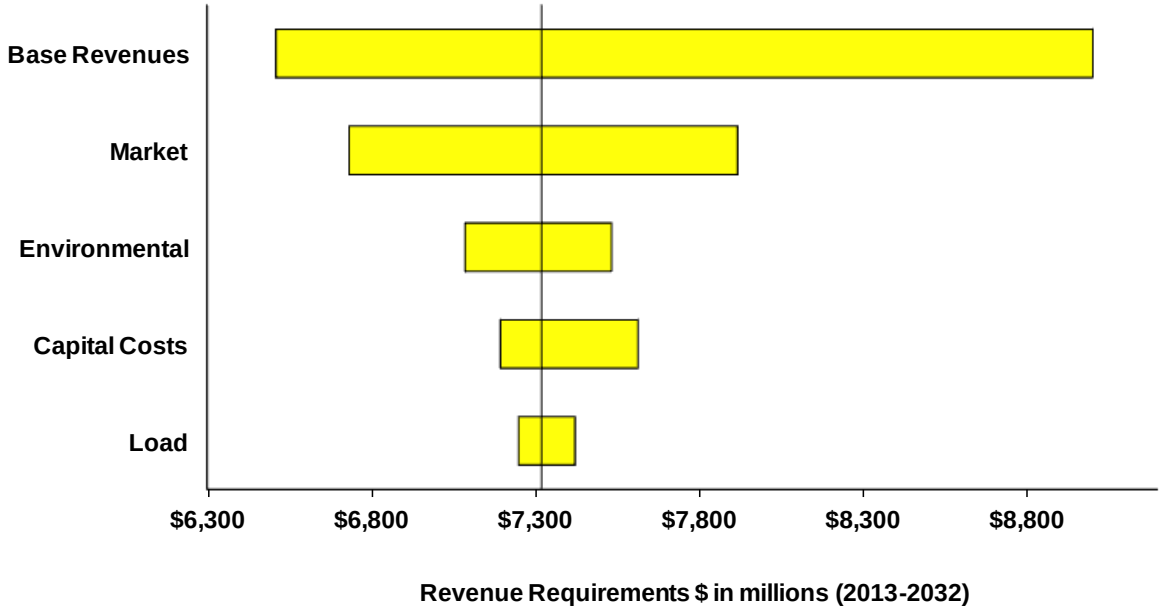


Figure 6-154 - Plan 11 (No DSM) Tornado Diagram

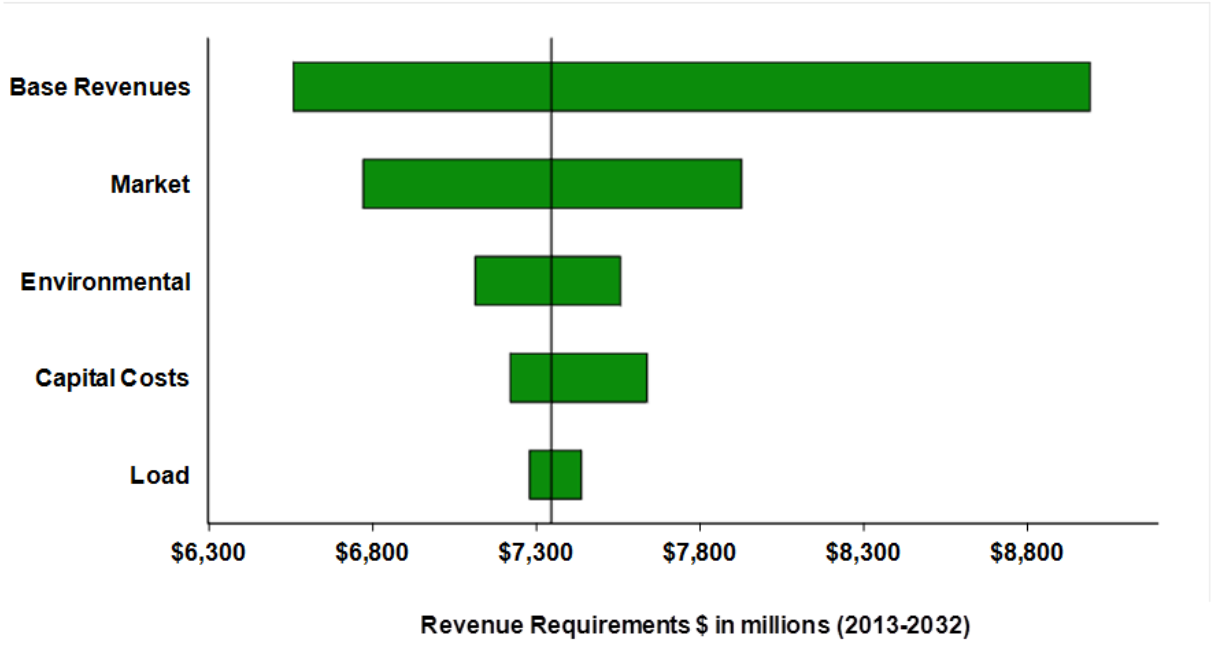


Figure 6-155 - Plan 12 (RAP - DSM) Tornado Diagram

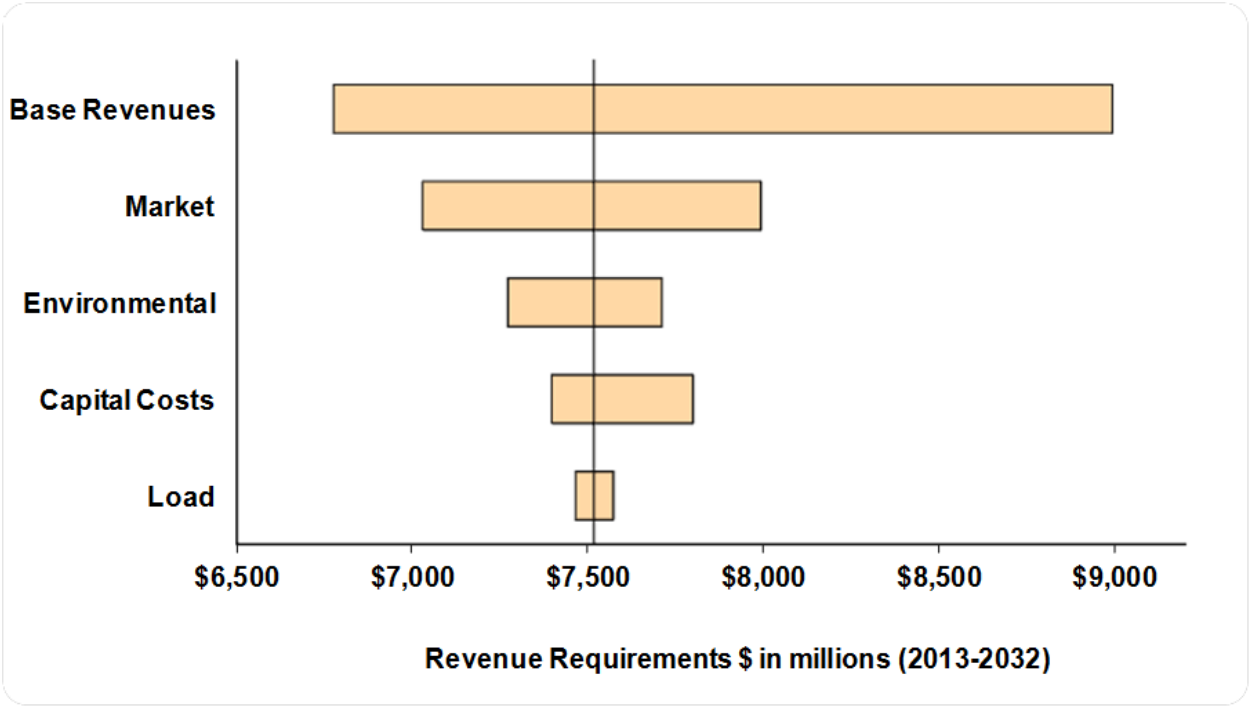


Figure 6-156 - Plan 13 (High Fuel) Tornado Diagram

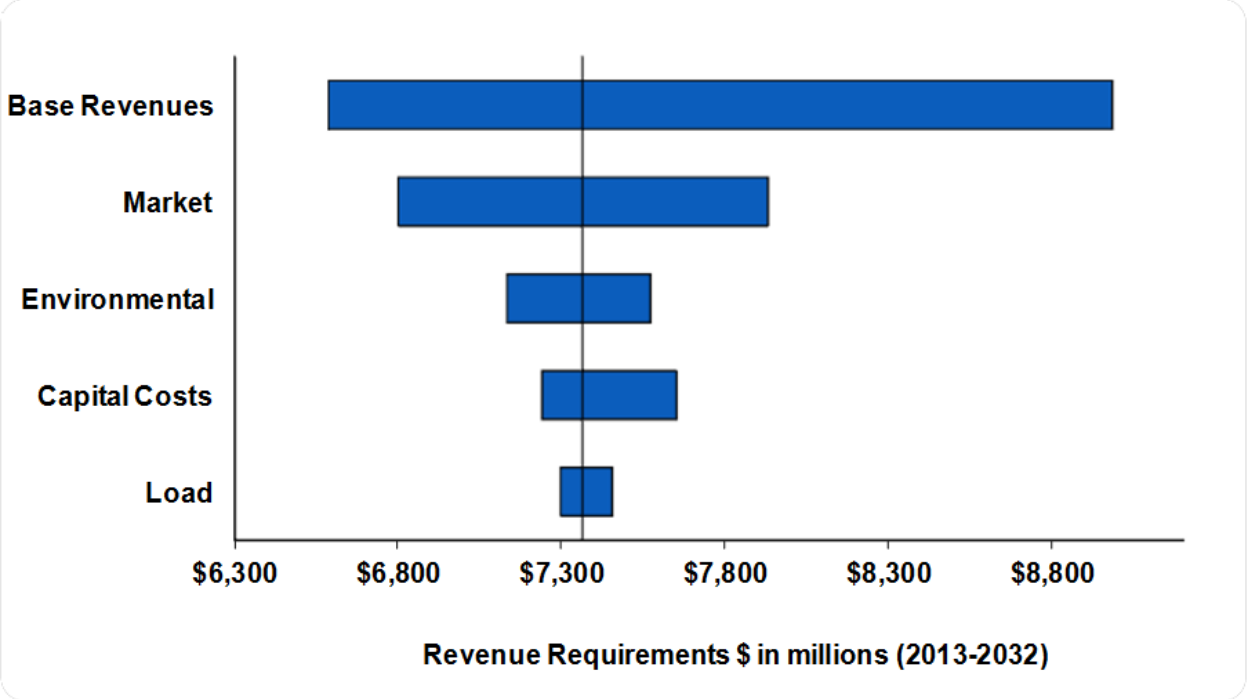


Figure 6-157 - Plan 14 (Low Fuel) Tornado Diagram

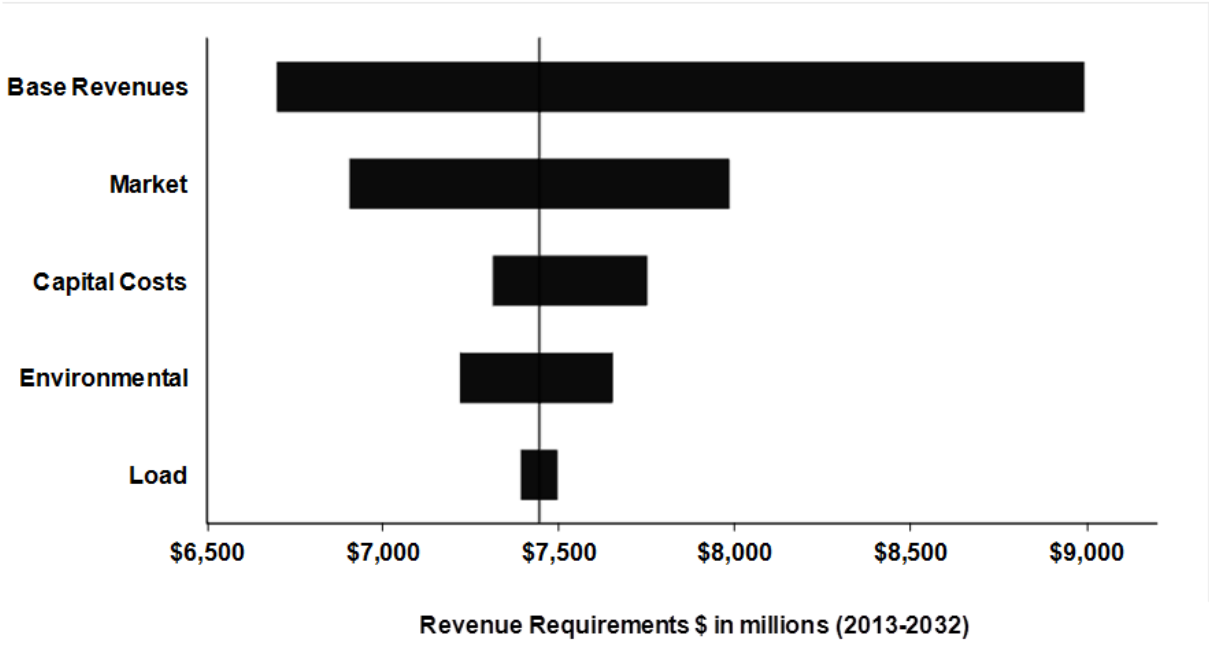


Figure 6-158 - Plan 15 (High Load) Tornado Diagram

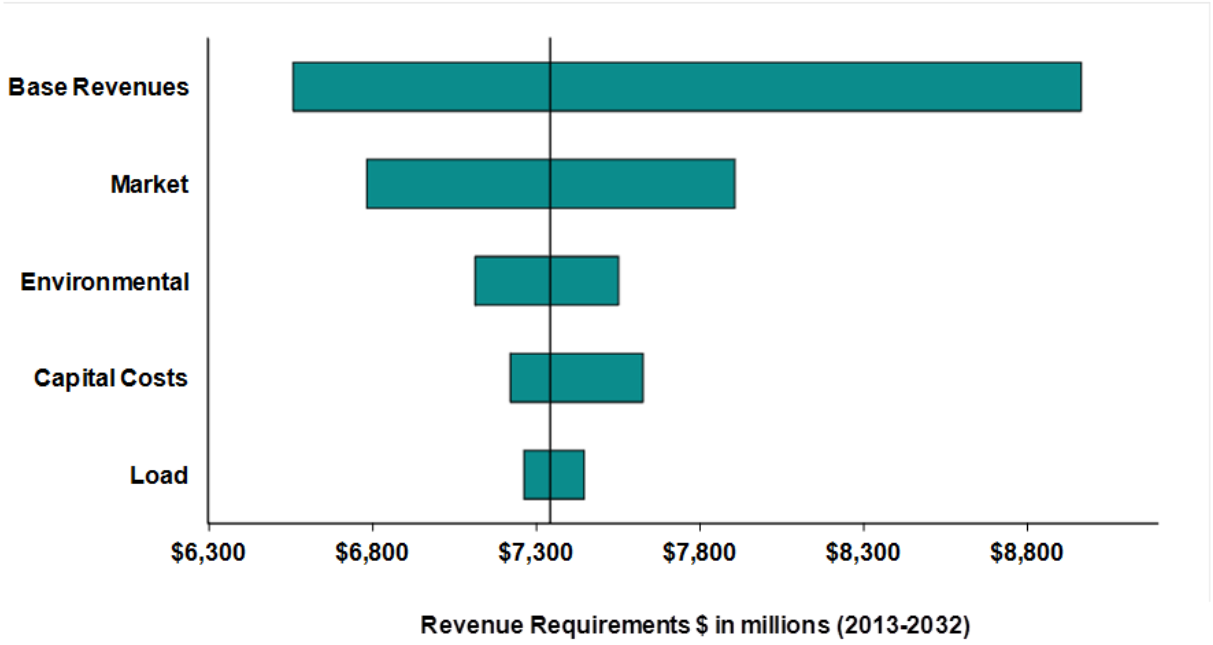


Figure 6-159 - Plan 16 (Low Load) Tornado Diagram

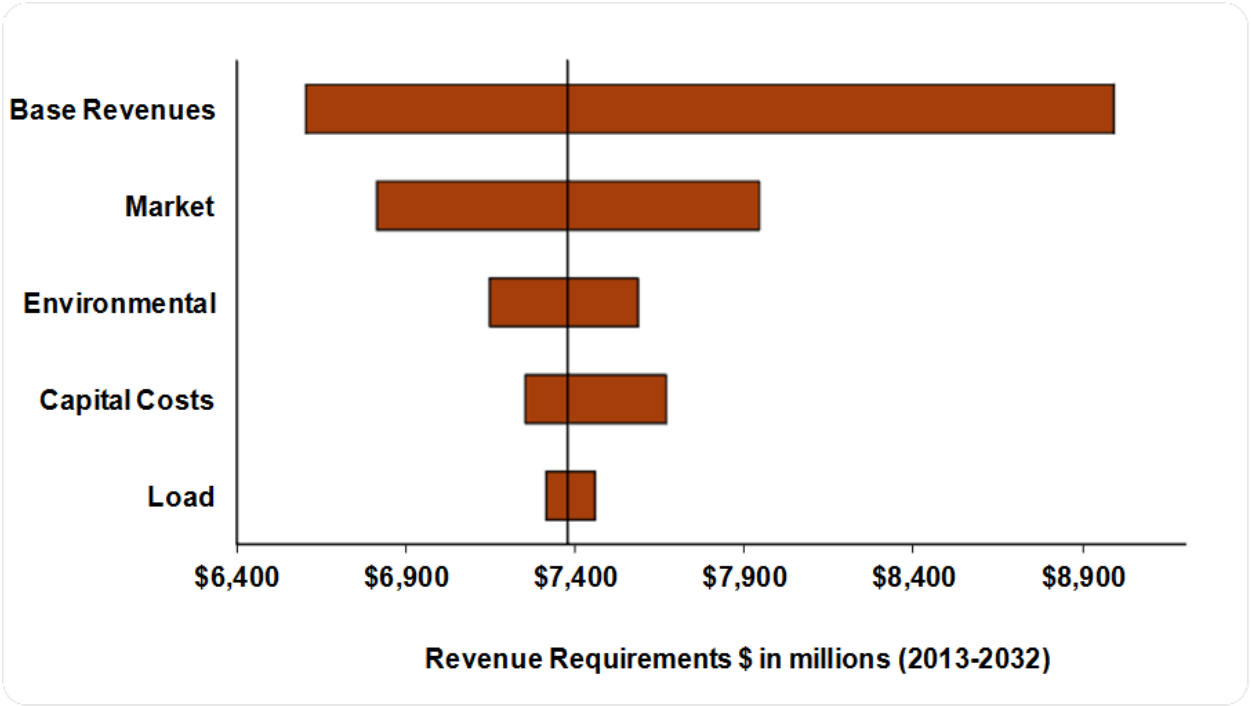


Figure 6-160 - Plan 17 (High Fuel - No Future Coal) Tornado Diagram

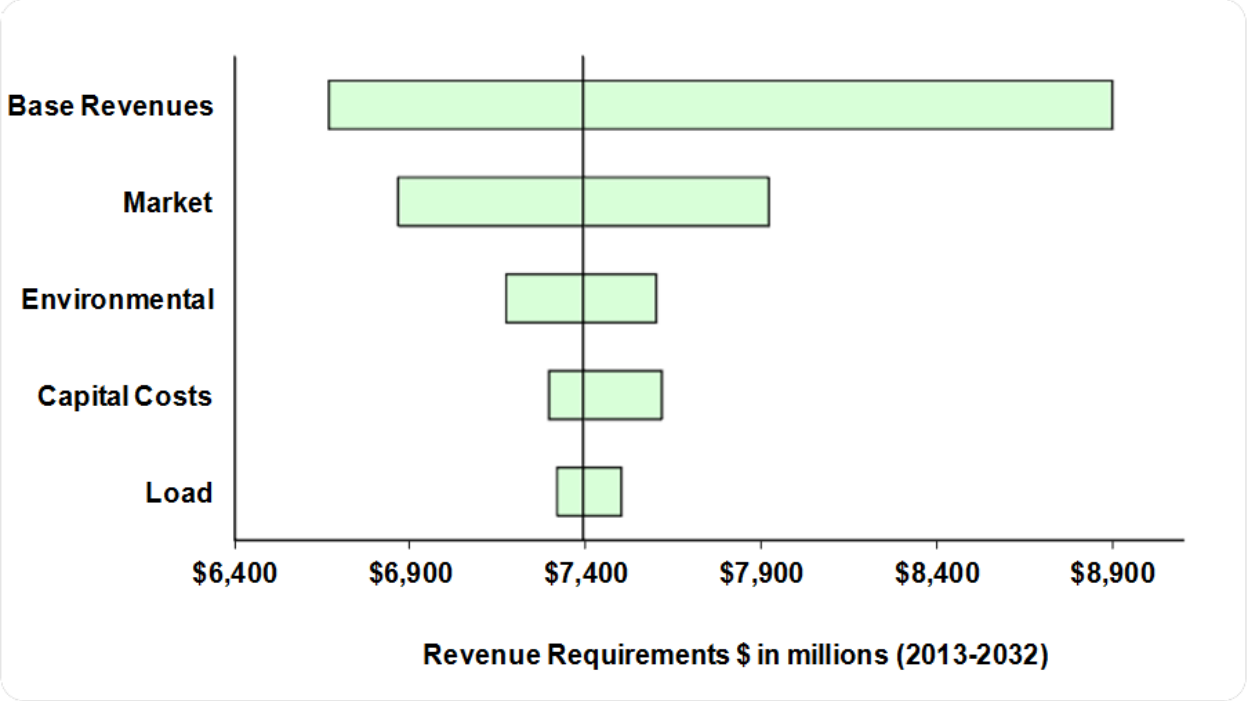


Figure 6-161 - Plan 18 (Aggressive Renewable) Tornado Diagram

Figure 6-162 adds the risk (stochastic) values for each plan to the calculated (deterministic) PVRR to present the total risk associated with each plan.

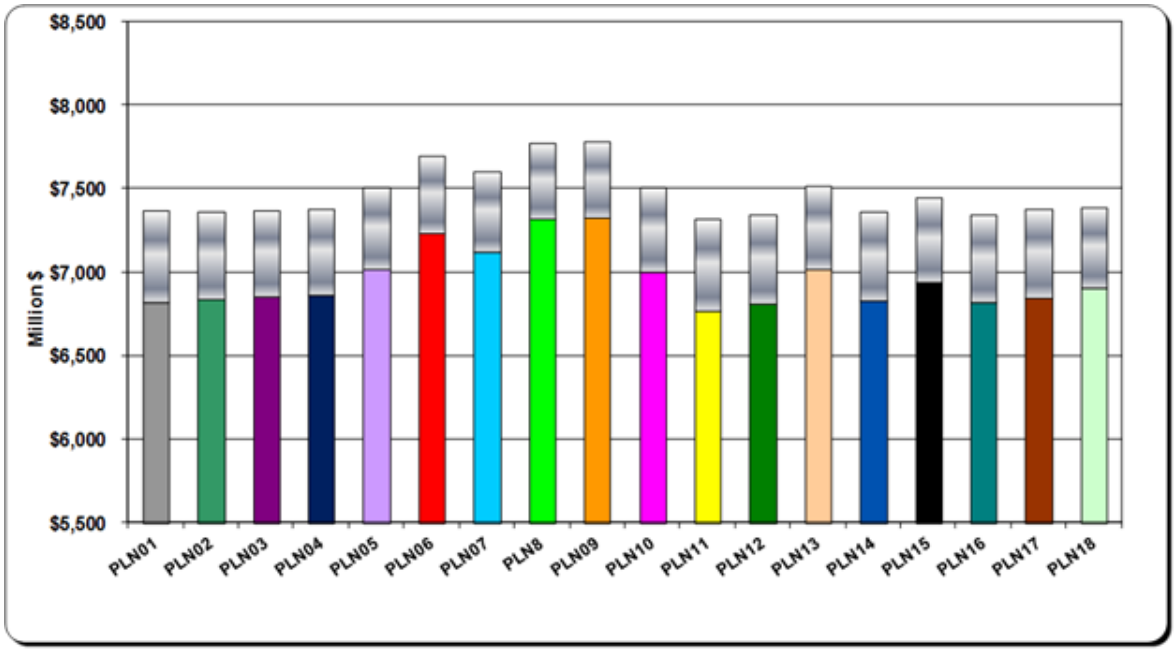


Figure 6-162 - PVRR with Risk Value for Alternative Resource Plans

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 6-163.*

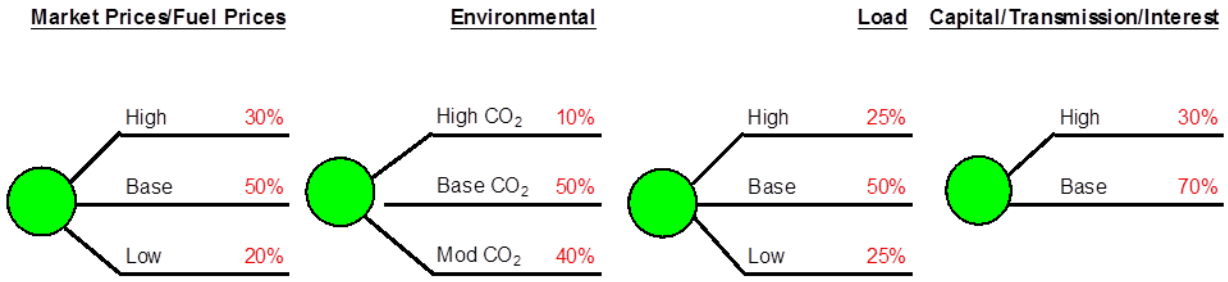


Figure 6-163 - Decision Tree Uncertainties

The decision tree represents the uncertainties considered for each plan that resulted in a total of 54 combinations or endpoints per plan or a total of 972 endpoints for all of the 18 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 6-69*.

****Highly Confidential in its Entirety****
Table 6-69 - 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 6-70 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.

[redacted]

****Highly Confidential in its Entirety****
Table 6-70 - Standard Deviation of Plan Performance Measures

Combining the uncertainty with the calculated PVRR for each plan provides a graphic comparison of the plans as presented in *Figure 6-164*.

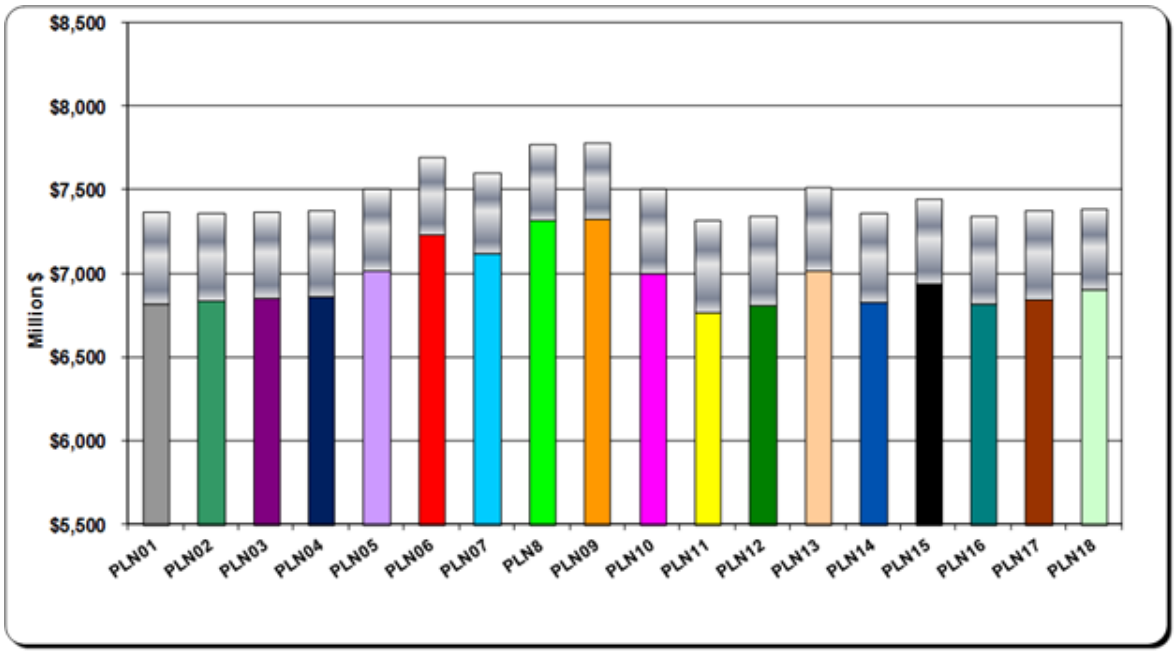


Figure 6-164 - PVRR with Risk Value for Alternative Resource Plans

(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 54 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 Ventyx 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 management and subsequently with the IRP Stakeholder Advisory Group. The resulting critical uncertain factors were consistent with the two previous Empire IRP filings in 2007 and 2010.

For market/fuel prices, Empire began with the Ventyx 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 6-165* illustrates the probabilities selected for market/fuel prices uncertainty factor.

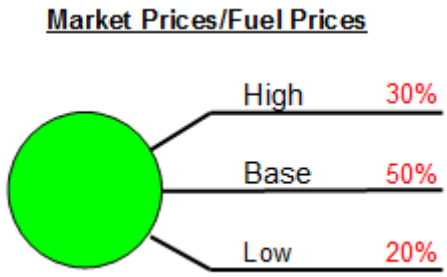


Figure 6-165 - Market Probabilities

Figure 6-166 illustrates the environmental uncertainty characteristic used in this study. For the environmental uncertainty factor, the expectation of CO_2 regulations was used to develop probabilities by a survey of subject matter experts at Empire Ventyx and Sega, Inc. Polling indicated a 10 percent expectation that CO_2 regulation would be implemented as soon as 2015 for existing fossil-fired electric generating plants which set the high condition. The base condition was set at 50 percent from the polling expectation that no CO_2 regulations would be implemented for existing generating plants within the planning horizon of the study. The moderate condition was the result of polling expectation that CO_2 regulations would be implemented for existing generating plants by 2021.

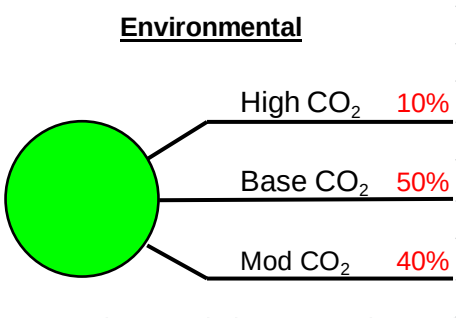


Figure 6-166 - Environmental Probabilities

Load forecast uncertainties were determined in Volume 3 - Load Analysis and Load Forecasting of this report with the development of the high and low load forecasts. The high and low case probabilities were developed by Itron. The economic forecast and model error were adjusted by applying confidence levels that resulted in equal probability of higher or lower environmental costs.

For more explanation, refer to Volume 3 - Load Analysis and Load Forecasting and Section 8 - Sensitivity Analysis. *Figure 6-167* illustrates this portion of the decision tree used in the analysis.

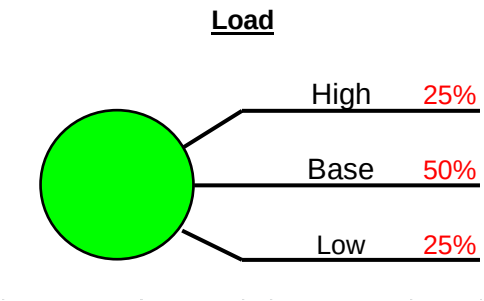


Figure 6-167 - Load Probabilities

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. Nuclear expansion units were 1.5 times higher than base. Interest rates were increased three 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 6-168* illustrates this portion of the decision tree.

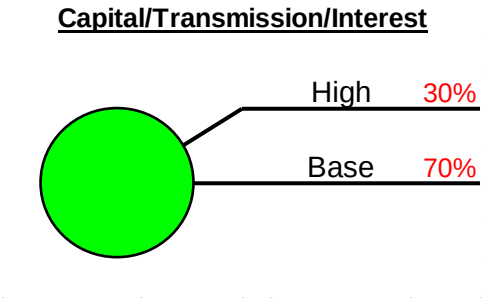


Figure 6-168 - Capital/Transmission/Interest Probabilities

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 Ventyx 2013 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 6-169 through *6-172* are plots of the cumulative probability distribution of each district performance measure for each alternative resource plan.

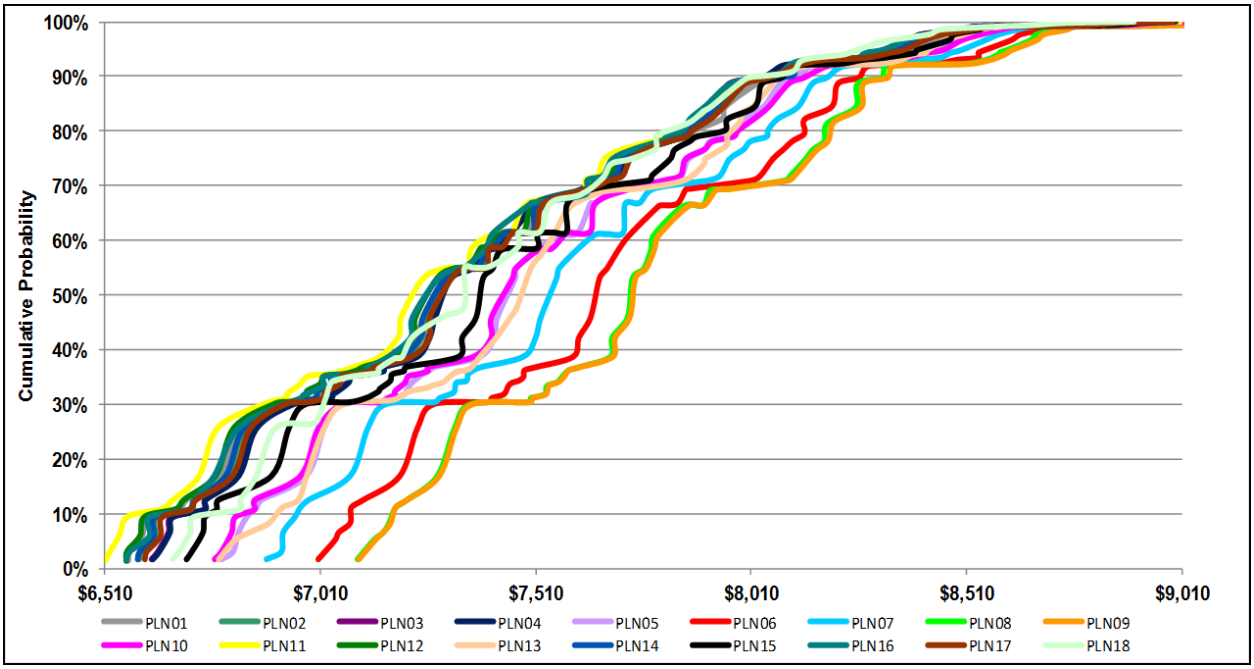


Figure 6-169 - Cumulative Probability of PVRR ($MM)

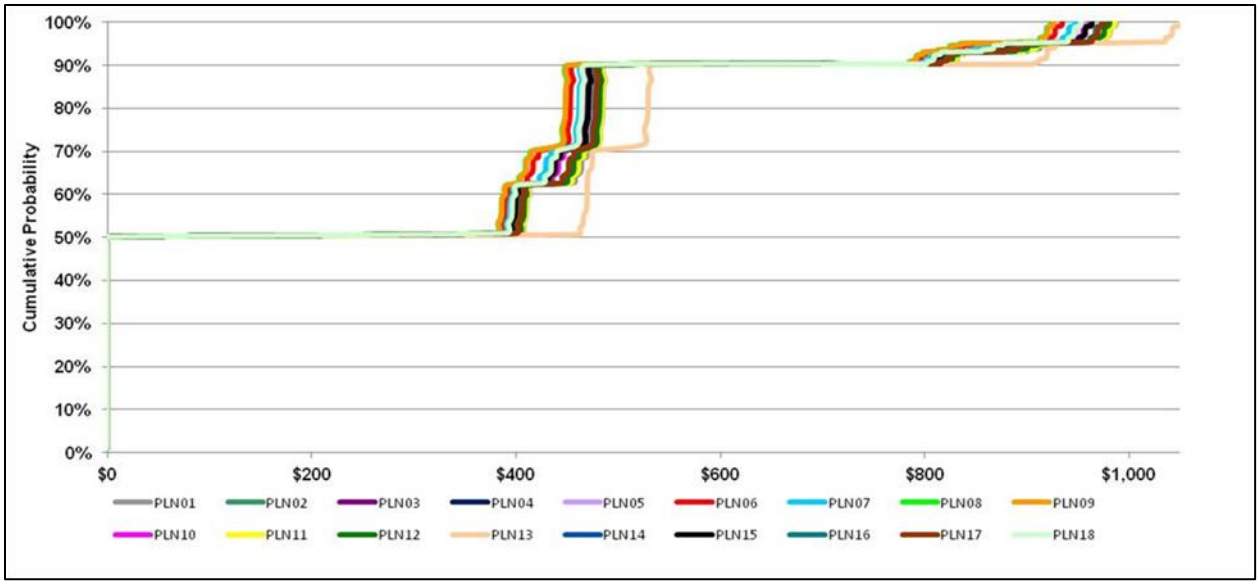


Figure 6-170 - Cumulative Probability of Probable Environmental Costs ($MM)

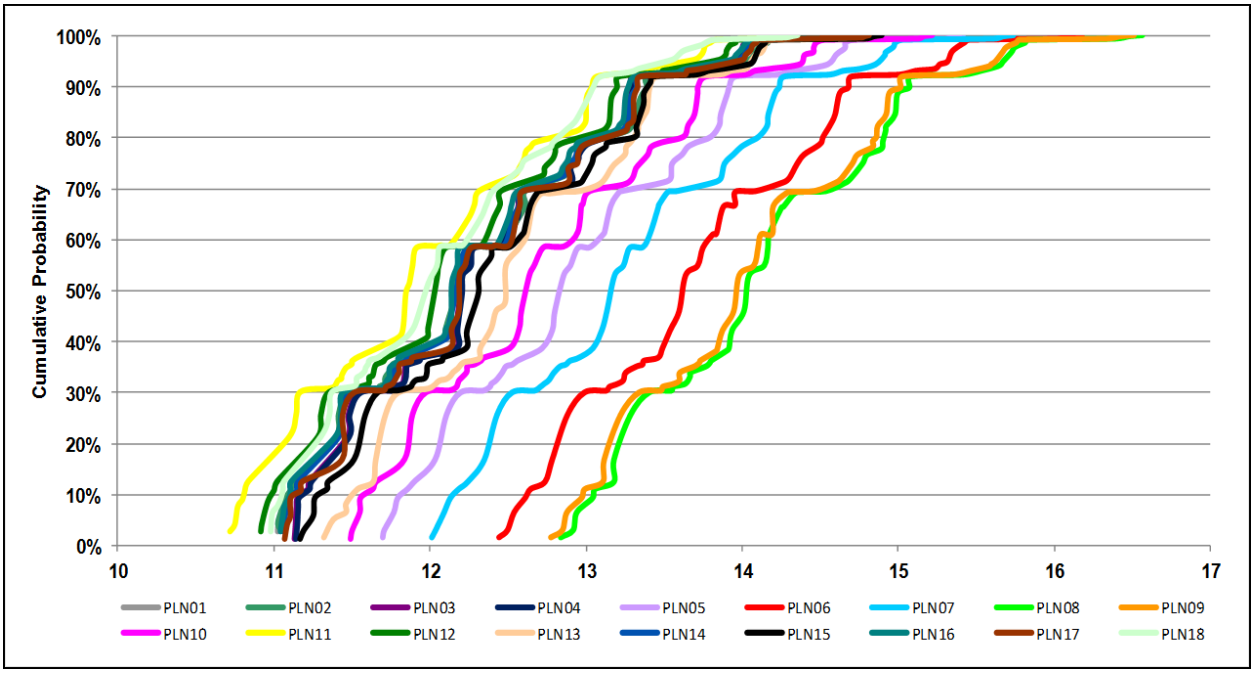


Figure 6-171 - Cumulative Probability of Average Rates (cents/kWh)

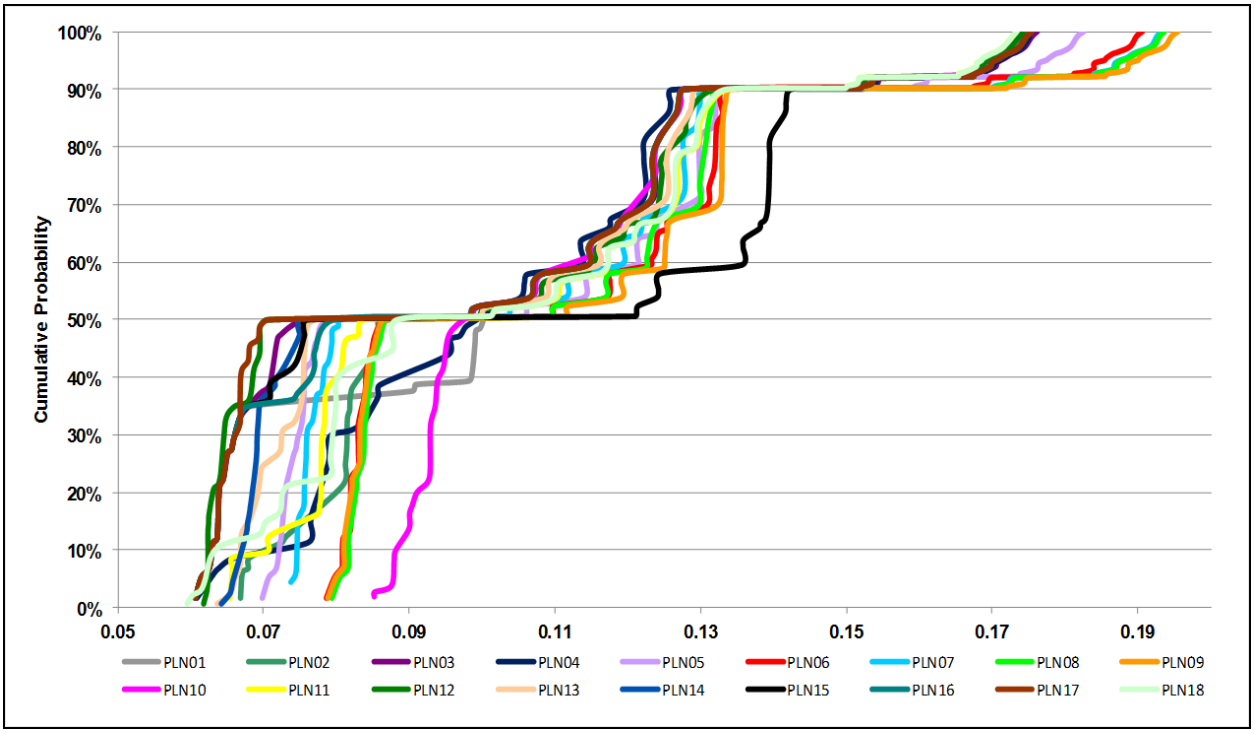


Figure 6-172 - Cumulative Probability of Rate Increases (%)

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 6-71 - Expected Values of Plan Performance Measures

Highly Confidential in its Entirety
Table 6-72 - 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.

Ventyx 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 6-173 is a plot of the expected level of annual unserved hours for each alternative resource plan over the planning horizon.

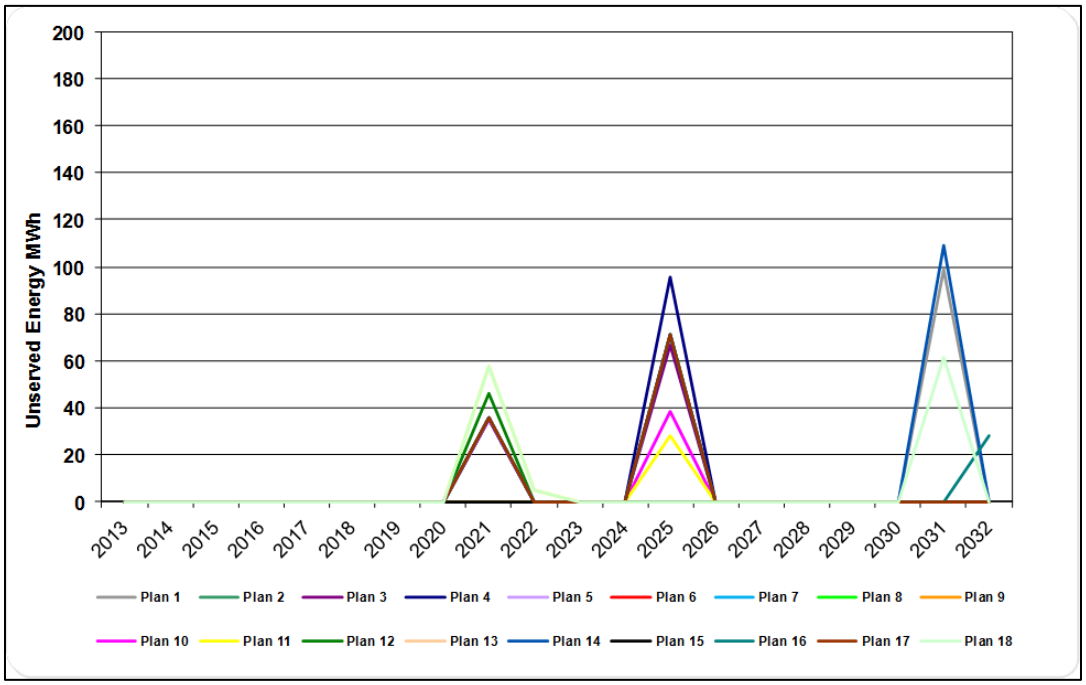


Figure 6-173 - Annual Unserved Hours for All Alternative Resource Plans

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

Special contemporary issues are a written list of issues 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. Each utility shall evaluate and incorporate special contemporary issues in its triennial compliance filing or annual update filing. In File No. EO-2013-0105, the Commission's order effective on November 1, 2012 established three special contemporary planning issues for Empire to analyze and document in its 2013 triennial Integrated Resource Plan. Each special contemporary issue and Empire's response are found below.

8.1.1 Distributed Generation, DSM, and CHP Opportunities

a. Analyze and document the impacts of opportunities to implement distributed generation, DSM programs and CHP projects in collaboration with municipal water treatment plants and other local waste or agricultural/industrial processes with on-site electrical and thermal load requirements, especially in targeted areas where there may be transmission or distribution line constraints.

This issue appears to involve three separate resource types (distributed generation, DSM and CHP) and three distinct customer types. First, this response will address how DSM might impact these customers. These customer types have unique characteristics with respect to energy efficiency opportunities and are therefore addressed separately below:

1. Municipal Waste Water Treatment Plants: Waste water treatment plants are potential candidates for energy efficiency projects. The opportunities for these projects are highly site specific and depend on factors including:

   a. Design, peak, and average waste water flow rates.

   b. Process designs and discharge permit requirements.

   c. Types of sludge processing and handling.

   The most common types of efficiency projects at waste treatment plants fall into two categories: motor controls, including variable frequency drives, for pumps, fans, blowers and other fluid handling equipment, and process controls. In some cases, exterior lighting is also an opportunity. Empire's proposed commercial-industrial custom and prescriptive programs would include such projects.

2. Industrial Processes: Energy efficiency opportunities are numerous in industrial facilities and cover a very wide range of technologies and end uses. Empire already addresses industrial energy efficiency through its custom and prescriptive programs, and this would continue under Empire's proposed programs.

3. Agricultural Sector: Opportunities for energy efficiency in the agricultural sector are driven by the types of agricultural operations. In Empire's case, the opportunities for electric energy efficiency are mainly related to poultry growing. At the grower's level, opportunities for electric energy efficiency exit within the poultry houses. The two primary opportunities are:

   a. *Lighting*: Poultry houses utilize lighting to manage flock growth and can account for a significant amount of electricity usage. Lighting in poultry houses has typically been dominated by incandescent lamps due to the requirements for accurate dimming and low initial cost. Cold-cathode CFLs and LEDs have become more viable and accepted in these applications, although some barriers still exist.

b. *Fans:* Poultry houses use various types of fans for ventilation and cooling and usually account for the largest portion of a grower's electric bill. High efficiency tunnel fans provide a retrofit opportunity for houses using more conventional fans.

Poultry growers, as well as other agricultural customers can apply for the specific measures described above, as well as any other measures available in Empire's proposed commercial-industrial prescriptive and custom programs.

4. Combined Heat and Power: Based on a definition of CHP that was provided by The Missouri Department of Natural Resources (MDNR) at an Empire Stakeholder Advisory Group meeting, combined heat and power (CHP) is a form of distributed generation in which generation of electricity is part of an integrated energy system in which (a) the same energy source is used for the simultaneous or sequential provision of useful thermal energy and on-site electric generation; and (b) at least some of the useful thermal energy or electricity that is produced in this integrated energy system is used to meet on site energy needs. Under this definition, a cogeneration system in which waste heat captured from electric generation is used exclusively to generate more electricity is not an example of CHP. CHP is not a single technology, but an integrated energy system that can be modified depending upon the needs of the energy end user. CHP systems are found in the industrial sector, the commercial sector (including institutional end users such as college campuses, hospitals, and office buildings) and multifamily residential buildings. Examples of thermal load served in CHP system include space heating, cooling or dehumidification and industrial process heating and cooling needs. Examples of the generation technologies used in CHP systems include steam turbines, gas turbines, micro turbines, reciprocating engines, and fuel cells.

CHP has been a topic in several of Empire's Stakeholder Advisory Group meetings. CHP requires a partner or host facility such as with a sewage treatment plant, hospital, nursing home, and colleges-or in this case in collaboration with municipal water treatment plants and other local waste or agricultural/industrial processes. A generator supplies power to the grid and the waste heat can be utilized by the CHP partner. With regards to potential CHP in the Empire service territory, Empire reported to the Advisory Group that some poultry processing plants within the service territory were potential candidates. One of the larger poultry processing plants in Empire's service territory has analyzed CHP potential, but decided that the project was not economically feasible. It would be difficult to evaluate a generic CHP project since costs and other project details are very project specific and require a CHP partner. The Advisory Group suggested a periodically monitoring system to check for CHP opportunities. It was discussed among the Advisory Group that Empire can continue to monitor CHP for the next IRP, but CHP cannot be a

resource that Empire can reasonably be expected to use, develop, or acquire since costs and other project details are very project specific and require a CHP partner. The IRP rule states that the utility must evaluate existing and potential supply-side resource options that *can reasonably be expected to use, develop, or acquire*. Therefore, Empire will continue to look for CHP opportunities, but will not consider CHP as a supply-side candidate in this IRP.

However, distributed generation (DG) was considered as a supply-side candidate resource in this IRP and it was selected for some plans, mainly based on economics and its scalability or small 5-MW size. As mentioned, the IRP process is a long-term planning exercise evaluating mainly generic resources, and Empire did not target any areas where there may be transmission or distribution line constraints for purposes of this long-term IRP. Similar to CHP opportunities Empire will continue to look for distributed generation opportunities as they arise on the system.

8.1.2 Potential Impacts of Aggressive Regulations on the Preferred Plan

b. Investigate and document the impacts on the Company's preferred resource plan and contingency plans of aggressive regulations by the FERC, regional transmission organizations, or Missouri statutes or regulations to allow aggregators of retail customers to operate and market demand response services in Missouri.

In File No. EO-2013-0105, Empire asked for and was provided clarification on this contemporary issue from the Commission Staff.

Staff Statement of Clarification Concerning this Contemporary Issue:

To satisfy this special contemporary issue, Empire could, for example, provide a discussion that includes the identification of how currently Empire participates within the Southwest Power Pool (SPP market) (market participation in the Energy Imbalance (EI) market, etc.) and how this level of participation may change due to:

1. SPP compliance with FERC Order No. 745 that requires demand response resources be compensated at the full Locational Marginal Price (LMP);

2. The presence of an ARC or Curtailment Service Provider (CSP) which registers as a SPP market participant to sell Ancillary Services of aggregated Empire retail customers up to 5 percent of the market potential; and

3. Changes within SPP that include the implementation of a Day Ahead Energy Market and/or other SPP market products that Empire anticipates participating in.

Based on Staff's clarification, Empire's response:

As stated above, Empire currently operates in the EI market; however, the three considerations that follow directly relate to the Integrated Market (IM) or Day Ahead (DA) Energy Market that is expected to go-live March 2014 and not the current EI market. With that being said, Empire would respond to the three considerations as follows:

1. SPP's compliance with FERC Order No. 745 has produced a Net Benefits threshold price to determine whether the demand response (DR) resource should be compensated at full location imbalance pricing (LIP). Since Empire (EDE) currently participates in the EI market, EDE expects no significant change in the DA market.

2. In the event that customers within EDE's service territory would participate with an ARC or CSP, EDE would have to be privy to the either the calculated savings accepted by SPP or to the real-time accepted production in the event that a contingency reserve event was ordered to avoid double counting. If the ARC or CSP registers as a market participant (MP) and gets day ahead (DA) awards for operating reserve (OR) capability, this would have no impact on EDE's responsibility to provide it's allocated OR products to SPP or any rate effect of the aggregated customers.

The only impact, aside from the aforementioned (2), would be if the ARC or CSP registered as an MP and qualified for participation in the energy market (DA or real-time (RT)). In the event that the DR was dispatched in the RT market, EDE would have to be privy to the kW dispatched so that the customer's MP's load could be grossed up by that amount and would avoid what would in effect be a double payment.

Additionally, Empire analyzed alternate plans with 11 different demand-side portfolios. This ranged from a no DSM case to several aggressive DSM cases (or from a zero impact on coincident demand to up to 376-MW impact on coincident demand by year 2032 in the most aggressive DSM case). As a result, Empire has studied a wide range of plans with regard to impacts on the system peak.

8.1.3 Disclosure of Fuel Source Subsidies

c. Disclose and discuss the amount and impact of every state or federal subsidy the Company expects to receive with regard to any or all fuel sources it intends to use during the IRP study period.

Empire does not expect to directly receive any state or federal subsidies for the fuel resources considered during the IRP study period.