

Table 0.5 16 Preliminary Candidate Resource Plans

Supply-Side	Meramec Status	Renewable Portfolio	DSM Portfolio	Noranda Status
--	Retired 2022	Missouri RES	MAP	Continues Expires
--	Retired 2022	Missouri RES	RAP	Continues Expires
Coal w/CCS	Retired 2022	Missouri RES	Low Risk	Continues Expires
CC-Greenfield	Retired 2022	Missouri RES	Low Risk	Continues Expires
Simple Cycle	Retired 2022	Missouri RES	Low Risk	Continues Expires
Pumped Storage	Retired 2022	Missouri RES	Low Risk	Continues Expires
Nuke 30%	Retired 2022	Missouri RES	Low Risk	Continues Expires
Wind/SC	Retired 2022	Missouri RES	Low Risk	Continues Expires

9.2 Sensitivity Analysis¹³

Sensitivity analysis involves determining which of the candidate independent uncertain factors are critical independent uncertain factors.¹⁴ Once identified in this step, critical uncertain factors were added to the scenario probability tree discussed in Chapter 2.

9.2.1 Uncertain Factors¹⁵

Ameren Missouri developed a list of 22 uncertain factors to determine which factors are critical to resource plan performance. Table 9.6 contains the list as well as information about the screening process.

Table 0.6 Uncertain Factor Screening

Uncertain Factor	Candidates?	Critical?	Included in Final Probability Tree?
Load Growth	✗**	--	✓
Interest Rates	✓	✓‡	✓‡
Carbon Policy	✗**	--	✓
Fuel Prices	✓*^	✗	✓††
Project Cost	✓	✓	✓
Project Schedule	✓	✗	✗
Purchased Power	✗	✗	✗
Emissions Prices	✗^	--	✗^
Fixed O&M	✓	✗	✗
Forced Outage Rate	✓	✗	✗
DSM Load Impacts	✓	✓†	✓†
DSM Cost	✓	✓†	✓†
Off-System Sales	✓	✗	✗
Investment Tax Credit	✗	✗	✗
Variable O&M	✓	✗	✗
Return on Equity	✓	✓‡	✓‡
Hourly Price Shapes	✗	✗	✗
Power Price Volatility	✗	✗	✗
Transmission Interconnection Costs	✗	✗	✗
Nuclear Incentives	✓	✗	✗
Wind Capacity Factor	✓	✗	✗
Solar Capacity Factor	✗	✗	✗

¹³ 4 CSR 240-22.070(2)

¹⁴ 4 CSR 240-22.070(1)

¹⁵ 4 CSR 240-22.070(2)(A through L); 4 CSR 240-22.070(11)(A)2.

* Nuclear fuel prices only

** Included in the scenario probability tree

-- Not tested in sensitivity analysis

† DSM impacts and costs were combined

‡ Return on Equity and Long-term Interest rates were combined

†† Natural Gas Prices

^ SO₂, NO_x, coal prices, and energy prices were outputs of the scenarios

Chapter 2 described how 3 of these 22 candidate uncertain factors were determined to be critical dependent uncertain factors, which defined the scenarios. Those 3 factors were load growth, carbon policy, and natural gas prices.¹⁶ It is also noteworthy that emissions prices, coal prices, and energy prices were outputs of the scenarios and thus reflect a range of uncertainty consistent with the scenario definitions.

A review of these candidates prior to the sensitivity analysis determined several could be eliminated without conducting quantitative analysis.

- Purchased Power – As discussed in Chapter 4, Ameren Missouri did not include any Purchase Power Agreements as supply-side options so there is no application for the uncertain factor.
- Investment Tax Credit (ITC) – The ITC is limited to renewables and the earliest in-service dates of qualifying renewables in the candidate resource plans are at least 5 years beyond the date of reasonable extension of the investment tax credit.
- Hourly Price Shapes and Power Price Volatility - The price shaping methodology discussed in Chapter 2 already differentiated price shapes by altering on-peak/off-peak ratios of scenarios with and without carbon prices.
- Transmission Interconnection Costs – As discussed in Chapter 4, these costs are embedded in the project cost uncertain factor as a subcomponent of project cost.
- Solar Capacity Factor - Solar resources were included to meet renewable requirements and thus are consistent across plans. All plans would experience the same risk so varying solar capacity factor would not add any differentiation between plans.

There are two pairs of candidate independent uncertain factors that are highly correlated;

- Interest Rates and Return on Equity
- DSM Cost and DSM Load Impacts

Including the possible interactions of high/base/low would geometrically increase the analysis while some combinations would be less meaningful and less probable. Since the expectation is that these factors are highly correlated, the simplifying assumption is to combine the individual probably nodes into a combined probability node containing

¹⁶ 4 CSR 240-22.070(4)

the high value for both, base value for both, and low value for both without explicitly considering the joint probabilities.

Uncertain Factor Ranges¹⁷

The sensitivity analysis examines whether or not candidate independent uncertain factors have a significant impact on the performance of candidate resource plans, as measured by their PVRR (present value of revenue requirements).

Most of the 13 candidates had a 3-level range of values for this analysis, those 3 levels being low, base, and high values. Two of the candidates, off-system sales and nuclear tax incentive, had a 2-level range of values, which were a default value and an alternative value.

Unless the meaning of low, base, and high are treated in a standardized manner, the probability of occurrence for the value used for “low” for one uncertain factor could be significantly different than the probability of occurrence for the value used for “low” for other uncertain factors. Thus, for this analysis, Ameren Missouri standardized the meaning of low to be the value found at the 10th percentile of a probability distribution of values for an uncertain factor, the value at the 50th percentile for the base value, and the value at the 90th percentile for the high value. The probability distribution used for each candidate uncertain factor was the one implied by a series of estimated values produced by a subject matter expert for that uncertain factor.

The selection of these particular percentiles (10 and 90) to represent low and high also reflected Ameren Missouri’s incorporation of more extreme outcomes in this IRP than in its 2008 IRP¹⁸. In the 2008 IRP, “low” meant a value found at the 25th percentile, and “high” meant a value found at the 75th percentile. In addition, the amount of probability assigned to low and to high values in this IRP, compared to the amount of probability assigned to the base value, reflected consideration of more extreme outcomes. In this IRP, a 20% probability was used for the low value and for the high value, which is less than the 25% probability used for low and for high in the prior IRP. A lower probability is associated with a more extreme outcome, and a higher probability is associated with a less extreme outcome.

Ameren Missouri reviewed and considered use of available measurement techniques such as Value at Risk for appropriate uncertain factors when addressing risk associated with extreme outcomes¹⁹. Ameren Missouri reviewed, among others, the document suggested by Missouri Department of Natural Resources consultant Synapse on application of Value at Risk (VaR) in utility resource planning: “Energy Portfolio

¹⁷ EO-2007-0409 – Stipulation and Agreement #34

¹⁸ EO-2007-0409 – Stipulation and Agreement #33

¹⁹ EO-2007-0409 – Stipulation and Agreement #33

Management: Tools and Practices for Regulators,” Synapse Energy Economics, October 2006. This document suggests focusing on a particular region of a probability distribution, selecting a representative value in that region and an associated probability. That approach is similar to Ameren Missouri’s approach for dealing with low, base, high values of uncertain factors.

For the majority of cases probability distributions were used to obtain the values for low, base, and high. This process began with subject matter experts providing estimates of (A) a standard value, (B) estimates of deviations from that standard value, and (C) the probabilities of those deviations from the standard value. That information was used to create the probability distribution collectively implied by that data. Values at the 10th, 50th, and 90th percentiles of those implied probability distributions were then obtained for use as the values for low, base, and high for the various candidate independent uncertain factors.

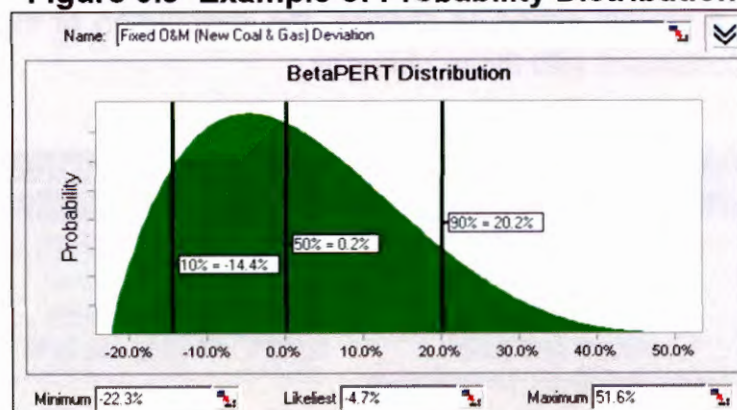
Example

The standard value for Fixed Operations & Maintenance (FOM), for the greenfield Combined Cycle is \$7.04/kW-year. FOM and some other candidate uncertain factors have differing standard values among various supply-side types, while some other candidate uncertain factors do not have different standard values among supply types. For example the Long Term Interest Rates uncertain factor does not differ depending on the supply-side type; it is the same across all supply-side types.

The subject matter expert, in this case Black and Veatch, provides estimates of deviations from the standard value as well as the probabilities of those deviations. An example of that initial uncertainty distribution is shown in Table 9.7. In this example, the first of these estimates for FOM deviations was a -20% deviation from the FOM standard value with a 5% probability of occurring. These deviation estimates provide sufficient information to derive continuous probability distributions from which the low/base/high values can be selected.

Table 0.7	
Fixed O&M Uncertainty Distribution	
Deviation	Probability
-20%	5%
-10%	25%
0%	40%
15%	25%
30%	5%

The process of developing the probability distributions involved using Crystal Ball software. This software, when provided with a series of observations like these deviation estimates, can determine the probability distribution implied by the set of estimates. An example of the result of analyzing deviation estimates using Crystal Ball is shown in Figure 0.. From this distribution the values for the low, base, and high deviations from the standard value (-14.4%, 0.2%, 20.2%) are shown at the respective percentile markers in the Figure and represent the 10th, 50th, and 90th percentiles.

Figure 0.9 Example of Probability Distribution

The final step in the process of developing for low, base, and high values for uncertain factors involved multiplying the standard value for an uncertain factor times its low, base, and high deviation factors. Continuing with the FOM example, this step is shown in Table 9.8. The standard value of \$7.04/kW-Year was multiplied by the quantity 1 plus the low, base, and high deviation factors (-14.4%, 0.2%, 20.2%) to create the low, base, and high values for FOM for the greenfield Combined Cycle.

Table 0.8

Standard value	\$7.04
Deviation Low	-14.4%
Deviation Base	0.2%
Deviation High	20.2%
Value Low	\$6.03
Value Base	\$7.05
Value High	\$8.46

Table 9.9 contains the uncertain factor ranges for the factors that are resource-specific while Table 9.10 contains the uncertain factor ranges for factors that are common across supply-side options.

Table 0.9 Resource-Specific Uncertain Factor Ranges

Uncertain Factor	Value	Probability	Coal w/CC	CC Greenfield	SC Greenfield	Pumped Storage	Nuclear (100%)	Wind (100 MW)
Project Cost (\$MM)	Low	20%	3,018	591	226	1,421	5,701	171
	Base	60%	3,533	692	264	1,663	6,755	200
	High	20%	4,238	830	317	1,995	8,001	240
Project Schedule (yrs*)	Low	20%	6	3	2	5	7	3
	Base	60%	7	4	3	6	8	4
	High	20%	9	5	4	8	9	5
Fixed O&M (\$/kW-yr)	Low	20%	\$31.93	\$6.03	\$5.90	\$2.72	\$37.88	\$42.80
	Base	60%	\$37.37	\$7.05	\$6.90	\$3.19	\$45.17	\$50.10
	High	20%	\$44.83	\$8.46	\$8.28	\$3.82	\$54.85	\$60.10
Variable O&M (\$/MWh)	Low	20%	\$5.58	\$1.97	\$6.85	\$1.74	\$1.72	\$3.14
	Base	60%	\$10.90	\$3.64	\$12.80	\$3.22	\$2.05	\$6.00
	High	20%	\$15.81	\$5.31	\$18.75	\$4.69	\$2.49	\$8.86
EFOR (%)	Low	20%	4.1%	1.1%	1.1%	0.7%	2.1%	2.7%
	Base	60%	8.0%	2.1%	5.0%	4.7%	2.4%	5.0%
	High	20%	11.9%	3.6%	8.9%	15.5%	2.7%	7.3%

Table 9.9 includes the uncertain factor for project schedule. It is noteworthy that as the number of years in a project schedule change, the distribution of the cash flows was also updated to be consistent with those changes.

Table 0.10 Uncertain Factor Ranges

Uncertain Factor	Low	Base	High
Probability->>	20%	60%	20%
Wind Capacity Factor	31.4%	37.6%	43.5%
Nuclear Fuel Price	varies by year		
Long Term Int. Rates	5.7%	7.2%	8.4%
Return on Equity	10.16%	11.35%	13.27%
Energy Efficiency Load Impact			
MAP	69%	96%	113%
RAP	74%	99%	115%
Low Risk	73%	100%	112%
Demand Response Load Impact			
MAP	72%	100%	118%
RAP	75%	100%	116%
Low Risk	73%	100%	112%
DSM Cost			
MAP	90%	100%	110%
RAP	90%	100%	110%
Low Risk	90%	100%	110%

The two candidate independent uncertain factors that had 2 value levels instead of the typical low/base/high structure were off-system sales and nuclear tax incentives.

As a default, with a 50% probability, off-system sales included no premium to achieve market sales or purchases. As an alternative, with a 50% probability, off-system sales were limited to those after a \$10 premium was required to achieve market sales or purchases.

As a default, with a 75% probability, no nuclear tax incentives were included. As an alternative, with a 25% probability, a 10% tax credit plus the reduction of tax depreciation life from 15 to 5 years were included for nuclear plants.

9.2.2 Sensitivity Analysis Results

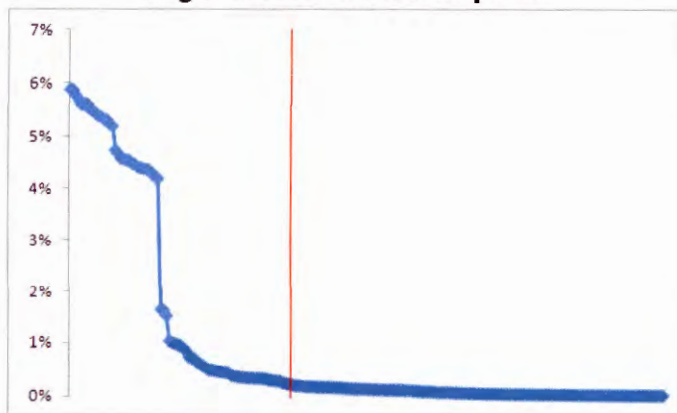
To conduct sensitivity analysis, each of the 16 preliminary candidate resource plans was analyzed using the varying value levels (low/base/high or default/alternative) for each of the 13 candidate independent uncertain factors, for each of the scenarios in the probability tree. A scenario-probability-weighted result (PVRR) was obtained for each plan for each relevant candidate uncertain factor. Finally, the results of using a “non-base” value were compared to the results of using a base value for each plan for each

candidate factor. The sensitivity analysis results are included in the electronic workpapers.²⁰

The results of this process produced 210 comparisons that were plotted to determine what significant differences had occurred and for which candidate uncertain factors. The comparisons were made using 2 metrics: absolute value of the percent difference in PVRR, and absolute value of the difference in rank.

Figure 9.10 shows the sensitivity results for the absolute value difference in PVRR and shows that 95% of the differences are to the left of a red vertical line. Nearly half of those observations were for the long term interest rate and return on equity pair of uncertain factors. In fact, all of the impacts greater than 4% were from that pair. The DSM cost and load impact pair of uncertain factors and the project cost uncertain factor were the next largest contributors to changes in PVRR.

Figure 0.10 PVRR Impacts



The second view of sensitivity analysis focused on the change in plan rank based on PVRR. In Figure 9.11 shows the results of this view and shows a red vertical line that separates non-zero rank changes on the left from zero rank changes on the right on this metric. A majority of the rank changes were attributed to the long term interest rate & return on equity pair of uncertain factors and the DSM cost and load impact pair of uncertain factors

Figure 0.11 Rank Impacts

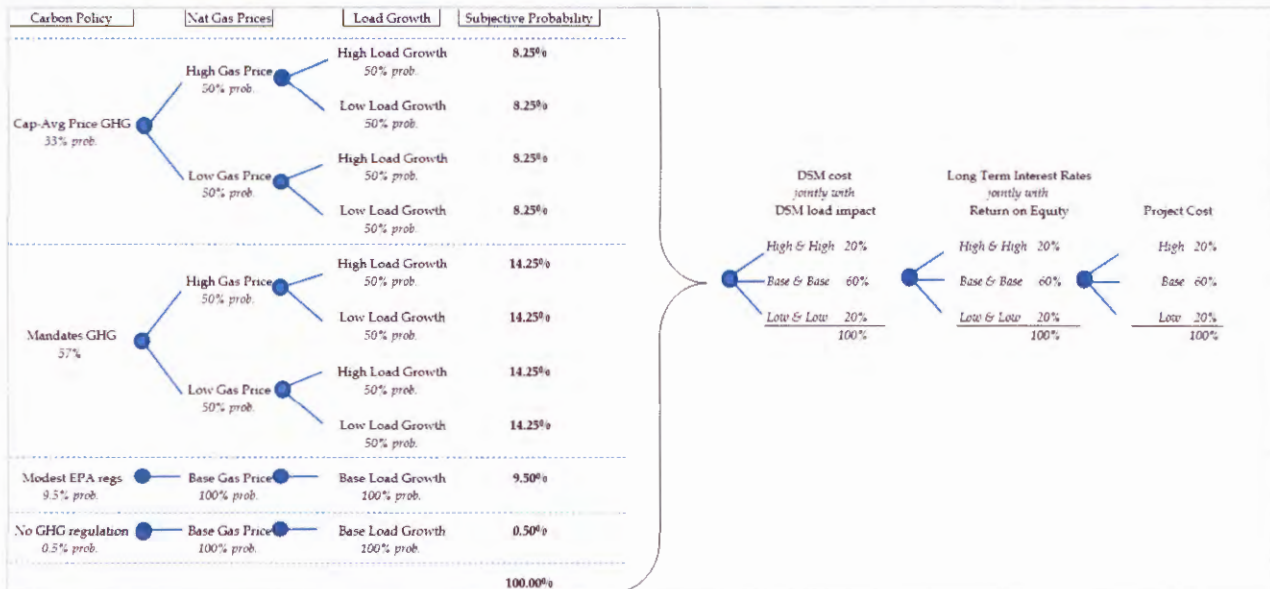


The conclusion from the sensitivity analysis results on these two metrics was that three critical independent uncertain factors needed to be considered in the risk analysis: the long term interest rate & return on equity pair of uncertain factors, the DSM cost and load impact pair of uncertain factors, and the project cost uncertain factor.

²⁰ "Sensitivity analysis_111710.xls"

These 3 critical independent uncertain factors were added as nodes to the scenario probability tree that was developed in Chapter 2. The updated and expanded probability tree is shown in Figure 0.12, with these 3 critical independent uncertain factors shown on the right hand side.²¹

Figure 0.12 Final Probability Tree Including Sensitivity Analysis Results



9.3 Risk Analysis

The Risk Analysis consisted of running each of the 16 preliminary candidate resource plans in Table 9.5 through each of the branches on the final probability tree.²² The probability tree consisted of 270 different branches. Each branch is the combination of different value levels among the 3 critical dependent uncertain factors (load growth, gas prices, and carbon policy) and the 3 critical independent uncertain factors (DSM cost together with DSM load impacts, project cost, and interest rates together with return on equity). Each branch therefore represents a unique combination of the critical uncertain factors. Once all the combinations are calculated the sum of the individual branch probabilities equals 100%.

9.3.1 Risk Analysis Results

Figures 9.13 and 9.14 show the PVRR results of the risk analysis for the 16 preliminary candidate resource plans. The Figures are separated to show results with and without Noranda to facilitate comparisons of resource types. Both Figures show, with the additional uncertain factors incorporated, RAP is now the lowest cost plan. It is also noteworthy that Simple Cycle, Combined Cycle, Wind/Simple Cycle, and Nuclear plans

²¹ 4 CSR 240-22.070(1); 4 CSR 240-22.070(3); 4 CSR 240-22.070(11)(A)

²² 4 CSR 240-22.070(1)

are in a relatively tight range. Furthermore, the figures indicate the status of Noranda does not affect the relative performance of resource types.

**Figure 0.13 Probability Weighted PVRR
Noranda Continues**

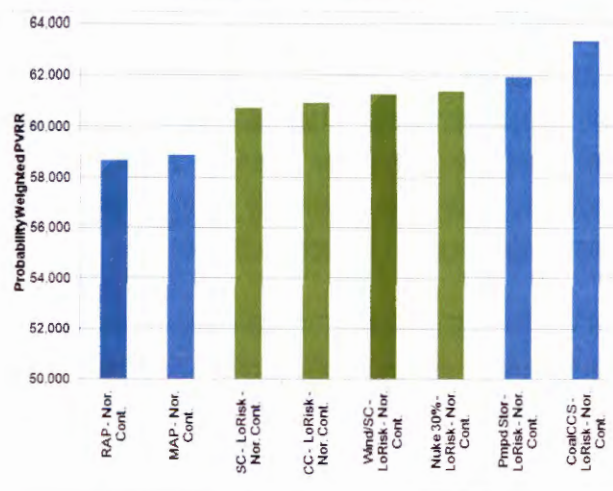
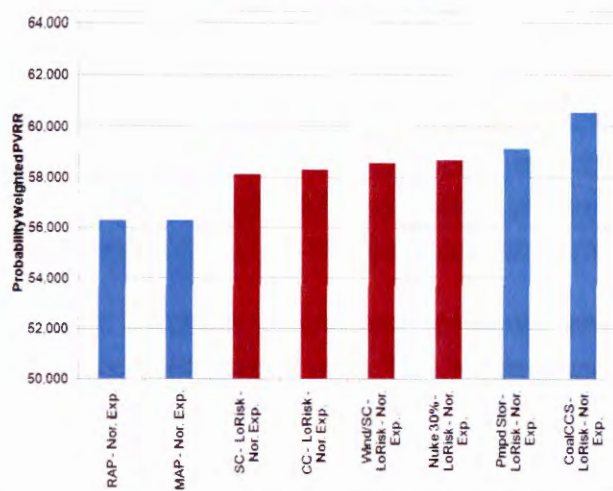


**Figure 0.14 Probability Weighted PVRR
Noranda Expires**



Conclusions²³

- Pumped storage and coal with carbon capture significantly underperform; therefore, there is no need to continue to analyze these resource options.
- RAP's risk adjusted PVRR is lower than MAP's risk adjusted PVRR. In addition, given the maturity of Ameren Missouri DSM programs, the challenging regulatory environment, and expected customer acceptance, MAP is not a resource that can be realistically implemented at this time.
- The status of Noranda has little impact on relative resource performance. All further analysis in this IRP was based on Noranda continuing as an Ameren Missouri customer throughout the planning horizon.
- The combined cycle option is an attractive option for near-term development due to its competitive overall cost, relatively low capital cost and relatively short lead time. It also adds intermediate gas to Ameren Missouri's portfolio.
- While the simple cycle resource option performs well on total cost, Ameren Missouri's existing resource portfolio includes a robust fleet of peaking resources already. For that reason, additional gas-fired peaking generation is considered a contingency resource option that may be pursued under circumstances when rapid resource deployment may be needed.

²³ 4 CSR 240-22.060(4)

9.3.2 Incorporating the Meramec Retirement Analysis

Initial analysis design called for a separate analysis of Meramec retirement possibilities through consideration of various values for the Meramec retirement attribute of resource plans. The relevant results from that step would be brought back into Risk Analysis.

Limiting the number of possibilities for the Meramec retirement analysis and reducing the number of resource plans allows the incorporation of the retirement analysis into the Risk Analysis. This also allowed for and enriched risk analysis with a more comprehensive consideration of environmental controls; and by having a variety of environmental controls possibilities, we introduced consideration of uncertainty for environmental control capital costs as part of the project cost uncertain factor.

The Meramec retirement analysis included the following options: continue as-is, retire and replace with new resources, continue with addition of environmental controls, and conversion to natural gas boiler operation. Environmental controls were either Moderate or Aggressive, as discussed in Chapter 8. A retirement date of 2016 was analyzed to match the avoidance of major environmental controls in the Aggressive scenario.

As a reminder, the alternative resource plans were originally developed by incorporating one major supply-side resource, if necessary, and then using market capacity purchases to meet the remaining capacity needs. By developing alternative resource plans in this manner the analysis provides a direct comparison of resource types. That direct comparison was analyzed in the initial risk analysis and this stage of the IRP analysis allows for the development of plans with multiple supply-side resource types ("multi-resource" plans). Multi-resource plans are only necessary in the case of Meramec retirement where resource needs are coincident with the 2016 Meramec retirement. As discussed in section 9.3.1, the combined cycle resource option is an attractive option to be developed in the near-term so it was used as the first major supply-side resource followed by one of the top four supply-side options: combined cycle, simple cycle, simple cycle/wind, and nuclear. Even with Meramec retirement in 2016, no supply-side resources are needed with RAP DSM. In the cases in which Meramec is not retired, only one major supply-side resource is needed late in the planning horizon. Table 9.11 shows the 14 final candidate resource plans that are created by incorporating the Meramec retirement analysis into the risk analysis.²⁴

²⁴ EO-2007-0409 – Stipulation and Agreement #35; 4 CSR 240-22.060(4); 4 CSR 240-22.070(11)(A)1.

Table 9.11 14 Candidate Resource Plans

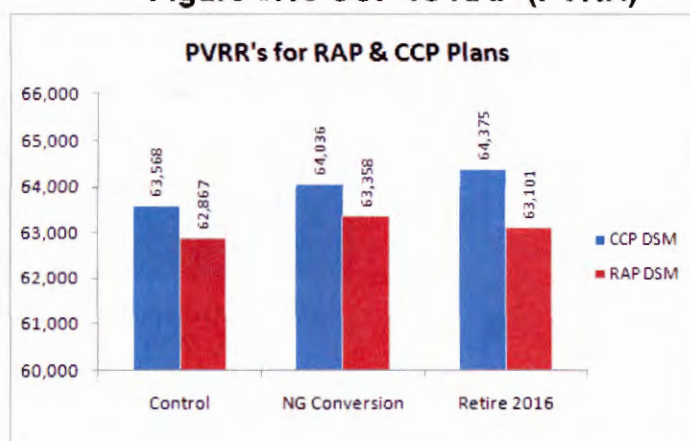
Envir. Scenario	Meramec Status	First Supply-Side	Second Supply-Side	Renewable Portfolio	DSM Portfolio	Noranda Status
Moderate	Continues As-Is	--	--	Missouri RES	RAP	Continues
Moderate	Continues As-Is	Combined Cycle	--	Missouri RES	Low Risk	Continues
Moderate	Continues As-Is	Simple Cycle	--	Missouri RES	Low Risk	Continues
Moderate	Continues As-Is	Nuclear 30%	--	Missouri RES	Low Risk	Continues
Moderate	Continues As-Is	Wind/SC	--	Missouri RES	Low Risk	Continues
Aggressive	Retired 2016	--	--	Missouri RES	RAP	Continues
Aggressive	Retired 2016	Combined Cycle	Combined Cycle	Missouri RES	Low Risk	Continues
Aggressive	Retired 2016	Combined Cycle	Simple Cycle	Missouri RES	Low Risk	Continues
Aggressive	Retired 2016	Combined Cycle	Nuclear 30%	Missouri RES	Low Risk	Continues
Aggressive	Retired 2016	Combined Cycle	Wind/SC	Missouri RES	Low Risk	Continues
Aggressive	Controlled	--	--	Missouri RES	RAP	Continues
Aggressive	Controlled	Combined Cycle	--	Missouri RES	Low Risk	Continues
Aggressive	Gas Conversion	--	--	Missouri RES	RAP	Continues
Aggressive	Gas Conversion	Combined Cycle	--	Missouri RES	Low Risk	Continues

9.3.3 DSM Portfolio Comparison²⁵

Ameren Missouri tested an alternative combination of DSM resources by assuming implementation of all available demand response resources first, then incorporating energy efficiency as needed to just meet capacity needs. This allowed us to test, in a fully integrated fashion, whether the additional load reduction provided by the RAP portfolio was cost effective. As a reminder, the plans were originally created in an opposite fashion by using all available energy efficiency resources then using demand response to meet any remaining capacity needs. The new portfolio, the Capacity Calibrated Portfolio (CCP), produced energy savings between the RAP and Low Risk DSM Portfolios. For comparison, we considered plans for each of three Meramec paths -- control, retire, or natural gas conversion -- with both CCP and with RAP.

Results of this analysis showed that comparable RAP plans provided consistently better (lower) PVRRs than CCP plans, as shown in Figure 9.15, thus indicating that further analysis of the CCP portfolio is unnecessary.

Figure 9.15 CCP vs RAP (PVRR)



²⁵ 4 CSR 240-22.010(2)(A)

9.3.4 Risk Analysis 2.0 Results

Figures 9.16, 9.17 and 9.18 show the PVRR results of the risk analysis for the 14 candidate resource plans. The comparisons are grouped by resource type to facilitate the comparisons of different Meramec outcomes. Figure 9.16 shows the results under the Energy Bill Mandates scenarios while figure 9.17 shows the results under the Cap and Trade scenarios, and Figure 9.18 shows the results across all of the planning scenarios. It is evident from these results that continuing to operate Meramec without significant additional environmental controls will yield the lowest PVRRs. It is also evident that the supply-side resource options are performing very similarly while the DSM-only plans yield the lowest PVRRs. Other performance measures can be found in Chapter 9 – Appendix A.²⁶

Figure 0.16

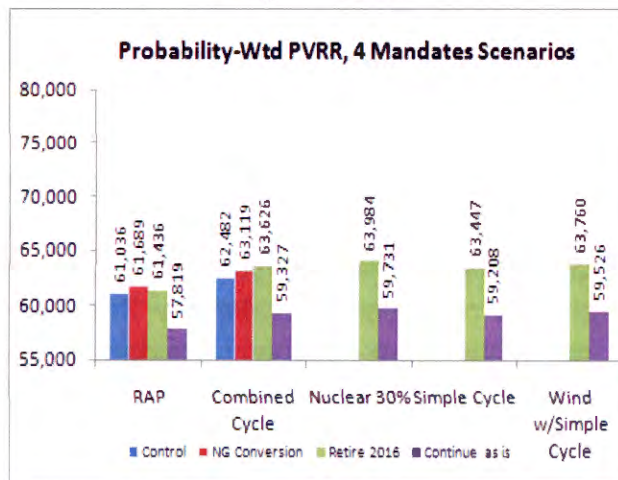


Figure 0.17

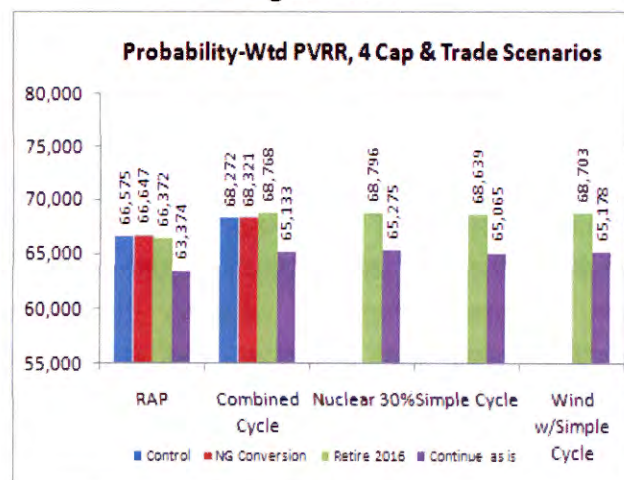
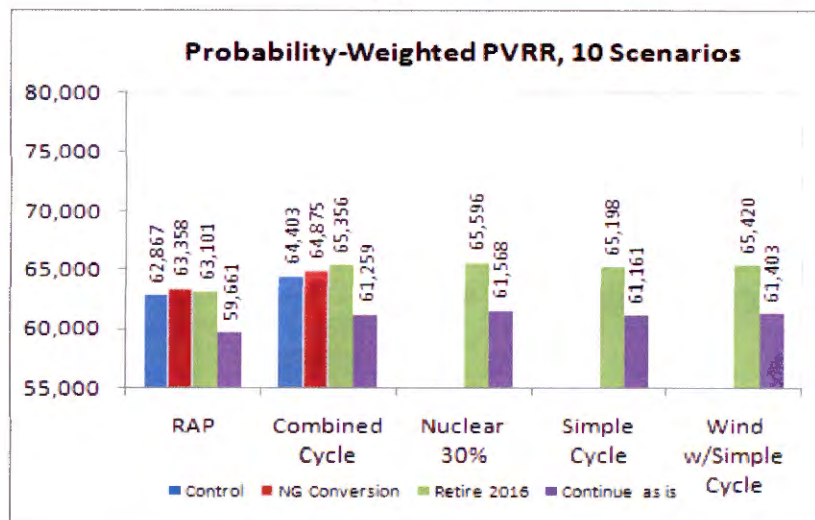


Figure 0.18



²⁶ 4 CSR 240-22.060(A); 4 CSR 240-22.060(6)(B); 4 CSR 240-22.060(6)(C)(1 through 10); 4 CSR 240-22.070(5); 4 CSR 240-22.070(5)(A); 4 CSR 240-22.070(5)(B)

If decision making were solely based on PVRR then the analysis would be complete at this point. Since decision making is multi-dimensional, Ameren Missouri created a scorecard that embodied its policy objectives. That scorecard was used throughout the analysis as a means to winnow a large number of resource plans down to a short list of the most promising plans. The analysis to this point has also been based solely on perfect ratemaking as modeled in MIDAS²⁷. With only 14 plans remaining, Ameren Missouri can take an even closer look at the performance of the plans by introducing realistic ratemaking and financial constraints. Ameren Missouri is then able to expand the scorecard to include additional measures based on the policy objectives and ultimately select an appropriate strategy based on understanding the trade-offs across multiple planning objectives. Chapter 10 – Strategy Selection includes the additional analysis and decision-making considerations that lead to the selection of the Resource Acquisition Strategy.

²⁷ 4 CSR 240-22.060(4)(B)

9.4 Compliance References

4 CSR 240-22.010(2)(A)	2, 23
4 CSR 240-22.010(2)(B)	7
4 CSR 240-22.060(1)	2
4 CSR 240-22.060(2)	5, 7
4 CSR 240-22.060(3)	2
4 CSR 240-22.060(4)	5, 7, 11, 21, 22
4 CSR 240-22.060(4)(A)	6, 7
4 CSR 240-22.060(4)(B)	25
4 CSR 240-22.060(4)(D)	6
4 CSR 240-22.060(6)(A)	5
4 CSR 240-22.060(6)(B)	7, 24
4 CSR 240-22.060(6)(C)(1 through 10)	24
4 CSR 240-22.060(6)(E)	5
4 CSR 240-22.060(A)	24
4 CSR 240-22.070(1)	13, 20
4 CSR 240-22.070(11)(A)	20
4 CSR 240-22.070(11)(A)1.	22
4 CSR 240-22.070(11)(A)2.	13
4 CSR 240-22.070(2)	13
4 CSR 240-22.070(2)(A through L)	13
4 CSR 240-22.070(3)	20
4 CSR 240-22.070(4)	14
4 CSR 240-22.070(5)	24
4 CSR 240-22.070(5)(A)	24
4 CSR 240-22.070(5)(B)	24
EO-2007-0409 – Stipulation and Agreement #33	15
EO-2007-0409 – Stipulation and Agreement #34	15
EO-2007-0409 – Stipulation and Agreement #35	22

Chapter 9 - Appendix A

Candidate Resource Plans

Table 9.A.1 Type, Size, Timing of Resource Addition/Retirement¹

Plan B1: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position		-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades/adjustmts		2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables		0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency		-47	-78	-105	-137	-171	-205	-239	-287	-333	-372	-412	-450	-489	-526	-567	-606	-642	-675	-708	-735
- Demand response		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-20	-83	-158	-236
+ New primary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts		-67	295	659	618	604	476	512	483	426	411	358	302	245	184	119	75	67	61	58	60
Purchases(-) or sales(+)		67	-295	-659	-618	-604	-476	-512	-483	-426	-411	-358	-302	-245	-184	-119	-75	-67	-61	-58	-60
Plan B2: Combined Cycle - Nuke 30% - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position		-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades/adjustmts		2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables		0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency		-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response		0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480	480	480
+ New secondary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts		-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	185	85	-20
Purchases(-) or sales(+)		66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	-185	-85	20
Plan B3: Combined Cycle - Simple Cycle - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position		-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades/adjustmts		2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables		0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency		-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response		0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	692	692	692
+ New secondary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts		-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	185	297	192
Purchases(-) or sales(+)		66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	295	-297	-192
Plan B4: Combined Cycle - Wind/Simple Cyc - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position		-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades/adjustmts		2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables		0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency		-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response		0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410	410	410
+ New secondary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts		-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	115	15	-90
Purchases(-) or sales(+)		66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	-115	-15	90
Plan C1: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer controlled - Nor continues		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position		-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades/adjustmts		2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables		0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency		-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response		0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600
+ New secondary supply side		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts		-66	286	643	593	567	439	495	460	387	357	282	208	128	46	-45	-131	-222	277	177	72
Purchases(-) or sales(+)		66	-286	-643	-593	-567	-439	-495	-460	-387	-357	-282	-208	-128	-46	45	131	222	-277	-177	-72

¹ For the 14 final candidate resource plans: 4 CSR 240-22.060(6)(A)

Plan C2: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer nat gas convert - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	277	209	127	24	-63	-157	-253	-352	-453	-561	-667	-777	-893	-1,010	-1,130
+ Total plant upgrades adjustmts	2	6	30	34	38	-31	39	39	39	69	69	69	69	69	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustmts	-66	286	643	593	567	426	482	447	374	344	269	195	115	33	-58	-144	-235	264	164	59
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-426	-482	-447	-374	-344	-269	-195	-115	-33	58	144	235	-264	-164	-59

Plan C3: Combined Cycle - Combined Cycle - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjustmts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600	600	600
= Capacity position after adjustmts	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	-299	215	124	23	-77	-182
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	299	-215	-124	-23	77	182

Plan H1: Combined Cycle - Nuke 30% - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjustmts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480	480	480	480	480	480
= Capacity position after adjustmts	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	181	95	4	-97	-197	-302
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	-181	-95	-4	97	197	302

Plan H2: Combined Cycle - Simple Cycle - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjustmts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	692	692	692	692	692
= Capacity position after adjustmts	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	-299	307	216	115	15	-90
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	299	-307	-216	-115	-15	90

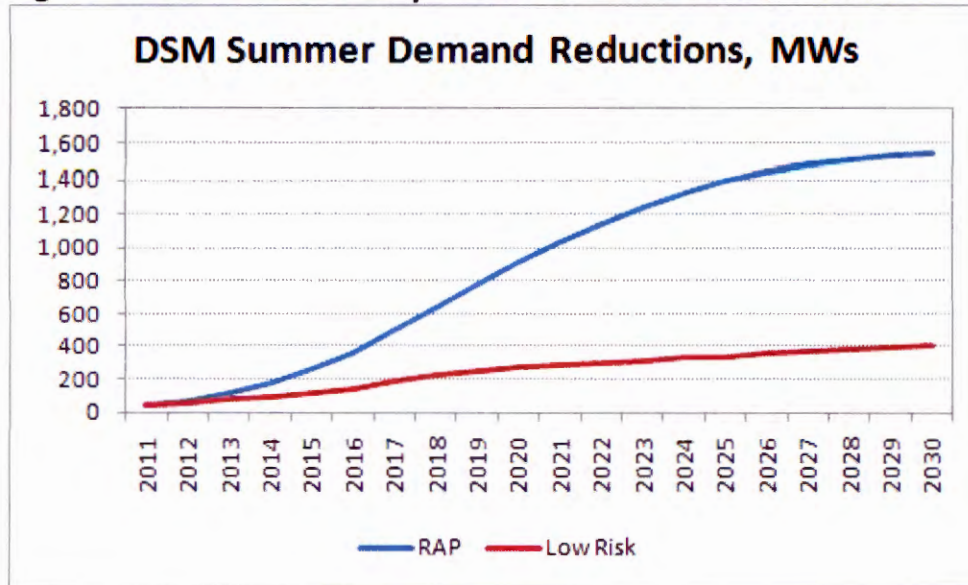
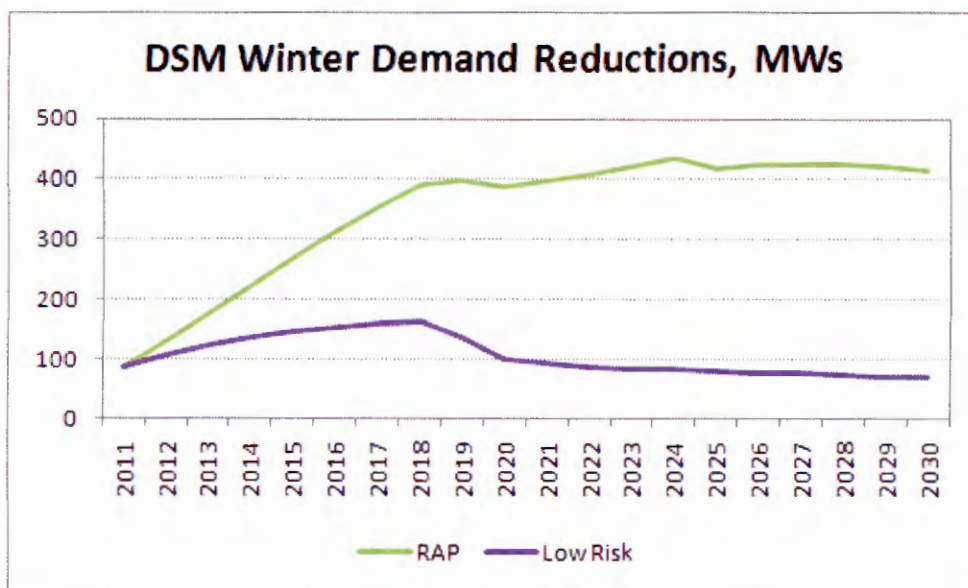
Plan H3: Combined Cycle - Wind/Simple Cye - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjustmts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410	410	410	410	410	410
= Capacity position after adjustmts	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-202	111	25	-66	-167	-267	-372
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	-202	-111	-25	66	167	267	372

Plan R0: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjstmnts	2	6	30	34	38	15	85	85	91	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjstmnts	-66	302	688	692	739	752	854	873	855	847	821	785	733	639	557	466	370	262	151	31
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-752	-854	-873	-855	-847	-821	-785	-733	-639	-557	-466	-370	-262	-151	-31

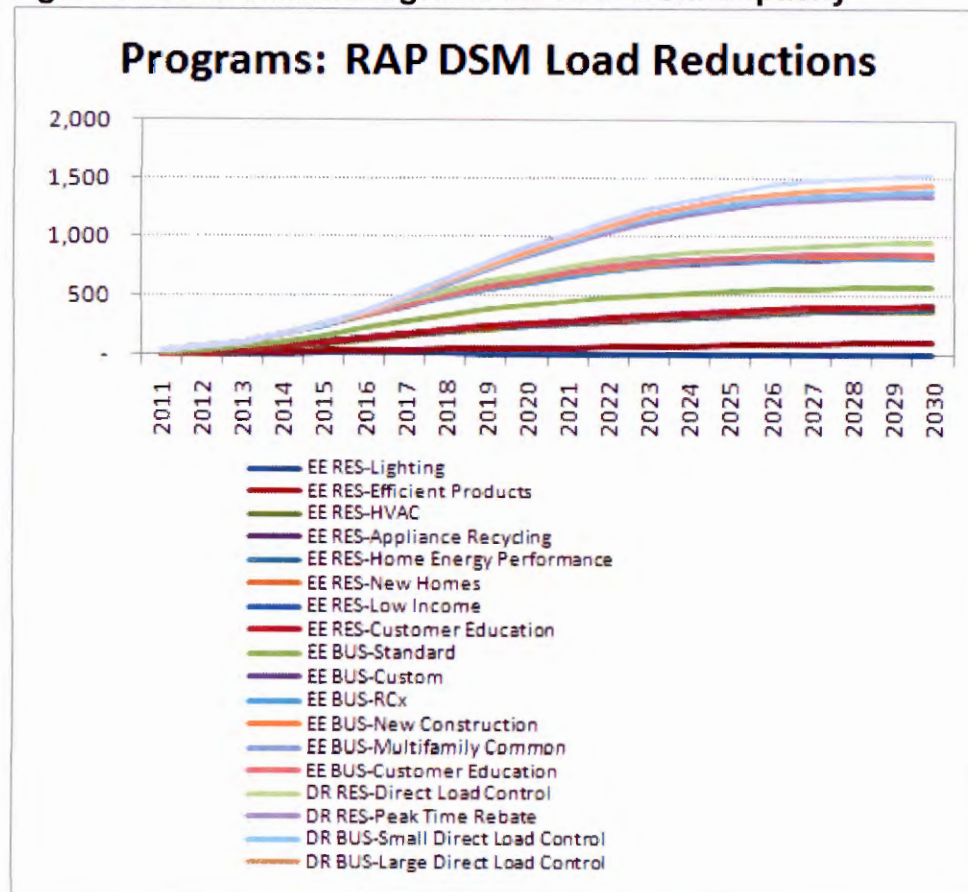
Plan R1: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer controlled - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjstmnts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjstmnts	-66	302	688	692	739	678	780	799	781	797	771	735	683	612	529	438	342	234	123	3
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-678	-780	-799	-781	-797	-771	-735	-683	-612	-529	-438	-342	-234	-123	-3

Plan R2: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer nat gas convert - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	277	209	127	24	-63	-157	-253	-352	-453	-561	-667	-777	-893	-1,010	-1,130
+ Total plant upgrades adjstmnts	2	6	30	34	38	-31	39	39	39	69	69	69	69	69	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-20
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjstmnts	-66	302	688	692	739	665	767	786	768	784	758	722	670	599	516	425	329	221	110	10
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-665	-767	-786	-768	-784	-758	-722	-670	-599	-516	-425	-329	-221	-110	-10

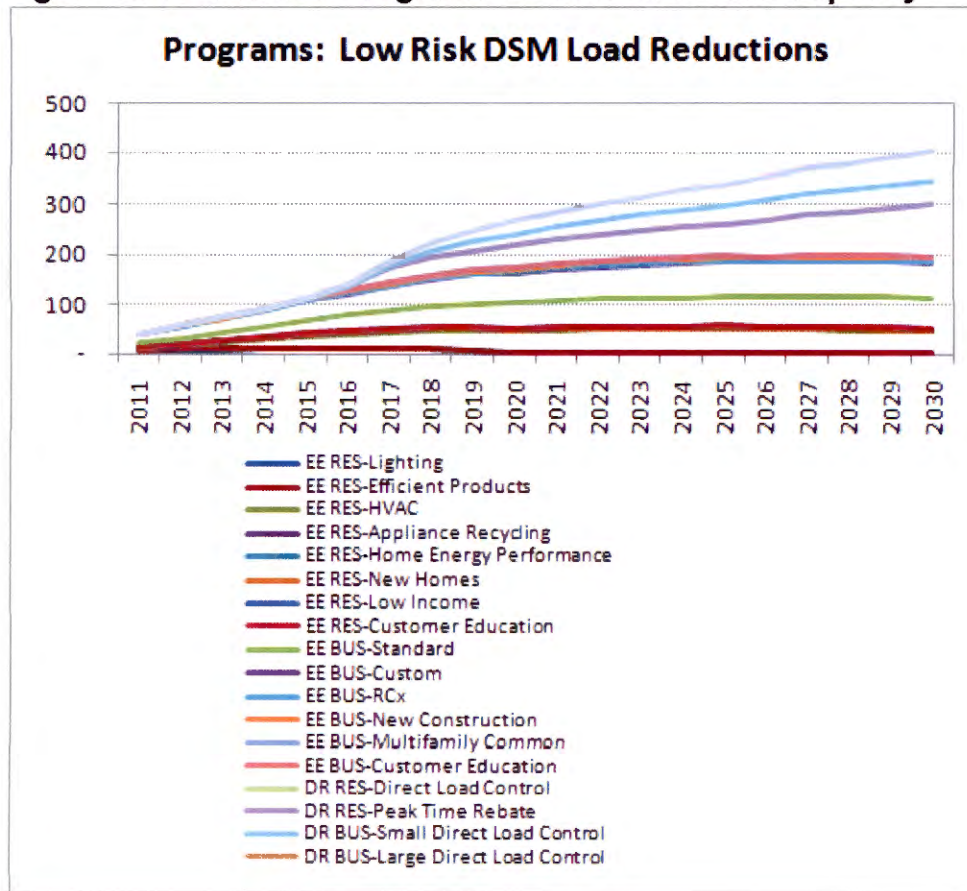
Plan R3: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades adjstmnts	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	-20	-83	-158	-236	-329	-399	-474	-549	-620	-679	-732	-765	-784	-805	-826
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjstmnts	-66	302	688	692	739	-156	10	103	163	272	316	355	378	378	354	316	252	164	74	-25
Purchases(+) or sales(-)	66	-302	-688	-692	-739	156	-10	-103	-163	-272	-316	-355	-378	-378	-354	-316	-252	-164	-74	25

Figure 9.A.1 Combined Impact of DSM on Summer Peak Demand²Figure 9.A.2 Combined Impact of DSM on Winter Peak Demand³² 4 CSR 240-22.060(6)(C)1.³ 4 CSR 240-22.060(6)(C)1.

14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

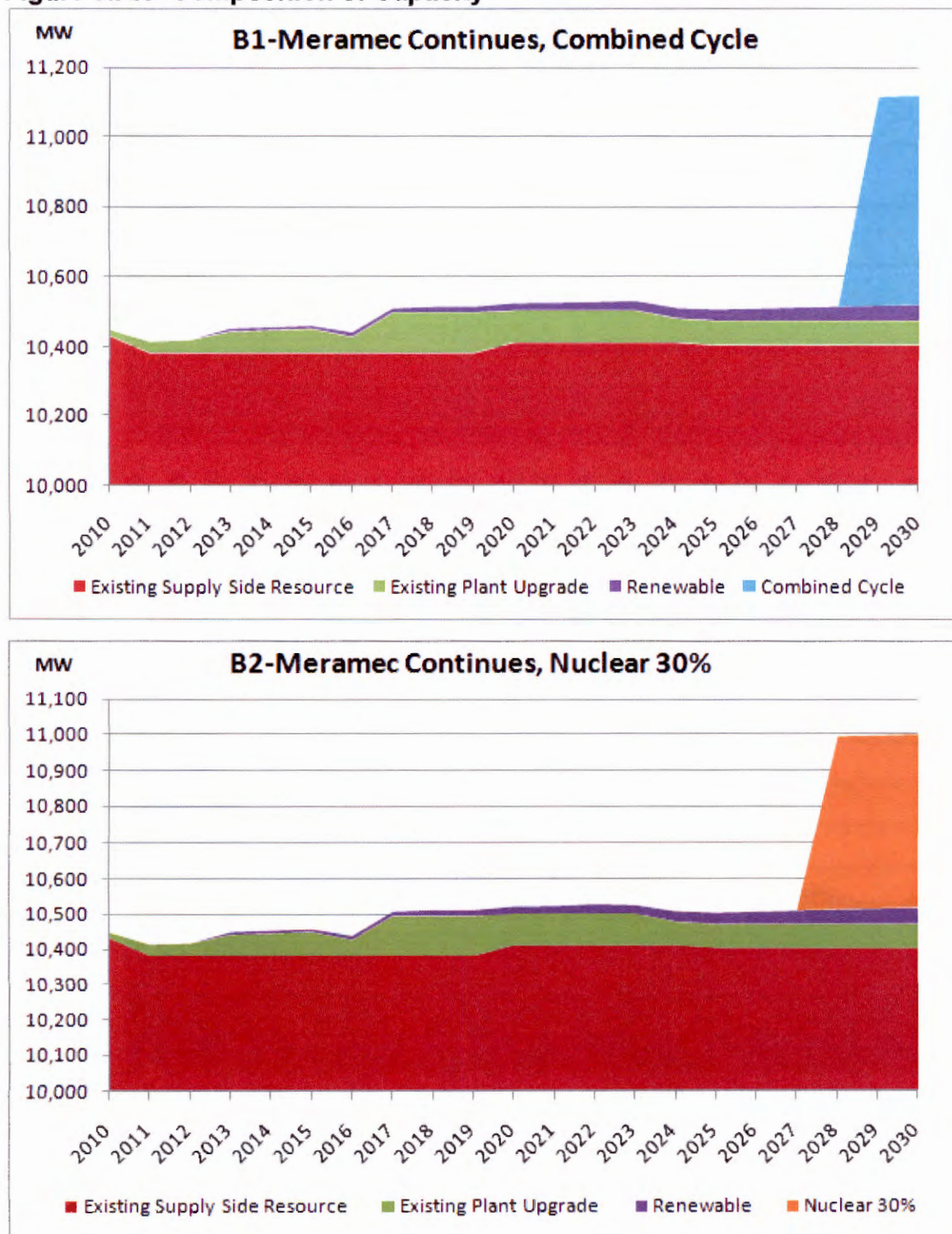
Figure 9.A.3 Stacked Programs for RAP DSM Capacity⁴

⁴ 4 CSR 240-22.060(6)(C)2.
14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

Figure 9.A.4 Stacked Programs for Low Risk DSM Capacity⁵

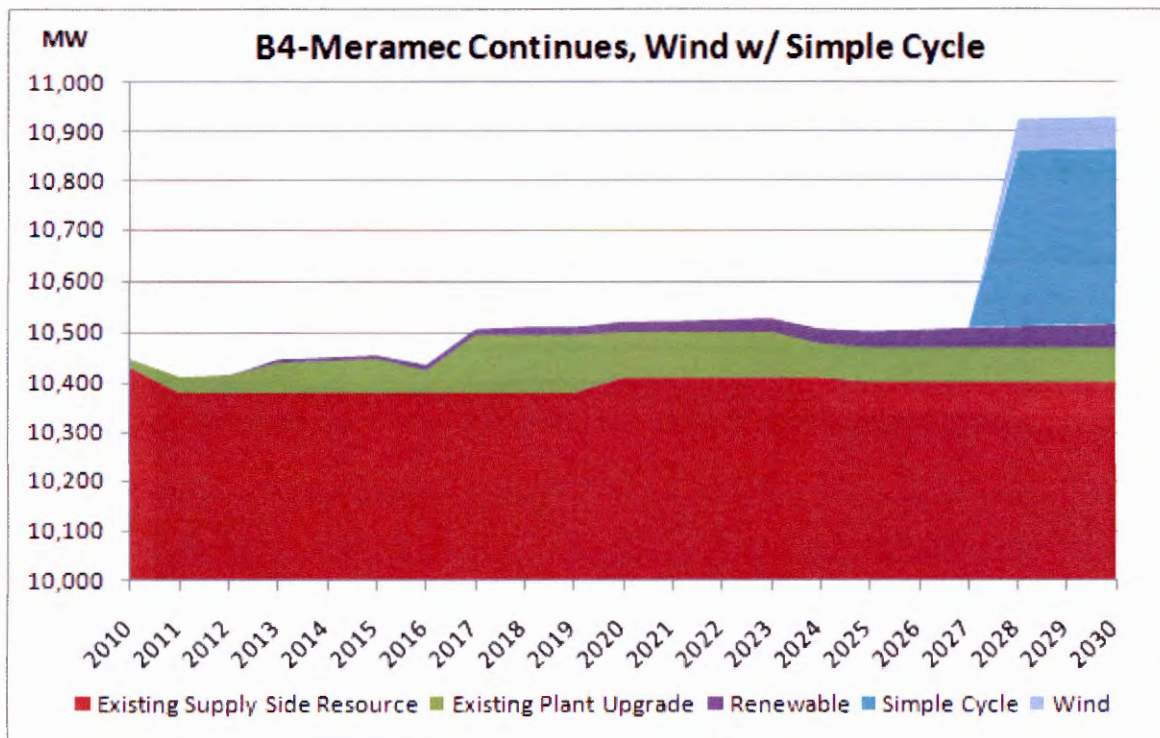
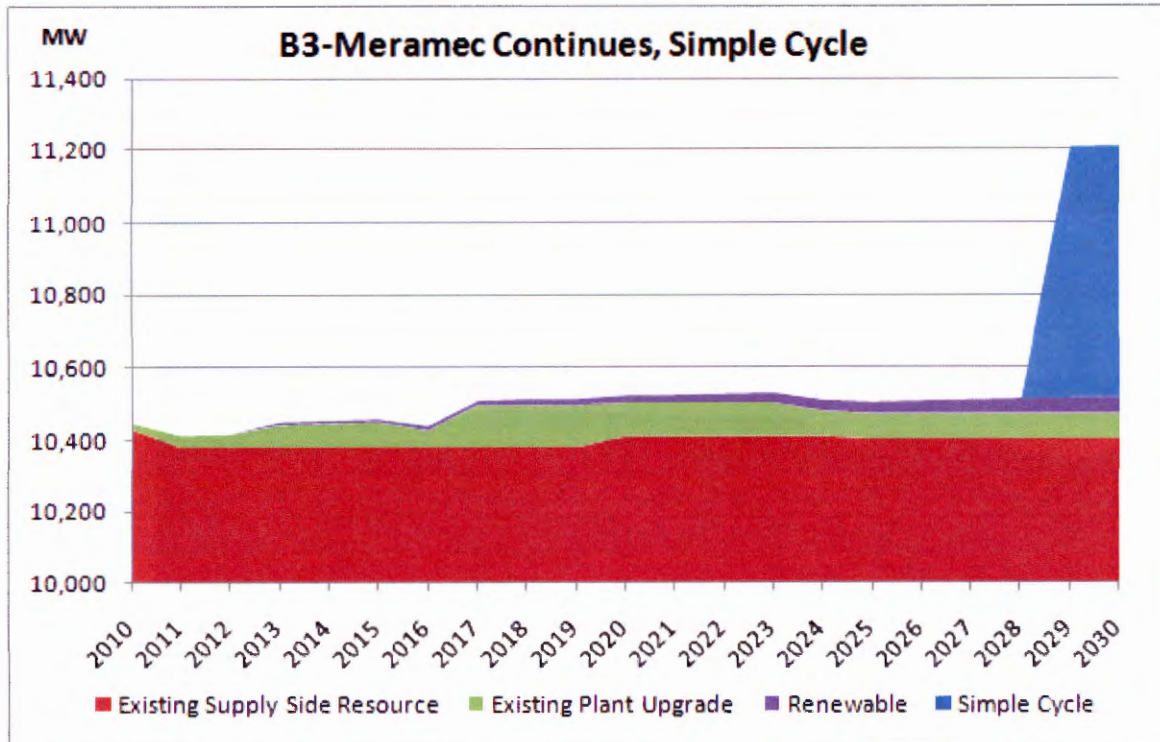
⁵ 4 CSR 240-22.060(6)(C)2.

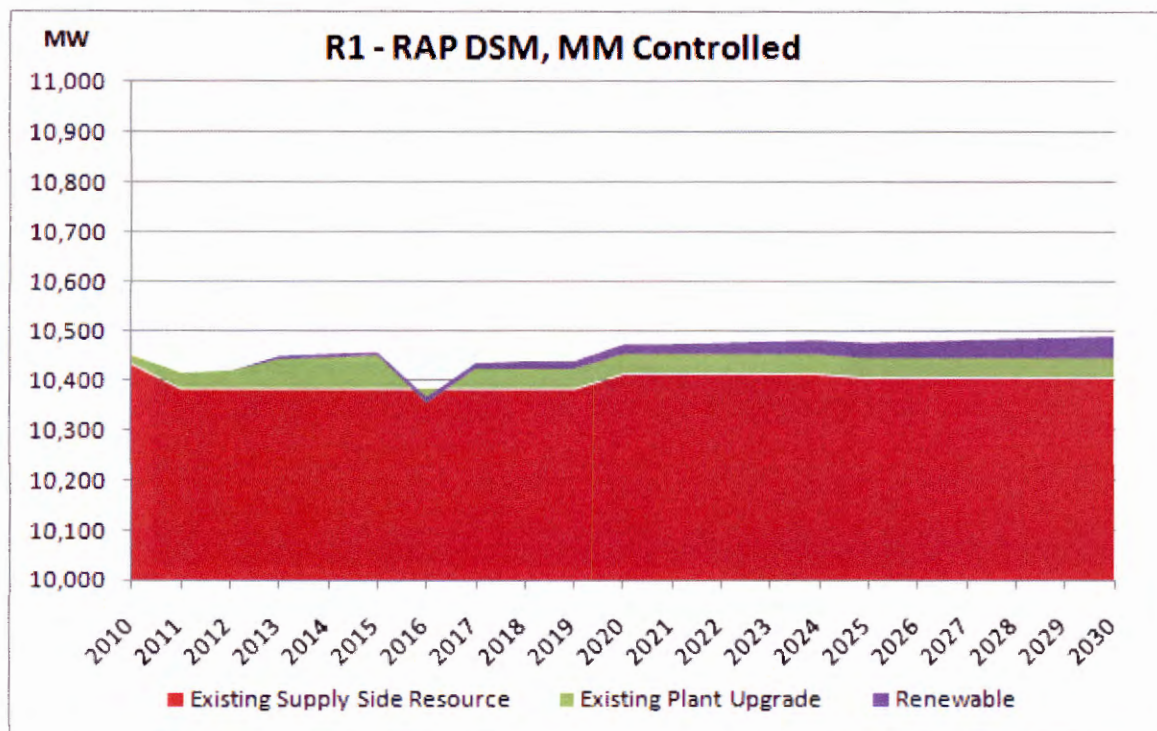
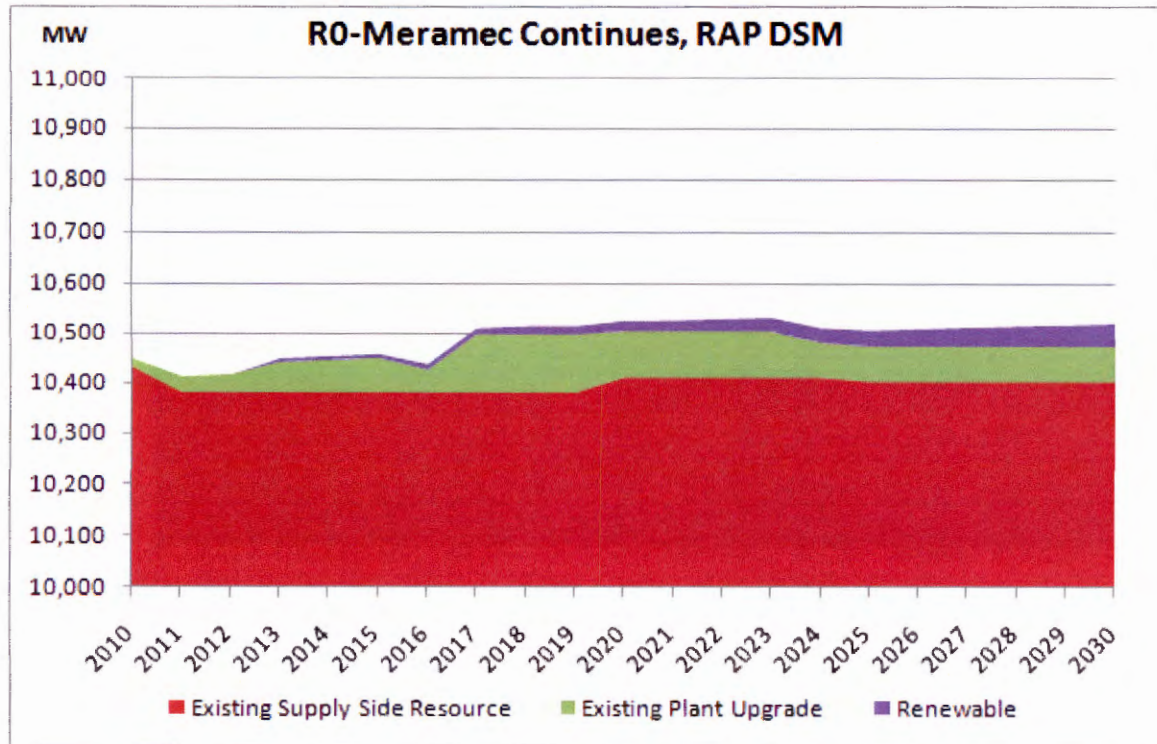
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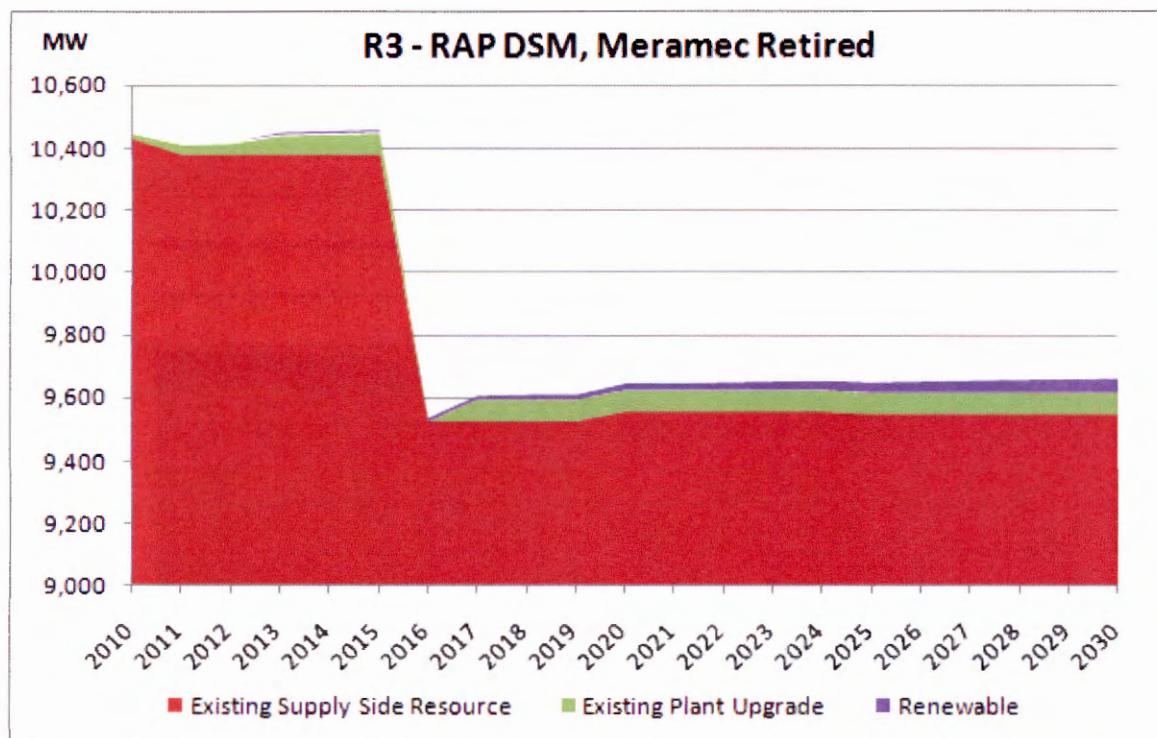
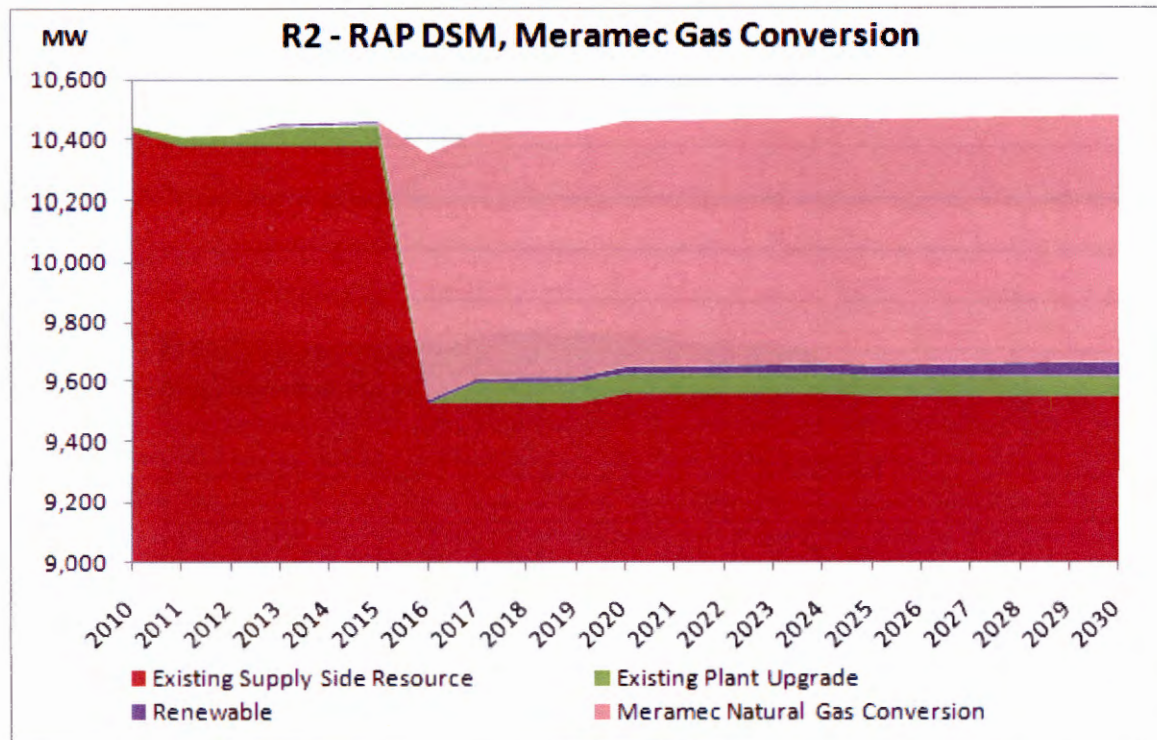
Figure 9.A.5 Composition of Capacity⁶

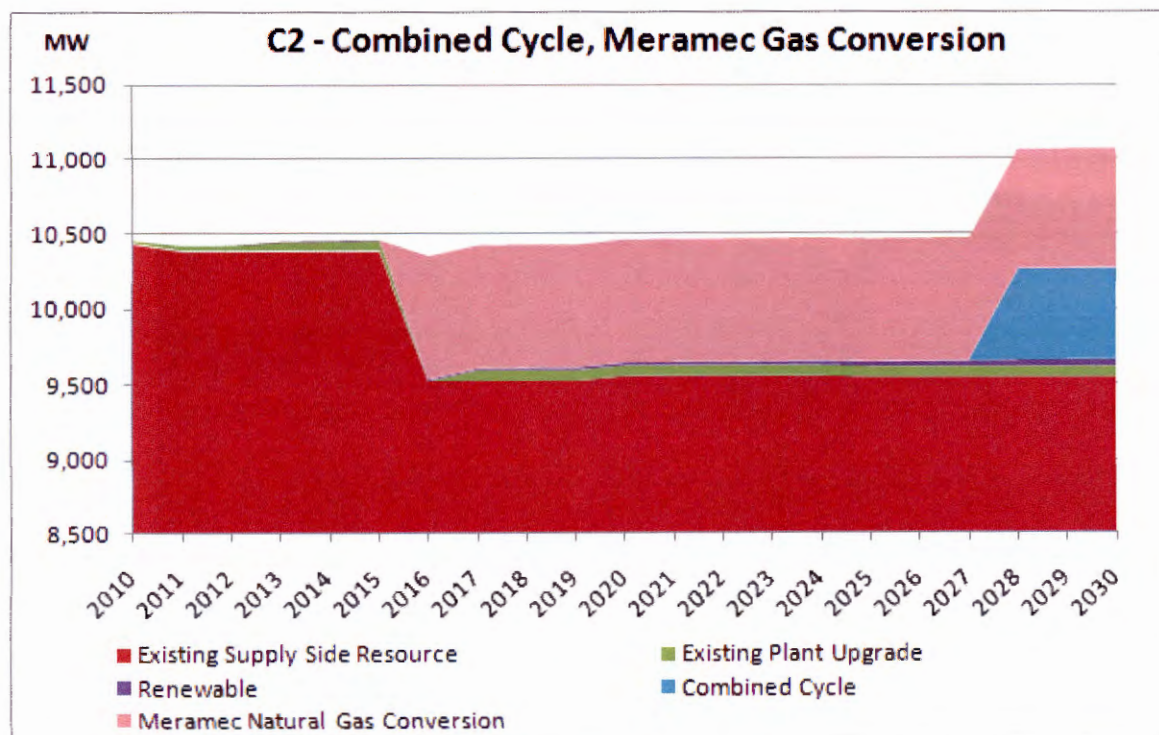
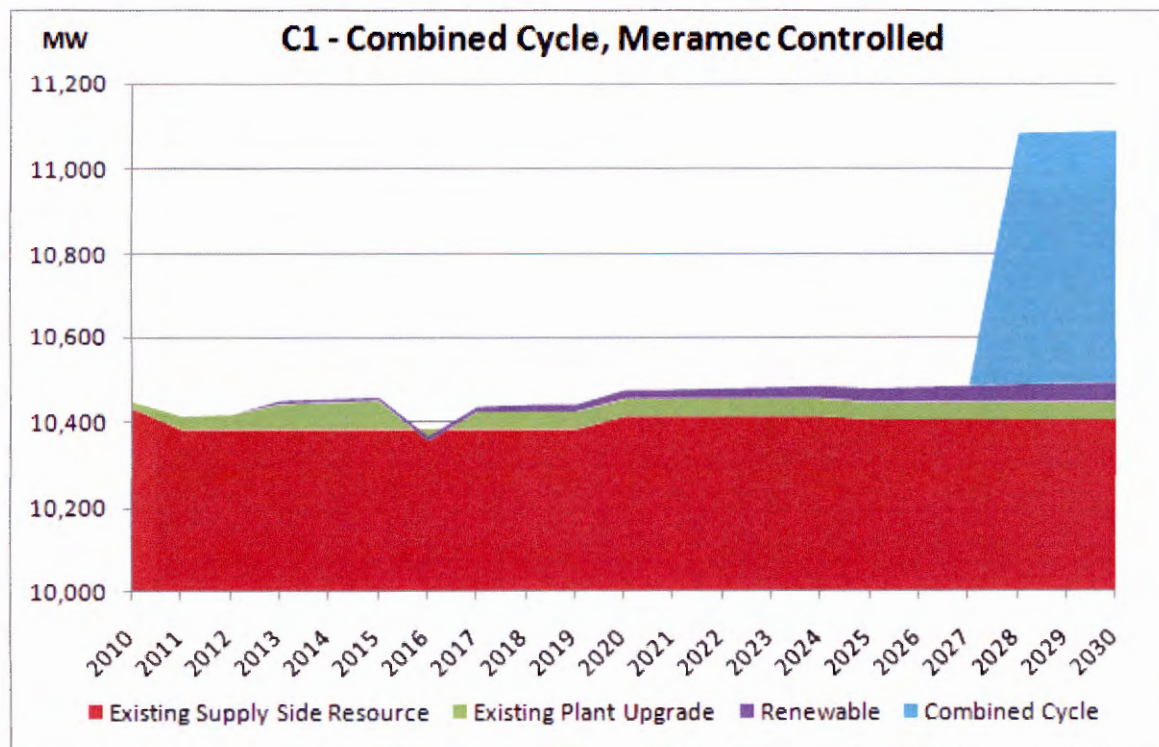
⁶ 4 CSR 240-22.060(6)(C)3.

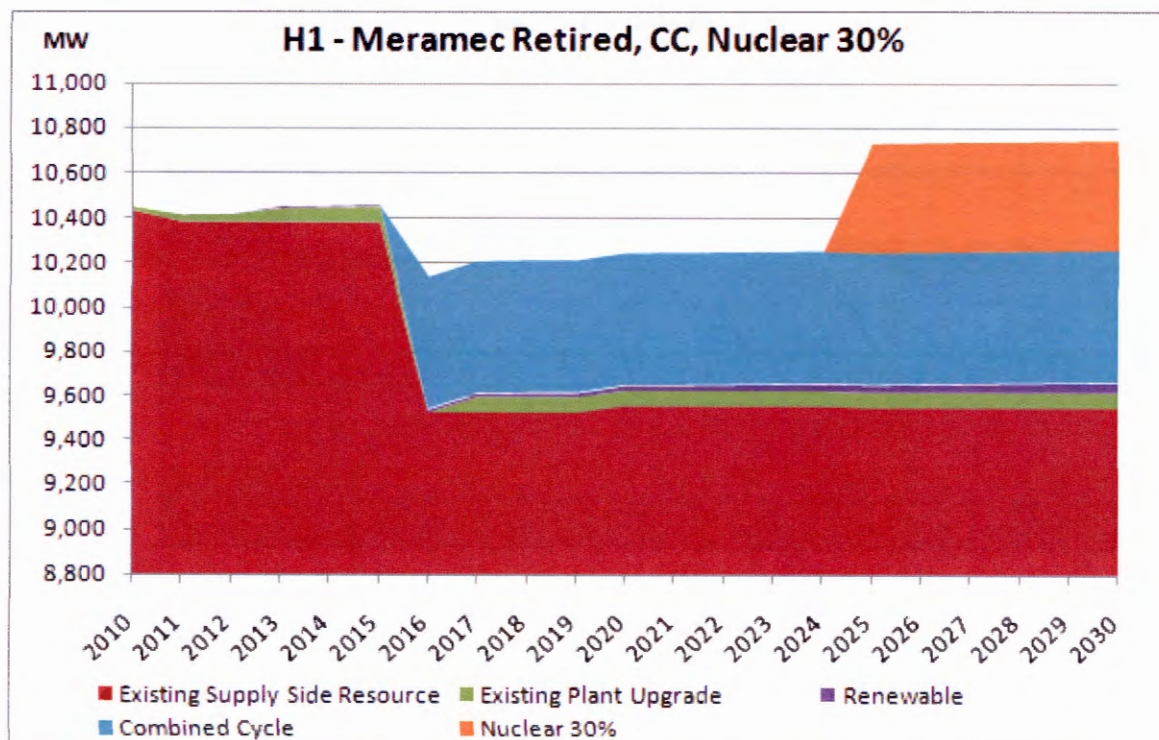
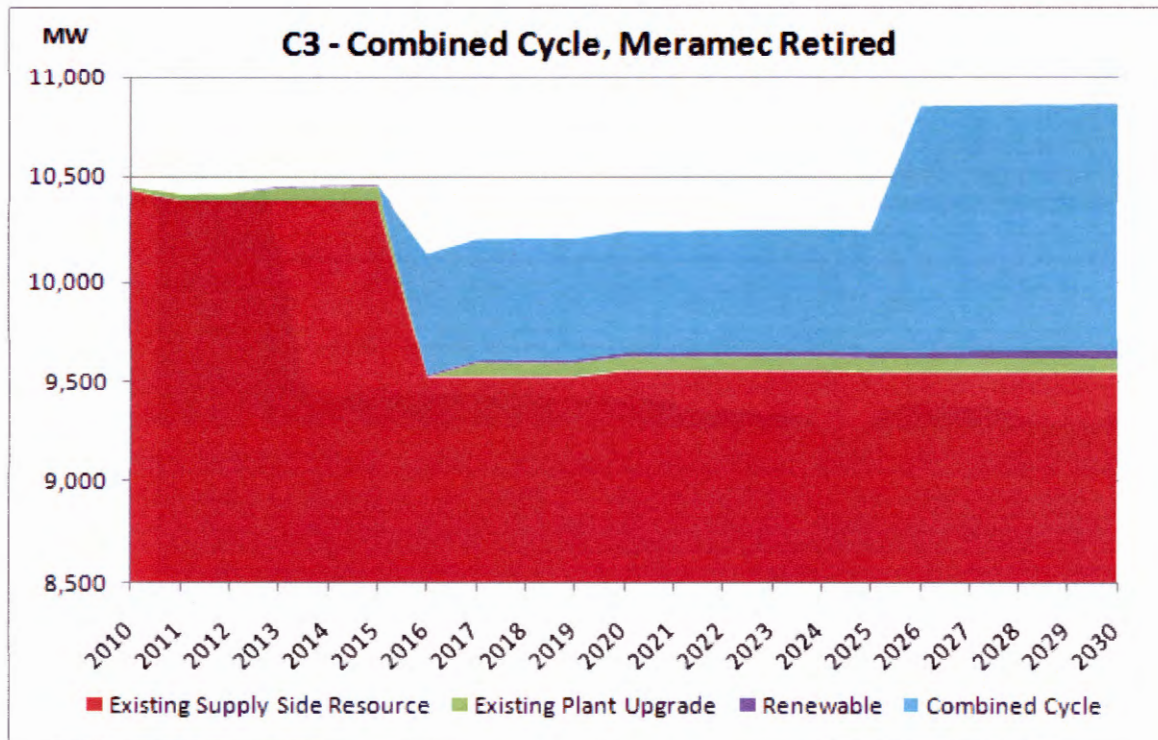
14 candidate resource plans - 060(6)(C)(3).xlsm











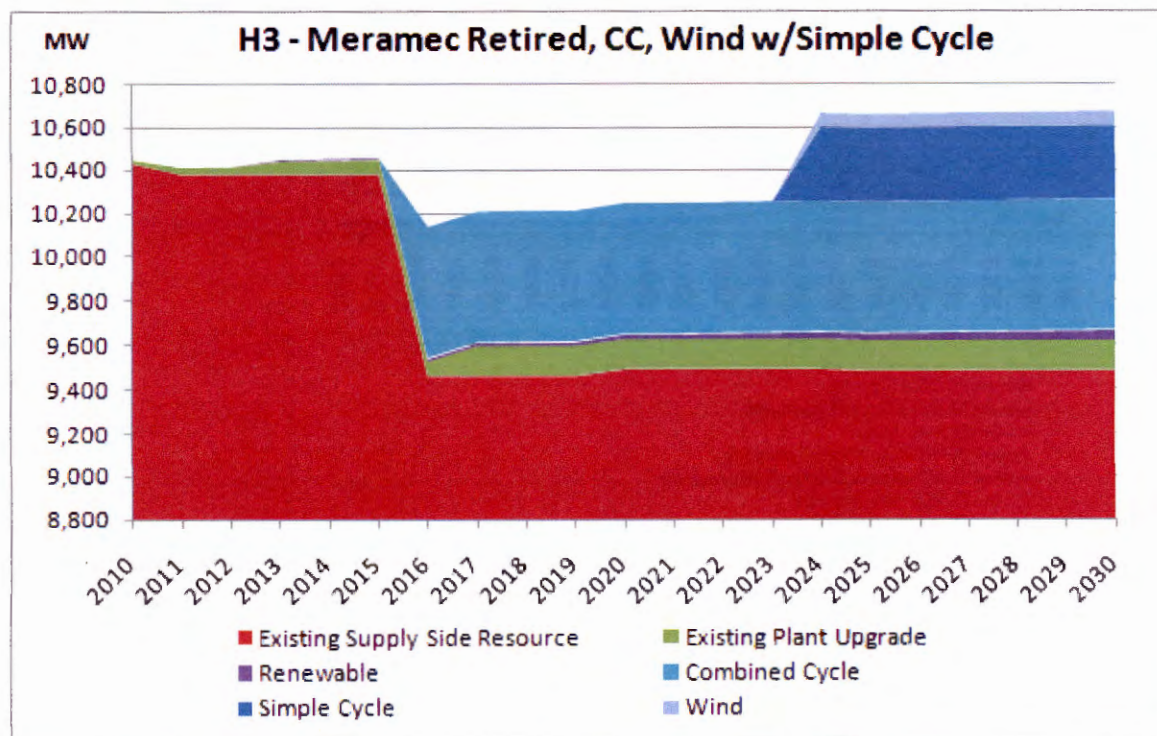
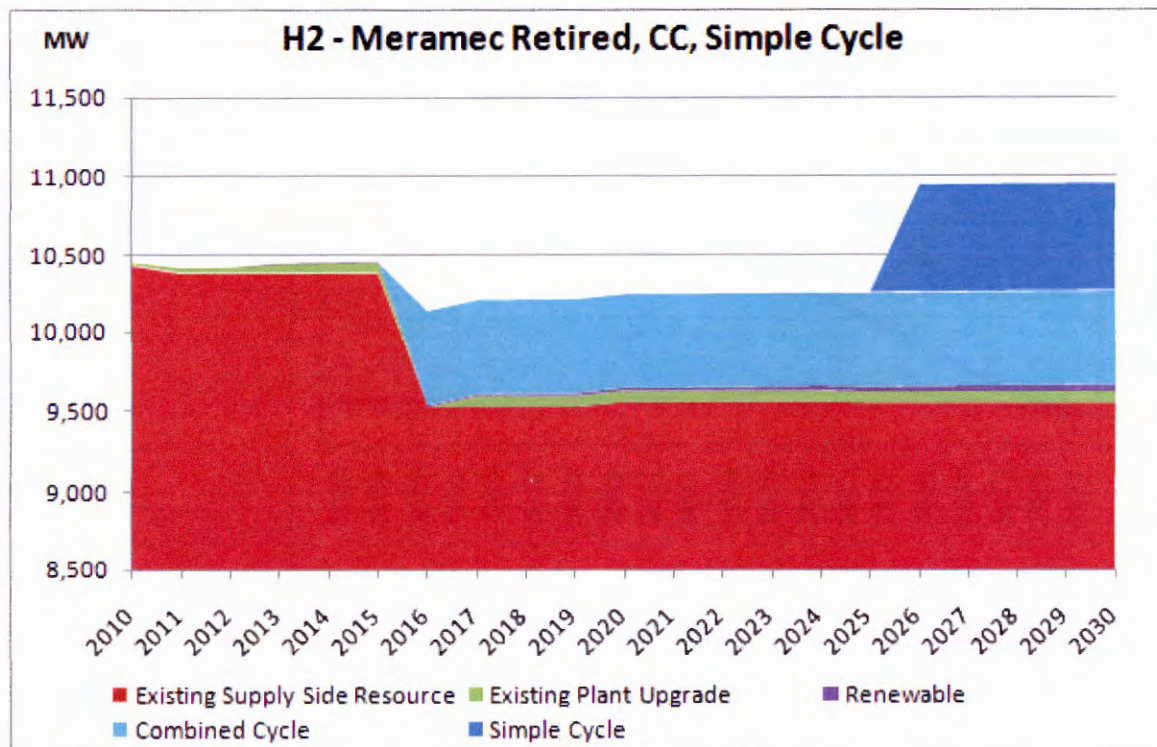
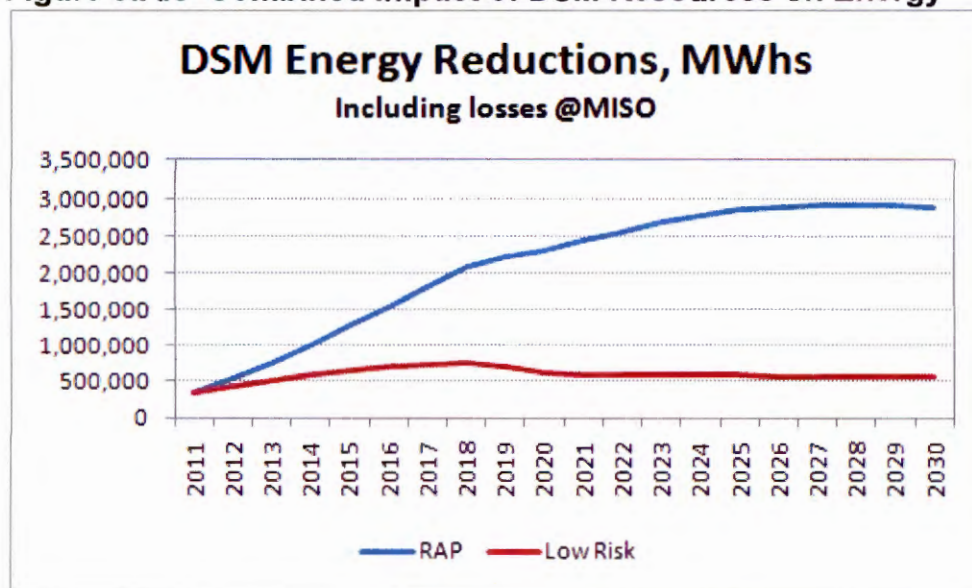
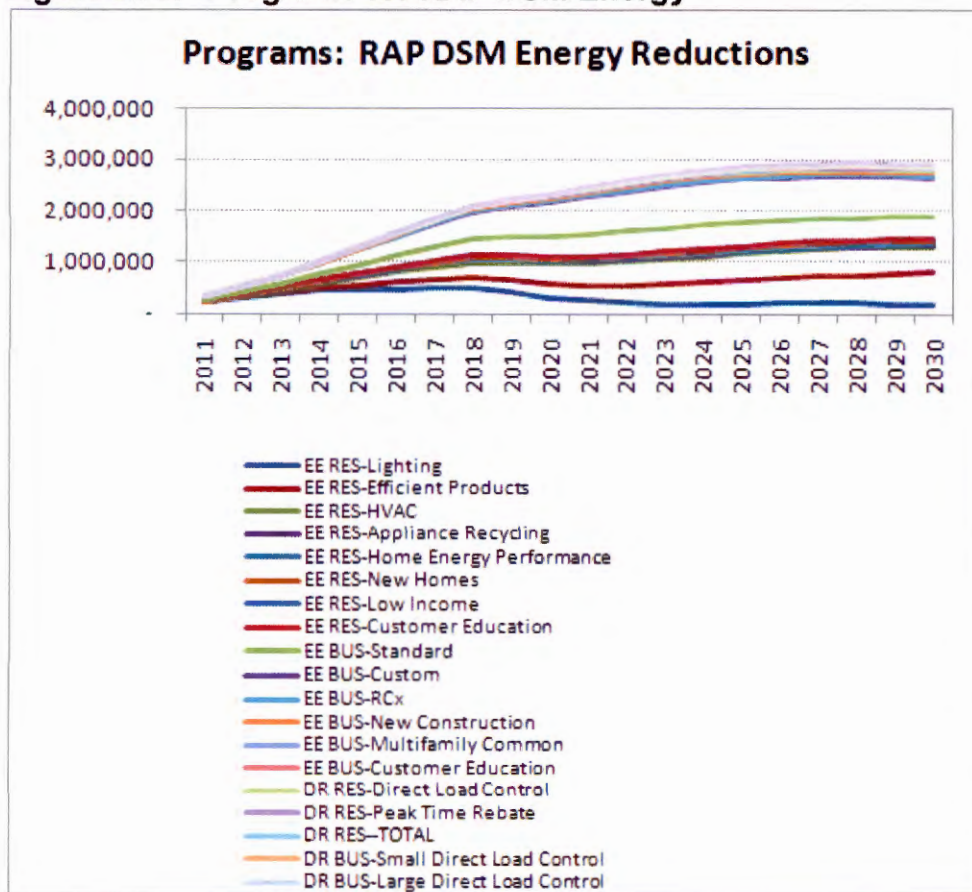
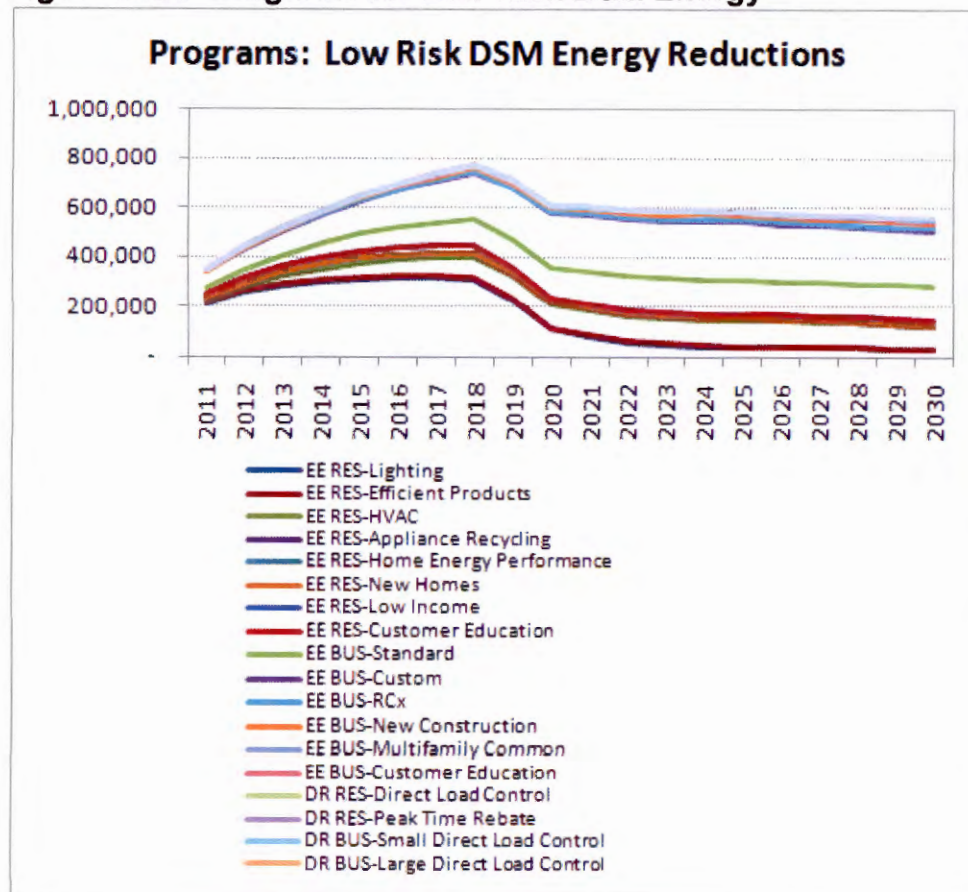
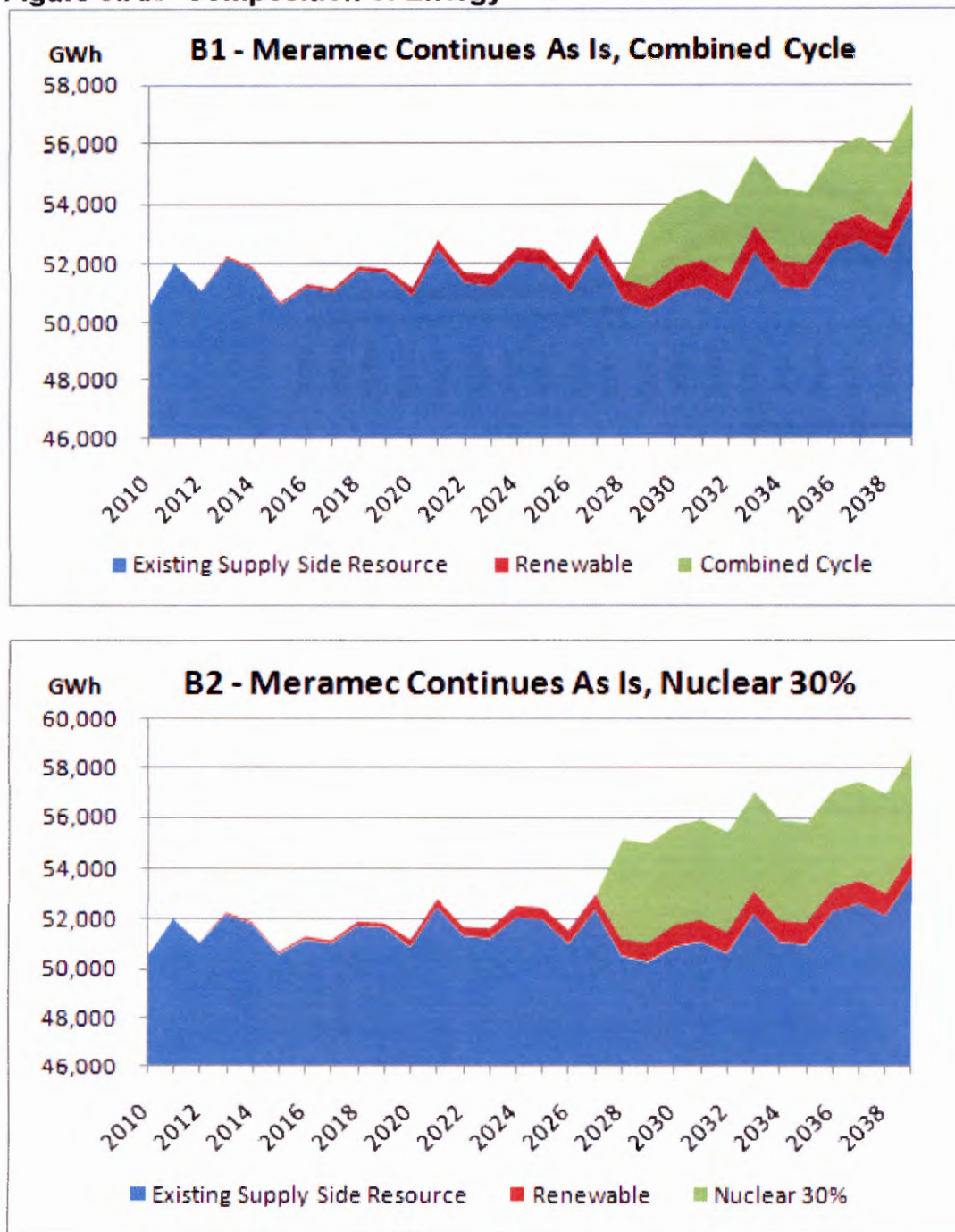


Figure 9.A.6 Combined Impact of DSM Resources on Energy⁷Figure 9.A.7 Programs for RAP DSM Energy⁸⁷ 4 CSR 240-22.060(6)(C)4.⁸ 4 CSR 240-22.060(6)(C)5.

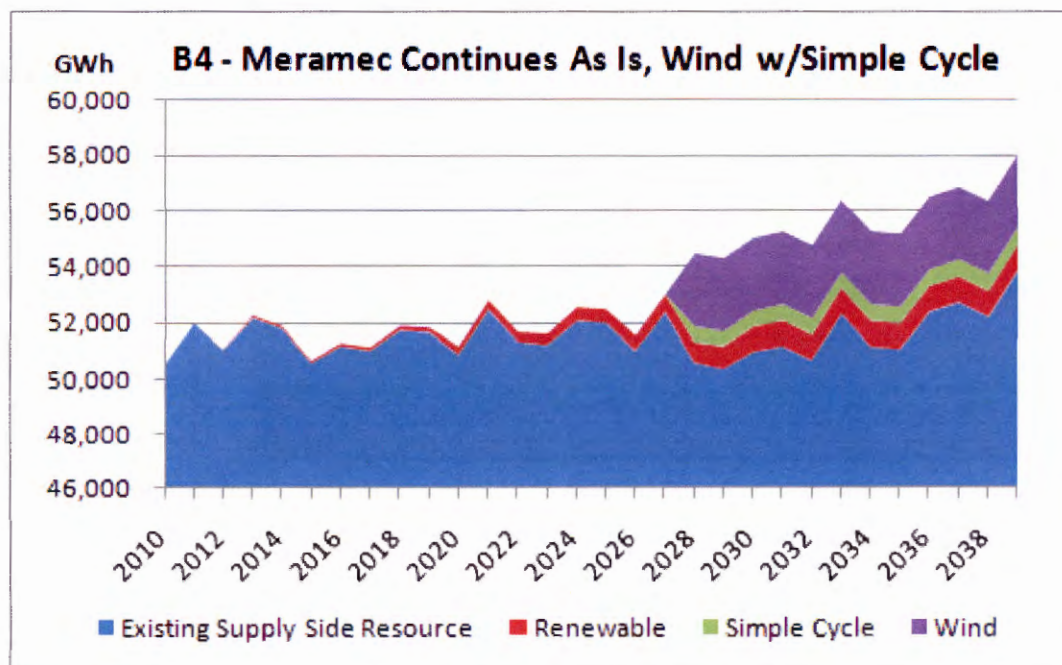
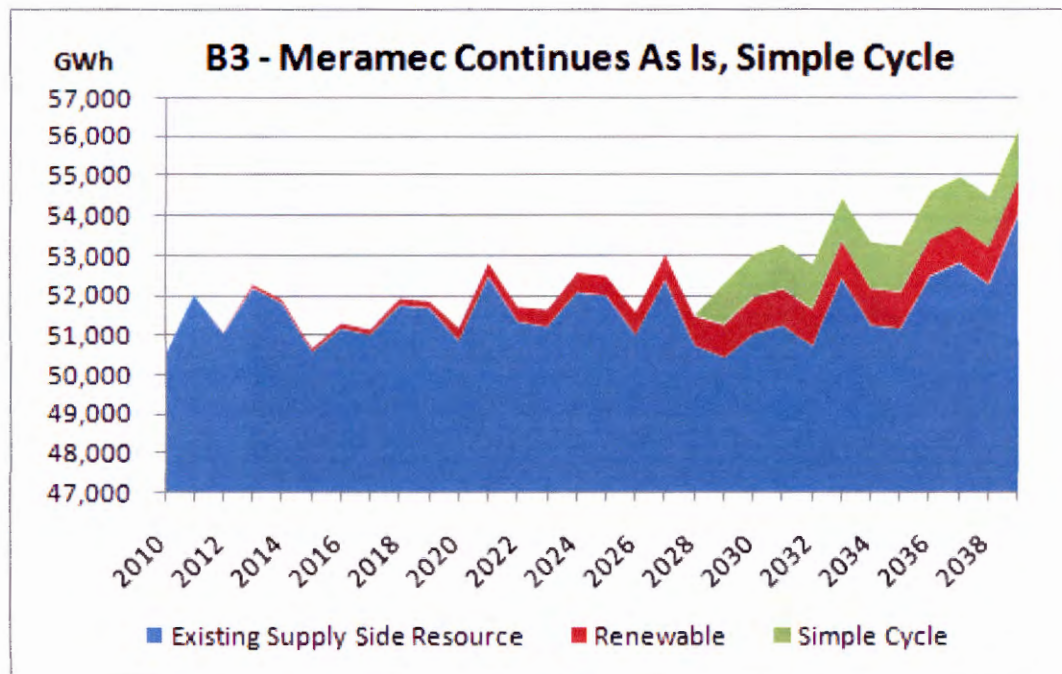
14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

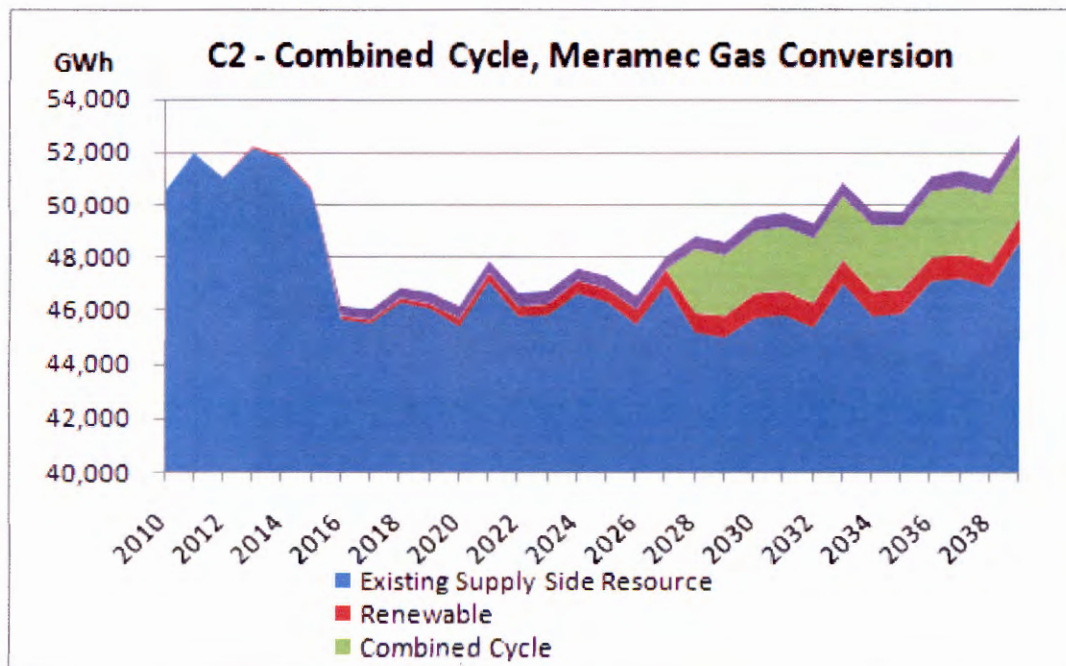
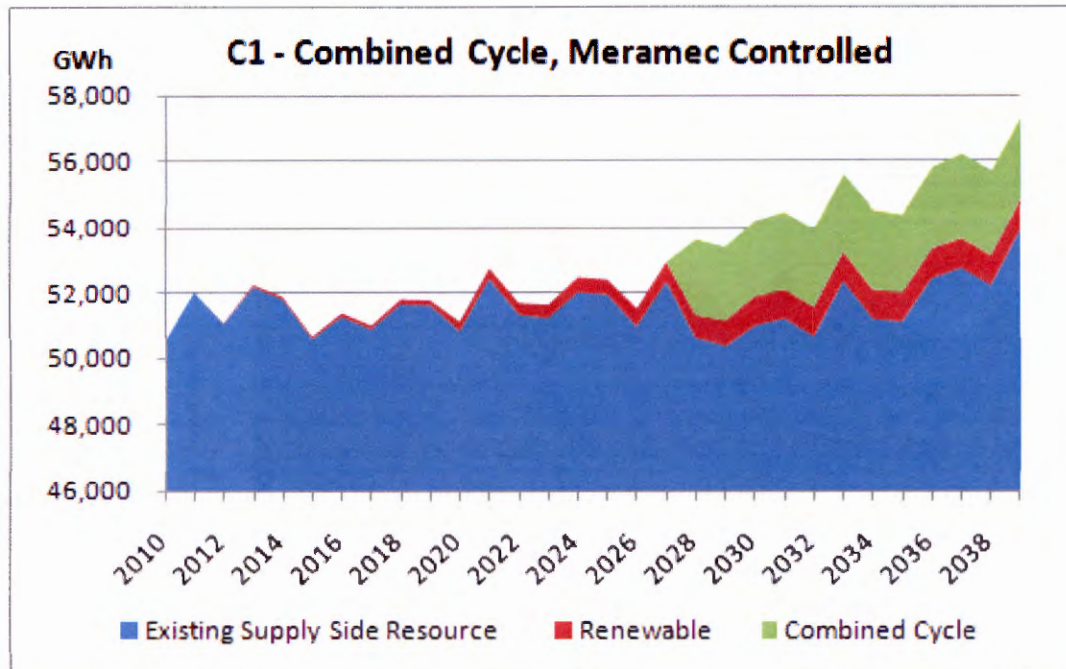
Figure 9.A.8 Programs for Low Risk DSM Energy⁹⁹ 4 CSR 240-22.060(6)(C)5.

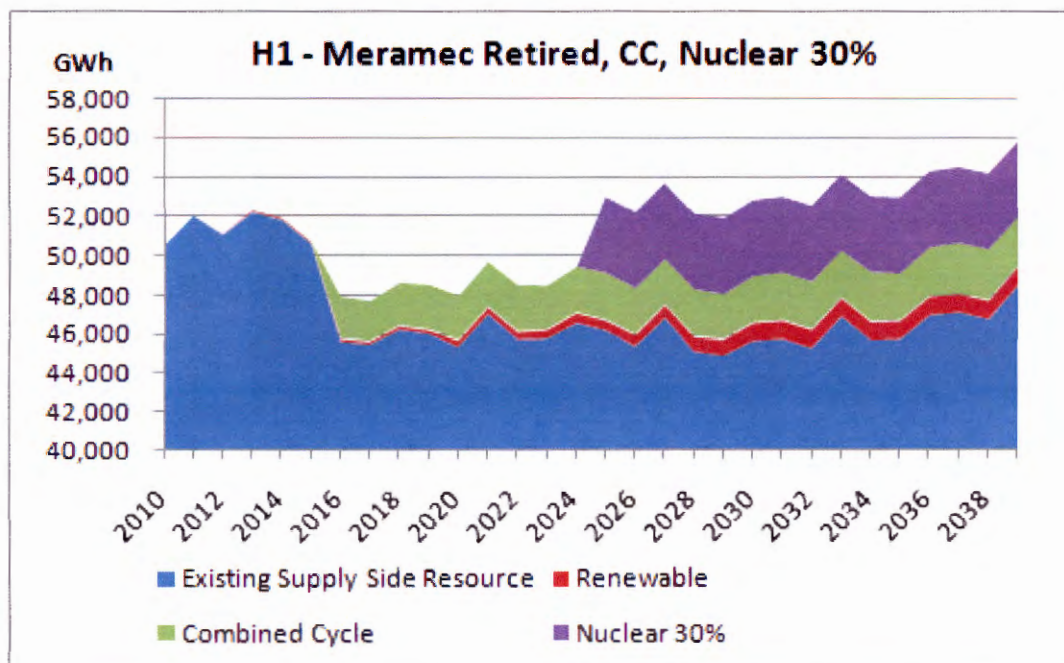
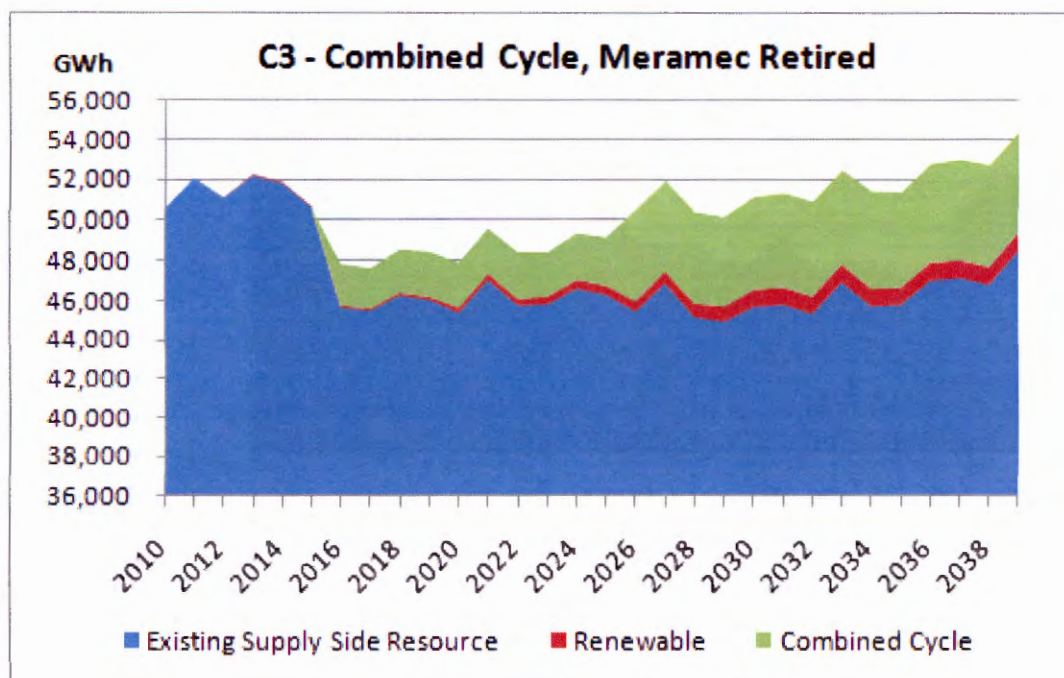
14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

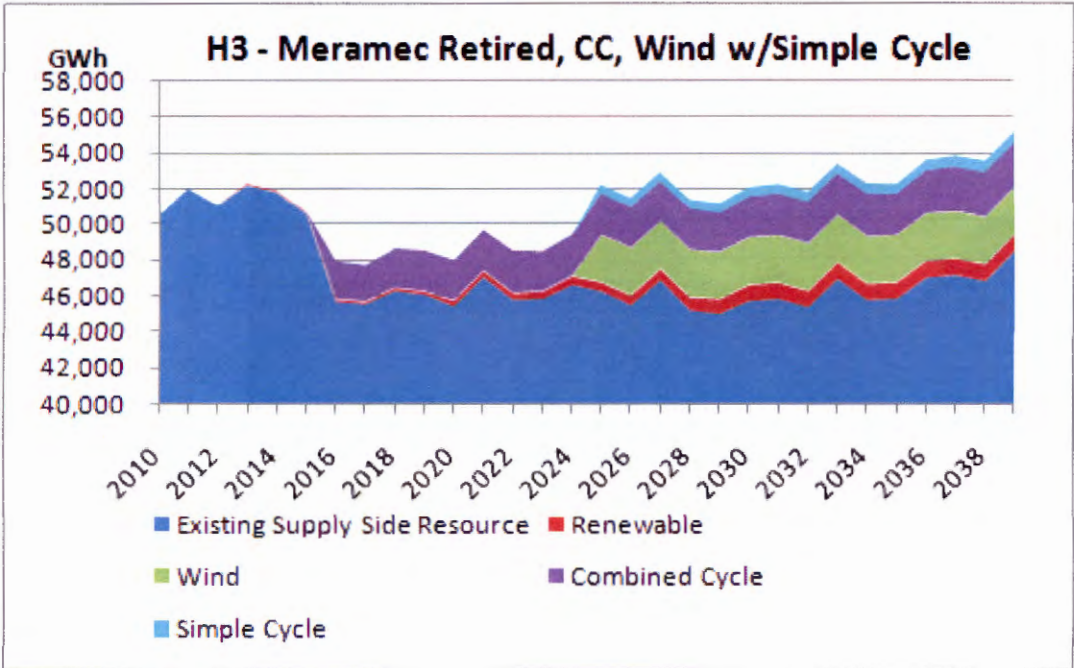
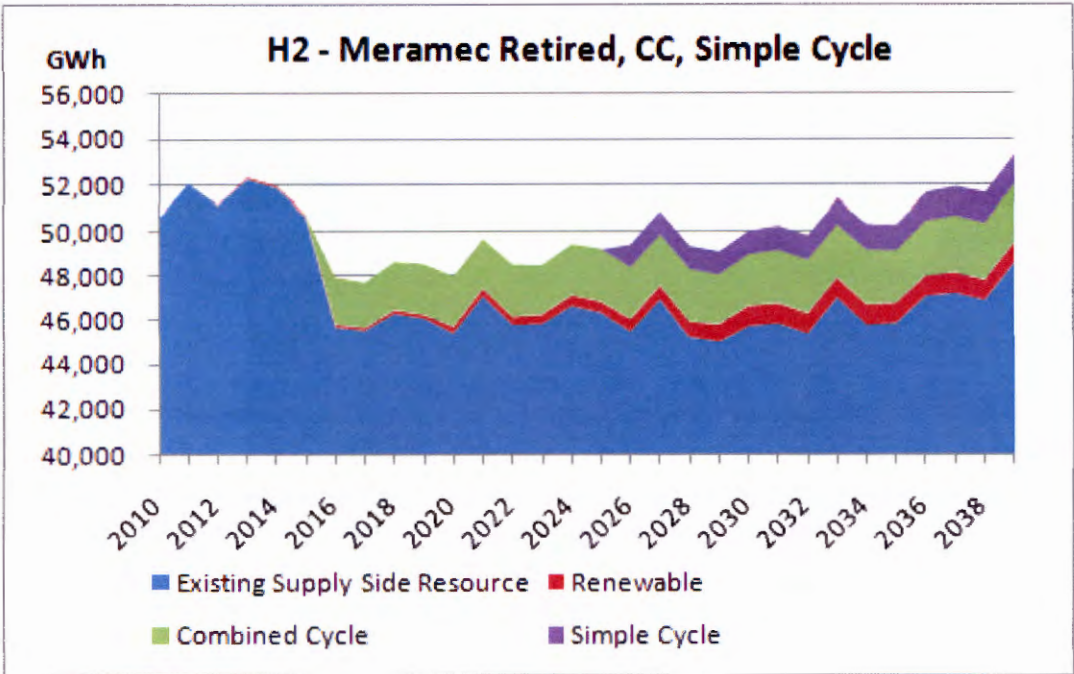
Figure 9.A.9 Composition of Energy¹⁰

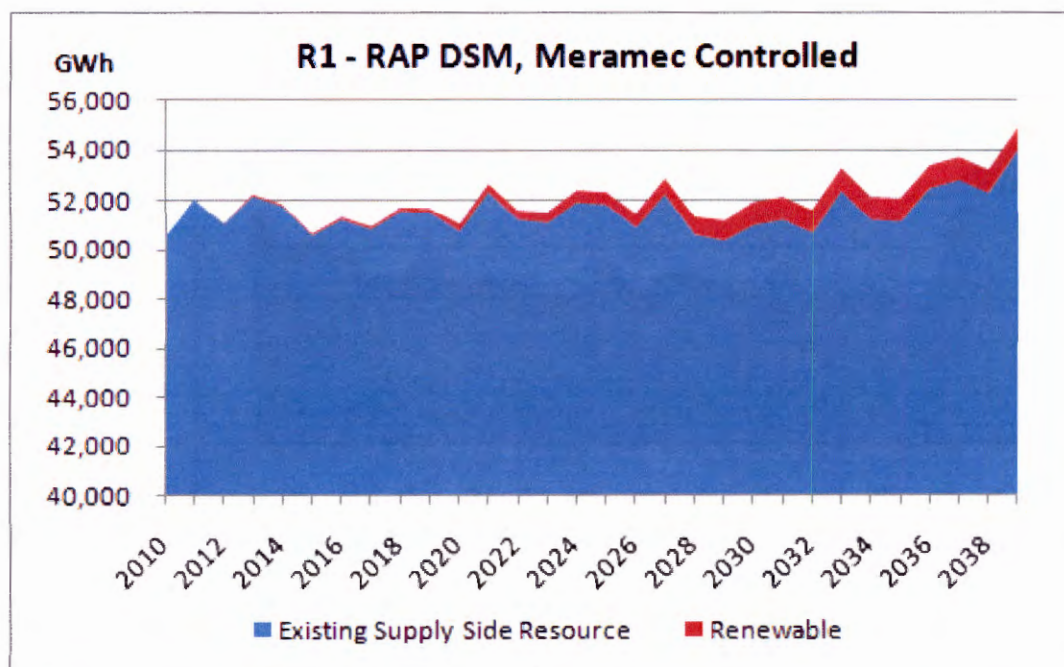
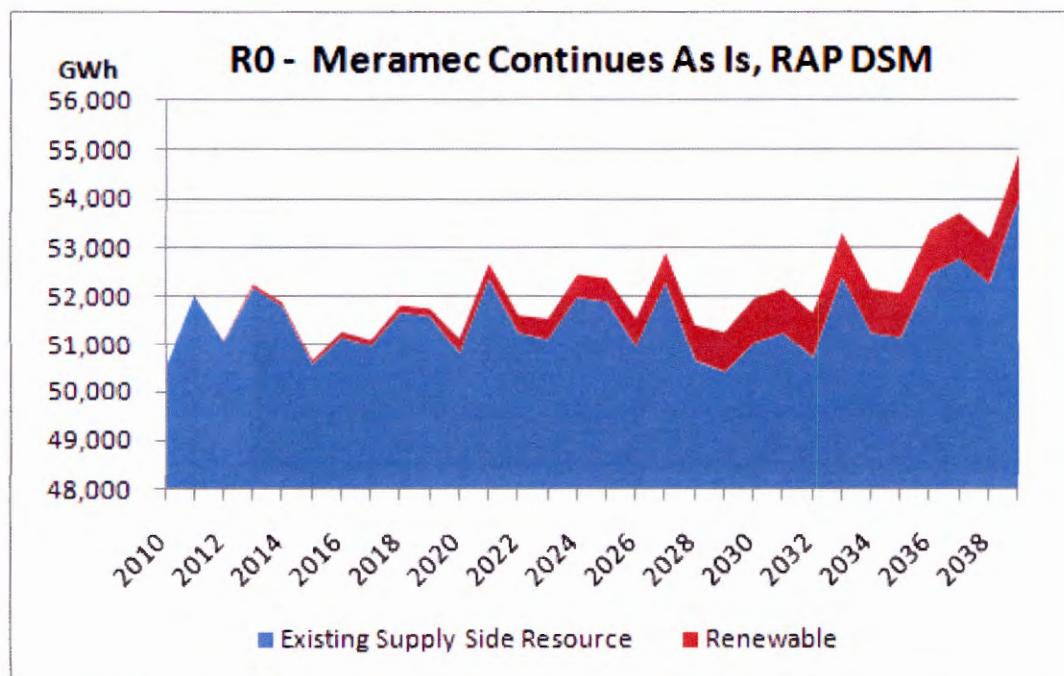
¹⁰ 4 CSR 240-22.060(6)(C)6.
14 candidate resource plans - 060(6)(C)(6).xlsx











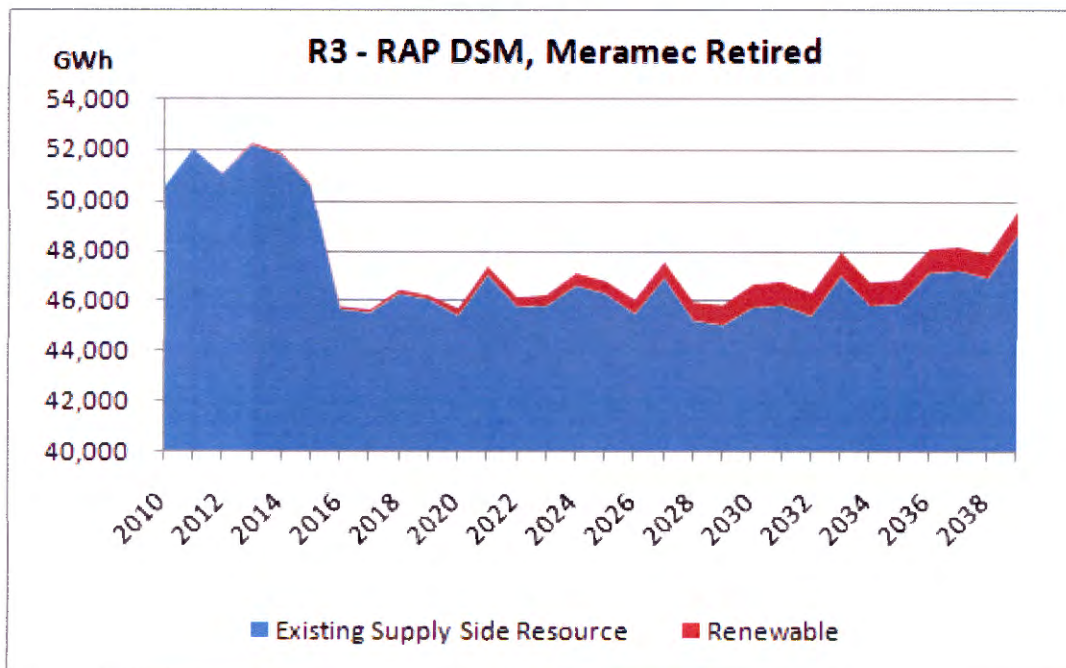
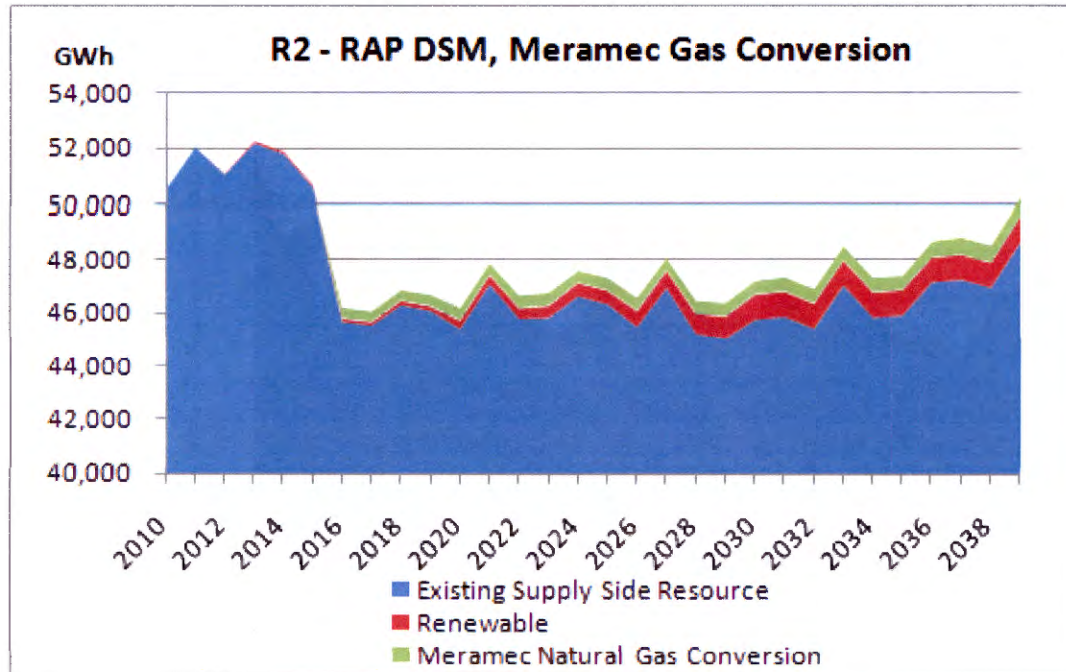
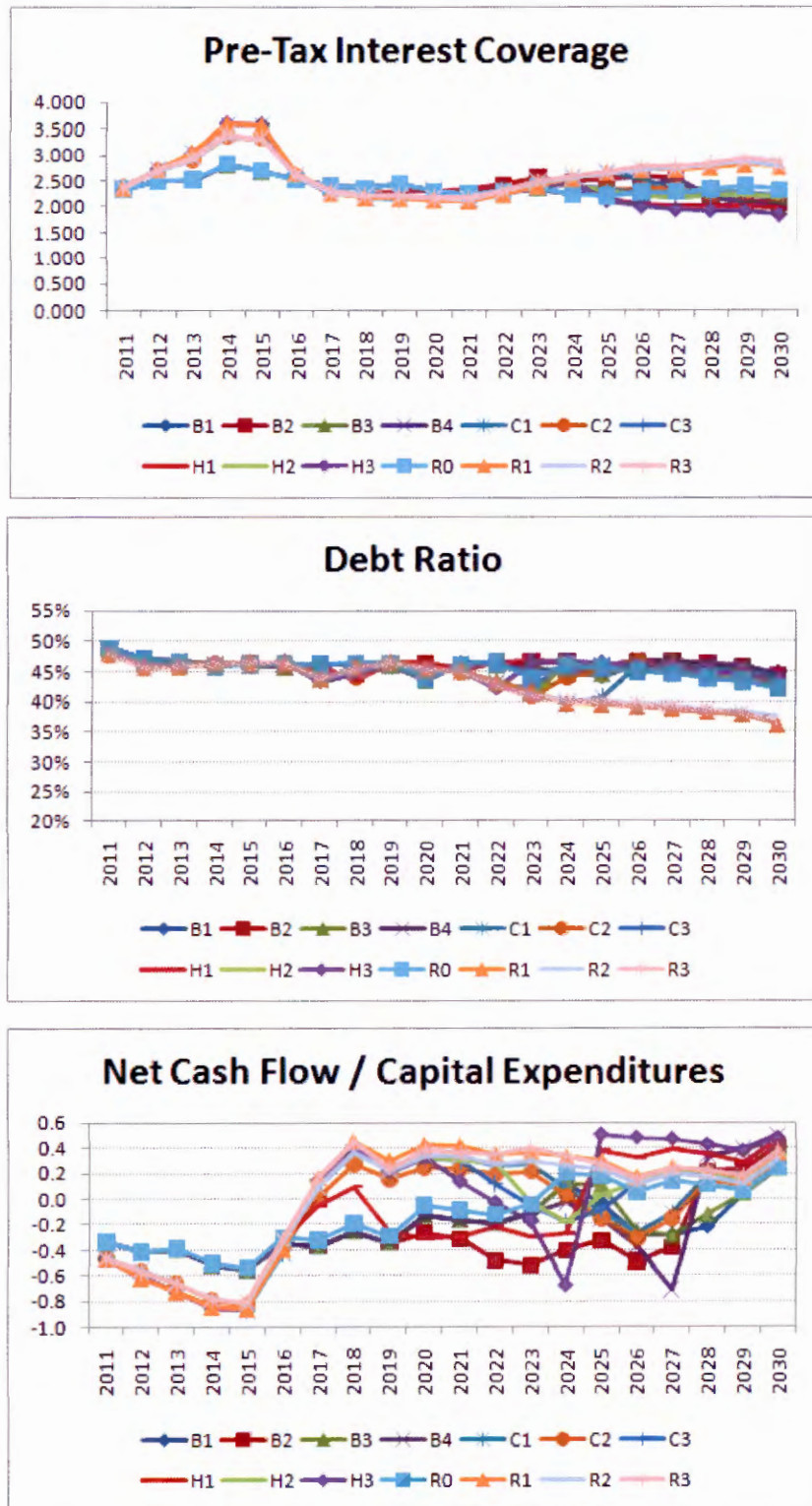
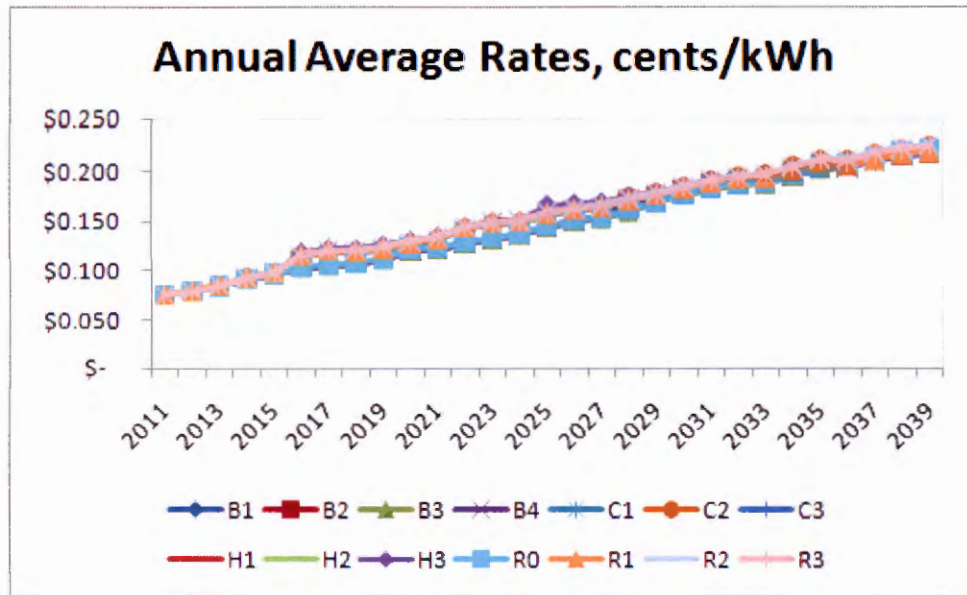


Figure 9.A.10 Financial Measures¹¹¹¹ 4 CSR 240-22.060(6)(C)7.

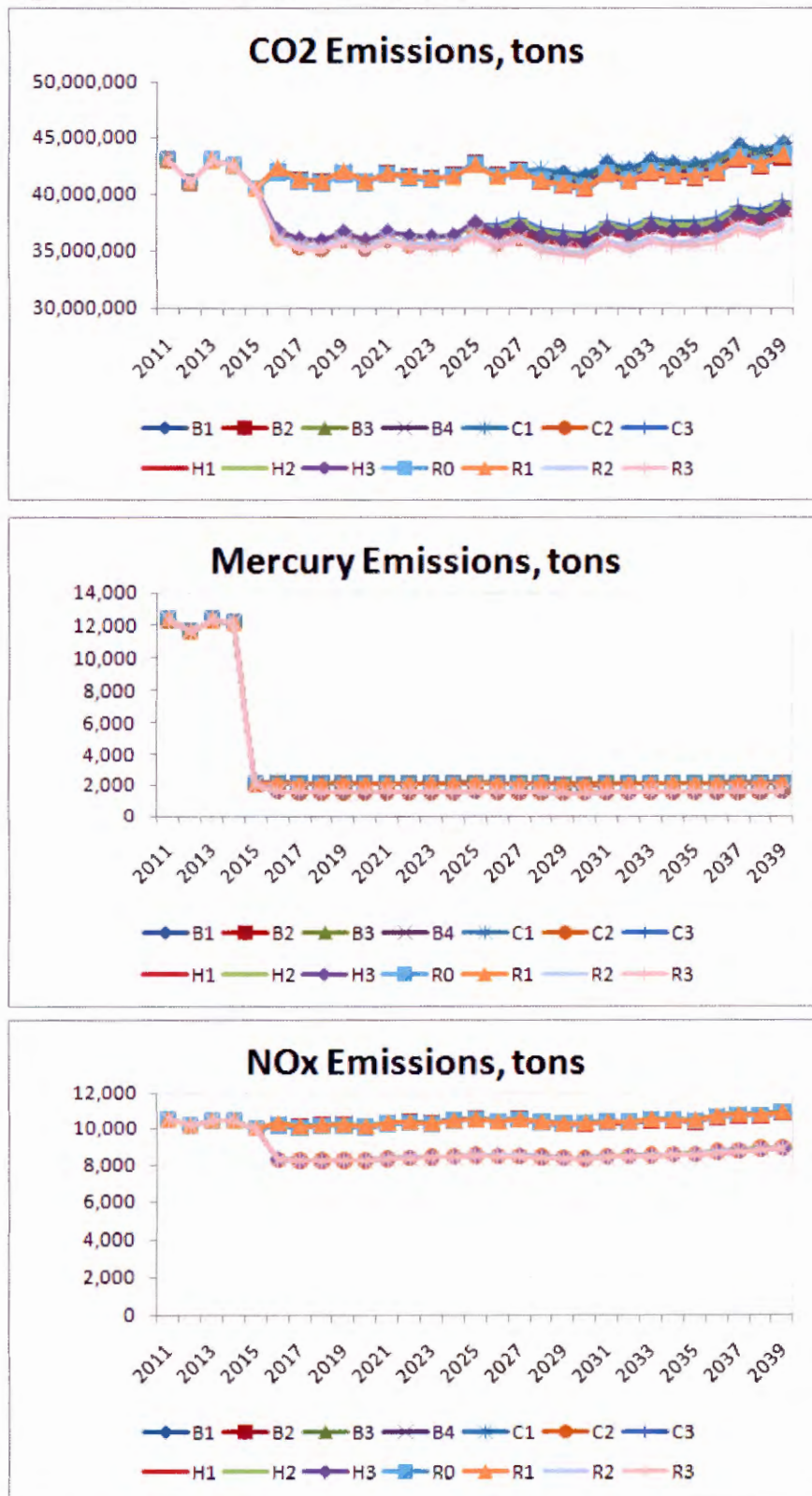
14 candidate resource plans - 060(6)(C)(7).xlsx

Figure 9.A.11 Annual Average Rates¹²



¹² 4 CSR 240-22.060(6)(C)8.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

Figure 9.A.12 Annual Emissions¹³¹³ 4 CSR 240-22.060(6)(C)9.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

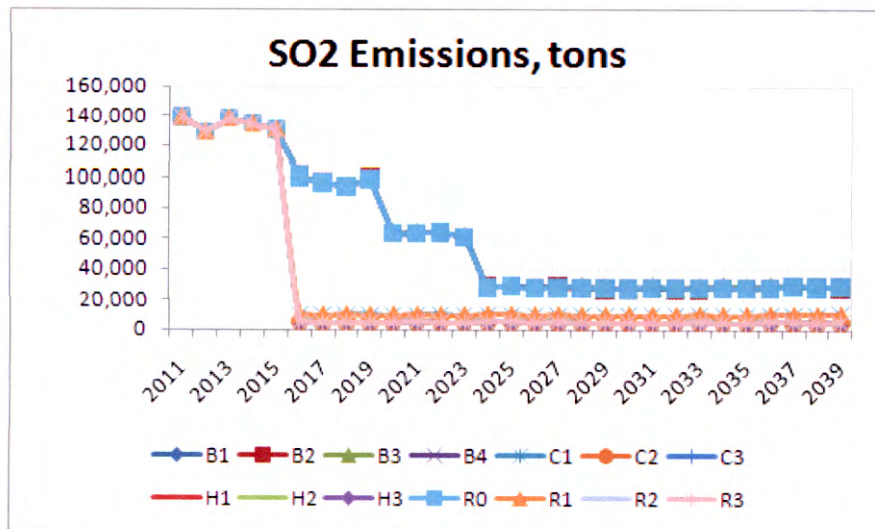
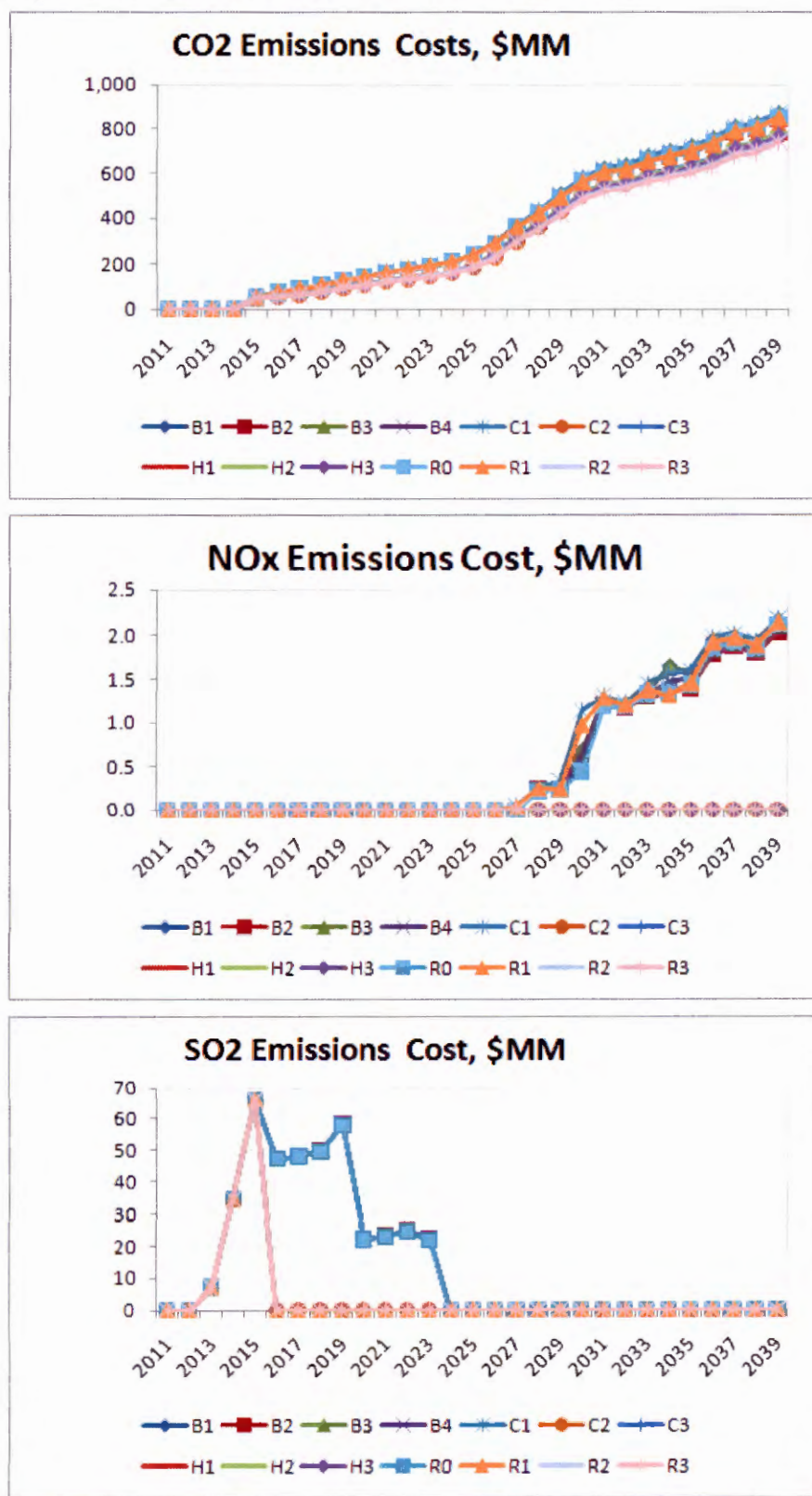


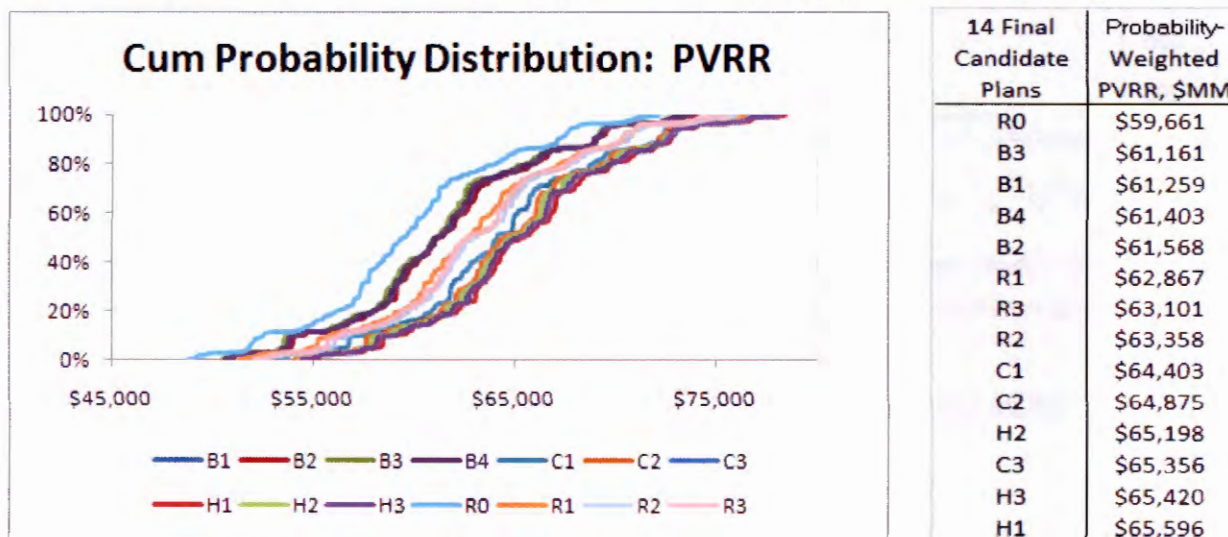
Figure 9.A.13 Probable Environmental Costs¹⁴¹⁴ 4 CSR 240-22.060(6)(C)10.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

Selected Performance Measures¹⁵

The CDF for PVRR is shown in Figure 9.A.144 for the 14 final candidate resource plans, identified by their 2-digit plan codes, while a more summarized measure, the expected value for PVRR is shown in the table next to the chart, in rank order of PVRRs.

Figure 9.A.14 Cum Probability Distribution of PVRR & Probability Weighted PVRR



Both the chart and the table provide the same ranking results, but it was more difficult to reach a conclusion using the CDF lines compared to using the single number for the expected values. This was because a conclusion using CDF lines required evaluating how all 270 points on each line compared the 270 points on each of the other CDF lines, how much of each line was to the left (better) of any other line, how each line started and ended compared to the start and end of other CDF lines, and the overall tendency of each CDF line. By comparison, the expected value for each line captured all of this information in a single number; essentially the CDF lines and the expected values were the same data in two different formats.

Since it was more difficult to make conclusions using CDFs than by using expected values, Ameren Missouri first examined the ranks of these plans using expected values for these 5 measures. The data for these 5 measures and their ranks on each measure are shown in Table 9.A.. This table is arranged in ascending rank order of PVRRs.

¹⁵ 4 CSR 240-22.070(5); 4 CSR 240-22.070(11)(B)

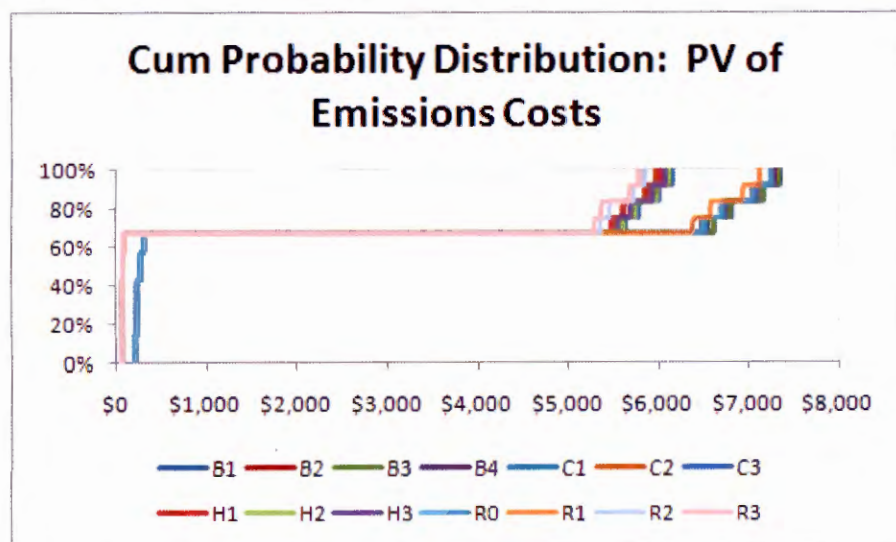
Table 9.A.2 Expected Values and Rank Order for Selected Performance Measures

14 Final Candidate Plans	Expected Value of PVRR, \$MM	Expected Value of PV of Emissions Costs, \$MM	Expected Value of Costs for DSM Participants, \$MM	Expected Value for Levelized Annual Rates	Expected Value for Maximum Single Year Rate Increase	Rank on				
						PVRR	Emissions	DSM Costs	Rates	Rate Increase
R0	\$59,661	\$2,428	\$1,001	\$0.1249	22.1%	1	11	11	3	9
B3	\$61,161	\$2,458	\$162	\$0.1245	21.9%	2	13	1	1	6
B1	\$61,259	\$2,468	\$162	\$0.1247	22.0%	3	14	1	2	8
B4	\$61,403	\$2,443	\$162	\$0.1250	21.8%	4	12	1	4	4
B2	\$61,568	\$2,427	\$162	\$0.1253	21.8%	5	10	1	5	2
R1	\$62,867	\$2,281	\$1,001	\$0.1316	22.0%	6	8	11	7	7
R3	\$63,101	\$1,878	\$1,001	\$0.1321	22.6%	7	1	11	9	13
R2	\$63,358	\$1,899	\$1,001	\$0.1326	22.7%	8	2	11	10	14
C1	\$64,403	\$2,323	\$162	\$0.1311	21.7%	9	9	1	6	1
C2	\$64,875	\$1,940	\$162	\$0.1320	22.5%	10	3	1	8	12
H2	\$65,198	\$1,981	\$162	\$0.1327	22.2%	11	6	1	11	10
C3	\$65,356	\$1,994	\$162	\$0.1330	22.2%	12	7	1	12	11
H3	\$65,420	\$1,965	\$162	\$0.1331	21.9%	13	5	1	13	5
H1	\$65,596	\$1,947	\$162	\$0.1334	21.8%	14	4	1	14	3
Min	\$59,661	\$1,878	\$162	\$0.1245	21.7%					
Max	\$65,596	\$2,468	\$1,001	\$0.1334	22.7%					
Range	\$5,935	\$590	\$839	\$0.0089	1.0%					
Avg	\$63,230	\$2,174	\$402	\$0.1297	22.1%					
StDev	\$1,962	\$246	\$393	\$0.0038	0.3%					

PV items are dollars in millions

The expected values for 1 of the 4 measures besides PVRR, levelized annual average rates, had essentially the same rank order as the PVRR rank order, so no CDF was produced for this measure.

Two of the remaining 3 other measures had technical issues that made their rank meaningless or not useful. The technical issue for DSM costs was that there were only 2 possible values for this measure among the 14 plans, so a rank order for this measure would be not very useful. The technical issue for the maximum single-year rate increase was that there was very little variation among the 14 values (minimum of 21.7%, maximum 22.7%) so a ranking on this measure would also not be very useful.

Figure 9.A.15 Cumulative Probability Distribution of PV of Emissions Costs

The final remaining measure besides PVRR, the present value of probable environmental costs, had a substantially different rank order on its expected values versus the rank order of PVRR.

Thus a CDF was developed for this

measure, which is shown in Figure 9.A.155.

Expected Value & Standard Deviations, Selected Performance Measures¹⁶

IRP rules also required expected values and some measure of the dispersion of the probability distribution of the 5 performance measures discussed in the prior section. These are provided in Table 9.A.3 and Table 9.A.4.

Table 9.A.3 Expected Values for Performance Measures

14 Final Candidate	Expected Value of 2011-2039 PVRR, \$MM	Expected Value of PV of 2011-2039 Emissions Costs, \$MM	Expected Value of 2011-2030 Costs for DSM Participants, \$MM	Expected Value for 2011-2039 Levelized Annual Rates	Expected Value for Maximum Single Year Rate Increase 2011-2039	Expected Value of Avg Annual 2011- 2039 Carbon Emissions, MM tons	Expected Value of 2011- 2039 PV of Free Cash Flow, \$MM	Expected Value for 2011- 2039 Average Return on Equity	Net Jobs 2011- 2030 in FTE- Years	Energy Savings 2011-2030, GWH
Plans										
R0	\$59,661	\$2,428	\$1,001	\$0.1249	22.1%	41.8	3,460	12.44%	11,991	41,092
B3	\$61,161	\$2,458	\$162	\$0.1245	21.9%	42.1	2,796	12.37%	4,749	11,875
B1	\$61,259	\$2,468	\$162	\$0.1247	22.0%	42.2	2,747	12.34%	5,095	11,875
B4	\$61,403	\$2,443	\$162	\$0.1250	21.8%	41.9	2,661	11.74%	4,662	11,875
B2	\$61,568	\$2,427	\$162	\$0.1253	21.8%	41.7	2,566	11.81%	28,403	11,875
R1	\$62,867	\$2,281	\$1,001	\$0.1316	22.0%	41.8	3,775	11.56%	11,991	41,092
R3	\$63,101	\$1,878	\$1,001	\$0.1321	22.6%	36.6	4,084	11.95%	8,496	41,092
R2	\$63,358	\$1,899	\$1,001	\$0.1326	22.7%	36.9	3,740	12.03%	11,991	41,092
C1	\$64,403	\$2,323	\$162	\$0.1311	21.7%	42.3	2,932	11.90%	5,125	11,875
C2	\$64,875	\$1,940	\$162	\$0.1320	22.5%	37.4	2,881	12.15%	5,125	11,875
H2	\$65,198	\$1,981	\$162	\$0.1327	22.2%	37.8	3,020	11.73%	3,321	11,875
C3	\$65,356	\$1,994	\$162	\$0.1330	22.2%	38.0	2,995	11.80%	3,652	11,875
H3	\$65,420	\$1,965	\$162	\$0.1331	21.9%	37.6	2,826	11.01%	3,345	11,875
H1	\$65,596	\$1,947	\$162	\$0.1334	21.8%	37.4	2,725	11.15%	28,070	11,875

Table 9.A.4 Standard Deviations for Performance Measures

14 Final Candidate	Standard Deviation of 2011-2039 PVRR, \$MM	Standard Deviation of PV of 2011- 2039 Emissions Costs, \$MM	Standard Deviation of 2011-2030 Costs for DSM Participants, \$MM	Standard Deviation for 2011-2039 Levelized Annual Rates	Standard Deviation for Maximum Single Year Rate Increase 2011-2039	Standard Deviation of Avg Annual 2011-2039 Carbon Emissions, MM tons	Standard Deviation of 2011-2039 PV of Free Cash Flow, \$MM	Standard Deviation for 2011-2039 Average Return on Equity	Standard Deviation of Net Jobs 2011-2030 in FTE-Years	Standard Deviation of Energy Savings 2011-2030, GWH
Plans										
R0	\$5,075	\$18		\$0.0085	0.10%	0.205	16.9	0.15%		
B3	\$5,129	\$18	With only	\$0.0085	0.10%	0.207	13.8	0.15%	This item was	With only
B1	\$5,125	\$18	2 different	\$0.0084	0.10%	0.207	13.7	0.15%	not addressed	2 different
B4	\$5,104	\$18	values among	\$0.0084	0.10%	0.206	13.2	0.14%	by a probability	values among
B2	\$5,135	\$18	14 plans,	\$0.0084	0.10%	0.205	12.8	0.15%	tree, thus it	14 plans,
R1	\$5,245	\$18	this is not a	\$0.0090	0.10%	0.205	18.5	0.14%	only had 1	this is not a
R3	\$5,012	\$15	meaningful	\$0.0083	0.11%	0.180	20.2	0.15%	estimate per	meaningful
R2	\$5,046	\$15	calculation	\$0.0085	0.11%	0.181	18.5	0.15%	plan, and thus	calculation
C1	\$5,303	\$18		\$0.0090	0.10%	0.208	14.6	0.15%	insufficient data	
C2	\$5,074	\$15		\$0.0084	0.11%	0.183	14.3	0.15%	to calculate	
H2	\$5,094	\$16		\$0.0084	0.10%	0.185	14.9	0.14%	a standard	
C3	\$5,100	\$16		\$0.0085	0.10%	0.186	14.8	0.15%	deviation for	
H3	\$5,083	\$15		\$0.0084	0.10%	0.184	14.0	0.14%	each plan's	
H1	\$5,136	\$15		\$0.0085	0.10%	0.184	13.6	0.14%	estimate	

CDF of PVRR Differences from Endpoint Best PVRR

Ameren Missouri also used a variation of the cumulative probability distribution (CDF) for PVRR in its IRP analyses. Instead of estimating a CDF for PVRR, Ameren Missouri estimated a CDF of the PVRR differences from the endpoint best PVRR among all 14 candidate plans. This alternative calculation provided the same ranking as a ranking

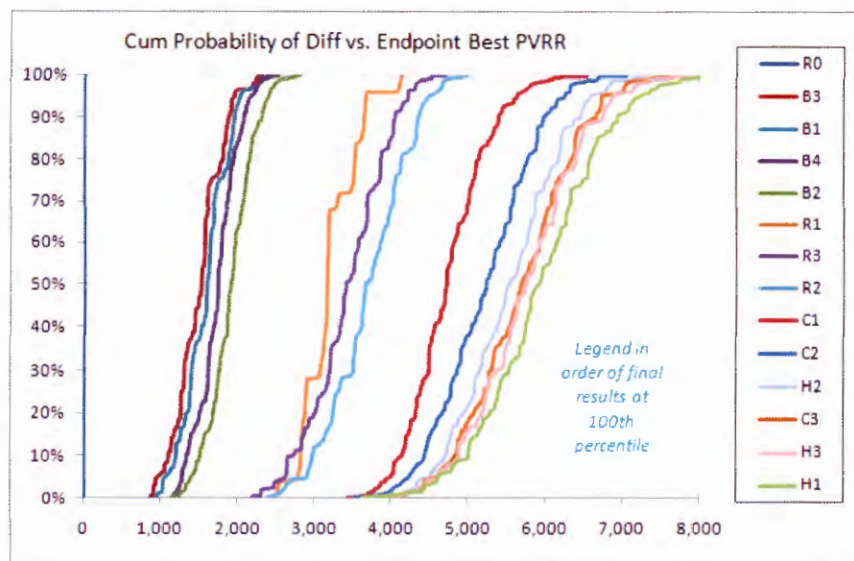
¹⁶ 4 CSR 240-22.070(5)(A); 4 CSR 240-22.070(5)(B); 4 CSR 240-22.060(6)(B)

done simply on the PVRR itself or on the CDF of the PVRR. However, this alternative approach more clearly identified the differences among plans.

Each of the 14 plans had the same 270 endpoints, but each plan had different PVRR outcomes for its own set of those same 270 endpoints from the probability tree. An example of one of the 270 endpoints on the probability tree was: “High Load – High Gas Prices – Mandates Carbon Policy – Base DSM Cost together with Base DSM Load Impact – Low Project Cost – High Interest Rates together with High Return on Equity.”

This particular endpoint existed for each of the 14 plans, but only one of the 14 plans had the best PVRR for this particular endpoint. All other plans had some positive difference (were worse) on this particular endpoint. Each of any plan’s 270 endpoints’ PVRRs was compared to the one best endpoint PVRR, and the difference versus the endpoint best PVRR was captured for each of the 270 endpoints of each plan. This data is shown

Figure 9.A.16 Cumulative Probability of Difference vs. Endpoint Best PVRR



In this chart, the vertical axis shows the range of each candidate plan’s difference from the best PVRR for each of 270 endpoints, and the vertical axis shows the probability of the difference from the best PVRR in percentile terms.

For example, the value at the 40% level on the vertical axis shows the PVRR difference that has a 40% probability of occurring for each plan, while the value at the 80% level shows the PVRR difference that has an 80% chance of occurring for each plan. It is clear that plans to the left are more desirable plans, since any plan to the left of any other plan has a lower PVRR difference.

Compliance References

4 CSR 240-22.060(6)(A)	1
4 CSR 240-22.060(6)(B)	30
4 CSR 240-22.060(6)(C)1	4
4 CSR 240-22.060(6)(C)10	27
4 CSR 240-22.060(6)(C)2	5, 6
4 CSR 240-22.060(6)(C)3	7
4 CSR 240-22.060(6)(C)4	14
4 CSR 240-22.060(6)(C)5	14, 15
4 CSR 240-22.060(6)(C)6	16
4 CSR 240-22.060(6)(C)7	23
4 CSR 240-22.060(6)(C)8	24
4 CSR 240-22.060(6)(C)9	25
4 CSR 240-22.070(11)(B)	28
4 CSR 240-22.070(5)	28
4 CSR 240-22.070(5)(A)	30
4 CSR 240-22.070(5)(B)	30

Chapter 9 - Appendix A

Candidate Resource Plans

Table 9.A.1 Type, Size, Timing of Resource Addition/Retirement¹

Plan B1: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	-295	205	100
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	295	-205	-100

Plan B2: Nuke 30% - No Secondary - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480	480	480
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	185	85	-20
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	-185	-85	20

Plan B3: Simple Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	692	692	692
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	-295	297	192
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	295	-297	-192

Plan B4: Wind/Simple Cyc - No Secondary - Prop C Renewables - Low Risk DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410	410	410
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	513	569	534	461	407	332	258	178	73	-17	-103	-194	115	15	-90
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-513	-569	-534	-461	-407	-332	-258	-178	-73	17	103	194	-115	-15	90

Plan C1: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer controlled - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	439	495	460	387	357	282	208	128	46	-45	-131	-222	277	177	72
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-439	-495	-460	-387	-357	-282	-208	-128	-46	45	131	222	-277	-177	-72

¹ For the 14 final candidate resource plans: 4 CSR 240-22.060(6)(A)

Plan C2: Combined Cycle - No Secondary - Prop C Renewables - Low Risk DSM - Mer nat gas convert - Nor continues

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	277	209	127	24	-63	-157	-253	-352	-453	-561	-667	-777	-893	-1,010	-1,130
+ Total plant upgrades	2	6	30	34	38	-31	39	39	39	69	69	69	69	69	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	286	643	593	567	426	482	447	374	344	269	195	115	33	-58	-144	-235	264	164	59
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-426	-482	-447	-374	-344	-269	-195	-115	-33	58	144	235	-264	-164	-59

Plan C3: Combined Cycle - Combined Cycle - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	600	600	600
= Capacity position after adjustment:	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	-299	215	124	23	-77	-182
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	299	-215	-124	-23	77	182

Plan H1: Combined Cycle - Nuke 30% - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480	480	480	480	480	480
= Capacity position after adjustment:	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	181	95	4	-97	-197	-302
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	-181	-95	-4	97	197	302

Plan H2: Combined Cycle - Simple Cycle - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	692	692	692	692	692
= Capacity position after adjustment:	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	-208	-299	307	216	115	15	-90
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	208	299	-307	-216	-115	-15	90

Plan H3: Combined Cycle - Wind/Simple Cyc - Prop C Renewables - Low Risk DSM - Mer retire 2016 - Nor continues

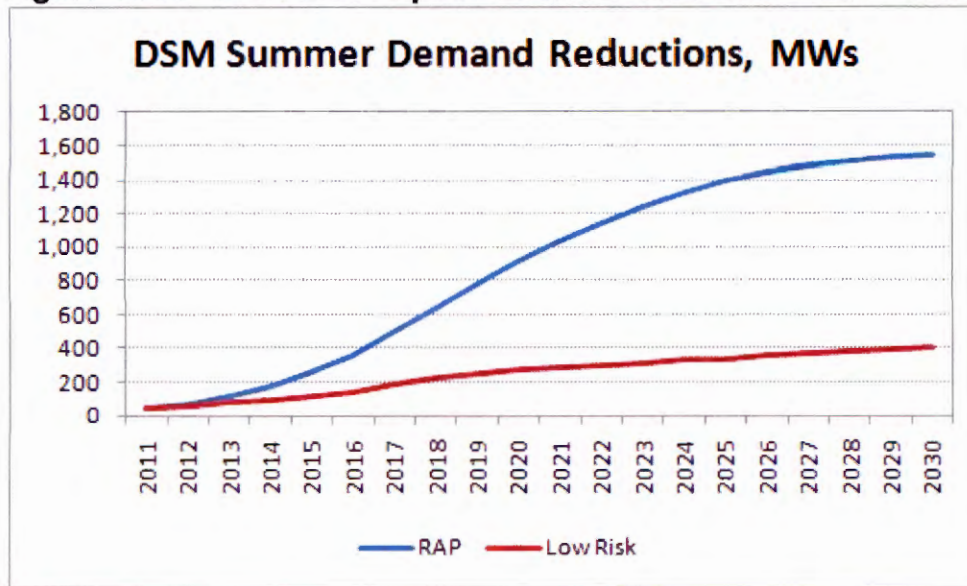
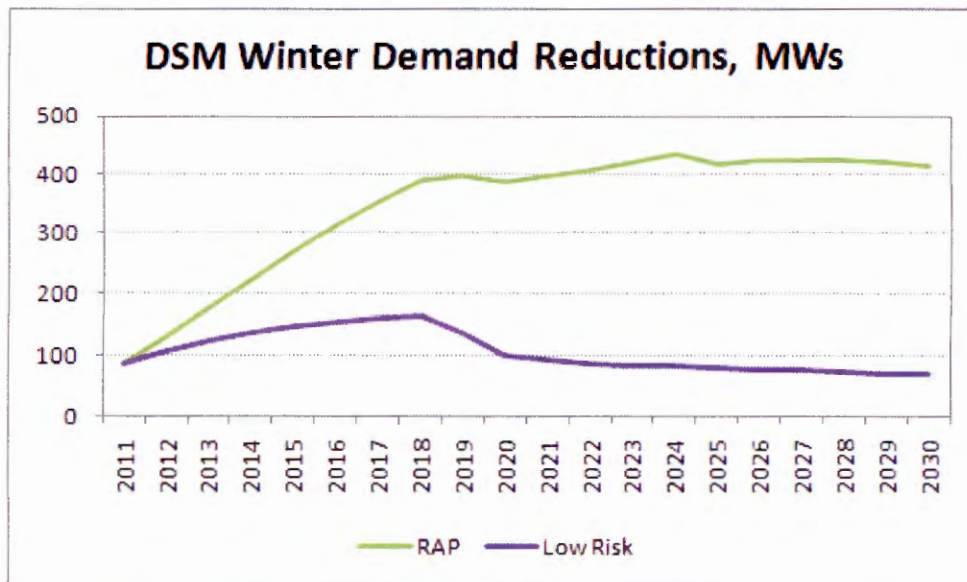
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	17	17	20	21	23	26	28	31	33	36	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-49	-69	-88	-111	-134	-154	-172	-189	-201	-206	-216	-223	-228	-232	-235	-235	-235	-236	-235	-232
- Demand response	0	0	0	0	0	-14	-49	-75	-93	-111	-121	-133	-145	-157	-167	-185	-202	-213	-229	-244
+ New primary supply side	0	0	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	410	410	410	410	410	410	410
= Capacity position after adjustment:	-66	286	643	593	567	185	241	206	133	103	28	-46	-126	202	111	25	-66	-167	-267	-372
Purchases(+) or sales(-)	66	-286	-643	-593	-567	-185	-241	-206	-133	-103	-28	46	126	-202	-111	-25	66	167	267	372

Plan R0: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer continues - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	15	85	85	85	91	91	91	91	68	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	302	688	692	739	752	854	873	855	847	821	785	733	639	557	466	370	262	151	31
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-752	-854	-873	-855	-847	-821	-785	-733	-639	-557	-466	-370	-262	-151	-31

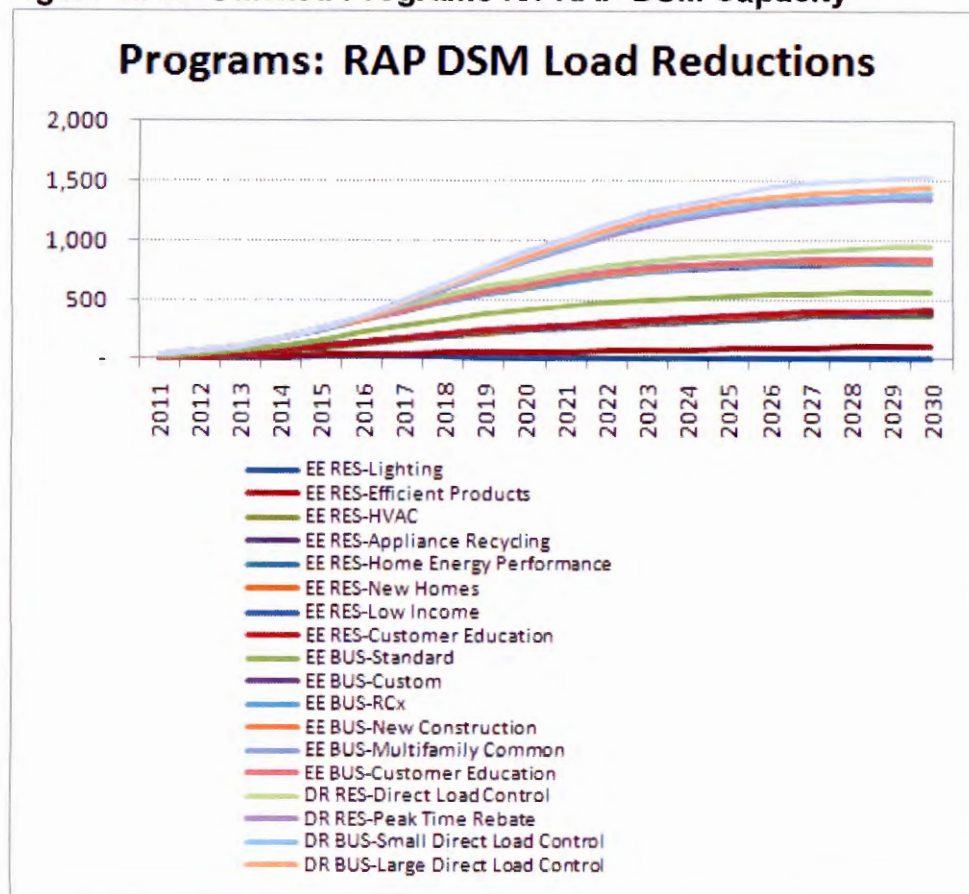
Plan R1: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer controlled - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	302	688	692	739	678	780	799	781	797	771	735	683	612	529	438	342	234	123	3
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-678	-780	-799	-781	-797	-771	-735	-683	-612	-529	-438	-342	-234	-123	-3

Plan R2: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer nat gas convert - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	277	209	127	24	-63	-157	-253	-352	-453	-561	-667	-777	-893	-1,010	-1,130
+ Total plant upgrades	2	6	30	34	38	-31	39	39	39	69	69	69	69	69	69	69	69	69	69	69
+ Meramec retirement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-20
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	302	688	692	739	665	767	786	768	784	758	722	670	599	516	425	329	221	110	10
Purchases(+) or sales(-)	66	-302	-688	-692	-739	-665	-767	-786	-768	-784	-758	-722	-670	-599	-516	-425	-329	-221	-110	-10

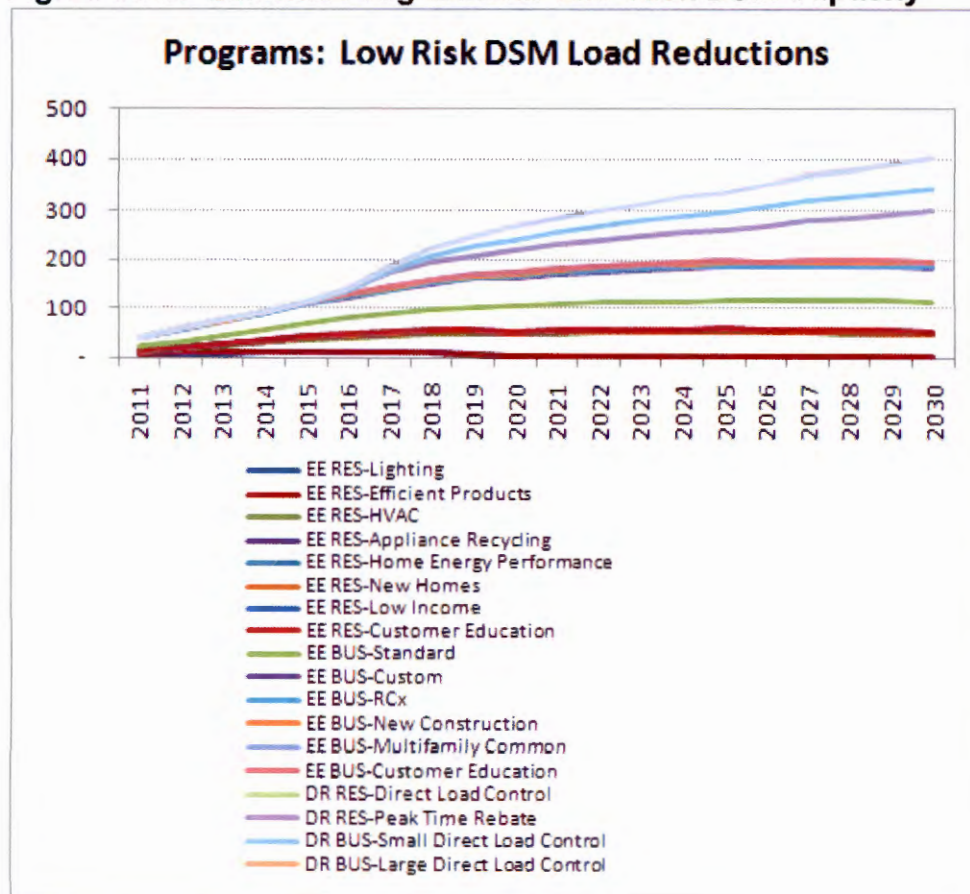
Plan R3: No Primary - No Secondary - Prop C Renewables - RAP DSM - Mer retire 2016 - Nor continues																				
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing capacity position	-117	211	516	440	387	318	250	168	65	-22	-116	-212	-311	-412	-520	-626	-736	-852	-969	-1,089
+ Total plant upgrades	2	6	30	34	38	-59	11	11	11	41	41	41	41	41	41	41	41	41	41	41
+ Meramec retirement	0	0	0	0	0	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854	-854
+ Renewables	0	0	8	8	8	12	12	16	16	20	21	24	26	29	31	34	37	39	41	44
+ Noranda termination	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- Energy efficiency	-48	-85	-134	-210	-306	-407	-507	-603	-688	-758	-825	-883	-927	-955	-977	-989	-1,000	-1,006	-1,009	-1,007
- Demand response	0	0	0	0	0	-20	-83	-158	-236	-329	-399	-474	-549	-620	-679	-732	-765	-784	-805	-826
+ New primary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
+ New secondary supply side	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
= Capacity position after adjustment:	-66	302	688	692	739	-156	10	103	163	272	316	355	378	378	354	316	252	164	74	-25
Purchases(+) or sales(-)	66	-302	-688	-692	-739	156	-10	-103	-163	-272	-316	-355	-378	-378	-354	-316	-252	-164	-74	25

Figure 9.A.1 Combined Impact of DSM on Summer Peak Demand²Figure 9.A.2 Combined Impact of DSM on Winter Peak Demand³² 4 CSR 240-22.060(6)(C)1.³ 4 CSR 240-22.060(6)(C)1.

14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

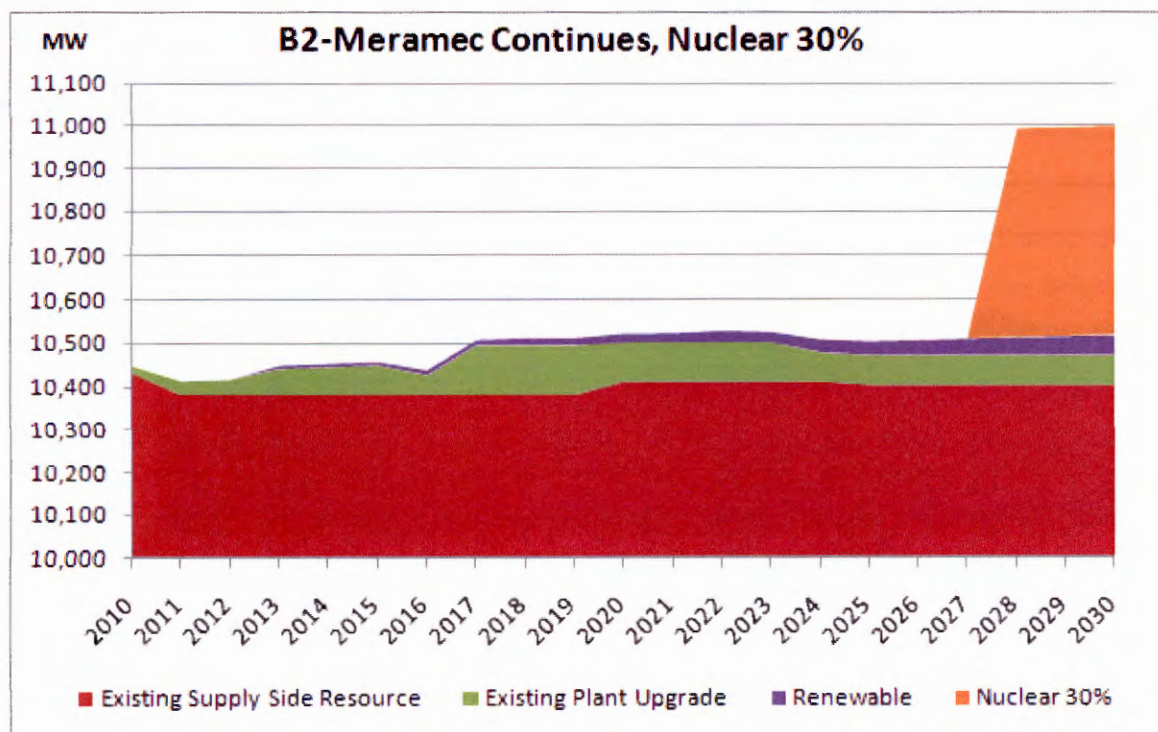
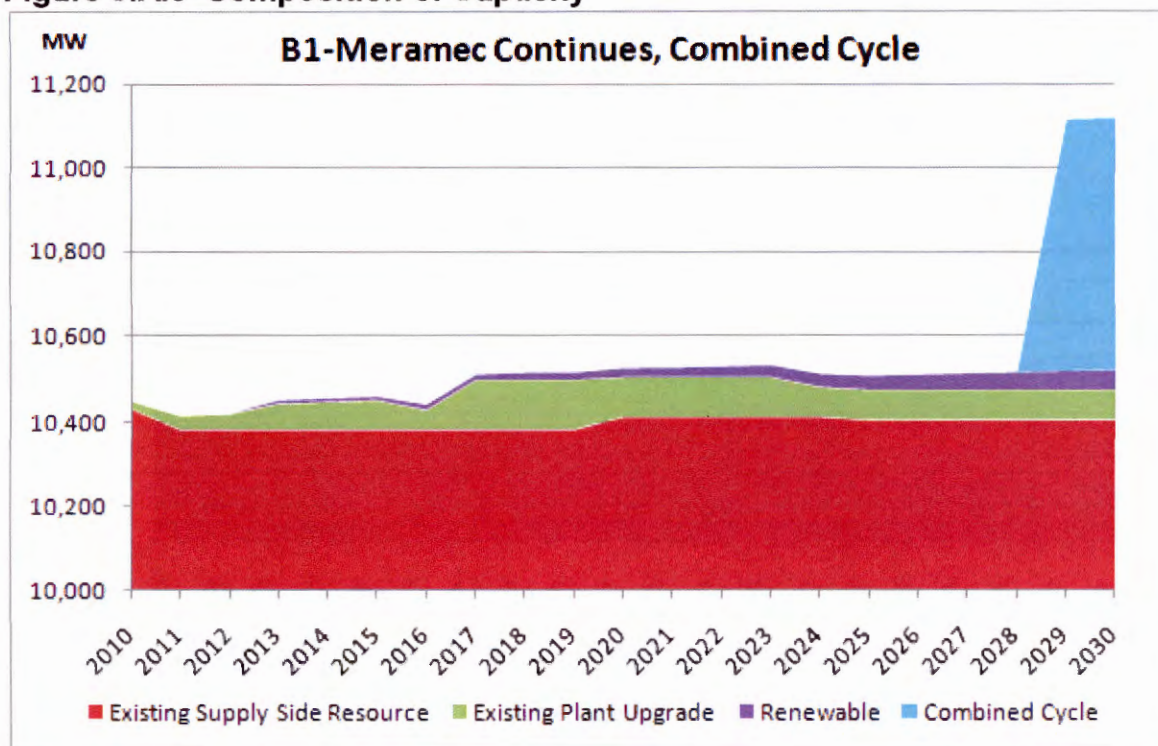
Figure 9.A.3 Stacked Programs for RAP DSM Capacity⁴

⁴ 4 CSR 240-22.060(6)(C)2.
14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

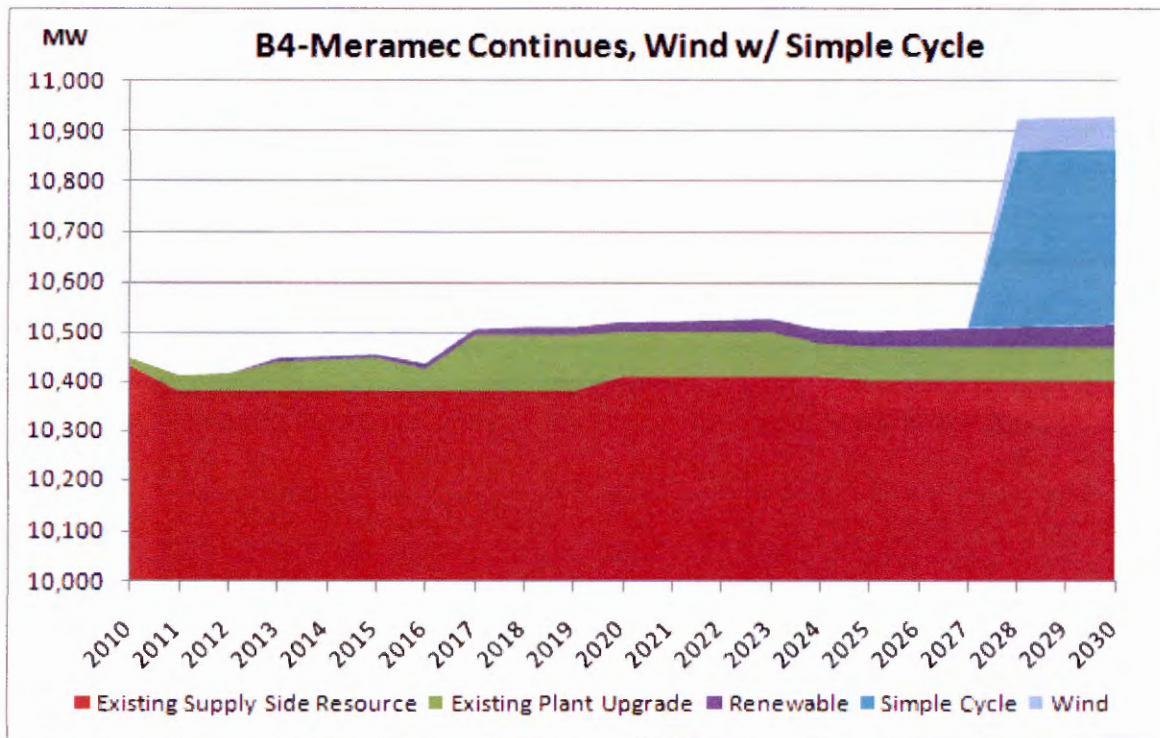
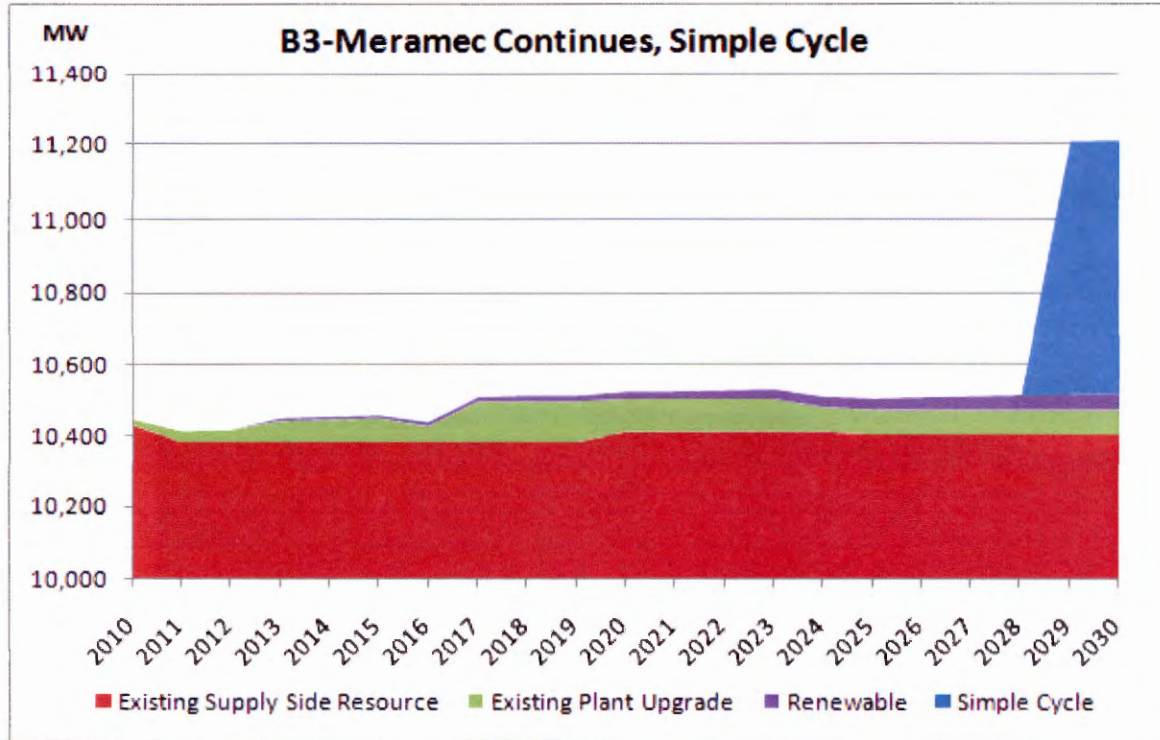
Figure 9.A.4 Stacked Programs for Low Risk DSM Capacity⁵

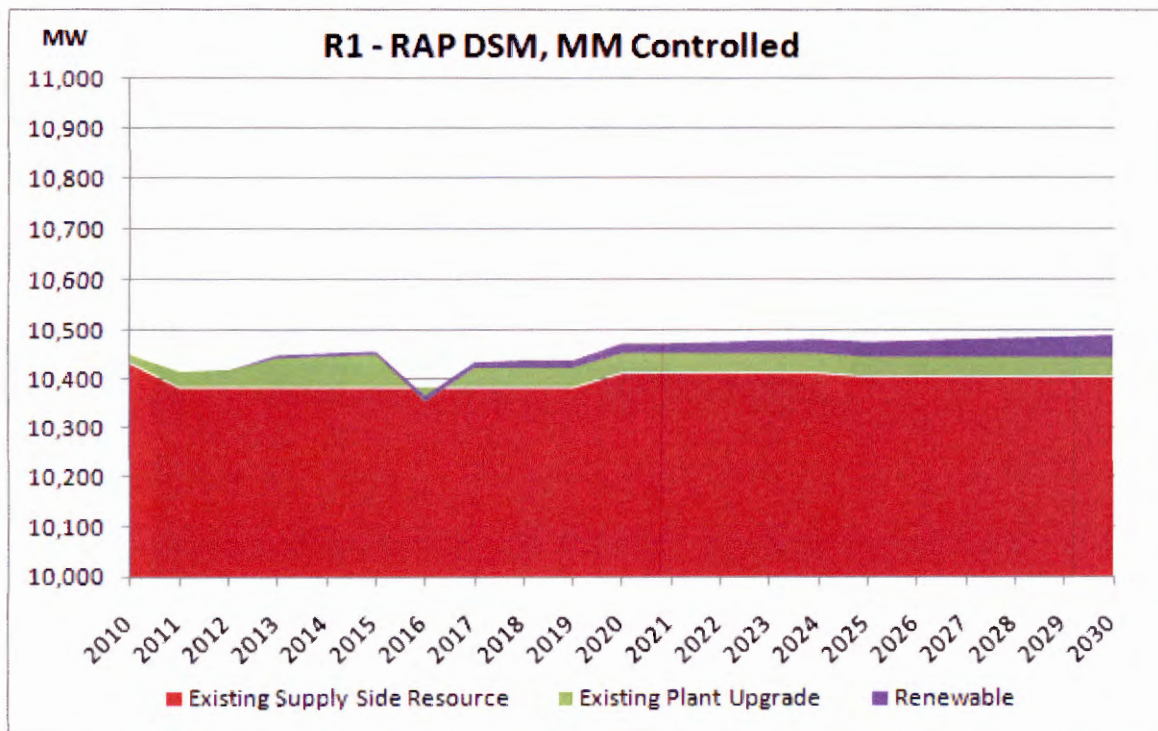
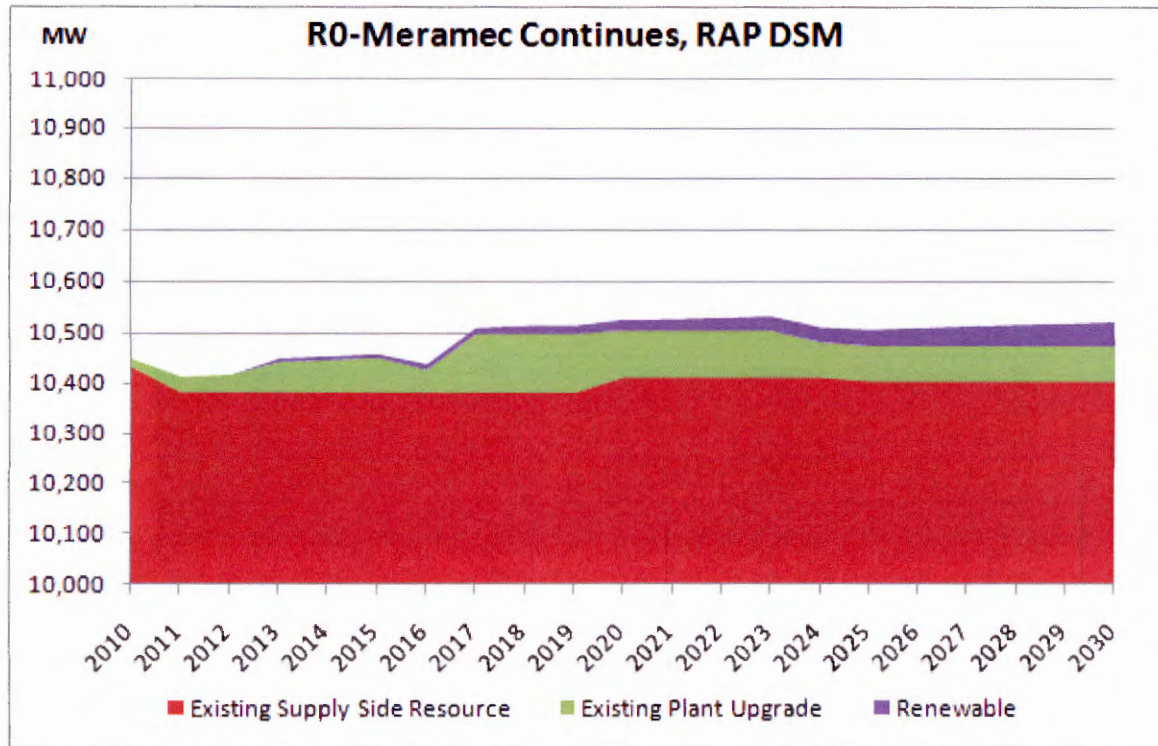
⁵ 4 CSR 240-22.060(6)(C)2.

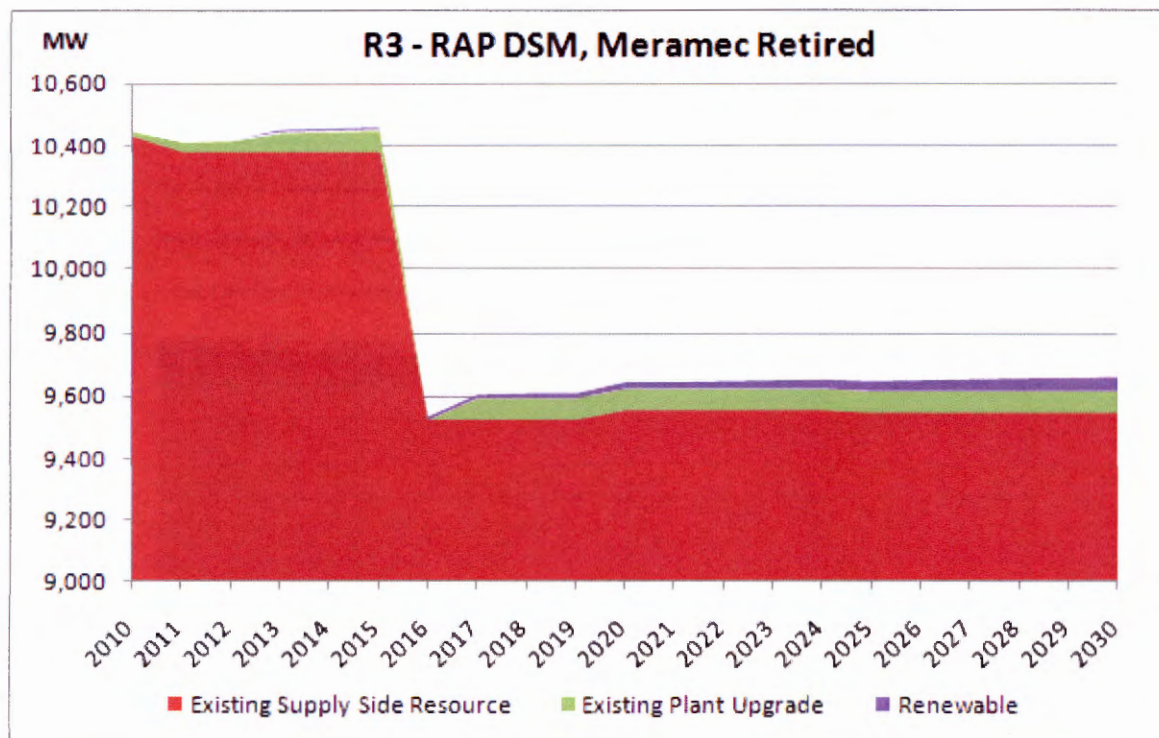
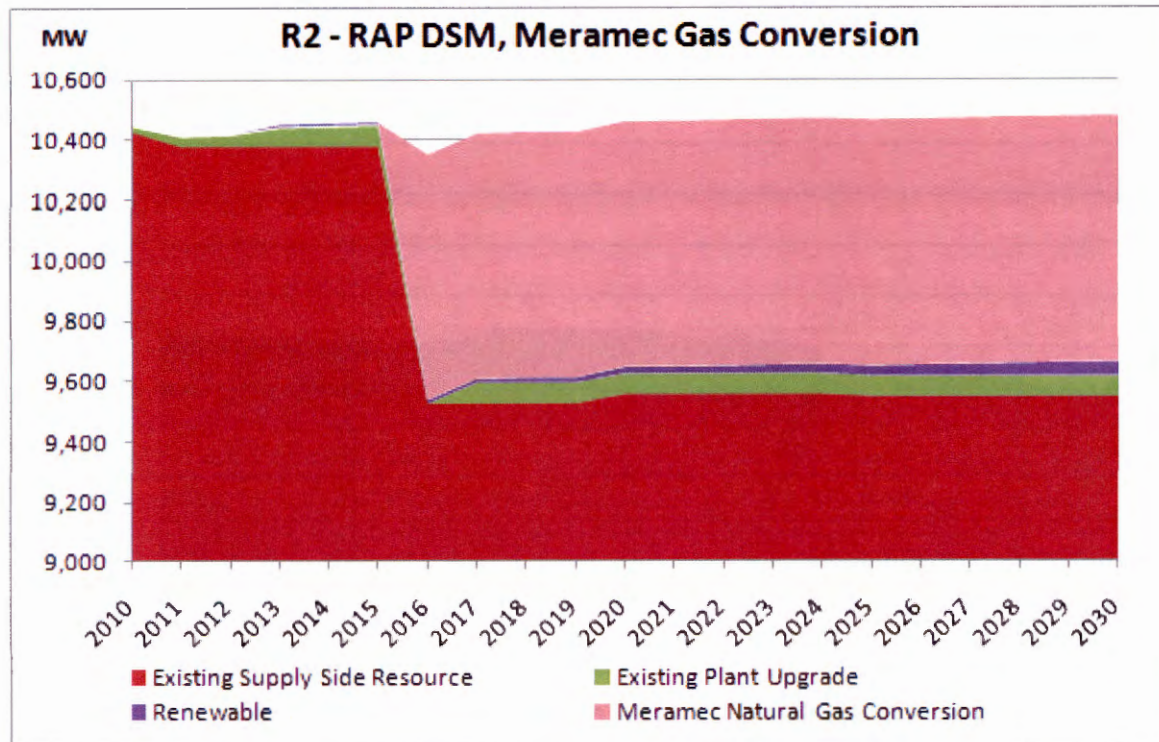
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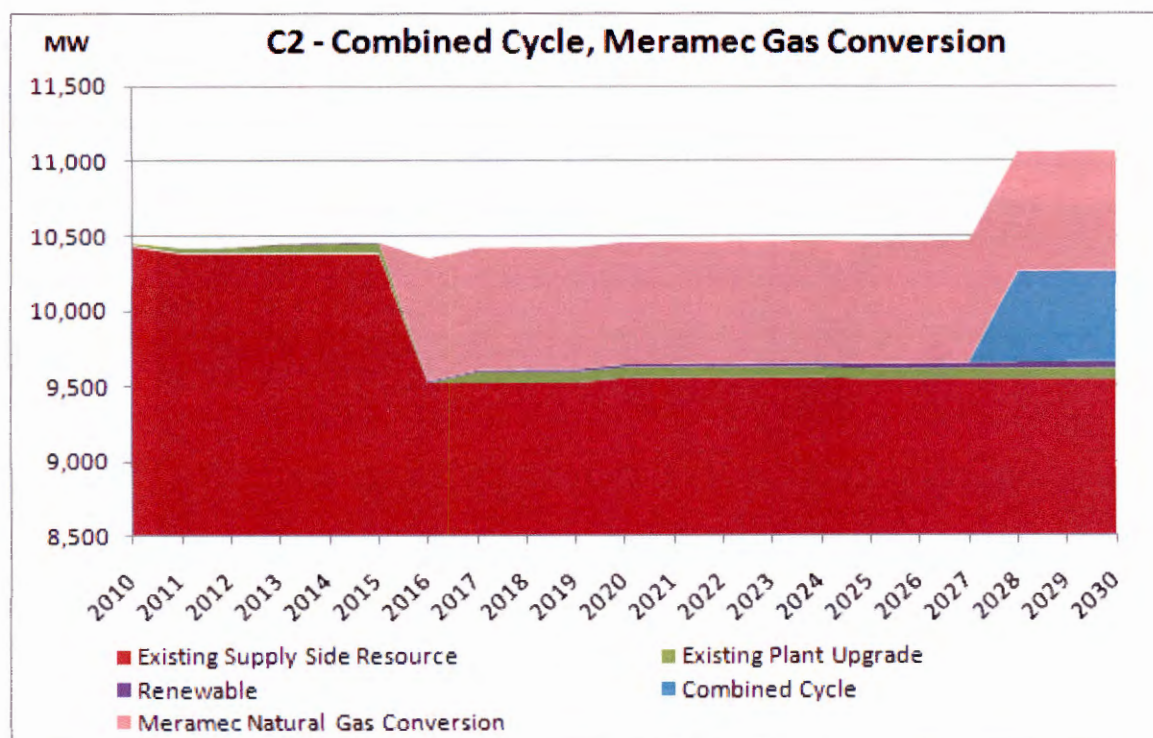
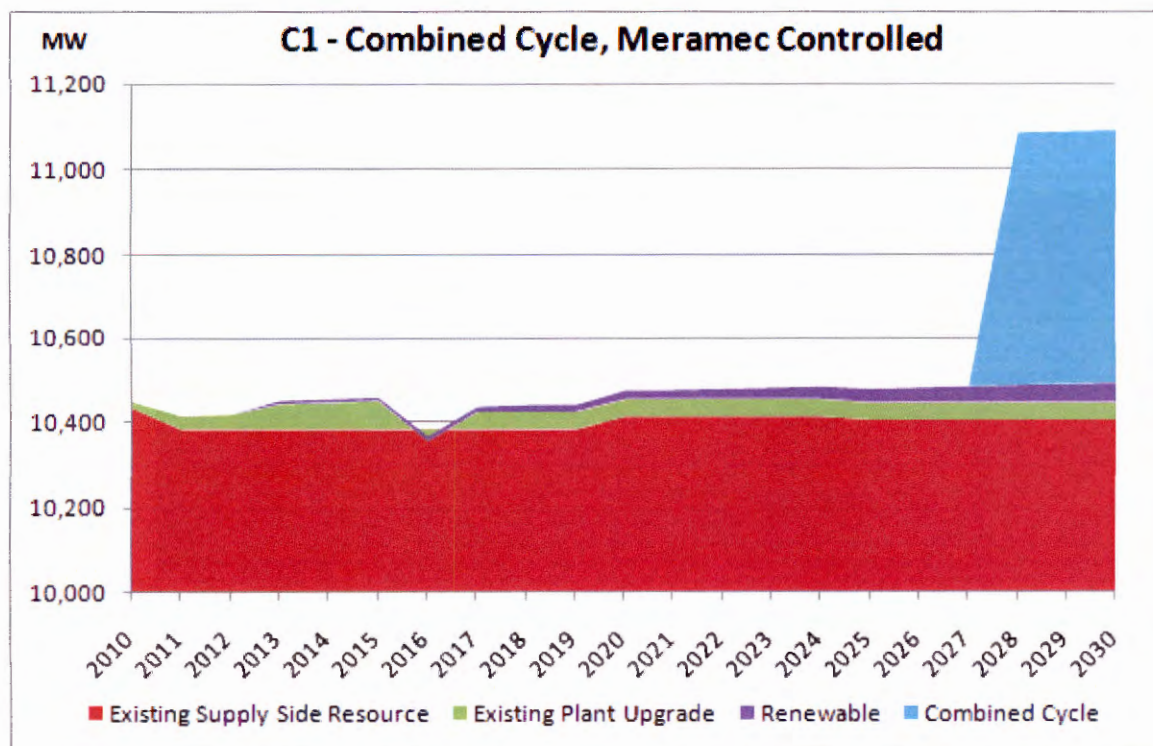
Figure 9.A.5 Composition of Capacity⁶⁶ 4 CSR 240-22.060(6)(C)3.

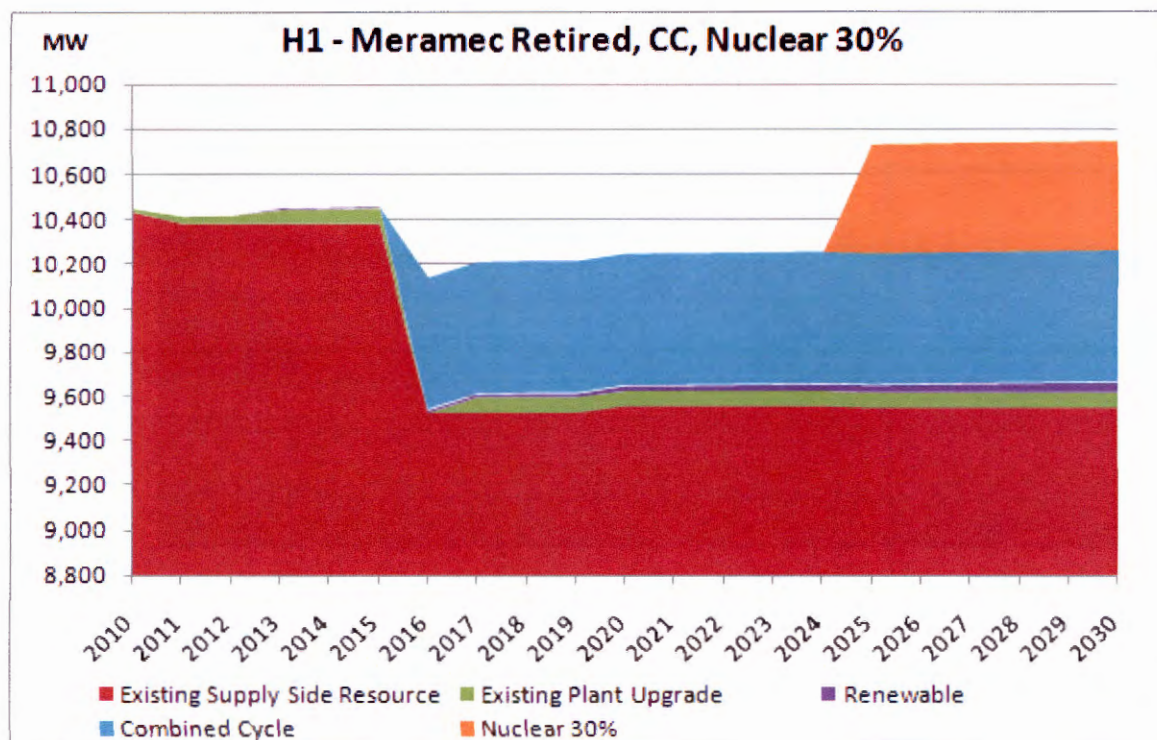
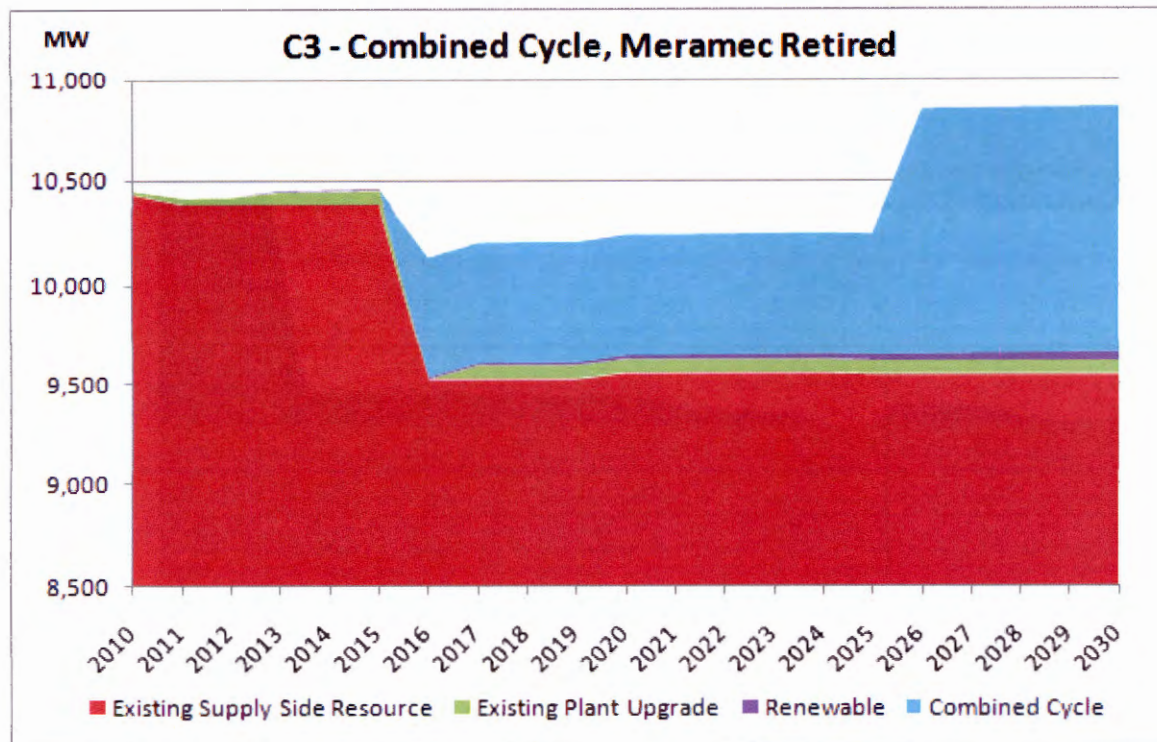
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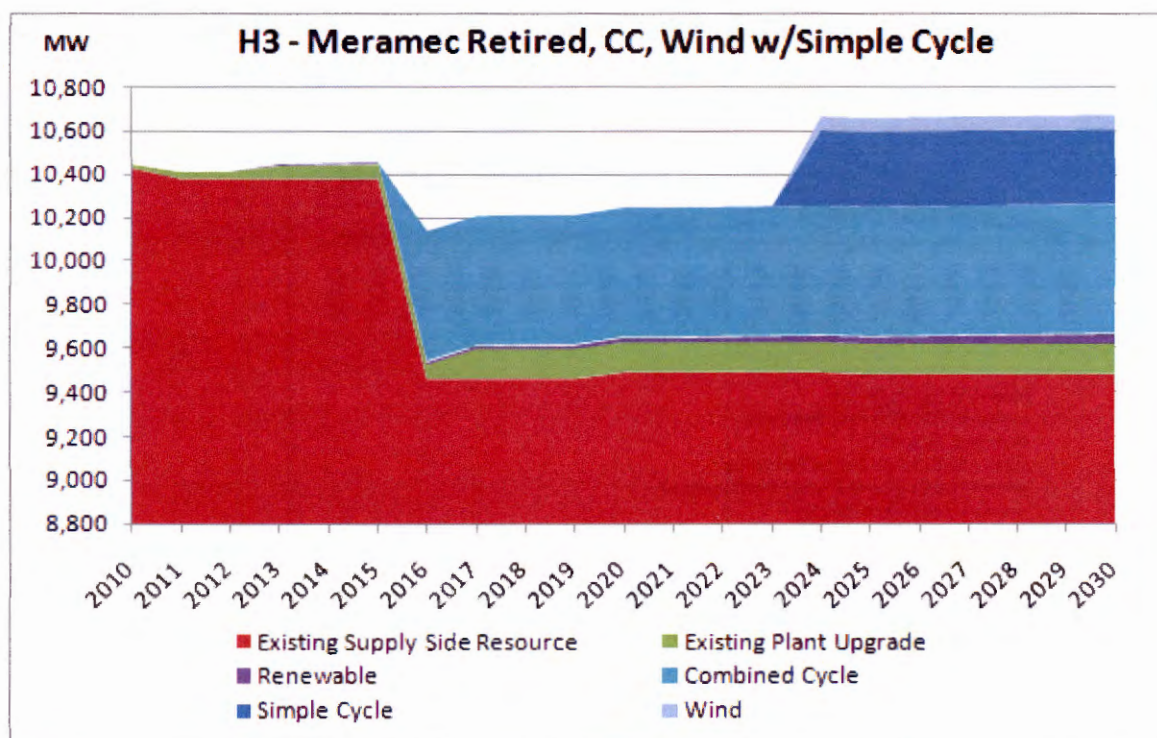
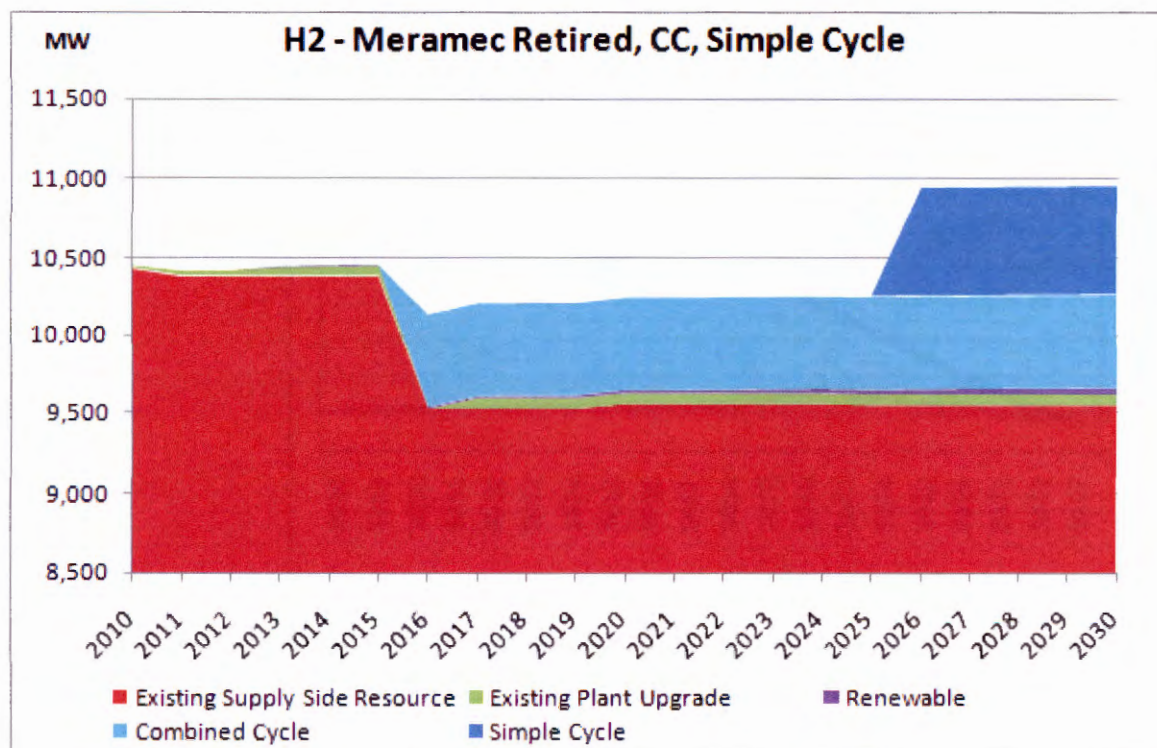
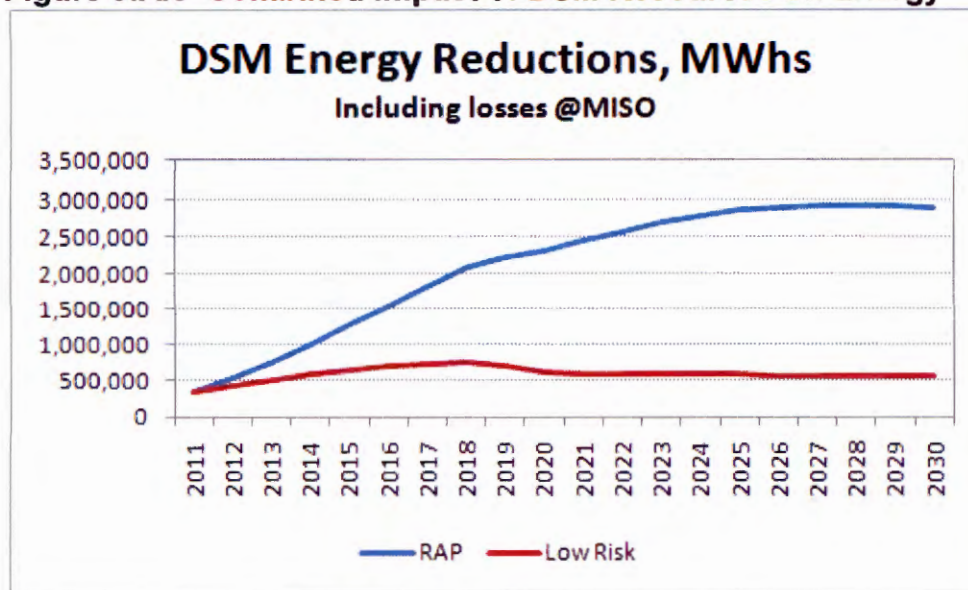
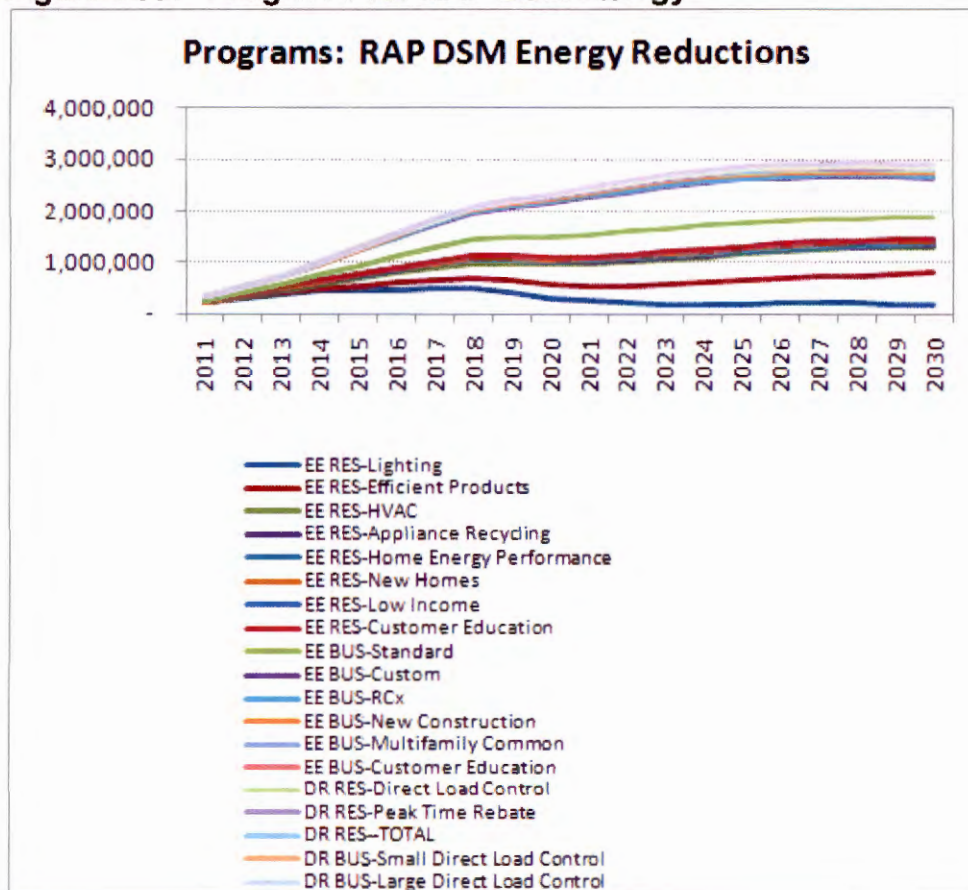
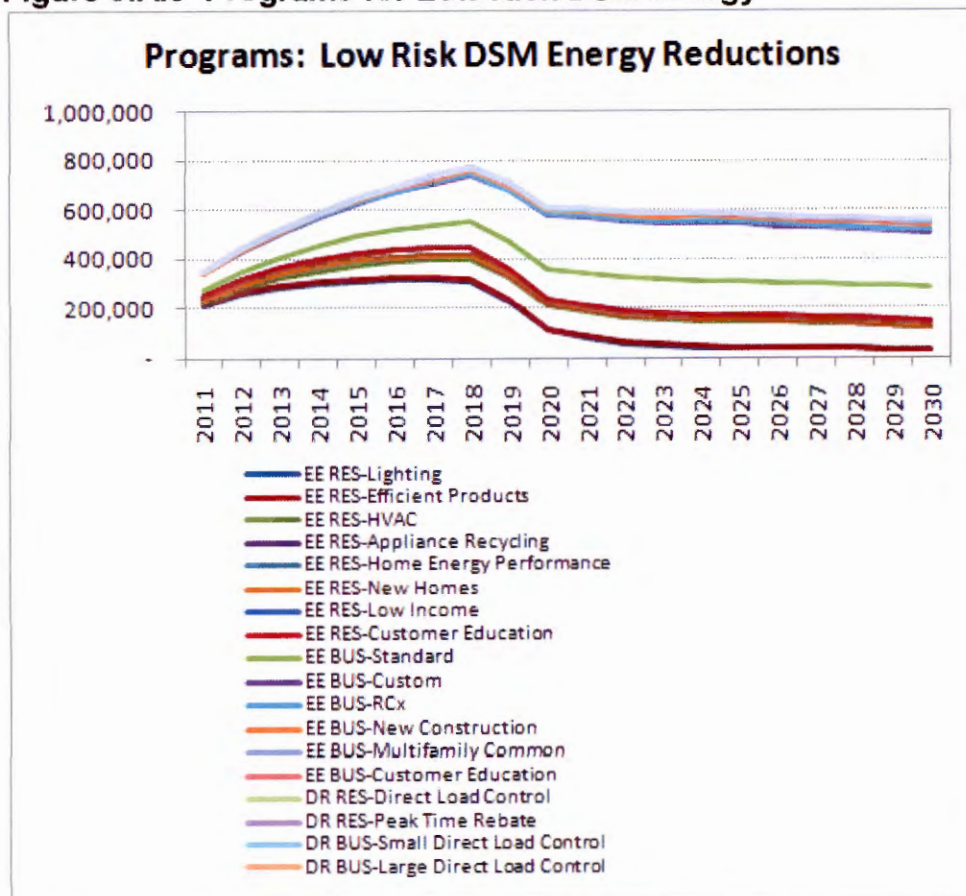


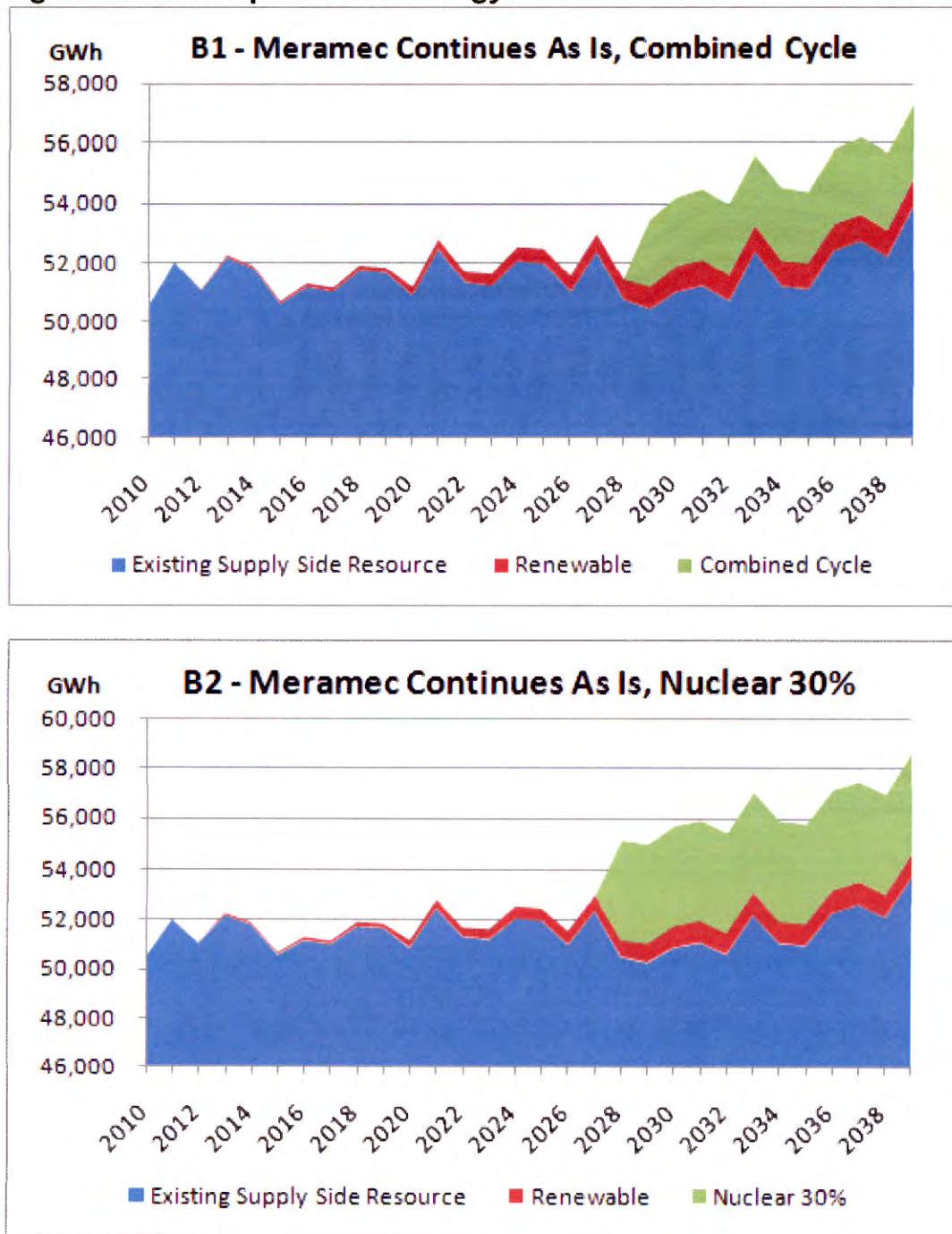
Figure 9.A.6 Combined Impact of DSM Resources on Energy⁷Figure 9.A.7 Programs for RAP DSM Energy⁸⁷ 4 CSR 240-22.060(6)(C)4.⁸ 4 CSR 240-22.060(6)(C)5.

14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

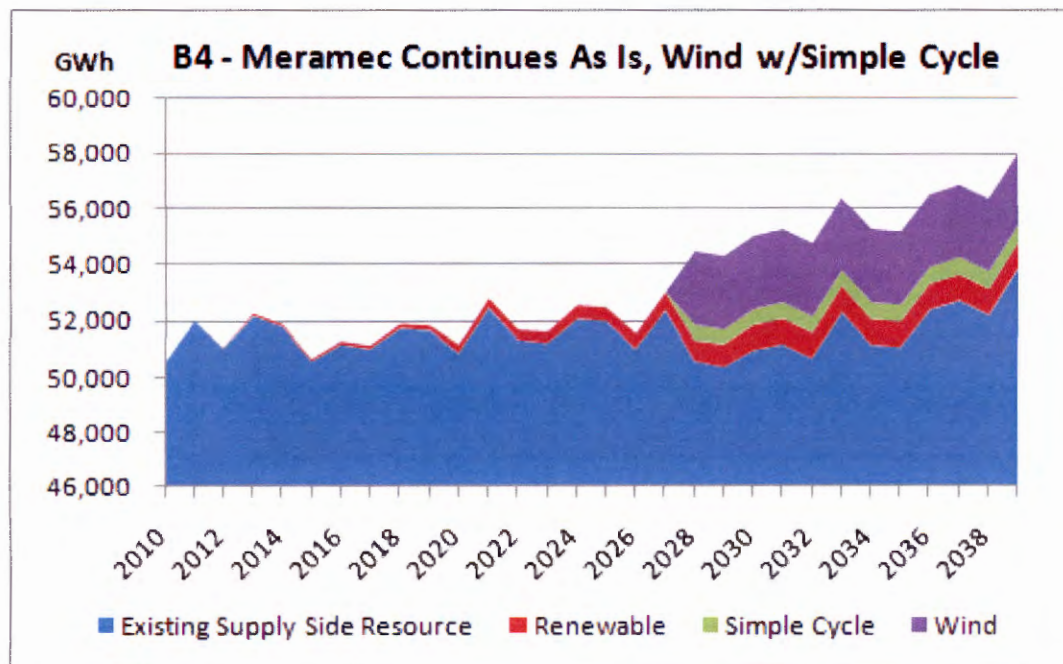
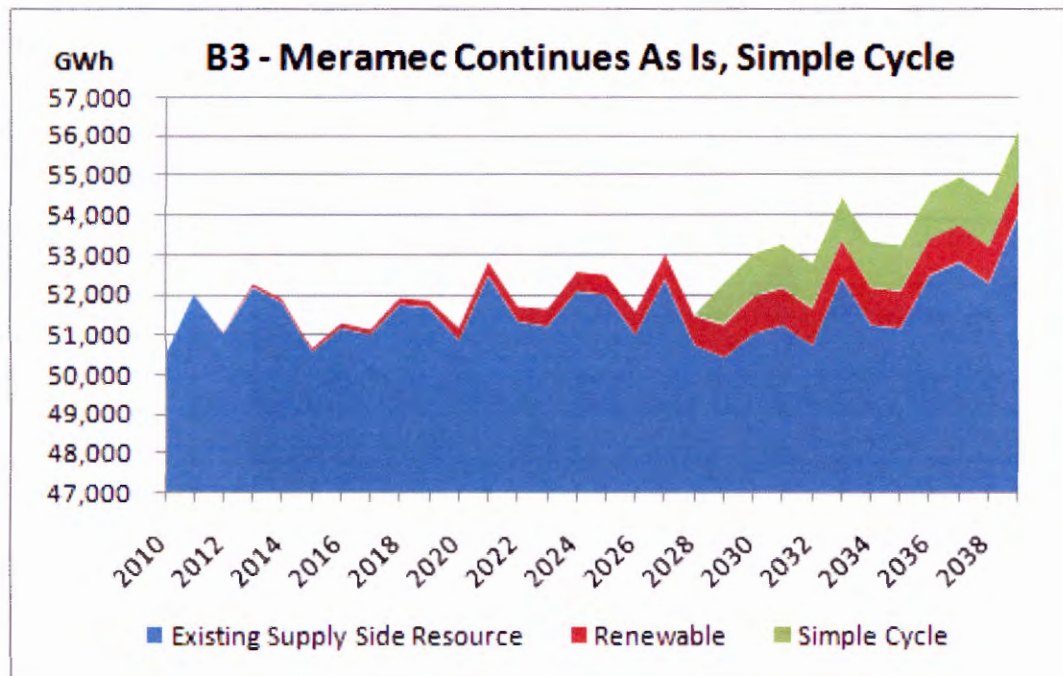
Figure 9.A.8 Programs for Low Risk DSM Energy⁹

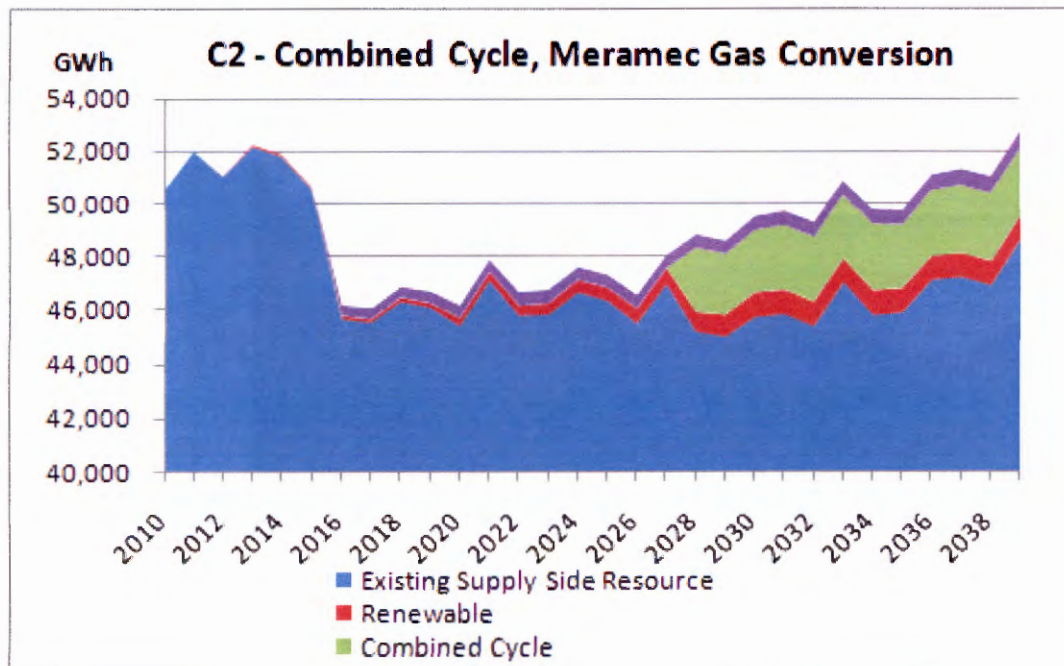
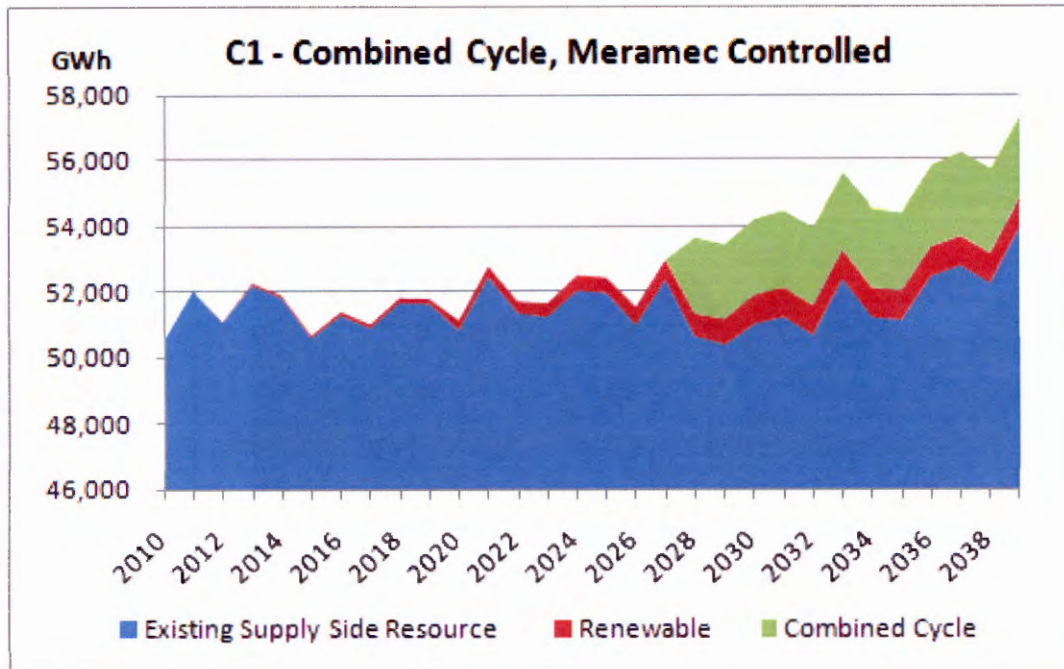
⁹ 4 CSR 240-22.060(6)(C)5.

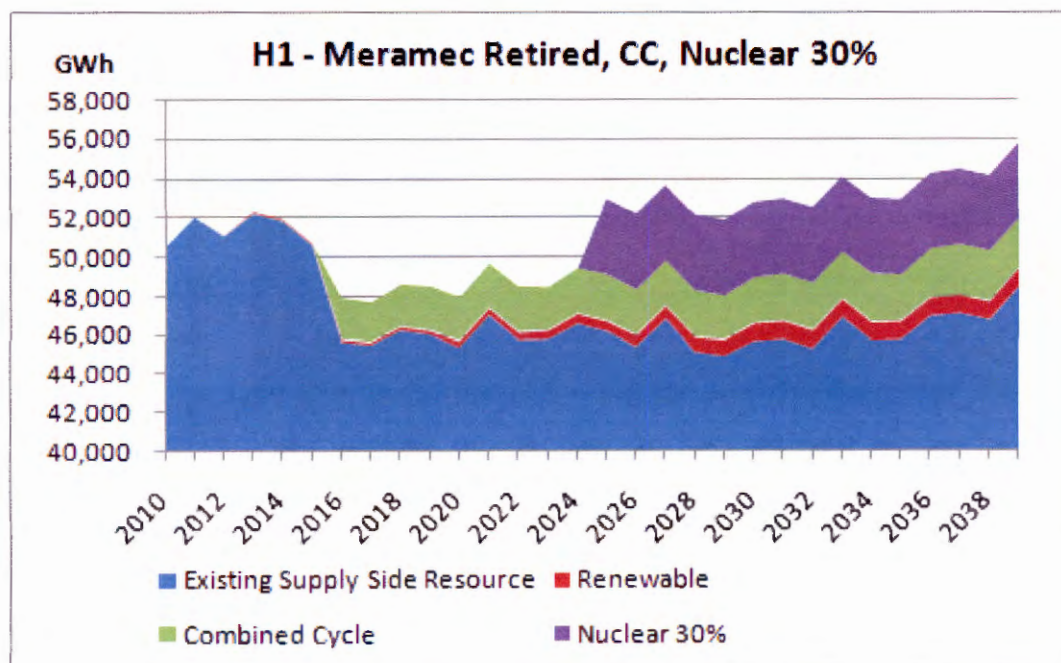
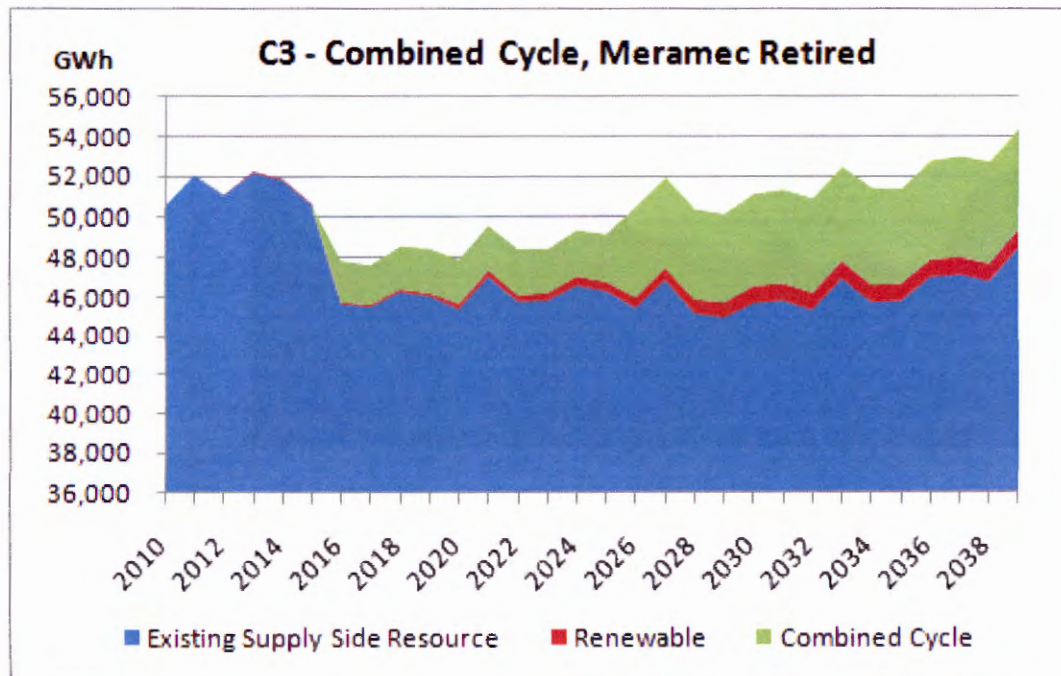
14 candidate resource plans - 060(6)(C)(1,2,4,5).xlsx

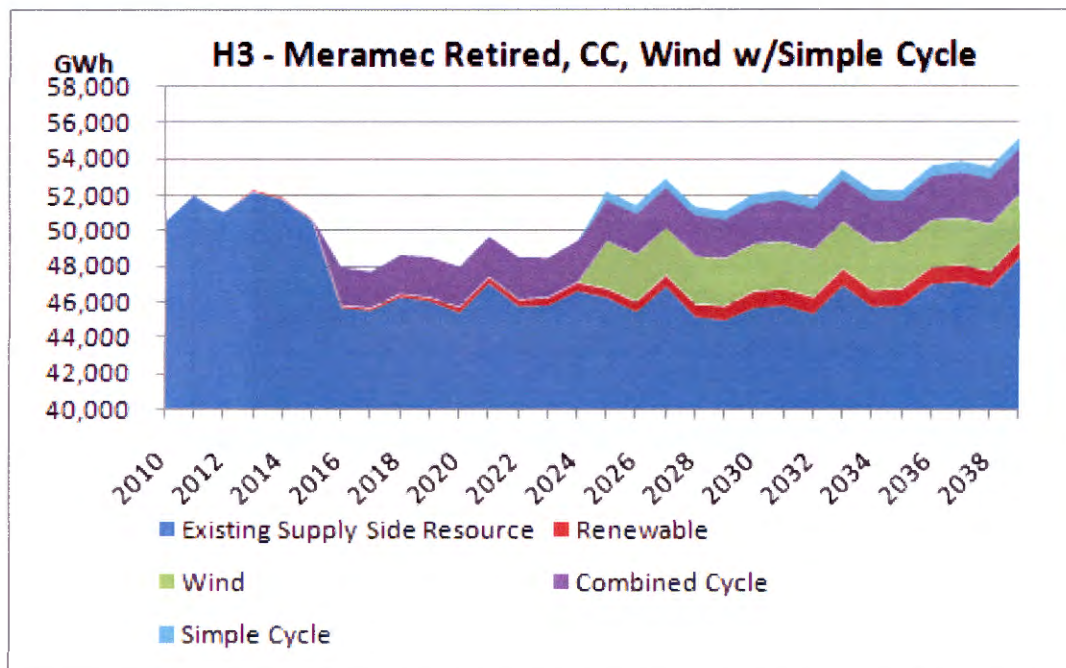
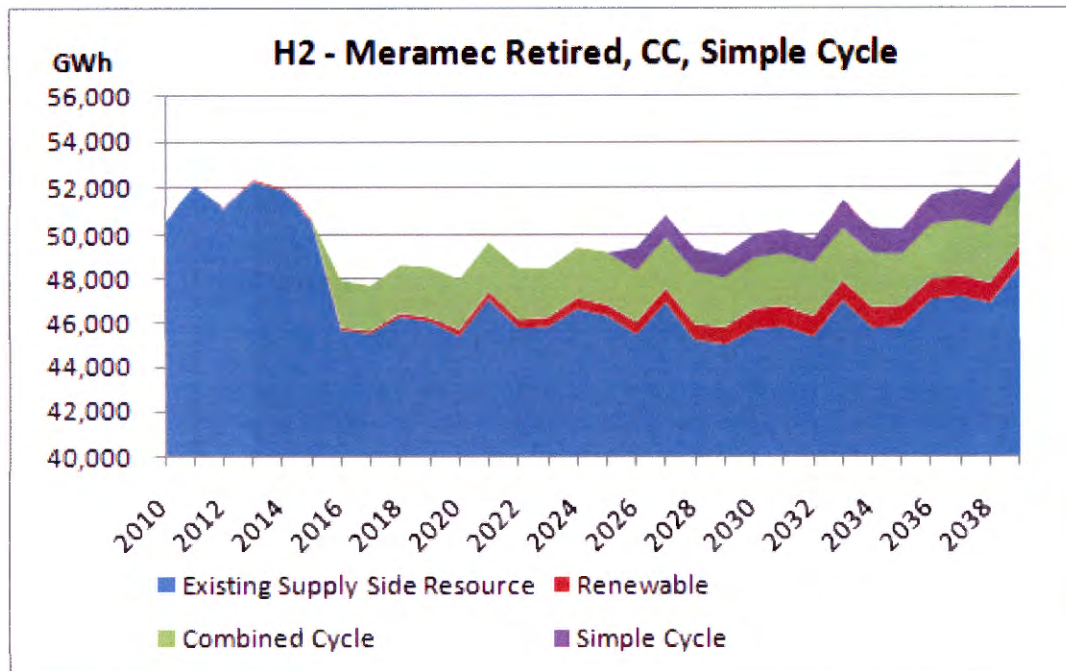
Figure 9.A.9 Composition of Energy¹⁰

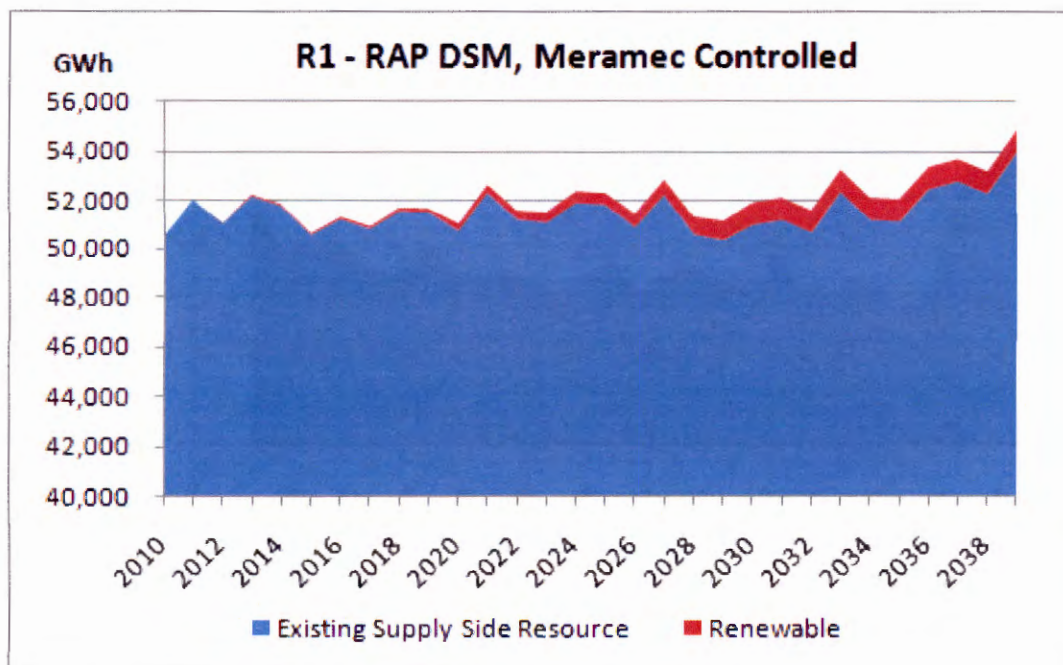
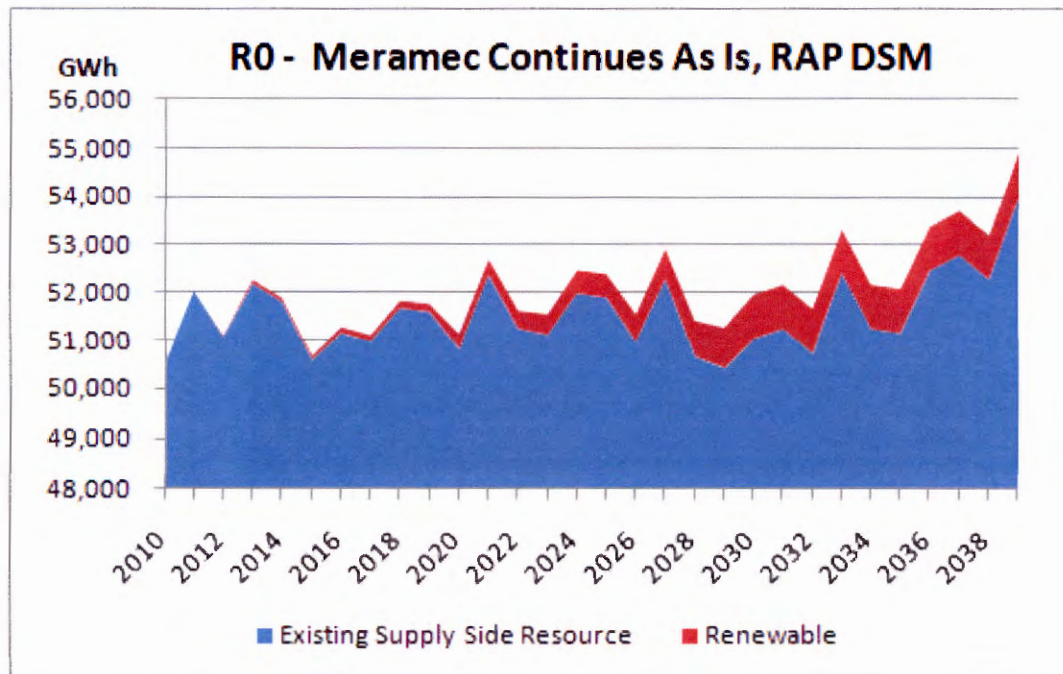
¹⁰ 4 CSR 240-22.060(6)(C)6.
14 candidate resource plans - 060(6)(C)(6).xlsx











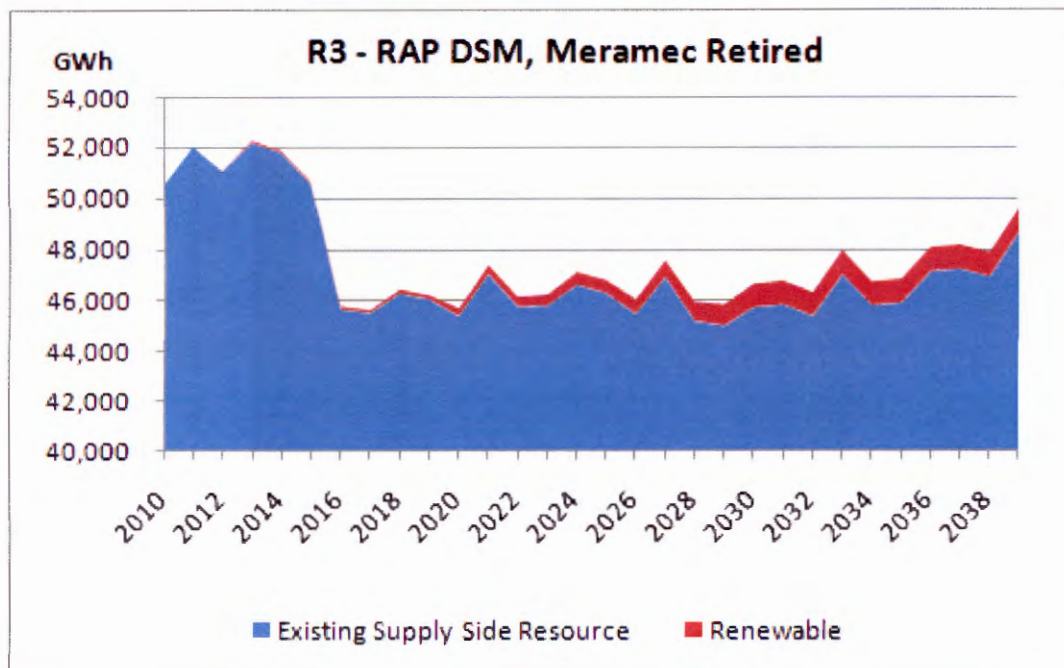
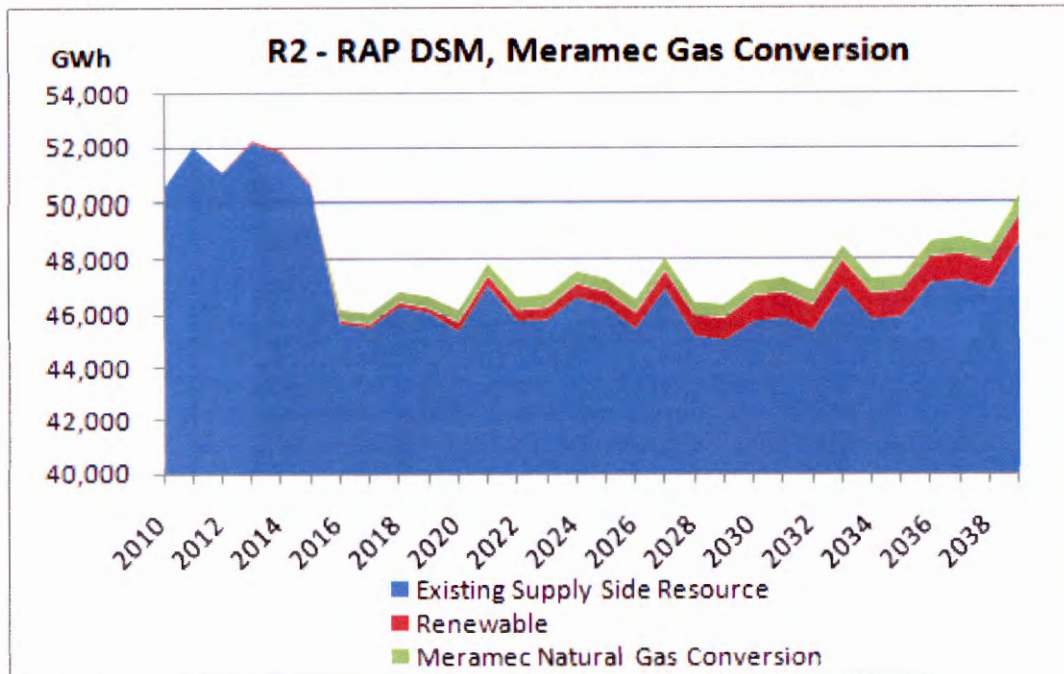
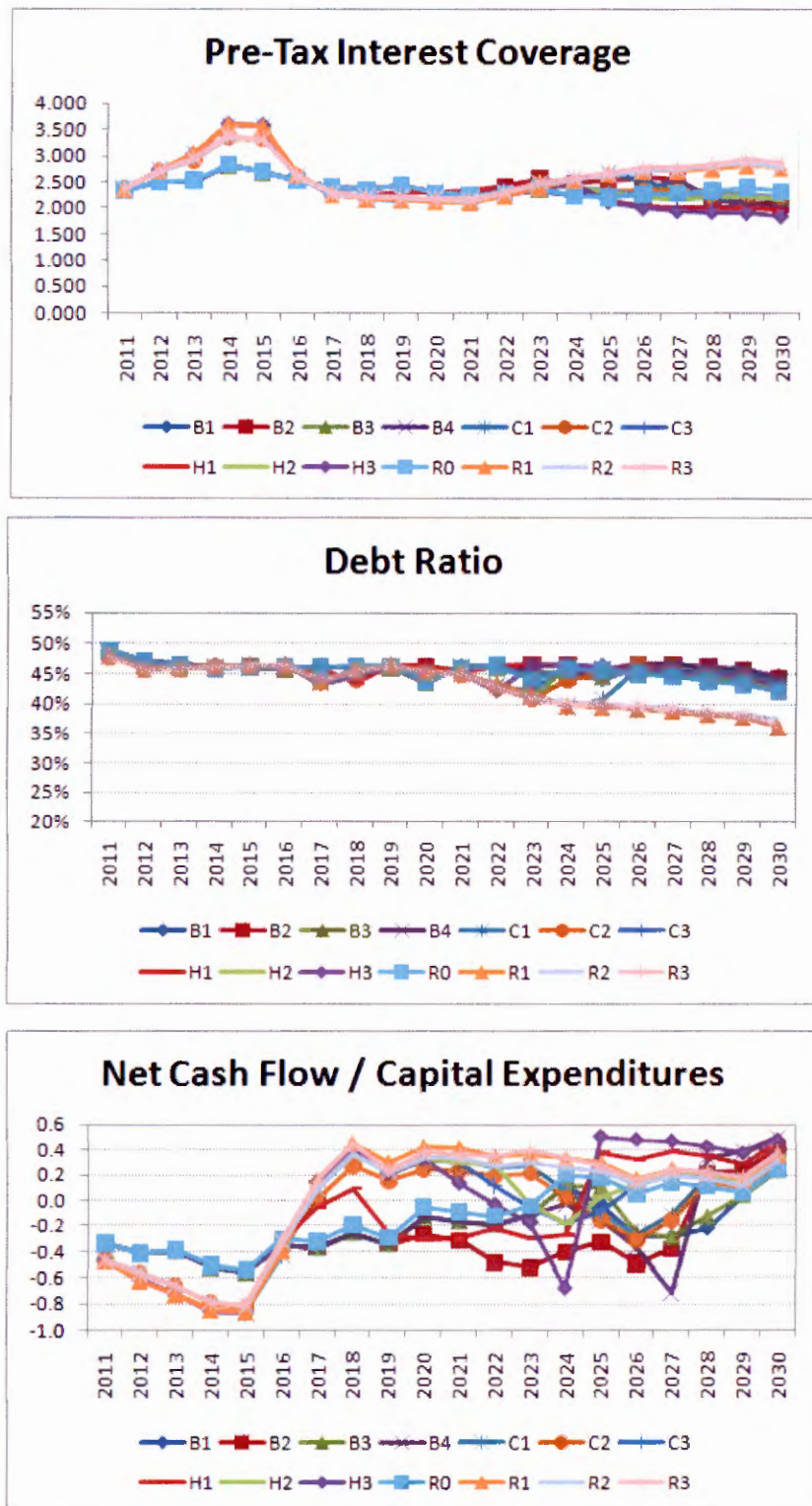
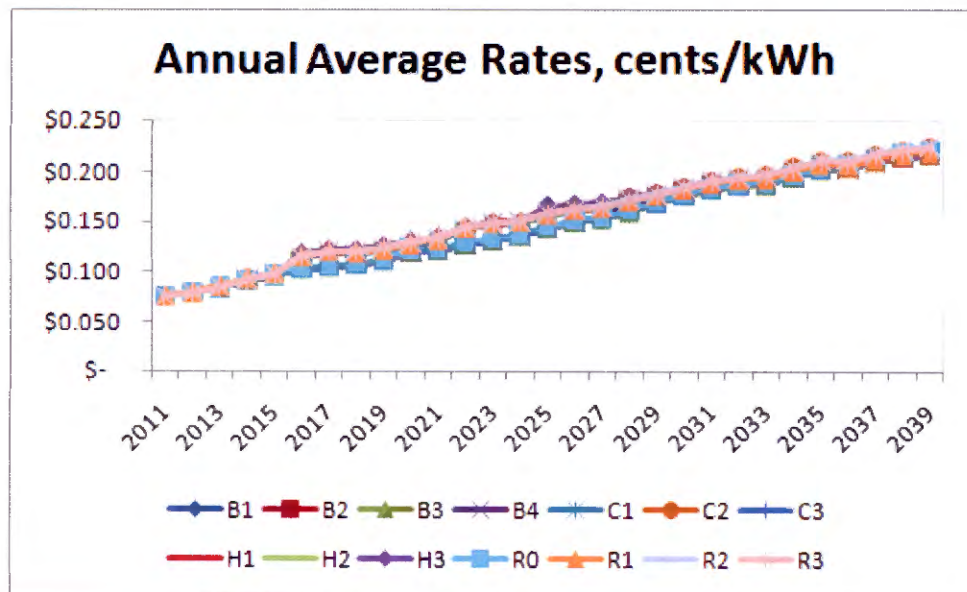


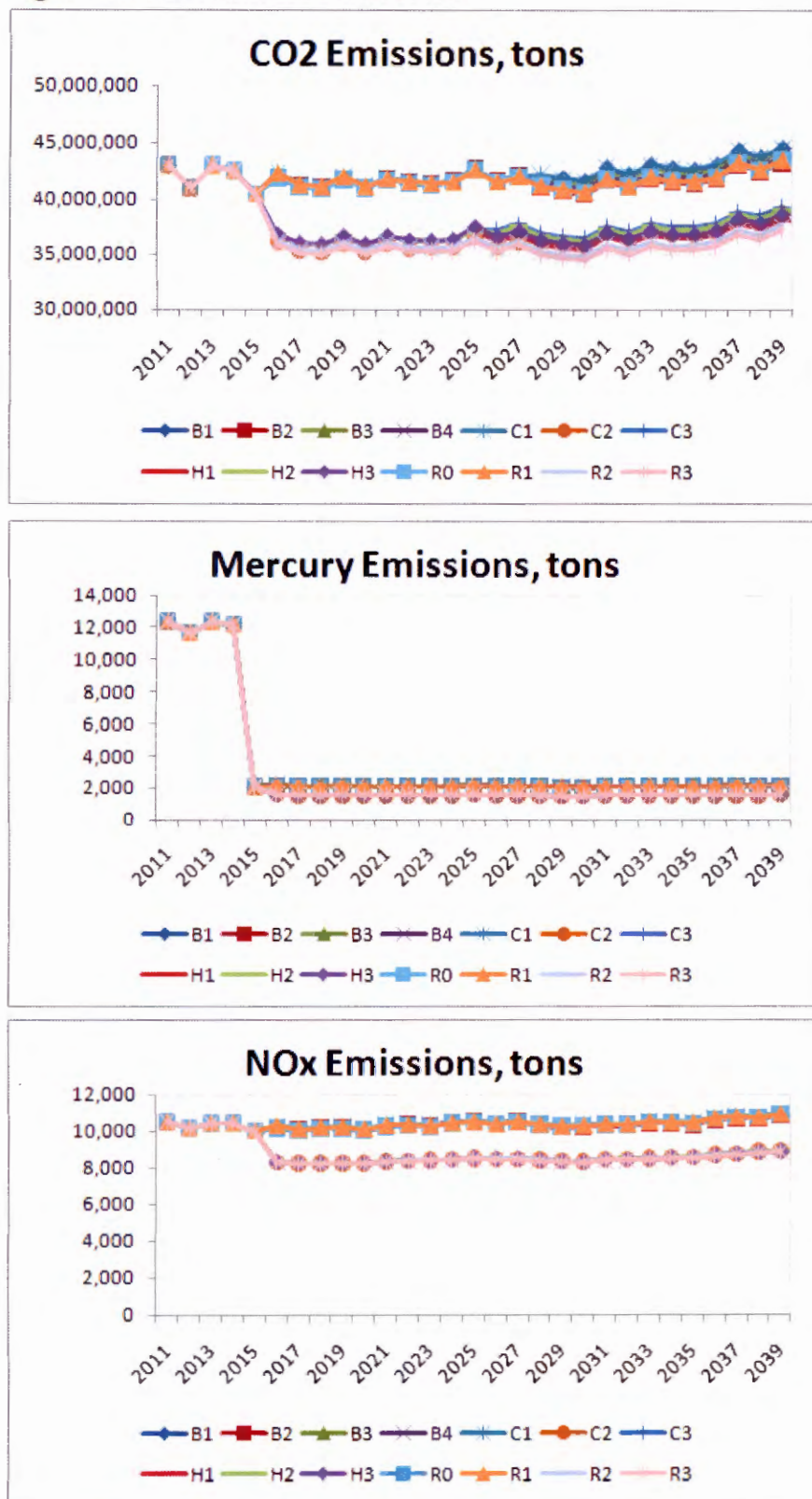
Figure 9.A.10 Financial Measures¹¹¹¹ 4 CSR 240-22.060(6)(C)7.

14 candidate resource plans - 060(6)(C)(7).xlsx

Figure 9.A.11 Annual Average Rates¹²

¹² 4 CSR 240-22.060(6)(C)8.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

Figure 9.A.12 Annual Emissions¹³¹³ 4 CSR 240-22.060(6)(C)9.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

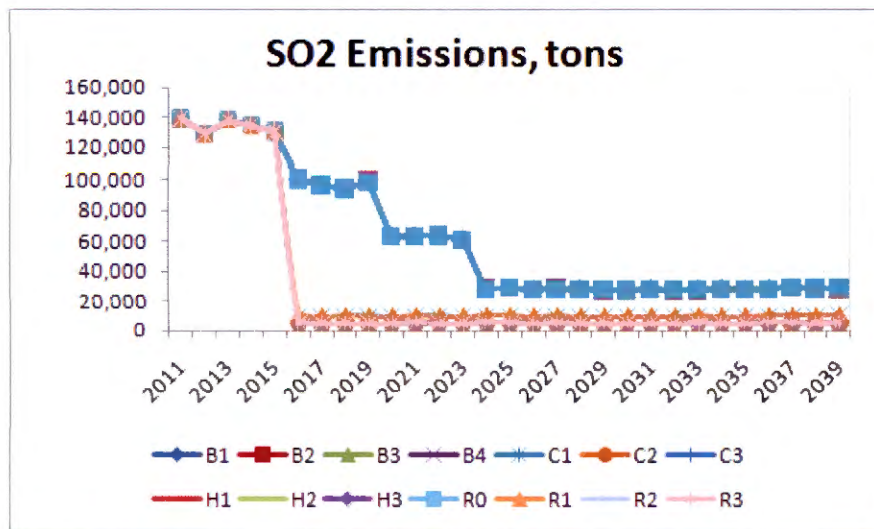
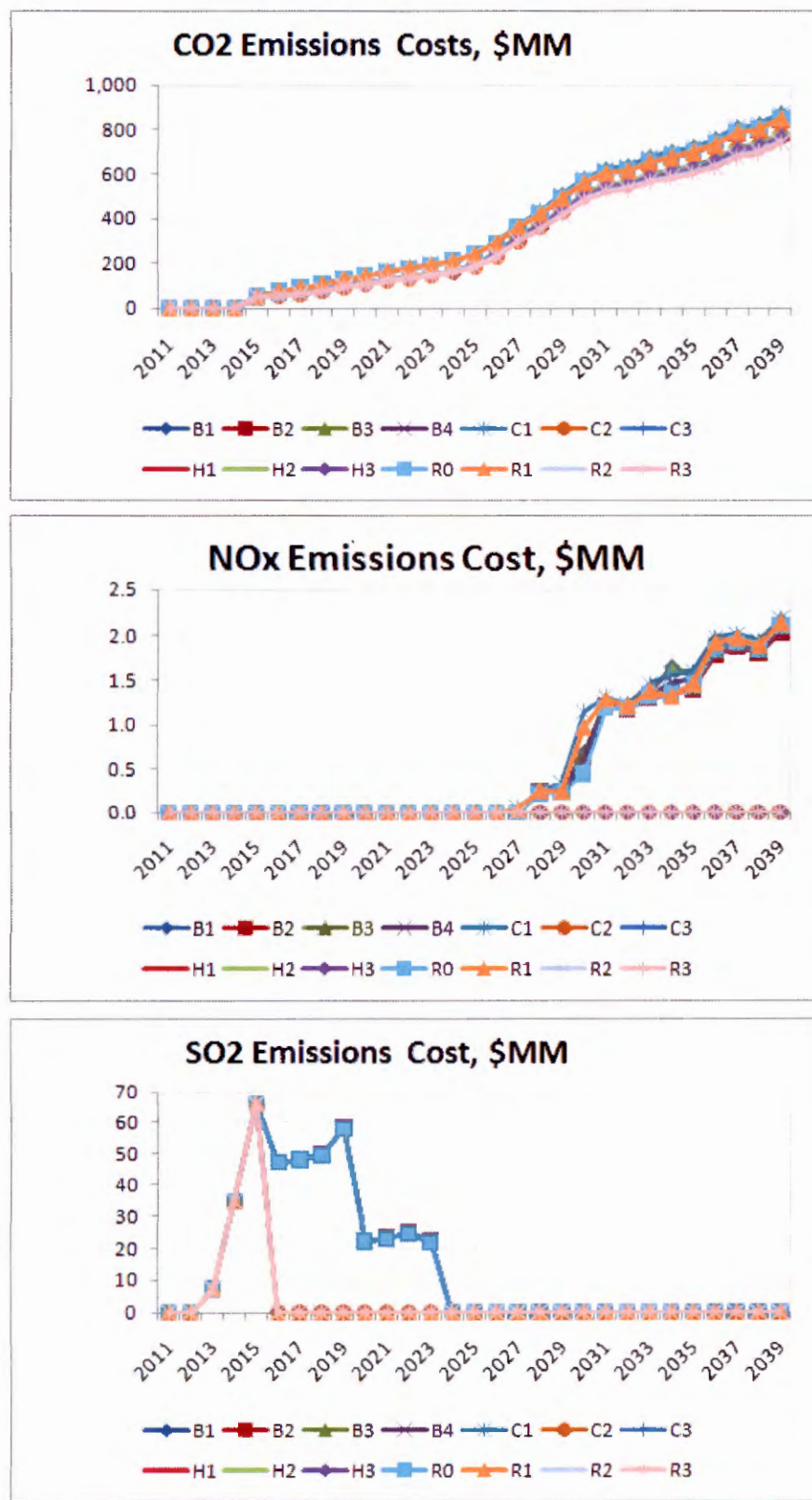


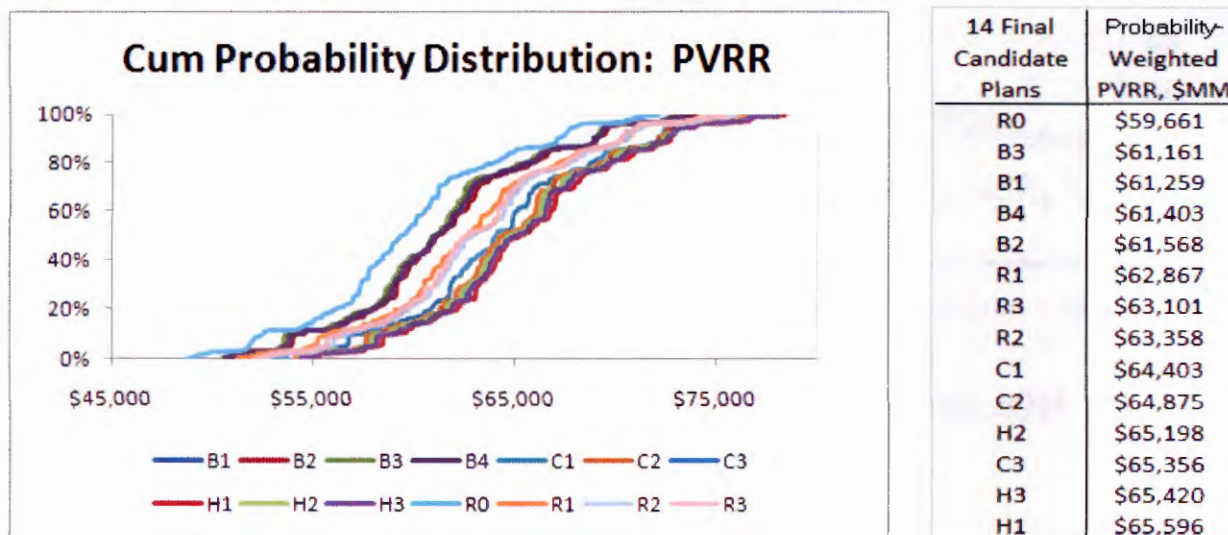
Figure 9.A.13 Probable Environmental Costs¹⁴¹⁴ 4 CSR 240-22.060(6)(C)10.

14 candidate resource plans - 060(6)(B), 060(6)(C)(8 thru 10), 070(5), 070(5)(A thru B).xlsx

Selected Performance Measures¹⁵

The CDF for PVRR is shown in Figure 9.A.14 for the 14 final candidate resource plans, identified by their 2-digit plan codes, while a more summarized measure, the expected value for PVRR is shown in the table next to the chart, in rank order of PVRRs.

Figure 9.A.14 Cum Probability Distribution of PVRR & Probability Weighted PVRR



Both the chart and the table provide the same ranking results, but it was more difficult to reach a conclusion using the CDF lines compared to using the single number for the expected values. This was because a conclusion using CDF lines required evaluating how all 270 points on each line compared the 270 points on each of the other CDF lines, how much of each line was to the left (better) of any other line, how each line started and ended compared to the start and end of other CDF lines, and the overall tendency of each CDF line. By comparison, the expected value for each line captured all of this information in a single number; essentially the CDF lines and the expected values were the same data in two different formats.

Since it was more difficult to make conclusions using CDFs than by using expected values, Ameren Missouri first examined the ranks of these plans using expected values for these 5 measures. The data for these 5 measures and their ranks on each measure are shown in Table 9.A.2. This table is arranged in ascending rank order of PVRRs.

¹⁵ 4 CSR 240-22.070(5); 4 CSR 240-22.070(11)(B)