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Public

Review and Assessment of Mississippi Power Company's Reserve Margin Plan

Report to the Mississippi Public Utilities Staff

Prepared by Bates White, LLC

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I. Executive Summary

Bates White was retained by the Mississippi Public Utilities Staff ("Staff") to provide an independent assessment of the Reserve Margin Plan ("RMP") filed by Mississippi Power Company ("MPC" or "Company") with the Mississippi Public Service Commission ("Commission") pursuant to the Company's Second Amended and Restated Stipulation ("Stipulation") in Docket No. 2017-AD-112. The initial RMP was filed on August 6, 2018. In the course of the initial review, discussions with MPC personnel, and responses to discovery requests, it became apparent that changed circumstances affecting inputs to the analyses underpinning the RMP warranted an update to certain portions of the RMP study. MPC provided revised analyses on September 17, 2019, and December 31, 2019. This report addresses the RMP methodology and results including those from the revised analyses.

Based on the review presented in this report, our conclusions and recommendations are as follows:

1. MPC has a substantial and persistent capacity overhang that imposes excess costs on ratepayers. This excess capacity position has existed since the Kemper County CCGT entered operation in August 2014, and has not diminished as anticipated, because load growth projected in MPC's 2010 IRP has not materialized. Projections reflected in the RMP are for a continued gradual decrease in peak load for much of the next decade, followed by minimal annual growth over the longer-term. In the absence of a plan to eliminate this excess capacity, ratepayers would bear the cost of approximately 500 megawatts ("MW") of unneeded capacity at least through 2029. MPC reports being unable to identify any willing buyers for the excess, which leaves accelerated retirement as the remaining means available to reduce costs.

2. The stipulations and orders intended to resolve outstanding matters associated with the Kemper County IGCC Project required MPC to evaluate ways to reduce the Company's capacity overhang and "to propose prudent financial safeguards for customers." MPC was required to conduct a Reserve Margin Plan to establish discrete alternatives to address excess capacity, timeframes for the alternatives, and estimates of implementation costs.

3. Analyses performed by MPC and updated periodically since 2018 have consistently identified accelerated retirement of Watson Unit 4 and Greene County Units 1 and 2 as providing net cost-reduction benefit. The remaining approximately 500 MW of excess capacity could be eliminated beneficially either through accelerated retirement of Watson Unit 5, or accelerated retirement of MPC's share of Plant Daniel Units 1 and 2, which is expected to be a single unit, once Gulf Power's announced plan to exit ownership of Daniel is executed by January 2024. In the latest RMP analysis update, the relative value of the two alternatives depends in part on the potential need for, and cost allocation of, $60 million in transmission upgrades if either resource is retired prior to 2024. MPC will need to confirm the need for such upgrades and the allocation of costs in order to establish a definitive retirement plan and schedule.

4. The general methodological structure of MPC's RMP study is reasonable in the way it assigns capacity value to marginal generation resources. However, we conclude that the method used to combine future scenarios into a single summary result may bias the results of the analysis. Specifically, taking the simple average across nine future scenarios implicitly assumes that each potential future is equally likely. The scope of our review did not provide for developing an analytical basis justifying a particular alternative weighting of the cases evaluated in the RMP. However, we present results for an alternative set of probability weights that we find more plausible than the equal probabilities implicit in taking the simple average across nine scenarios. We show that applying the alternative weightings would reverse the result for the base year 2024 retirement analysis, and would indicate that retaining Daniel Unit 1 in operation would impose net costs on customers.

5. The RMP analyses support the conclusion that MPC's older steam resources provide little or no net energy value to offset their going-forward costs. In simplified terms, keeping Daniel Unit 1 in operation and retiring Watson Unit 5 would impose higher fixed costs on customers, with certainty, than retiring Daniel Unit 1 and retaining Watson Unit 5. The higher fixed cost of Daniel would be offset, at least partially, by the value of generation from the plant, with the amount of value determined by the future scenario considered. MPC's analyses show net value for Daniel only in future scenarios that we conclude are relatively unlikely.

The balance of this report is organized as follows:

Section II summarizes the background to the RMP.

Section III addresses the MPC excess capacity context and presents a summary and assessment of the RMP evaluation methodology.

Section IV presents a discussion of issues related to the potential retirement of the remaining Daniel unit or Watson Unit 5.

An appendix, which summarizes the RMP evaluation results for the initial study and revised analyses, with a discussion of drivers of changes in the results.

II. Background

II.1. Initiation of the Docket

In its order of July 6, 2017, the Commission opened MPSC Docket No. 2017-AD-112 (In Re: Encouraging Stipulation of Matters in Connection with the Kemper County IGCC Project, "Settlement Docket"), which required that MPC, Staff and other intervening parties "expeditiously work to settle all outstanding matters associated with the Kemper Project."[1] The Kemper Project was initially proposed by MPC in a 2009 Certificate Petition as a lignite-fueled integrated gasification combined cycle ("IGCC") power plant, located in Kemper County, Mississippi, with a summer capacity rating of 582 MW. The combined cycle portion of the project, now known as Plant Ratcliffe, entered commercial service in 2014. Following years of extensive operational challenges, delays and cost increases, work on the gasification component of the facility was suspended in 2017. Plant Ratcliffe now operates as a 680 MW (net summer capability) generating facility fueled by natural gas.

The Commission's order opening the Settlement Docket established an expectation that the resulting settlement would resolve remaining matters of cost recovery and customer rate impacts associated with the Kemper Project and the in-service combined cycle power plant.

II.2. Second Amended Stipulation

Following several months of negotiations, MPC filed a Second Amended and Restated Stipulation ("Stipulation") on December 1, 2017, and the Commission subsequently found that the stipulation satisfied the settlement parameters set forth in the docket-opening order.[2]

In addition to resolving specific cost-recovery and ratemaking matters related to the Kemper Project and the combined cycle plant, the parties agreed in the Stipulation that:

> MPC has generating capacity that is in excess of the Company's long-term targeted reserve margin, and the Parties acknowledge that it is appropriate to examine MPC's reserve margin and propose prudent financial safeguards for customers.
>
> MPC shall, within six (6) months of the Commission's approval of this Stipulation and using the most current data available to MPC, develop, complete, and file with the Commission a Reserve Margin Plan ("Plan") and serve the Plan on all interested parties

[1] Order Opening Docket, MPSC Docket No. 2017-AD-112, July 6, 2017, Introduction.

[2] Order Approving Second Amended and Restated Stipulation, MPSC Docket No. 2017-AD-112, at 5.

for evaluation to allow a fully informed and transparent review of MPC's reserve margin.[3] (Emphasis added.)

The Stipulation further established parameters for the analyses to be performed as part of the RMP and the contents of the Plan. Specifically, the Stipulation stated that:

(a) The Reserve Margin Plan shall include, among other things: forecasting customer load and energy requirements; evaluating the resources available to meet the energy and capacity needs while satisfying strategic considerations; developing, evaluating and implementing demand side management and energy efficiency programs; and assessing and planning for existing and anticipated environmental laws and regulations and any other issues the Mississippi Public Service Commission deems relevant.

(b) MPC's Plan shall also contain: (i) discrete alternatives that the Company proposes to address its current reserve margin; (ii) the timeframe over which each alternative can be implemented; (iii) a preliminary estimate of the costs of implementing each alternative, including any incremental transmission capital investment and any costs associated with retiring any un-depreciated assets; and (iv) any other impacts (financial or otherwise) not specifically prescribed herein that would have a material impact upon the service provided by MPC or the costs to customers.[4]

[3] Stipulation at 14 and 15.

[4] Stipulation at 15 (a) and 15 (b).

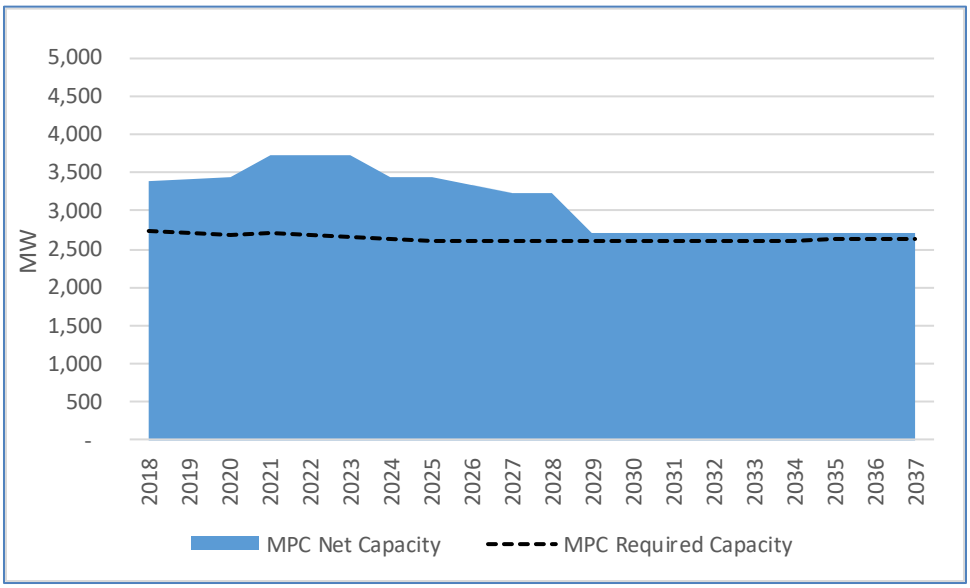
III. MPC Excess Capacity and RMP Methodology

MPC filed the RMP in August 2018. The report confirmed that MPC has supply resources substantially greater than its current need and that, assuming MPC's existing owned resources were retained through their full-depreciation dates, the high excess capacity situation would continue through 2028. In the absence of active changes to MPC's resource portfolio, the Company's capacity reserve margin would be expected to be greater than 40% through 2028, compared to a target capacity reserve margin under 15%.

III.1. Capacity and Load

Figure 1 graphs MPC's net capacity compared to its capacity need (peak load plus capacity reserve requirement).

Figure 1: MPC Net Capacity and Capacity Requirement, 2018-2036, MW (2018 RMP)



From 2021 through 2023, the years with the greatest excess, MPC exceeds its summer capacity need by more than 1,000 MW. The progressive decrease in capacity reflects the assumed retirement of assets when they are fully depreciated. Table 1 lists the relevant assets by depreciation date.

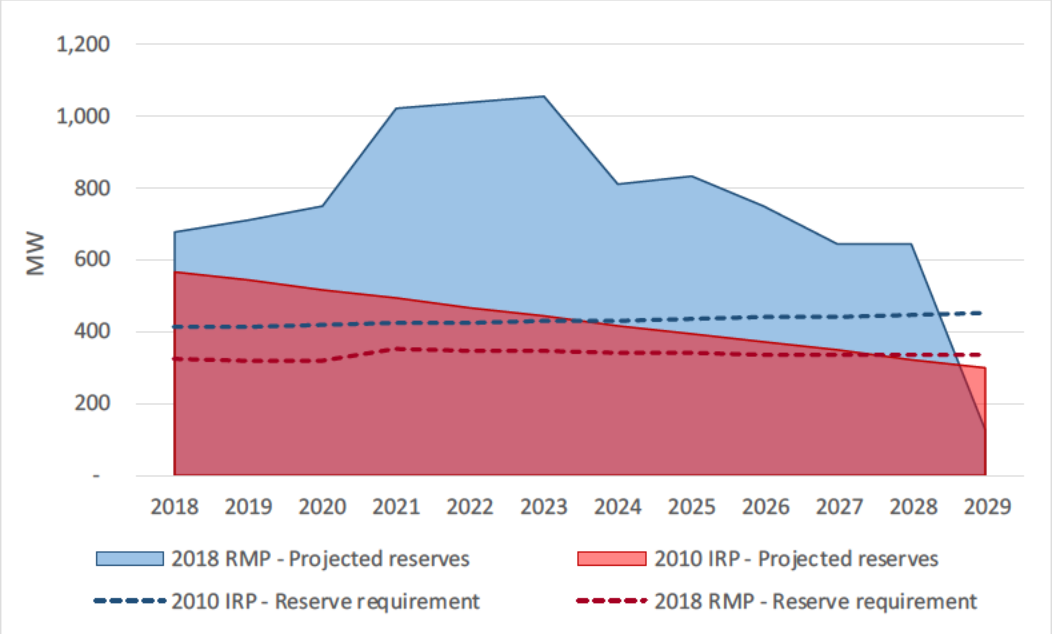
Table 1: MPC Assets with Completed Depreciation Dates Through 2028

Unit	Summary Capability (MW)	Depreciation Dates
Sweatt CT	32	2018
Watson CT	33	2018
Watson Unit 4	268	2023
Greene County Unit 1	106	2025
Greene County Unit 2	107	2026
Watson Unit 5	516	2028
Total	**1062**	

As discussed further below, Watson Unit 4 and Greene County Units 1 and 2 were identified through the RMP evaluation process as providing benefit from accelerated retirement. The remaining approximately 500 MW of excess capacity could be eliminated beneficially either through accelerated retirement of Watson Unit 5, or accelerated retirement of MPC's share of Plant Daniel, which is expected to be a single unit, once Gulf Power's announced plan to exit ownership of Daniel is executed by January 2024.

The RMP report provides a comparison of the current supply and demand context relative to that reflected in the Company's 2010 integrated resource plan ("IRP"), with a description of the key drivers behind the changed capacity reserve situation.

Figure 2: Projected Capacity Reserves, 2018 RMP and 2010 IRP, MW



III.1.1. Load changes

The RMP report explains the substantial change in capacity reserves using 2018 for reference. The most significant driver has been a gradual and sustained reduction in peak load. Compared to expectations in the 2010 IRP, retail load in the 2018 RMP was lower by 242 MW and wholesale load was lower by 189 MW, driven by what MPC terms "organic energy efficiency" (increased energy efficiency of appliances and adoption of other energy efficient technologies), and by an unexpectedly sluggish recovery from the 2008 recession. An additional load-related change affecting MPC's capacity reserve need was the reclassification of 163 MW of territorial wholesale load to a non-territorial capacity block sale. Though MPC will continue to serve the load, the reclassification means that MPC is not required to carry a capacity reserve on the associated load. The capacity block sale is instead treated as a reduction in capacity. Table 2 summarizes the peak load changes for 2018 from the 2010 IRP to the RMP. The effect on capacity need reflects MPC's 2018 target capacity reserve margin, with the effect of the load reclassification shown as just the reserve component (since the effect of the load is still reflected on the capacity side). The total reduction in MPC's capacity need from these effects is 511 MW.

Table 2: Change in 2018 peak load, 2010 IRP, and 2018 RMP, MW

	Peak Load	Effect on capacity need
2010 IRP projected load 2018	**2,998**	
Territorial load re-classification	(163)	(22)
Wholesale load	(189)	(214)
Retail load	(242)	(274)
Total 2018 – RMP	**2,404**	**(511)**

Looking forward, the RMP reflects further anticipated load reductions of approximately 0.75% (18 MW) annually through 2026, and nearly flat load after 2026 (less than a quarter of a percent annual growth). The projected contraction in load through 2026 reflects a continuation of current trends in increased energy efficiency ("organic"; i.e., non-program) and changes in contractual wholesale loads.

III.1.2. Capacity changes

Net capacity reflected in the RMP for 2018 is 165 MW lower than expected in the 2010 IRP. Three categories of change are identified: increased net capacity of existing resources (+136 MW), additional plant retirements (-94 MW), and additional net sales (-286 MW), resulting in a net reduction of 165 MW. The change in net sales includes +45 MW of capacity capability associated with recent wind power purchase agreements and approximately 286 MW of sales to Cooperative Energy under arrangements expected to end in March 2021.

The increased capacity from existing resources is the result of the repowering of the Watson and Greene County coal units to natural gas, as well as the higher net output of Ratcliffe operating as a gas-fired

combined cycle rather than an IGCC. In these cases, the increased net capacity reflects reduced station or 'parasitic' load. Plant retirements as of 2018 reflect an actual total of 444 MW in the RMP compared to 350 MW anticipated in the 2010 IRP. The sales to Cooperative Energy include a 200 MW short-term sale and 86 MW under sales tied to specified units.

Beyond 2018, the RMP reflects some incremental capacity increases. Ratcliffe's capacity increases by approximately 19 MW (summer capability) following an "Ultra-Low NOx[5] F6 Hot Gas Path" conversion, expected to be complete as of fall 2018.[6] An additional solar facility, in early stages of development, is expected to provide another 18 MW of summer equivalent capacity, in addition to the 45 MW from three operational solar facilities under PPAs.

The sales to Cooperative Energy are assumed to end in March 2021, which causes an increase in MPC's net capacity and reserves that can be seen in Figure 1 and Figure 2 in 2021.

III.2. RMP Assessment Approach

The RMP analysis methodology aims to identify whether accelerated retirement of certain MPC generation assets could provide cost savings. Accelerated retirement is considered as retirement prior to the date at which an asset is fully depreciated. In addition to the resources listed in Table 1, MPC evaluated all four of the Daniel units (two coal and two combined cycle) and Ratcliffe. The full list of evaluated resources is shown in Table 3. This represents MPC's entire generation portfolio with the exception of the five cogeneration units that are dedicated to the Chevron Refinery in Jackson County, Mississippi, and which are not candidates for retirement.

[5] Nitrogen Oxides ("NOx")

[6] RMP Report, Appendix A, note 4.

Table 3: MPC Generation Assets Evaluated (2018 capacity rating)

Unit	Generation type and fuel	Summer Capability* (MW)
Daniel Unit 1	Steam, coal	251
Daniel Unit 2	Steam, coal	251
Daniel Unit 3	Combined cycle, NG	538
Daniel Unit 4	Combined cycle, NG	557
Greene County Unit 1	Steam, NG	106
Greene County Unit 2	Steam, NG	107
Ratcliffe	Combined cycle, NG	680
Sweatt CT	Combustion turbine, NG	32
Watson CT	Combustion turbine, NG	33
Watson Unit 4	Steam, NG	268
Watson Unit 5	Steam, NG	516
Total		**3,339**

* Reflects MPC ownership shares for Daniel Units 1 and 2, and Greene County Units 1 and 2.

The RMP evaluation methodology is a multi-step screening that produces a net present value revenue requirement ("NPVRR") for each resource if it were kept in service over a 30-year evaluation horizon, assessed for each of nine future scenarios for natural gas prices and carbon prices. The nine fuel/carbon dioxide ("CO_2") cases correspond to scenarios developed as part of Southern Company's annual planning cycle. Table 4 summarizes how the nine scenarios are derived from three CO_2 price cases and three natural gas price cases. The indicated CO_2 price is the price in dollars per metric ton ([redacted]$) assumed to apply in 2026, after which the price is escalated at [redacted] percentage points above inflation. The natural gas prices in each of the high, moderate and low cases vary slightly with each of the CO_2 price cases. These scenarios are assessed further below.

Table 4: Fuel and CO_2 Price Scenarios

	CO_2 Price		
NG Price	**$0**	**$10**	**$20**
High	HG0	HG10	HG20
Moderate	MG0	MG10	MG20
Low	LG0	LG10	LG20

The evaluation of each asset produces an NPVRR value for each fuel/CO_2 price scenario, and the nine values are averaged to produce a single NPVRR result.

III.2.1. Context and Conceptual Approach

As noted above, the asset valuation involves a multi-step process, but it is perhaps easier to understand by first considering the underlying context and conceptual approach applied in the RMP. As a preliminary matter, it is important to recognize that a utility being long capacity is not necessarily a bad thing for ratepayers. If the excess generation can produce revenue in excess of costs, a capacity overhang may produce benefits by reducing net fuel costs. However, if the excess capacity is relatively inefficient, it will produce little or no net energy value, and if the broader market is long on supply, there may be little or no value for excess resources as capacity only. This is the situation confronted by MPC that prompted the settlement commitment to perform the RMP. MPC's older steam units (Daniel Units 1 and 2, Watson Units 4 and 5, and Greene County Units 1 and 2), totaling approximately 1,500 MW of summer capability, are relatively inefficient compared to other available resources on the Southern Company system, and they consequently operate at fairly low levels. The steam units also have limited marketable capacity value. MPC states in the RMP Report that "[d]espite significant effort over the last several years, MPC has had limited success in finding reasonable opportunities to market MPC's capacity above current reserve requirements."[7]

If there is little or no potential to extract net revenue from the excess steam capacity, then the question becomes whether there are costs that can be avoided by retiring one or more of the resources. Ultimately, that is the focus of the RMP: potential cost avoidance.

Finally, MPC establishes in the RMP that the asset valuation is a forward-looking, incremental analysis – i.e., one intended to address what can be changed going forward – and it therefore ignores sunk costs, which by definition cannot be changed or avoided. Consistent with this view, the estimation of NPVRR for each asset is not affected by remaining net book value, which it is assumed will be recovered in any scenario and so is not avoidable.

III.2.2. Components of Asset Cost and Value

The evaluation captures the following basic components of cost and value for each asset assuming it continues in service:

- Benefits (that would be lost if the resource were retired)
    - Energy – the net value of energy produced (or zero if generation is uneconomic);
    - Avoided transmission – a positive value that represents a saving of transmission upgrade costs that would be incurred if the asset were retired;

[7] RMP Report, page 1.

- Capacity – a positive value that reflects the cost of filling a capacity need that would be caused by retirement of the unit (this depends on whether other assets are assumed to be retired first; see discussion below);

- Costs (that would be avoided if the resource were retired)
  - Fixed Operations & Maintenance ("O&M") – reflecting annual costs that apply whether or not power is generated;
  - Maintenance capital – required capital expenditure in addition to fixed O&M;
  - Environmental capital – required environmental expenditures;
  - Non-variable fuel – fixed costs that could be avoided if the resource were retired;
  - Ad valorem taxes.

III.2.3. "Step 1" Rank Ordering of MPC Resources

In the first step of the evaluation, each asset is evaluated independently against a reference resource alternative over a 30-year horizon to establish a rank ordering of the MPC assets by value. The ordering is then used to determine the assumed order of potential retirement, with the lowest value (highest cost) resources retired first. The order of potential retirement is a critical part of the analysis, because it determines how much capacity value is assigned to each resource, as discussed further below.

One thing that is potentially confusing in MPC's reporting of RMP analysis results, and the changes that occurred in the updated analyses, is that resources considered for retirement are evaluated in the first rank-ordering step as having positive NPVRR value. For instance, Daniel Units 1 and 2 (assessed jointly) and Watson Unit 5 both have positive NPVRR values in the first step ranking across all the analyses that were performed. It is important to understand that this does not mean the assets have a positive net value on a standalone basis (otherwise, it would presumably not be so difficult for MPC to market its excess capacity to potential buyers). Rather, the positive NPVRR in the first step of the evaluation reflects the fact that the reference resource alternative – for instance a new-build combined cycle – constitutes more costly capacity than the MPC assets, for which most costs are sunk (i.e., cannot be avoided).

Each MPC asset is evaluated against the alternative resource assuming that the MPC asset remains in service for 30 years. While differences in remaining asset life might seem to be relevant to the determination of relative resource value, asset life is not a fixed period with a particular end date. Generation assets can be kept operating with major maintenance, component replacement, refurbishment, repowering, etc. Equally important is the MPC over-capacity context: the retirement of any single resource on its own would not cause a capacity need in the study horizon (with the exception of Daniel Units 3 and 4 considered jointly at more than 1,000 MW). Because the larger steam units provide little or no energy value in most of the fuel/CO_2 price scenarios, each of the resources considered individually would be found to impose a net cost on the system and would warrant immediate retirement. But the resources could not be retired all together without creating a capacity shortfall that would require costly

replacement. If the resources are each retired successively, the value of each to the MPC system can change because at some point a retirement will cause a future capacity replacement need, the cost of which should be treated as a value of continued operation of the existing asset. Because the particular sequence of retirement affects the value of each asset, the initial rank-ordering step is critically important.

Returning to the assumed operation of each asset for 30 years, this is a reasonable approach that puts the value of each asset on a comparable footing, and makes the evaluation tractable. An alternative that would account for potential differences in asset life would likely be infeasible to solve. The decision whether to invest more or retire would have to be assessed repeatedly over the evaluation period for each asset, and since that decision would depend on whether or not other assets had been retired, it would quickly become an insurmountably complex problem, and probably one with no single optimal result. The evaluation over 30 years provides a reasonable basis to establish an initial rank ordering of the MPC assets.

III.2.4. Determination of Capacity Value

One driver of the need to perform the RMP analysis is that MPC's excess capacity has no value in the market. Yet, as noted above, retirement of all the steam units would cause a capacity shortfall entailing replacement costs, the avoidance of which is properly considered as a value of some portion of retained capacity. The question is what assets should be assigned capacity value for preventing future capacity acquisition costs? This is resolved through the initial rank ordering in Step 1 of the evaluation. Any retirements are assumed to occur in order of highest NPVRR. Based on that retirement order, only those resources that cause a quantity of future capacity shortfall are assigned capacity value.

The analysis considers not only the capacity needed to meet MPC's installed capacity reserve requirement, but also capacity needed for other system support functions. For example, the Watson and Sweatt CTs were fully depreciated as of the end of 2018, and provide essentially zero net energy value, but they are assigned a capacity value because they provide critical system support through black start capability for system restoration.[8] If the units were retired, MPC would need to replace the black start capability at a cost.

The capacity value assigned to each asset has a substantial effect on the evaluation results. For example, as will be discussed in more detail below, assigned capacity value is the largest source of benefit for Daniel Units 1 and 2 in the initial RMP analysis, and causes the final NPVRR to be positive rather than negative.

[8] The RMP report identifies the Watson CT as a "designated black start unit required for system restoration" (RMP Report, footnote 16, page 8). The Sweatt CT is described as "black start-capable" (RMP Report, footnote 17, page 8).

III.2.5. Avoided Transmission Cost

Another important component of value in the RMP evaluation is avoided transmission cost. The retirement of a large generating asset may have impacts on system reliability that must be resolve through transmission upgrades. The cost of required transmission investments is treated as a benefit of continued operation for resources where it is applicable. While this factor is simpler than capacity value because it is not dynamic (required upgrades are associated with retirement of a particular resource), the determination of whether transmission upgrades are avoidable requires careful consideration. For example, the RMP Report notes that certain transmission projects need to be completed prior to retirement of Watson Units 4 and 5. However, these projects have already been reflected in MPC's budget, and they also resolve other transmission issues, so the associated costs were not considered avoidable by retaining either Watson unit in operation, and were not assigned to either unit as a benefit.[9]

Whether transmission cost is considered avoidable also depends on other factors, including how retirements are assumed to occur. In the August 2018 RMP, it was assumed that Daniel Units 1 and 2 would either retire or continue to operate together; individual unit retirement was not considered. This assumption reflects several characteristics of the units. First, the units share various facilities, including environmental infrastructure that would require significant investment going forward, and many associated costs could not be avoided by the retirement of a single unit. As a consequence, retiring one unit would increase the unit costs of the remaining unit, so it is doubtful that retiring one unit on economic grounds would not also indicate that the remaining unit should be retired. Additionally, each unit is jointly owned, 50/50, by MPC and Gulf Power, which makes an analysis of retiring one unit problematic without additional assumptions regarding how that would be effected. As the potential retirement of the full facility was being tested under the RMP, compared to continued operation of the full facility, the units were assigned the avoided transmission costs as a benefit. This value was $173 million on an NPV basis, contributing to a total NPVRR value in the final assessment of $192 million.

Circumstances justifying this evaluation treatment changed in January 2019, with the notice given by Gulf Power that it would retire its share of Plant Daniel in January 2024 (subject to an option for MPC to buy out Gulf Power's share for $1). The impacts of the change are discussed further in Appendix A.

Final Evaluation

The final step of the evaluation assesses each of the MPC resources over 30 years considering all the components of avoidable cost and benefit described above. The particular results of the 2018 RMP are summarized in Appendix A.

[9] RMP Report, page 15.

III.3. Assessment of Methodology and Assumptions

We find that the methodological structure of the RMP analyses is a reasonable approach to evaluating potential value in addressing MPC's current excess capacity position through accelerated asset retirement. The discussion of the evaluation elements presented above addresses the rationale for the key steps and assumptions. We consider the evaluated costs and benefits to be appropriate, and we conclude that the multi-step evaluation process, including the initial rank-ordering assessment and the subsequent assignment of capacity value to each resource, constitutes is a reasonable method to estimate asset value and potential savings from retirement. As we discuss below, updated evaluations using the same methodology, but reflecting changed circumstances and updated inputs, produced significantly different results. While this naturally raises questions regarding the stability and reliability of the analytical method, we conclude from our review that the changed results do not reflect methodological flaws, but are a consequence of material changes in factors that were appropriately addressed by MPC in its analysis updates. In particular, the changed analysis results were not driven by volatile market variables such that there is a significant risk that the results flip back based on subsequent updates.

III.3.1. Fuel and CO_2 Price Cases

One concern we have with respect to the underlying model cases used in the evaluations is that the nine fuel/CO_2 price scenarios cover a limited range of futures relevant to assessing the value of MPC's resources. In particular, it is our opinion that the high CO_2 price of $20 per metric ton ([redacted]$) beginning in 2026 and escalating at [redacted]% above inflation does not properly test the effects of potential stringent efforts to mitigate climate change. Additionally, the equal weighting of the cases in the asset evaluations undermines the applicability of the natural gas price cases.

The RMP evaluation applies Southern Company Services ("SCS") models that incorporate inputs developed by Charles River Associates ("CRA"), summarized in an annual report prepared for SCS. The nine scenarios applied in the evaluations for the August 2018 RMP correspond to those in the March 2018 CRA report "Scenario Fuel Forecast Documentation – Budget 2018." The same CO_2 price cases were also applied in the analysis updates in April 2019 and September 2019.

We find that the low, moderate and high natural gas price cases reasonably reflect a range of price paths useful in assessing the value of generation assets. However, by weighting the nine scenarios equally, the RMP analysis effectively assumes that the high natural gas price case is as likely as the low and moderate cases. We believe the high gas case – with natural gas prices roughly double the low case early in the analysis horizon, rising to four times the low case – is comparatively unlikely. The most relevant consequence of giving the high fuel price case equal weighting with the others is that it likely causes the energy value of Plant Daniel to be overstated.

With respect to the CO_2 prices, while a future with no price (explicit or effective) on CO_2 over the long-term is possible, we consider this to be a low likelihood future. In our view, a high CO_2 price case that

would test the effects of stringent mitigation policies would be far higher than the $20/metric ton ("MT") case used in the fuel/CO_2 scenarios. Figure 3 compares the moderate and high CO_2 cases represented in the nine future scenarios used in the RMP evaluations to the U.S. Government Social Cost of Carbon ("SCC"). The SCC values represent estimates of the long-term damage caused by a metric ton of CO_2 emissions in a given year. The U.S. Environmental Protection Agency and other federal agencies were required to use the SCC values to evaluate costs and benefits of CO_2 impacts from rulemakings. Though this requirement has been suspended under the Trump administration, the SCC series still represents the most current U.S. government technical estimate of CO_2 costs (revised as of August 2016).

Figure 3: CO_2 Price Cases Compared to the U.S. Social Cost of Carbon ([redacted] dollars)[10]

The comparison in Figure 3 shows that both the moderate and high CO_2 cases reflected in the nine evaluation scenarios are well below the U.S. SCC for the entire RMP evaluation period. Even the U.S. SCC values may underestimate current best estimates of the CO_2 price necessary to limit global temperature increases. The October 2019 *Fiscal Monitor* published by the International Monetary Fund presented the results of an analysis showing that a carbon tax (or policy equivalent) rising quickly to $75

[10] U.S. Government Social Cost of Carbon (3% social discount rate case) from: "Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866" (May 2013, Revised August 2016). https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html. Values adjusted to real 2016 dollars using historical inflation based on the U.S. GDP implicit price deflator, accessed at https://fred.stlouisfed.org.

per ton of CO_2 (2017$) in 2030 is required to limit warming to 2°C.[11, 12] This compares to the U.S. SCC value of approximately $58/ton in 2017 dollars.

The moderate and high CO_2 cases also incorporate assumed carbon capture and sequestration ("CCS") requirements on new gas-fired combined cycle power plants, beginning in 2036 in the $20 CO_2 price case and 2048 in the $10 CO_2 price case. In the referenced forecast document, CRA states that the combination of the $20 CO_2 price path and assumed CCS requirements starting in 2036 "represents a reasonable high bound, and that a higher price is not necessary to model."[13] While the CCS assumptions do augment the effect of CO_2 prices on new combined cycle power plants, they would diminish the effect of CO_2 prices on other generation sources, particularly coal-fired facilities such as Daniel Units 1 and 2. The assumed CCS requirements would increase the costs of incremental generation capacity from combined cycles, tending to increase wholesale market prices and the value of generation from existing resources. The resulting increase in energy value of generation would partially offset the already modest CO_2 price effect on coal generation.

With respect to the effect on the RMP evaluations, we believe that the CO_2 price cases applied in the nine scenarios do not represent an appropriate range of potential futures for assessing the value of existing coal-fired generation. Our conclusion is that all of the evaluations consequently overestimate the value Daniel Units 1 and 2. This issue is of more concern with respect to the results of the initial August 2018 study and the April 2019 update, which both showed value in the retention of Daniel Units 1 and 2. The concern is lessened somewhat with respect to the September 2019 study, which concluded that retirement of Daniel would provide savings (i.e., more appropriate CO_2 price cases would not change that conclusion). However, we find that the flawed CO_2 price cases cause Daniel to be overvalued in all the evaluation studies relative to the other MPC assets.

[11] IMF, "Fiscal Monitor: How to Mitigate Climate Change," (October 2019). https://www.imf.org/en/Publications/FM/Issues/2019/09/12/fiscal-monitor-october-2019#Mitigating%20Climate%20Change.

[12] The 2°C threshold, representing the average global temperature increase relative to pre-industrial levels, is often used as a reference target that is potentially achievable, allows for human adaptation, and moderates risk of catastrophic, runaway temperature increases.

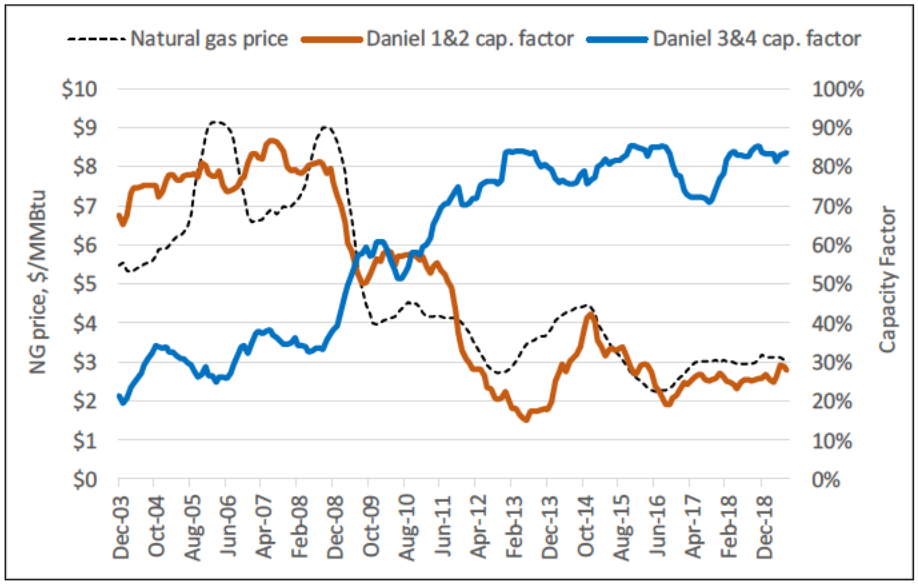
[13] Scenario Fuel Forecast Documentation – Budget 2018, page 9.

IV. Discussion of Daniel and Watson Retirement Potential

As indicated by the discussion above, the RMP evaluation was essentially guaranteed to identify around 1,000 MW of excess capacity for accelerated retirement. This follows from the fact that MPC's older steam resources, including Watson Unit 5 and Daniel Units1 and 2, provide little or no net energy value to offset their going-forward costs. As a consequence, none of the steam resources provides benefit in excess of cost unless a value is assigned to its capacity. Since the steam resources total approximately 1,500 MW, and MPC has about 1,000 MW of excess capacity, the question is which 500 MW should be retained? And that effectively comes down to Watson Unit 5 or MPC's share of Plant Daniel, each representing about 500 MW of capacity. If one is retired, the other takes on significant capacity value, because retiring the second would cause a capacity shortfall that would need to be filled.

The trajectory of the value of Daniel Units 1 and 2 over time can be illustrated by comparing generation from the plant to that from the Daniel Units 3 and 4 combined cycles located at the same site. The rolling 12-month capacity factors for the combined coal and gas units respectively since 2007 are shown in Figure 6, with the rolling 12-month average of natural gas prices at Henry Hub. It is apparent that, as natural gas prices have fallen (with the large and sustained rise in shale gas production), Daniel Units 3 and 4 have become less costly, and more valuable to operate, while the reverse has happened to Daniel Units 1 and 2.

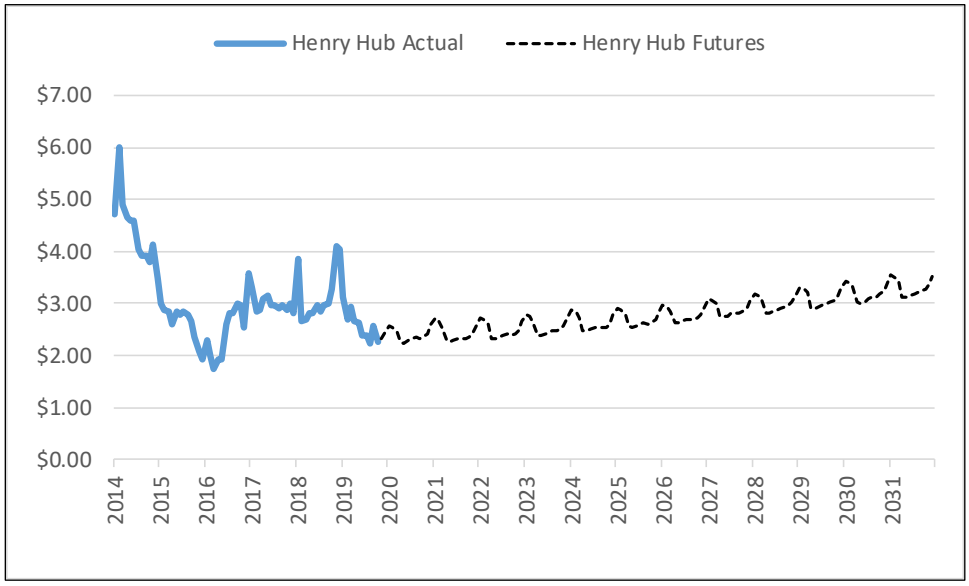
Figure 4: Daniel Units Rolling 12-mo. Capacity Factor; Rolling Avg. NG Price[14]



[14] Plant generation data from S&P Global Market Intelligence; natural gas price data for Henry Hub (average monthly spot) from the Energy Information Administration.

While natural gas prices continue to demonstrate seasonal variation in response to demand levels, and volatility in response to transient supply disruptions, e.g., from gulf coast hurricanes, average prices have stayed within a remarkably stable range for more than a decade. The 12-month rolling average price at Henry Hub shown in Figure 4 has been below $5.00 per MMBtu for 122 consecutive months. And futures prices indicate that the market expects natural gas production to remain high and prices to remain low. Monthly historical prices and futures prices are shown in Figure 5. While the futures market is illiquid in out years, and pricing tends to follow near-term trends, there is no indication that the new natural gas context is expected to change looking forward.

Figure 5: Natural Gas Historical and Futures Prices[15]



IV.1. Relative Value of Watson Unit 5 and Daniel Units 1 and 2

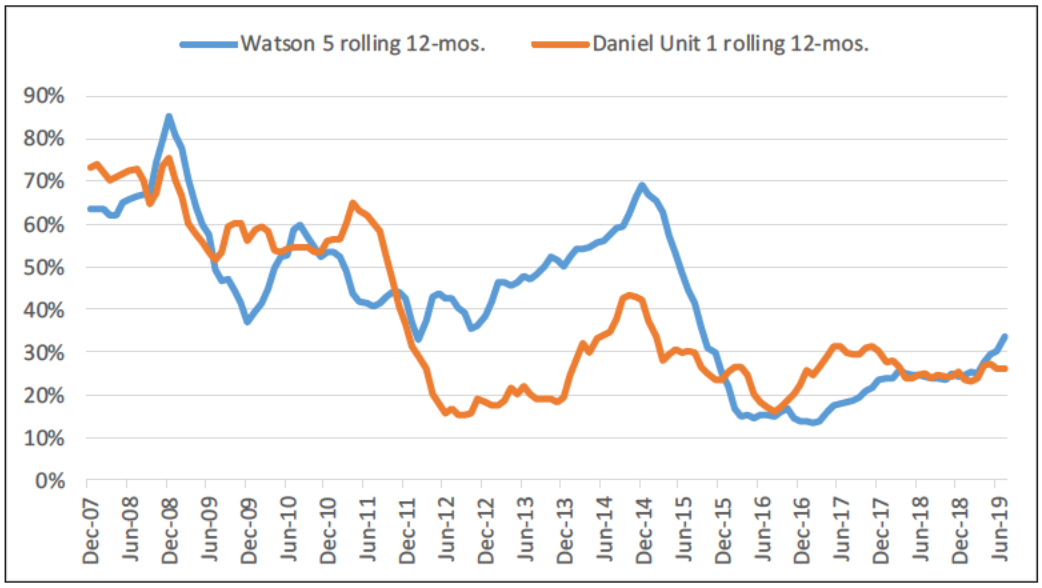
As indicated by the RMP Step 1 values summarized in Table A-3, above, the relative value of Watson Unit 5 and Daniel Units 1 and 2 has been close for all the evaluation analyses. The value of Daniel fell below that of Watson Unit 5 largely because retirement of one unit at Daniel became a certainty following Gulf Power's January 2019 notice. MPC acknowledged that the retirement of one unit would increase the costs of the remaining unit; in particular, that fixed costs would not be reduced by half, and per-kW costs would therefore increase. It is not clear that this effect has been fully assessed and incorporated in the September 2019 revised analysis. The latest result was driven predominantly because transmission

[15] Historical data from EIA; futures data from CME Group, https://www.cmegroup.com/trading/energy/natural-gas/natural-gas.html, accessed 10/25/19.

upgrade costs are no longer avoidable in the retain Daniel case, and environmental compliance costs *are* avoidable in the retire Daniel case.

As an alternative to keeping Daniel Unit 1 in operation, Watson Unit 5 is a comparable resource – similar in size, age, and generation value. Figure 6 shows the rolling 12-month capacity factor for Watson Unit 5 and Daniel Unit 1 since 2007. The units have been dispatched similarly, and since January 2007 (the earliest month for which net generation data were available for Watson Unit 5), Watson Unit 5 has produced slightly more aggregate net generation, by about 1 million MWh, than Daniel Unit 1.

Figure 6: Daniel Unit 1 and Watson Unit 5 Rolling Capacity Factor Since 2007[16]



IV.2. Fuel Diversity

MPC notes that Daniel is its last large generator that is not fueled by natural gas, and so is the only significant near-term source of fuel diversity. This is certainly true, and fuel diversity can reduce the volatility of average fuel prices over time. However, it is important to appreciate that the fuel diversity provided by retention of Daniel Unit 1 would be purchased at a cost, much like any fuel price hedge. Reducing fuel price volatility may protect against extreme events, but will generally increase average cost, which is what is indicated by the September 2019 analysis: retaining Daniel Unit 1 rather than Watson Unit 5 would increase expected costs.

Perhaps more important, retention of Daniel comes with other risks that may more than offset any fuel diversity benefit. As discussed in Section III.3.1, we find that the CO_2 price cases applied in the

[16] Data from S&P Global Market Intelligence.

evaluation do not appropriately test the value of Daniel Unit 1 in plausible – in our view likely – future climate change mitigation policy scenarios. Daniel Unit 1 is more exposed than Watson Unit 5 to potential future environmental costs.

IV.3. Economic Impacts of Retirement

MPC observes that retirement of Gulf Power's ownership interest in Plant Daniel would have "an adverse impact on the local community through reduced employment, ad valorem tax, etc."[17] The retirement of the remaining unit would have an additional adverse economic impact. While true, these impacts are not ignored in the RMP evaluation. Rather, the impacts are counted as *benefits* in the form of avoided costs and avoided ad valorem taxes that are explicit components of the resource valuations. We do not dismiss the reality of negative local impacts from retirement of Daniel, but we find that the RMP analysis is appropriately focused on potential cost savings that would accrue to MPC ratepayers, and that the cost savings are necessarily associated with reduced local economic stimulus. Additionally, because retirement of Daniel and Watson Unit 5 are effectively mutually-exclusive alternatives, negative economic impacts from retirement of Daniel would be linked to positive economic impacts from retention of Watson Unit 5.

[17] Response to data request MPUS (BW) 2-2.

A. Appendix – RMP Analysis Results

Section III.2 above addresses the key components of evaluated benefits and costs and how the RMP analytical approach assigns values of these to each MPC resource. To reiterate the fundamental, conceptual approach, the analysis focuses on costs and benefits caused by a decision to retain rather than retire each asset at a particular time. In the 2018 study, the "base year" corresponding to the retain/retire decision was 2019, while the revised analyses looked at a 2022 base year, and subsequently a 2024 base year.

The September 2019 analysis update indicated a switch in results for Watson Unit 5 and Daniel retirement alternatives, finding that the most economic RMP alternative would be to cease operation of Plant Daniel and retain Watson Unit 5, while the earlier analyses indicated the reverse. The change in results was driven largely by the following discrete events:

- Gulf Power's January 2019 notice that it would retire its 50% share of Plant Daniel, the effect of which was evaluated and incorporated in the analysis first in the September 2019 analysis;
- Study completed in July 2019 indicating that the compliance deadline for certain CCR projects at Daniel would be later, and thus avoidable in the case of retirement.

In assessing the value of continued operation of Daniel, these changes eliminate the benefit of avoided transmission cost, and add costs for environmental expenditures previously excluded because they were not expected to be avoidable. This caused the value of Daniel to change from positive to negative in the Step 1 rank ordering, dropping below the value of Watson Unit 5 (which also fell in the September 2019 evaluation). The change in Step 1 ordering caused the capacity value assigned to Daniel to fall, and that assigned to Watson Unit 5 to rise.

The December 2019 analysis incorporated further updates to the fuel price forecasts, budget forecasts, and transmission studies. A significant finding of the updated transmission studies was that retiring either Watson Unit 5 or Daniel Unit 1 prior to 2024 (assuming that Gulf Power retires Daniel Unit 2) would likely cause heightened operational risks "that go beyond typical transmission planning scenarios."[18] As a consequence, $60 million in transmission investment would be required to support system reliability in such an early retirement case, which could be avoided by keeping both units in service until 2024.

The December 2019 analysis of retiring either plant in 2024 determined that keeping Daniel Unit 1 in operation rather than Watson Unit 5 would provide $51 million in net present value (NPV) benefits. Retaining Watson Unit 5 in operation rather than Daniel Unit 1 would increase net costs on all nine Gas/CO_2 price scenarios evaluated. Retaining Daniel Unit 1 rather than Watson Unit 5 would increase

[18] Supplemental response to MPUS (BW) 2-1 Supplemental 2 (December 31, 2019), page 3.

net costs in five out of nine Gas/CO_2 price scenarios, but would be expected to provide significant net benefits in high gas / low CO_2 price cases, such that the average across nine cases is a positive net benefit.

August 2018 RMP Results

Table A-1 summarizes the final results of the August 2018 RMP analysis. Based on the final ordering by NPVRR, the conclusion stated in the RMP Report was that the analysis "currently indicates that the most economic alternative is to cease operation of Units 4 and 5 at Plant Watson and Units 1 and 2 at Plant Greene County prior to their current depreciation dates…"[19]

Table A-1: Aug 2018 RMP Final NPVRR Values by Evaluated Resource (2019 Base Year)

Unit	Avg. NPVRR, millions 2018$ (positive=benefit)	Summer Capability, MW	Cumulative Capacity, MW
Watson Unit 5	($280)	516	516
Watson Unit 4	($175)	268	784
Greene County Unit 2	($100)	107	891
Greene County Unit 1	($75)	106	997
Sweatt CT	$15	32	
Watson CT	$15	33	
Daniel Units 1 and 2	$198	502	
Ratcliffe	$399	680	
Daniel Units 3 and 4	$1,385	1095	

There are several things to note regarding the summary data in Table A-1 that help in understanding the changes in the updated analyses:

- The total capacity of the four resources with negative NPVRR (and therefore estimated to provide savings from accelerated retirement) is about 1,000 MW, which approximates MPC's near-term capacity excess.
- By the nature of the evaluation method, any significant amount of retirement beyond 1,000 MW would not be economic, because it would cause capacity shortfalls that would be costly to fill.
- The NPVRR value of Daniel Units 1 and 2 includes $385 million in capacity value, and results from Daniel being below the line – i.e., beyond 1,000 MW. Without the assigned capacity value, Daniel's NPVRR would be negative $188 million.

[19] RMP Report, page 2.

- The only way Daniel could be retired and not cause a significant capacity shortfall is if a corresponding amount of capacity above the line were not retired.
- Watson Unit 5 is the largest (and youngest) of the resources above the line, with approximately the same capacity as MPC's share of Daniel. Because Watson is assumed to retire first, it is assigned zero capacity value.
- The only plausible way a revised analysis could alter the retirement list from the August 2018 analysis is for Watson Unit 5 and Daniel to switch places in the Step 1 analysis, which would reduce or eliminate Daniel's assigned capacity value, and assign capacity value to Watson Unit 5 instead. This is precisely what did occur.

Table A-2 provides detail on the cost and value components of the final NPVRR results shown in Table A-1 (the NPVRR values in Table A-1 reflect rounding in MPC's presentation of totals, and so do not exactly equal the total numbers in Table A-2).

Table A-2: Aug 2018 RMP Cost and Value Components by Unit, $MM 2018$ (2019 Base Year)

Unit	Envtl Cost	Other Fixed Costs	Avoided Transm Cost	Energy Value Avg	Capacity Value Avg	Total
Watson Unit 5	(0)	(310)	0	0	28	**(282)**
Watson Unit 4	(4)	(188)	0	0	15	**(177)**
Greene County Unit 2	(2)	(106)	0	0	6	**(102)**
Greene County Unit 1	(2)	(80)	0	0	6	**(76)**
Sweatt CT	0	(17)	0	0	29	**13**
Watson CT	0	(17)	0	0	30	**13**
Daniel Units 1 and 2	(40)	(512)	173	192	385	**197**
Ratcliffe	0	(760)	58	467	634	**399**
Daniel Units 3 and 4	(7)	(692)	173	913	998	**1,386**

The large values assigned to Daniel Units 1 and 2 for avoided transmission costs and capacity value are evident. Another significant issue is that the environmental capital value reflected for Daniel Units 1 and 2 is only a small portion of expected costs required for CCR compliance. This reflects the determination in 2018 that few CCR compliance costs were potentially avoidable by closing the plant. This conclusion subsequently changed based on updated information, as discussed further below.

The April 2019 Revised Analysis

In April 2019, MPC provided revised analysis results for Daniel Units 1 and 2 and Watson Unit 5.[20] As noted above, only changes to the evaluations of these resources could plausibly alter the conclusions regarding accelerated retirements that offered savings. The initial evaluations were revised to reflect updated budgets and forecasts for the 2019 planning period.

The April 2019 revision showed a substantial decrease in the value of Daniel Units 1 and 2 in the Step 1 evaluation, and a smaller value decrease for Watson Unit 5. The difference in Step 1 value between the two resources decreased from a $111 million relative value for Daniel Units 1and 2 in the original RMP analysis to a $7 million relative value in the April 2019 revised analysis. MPC identified most of the change of value for Daniel Units 1 and 2 as resulting from decreased avoided transmission benefit, because an updated transmission study showed that some transmission upgrades would be required regardless of whether Daniel Units 1 and 2 ceased operation (so that portion could no longer be avoided by retaining Daniel). There was also a significant decrease in the estimated energy value of Daniel Units 1 and 2 that appears to be related to a reduction in natural gas prices in the high fuel cases.

Though the Step 1 value difference almost disappeared, the ordering of Watson Unit 5 ahead of Daniel Units 1 and 2 in assumed order of retirement meant that Daniel Units 1 and 2 was still assigned substantial capacity value in the final evaluation process, with the result that retaining Daniel Units 1 and 2 was still estimated to provide $136 million in NPVRR benefits.

2022 Base Year

In the April 2019 revision, evaluations of Watson Unit 5 and Daniel Units 1 and 2 were also performed for a 2022 base year. This later base year was selected because then-current studies by SCS indicated that transmission projects required to accommodate retirement of Watson Unit 5 or Daniel Units 1 and 2 could not be completed prior to 2022. The main effect of this change was to increase the value of Daniel Units 1 and 2 because environmental projects that were considered avoidable for a 2019 retirement year would have to be completed prior to 2022 even if the plant were to be retired in 2022, and so were considered sunk cost by then, and were not included in Daniel Units 1 and 2 costs. However, transmission costs were still considered avoidable because they would only be needed if the plant were retired.

The Step 1 value of Daniel Units 1 and 2 increased to $231 million, reflecting substantial value from avoided transmission cost and reduced (avoidable) environmental costs. The Step 1 relative value of Daniel Units 1 and 2 relative to Watson Unit 5 increased from $7 million to $105 million, and the final 2022 base year NPVRR value of retaining Daniel Units 1 and 2 was estimated to be $207 million.

[20] The revised results and accompanying descriptions were provided in response to data request MPUS (BW) 2-1.

Gulf Power Notice

Prior to the April 2019 revised analysis, Gulf Power had given notice of its intent to retire its 50% undivided interest in Daniel Units 1 and 2. However, the April 2019 analysis was not modified for this material change, because MPC had not yet determined the effect on ongoing operation of the Daniel units or the implications for the RMP. It was understood that Gulf Power sought to develop a plan under which the 50% ownership split of each unit would be modified so that MPC and Gulf Power would each own 100% of one of the units, which would facilitate retirement of Gulf Power's interest.

MPC did acknowledge that retirement of Gulf Power's ownership interest was expected "to have a negative impact on the economics of the operation of the remaining unit by MPC…."[21]

The September 2019 Revised Analysis

The second revised analysis, in September 2019, updated the 2022 base year results to reflect two substantial changes:

1. Daniel Units 1 and 2 were evaluated assuming that one unit (Unit 2 for the purposes of the analysis) would be retired by Gulf Power.

   The effect for evaluating retention versus retirement of MPC's share (e.g., Unit 1) is that the benefit of avoided transmission was eliminated, because it was determined that retirement of Gulf Power's Unit 2 would require the same upgrades as retiring both units, and so the costs could not be avoided by MPC retaining Unit 1.

2. A study completed in July 2019 concluded that there was no groundwater contamination attributable to the Daniel ash pond (which had been flagged as a concern based on previous tests). Under the CCR rule, this would eliminate the requirement for some near-term investments if there was a commitment to close the plant.

   The effect for the evaluation is that certain environmental upgrade costs became avoidable if Plant Daniel is retired, and so they are included in the cost of continued operation of Unit 1.

Both changes caused a decrease in the Step 1 value for Daniel. Updates to Watson Unit 5 also decreased its Step 1 value, but the aggregate result was that the relative positions of Watson Unit 5 and Daniel Units 1 and 2 were swapped in the Step 1 rank ordering; the September 2019 analysis showed greater value for Watson Unit 5 than Daniel Units 1 and 2, indicating that in the order of progressive retirements, Daniel

[21] Response to data request MPUS (BW) 2-2, page 1.

Units 1 and 2 should be retired before Watson Unit 5. The Step 1 values for Watson Unit 5 and Daniel Units 1 and 2 for each analysis and base year are summarized in Table A-3.

Table A-3: *Sep 2019* - Step 1 Benefit (Cost) of Watson Unit 5 and Daniel Units 1 and 2 for Rank Ordering, $millions

Analysis date	Aug 2018	Apr 2019 Analysis		Sep 2019
Base year	2019	2019	2022	2022
Watson Unit 5	$160	$152	$126	$92
Daniel Units 1 and 2	$271	$159	$231	$34
Daniel relative value	$111	$7	$105	($58)

The change in Step 1 ordering in the September 2019 analysis causes Watson Unit 5 rather than Daniel Units 1 and 2 to be assigned significant capacity value in the final NPVRR determination. This value assignment drives a significant change in the final step, flipping the results from prior analyses. The final NPVRRs from the September 2019 analysis for Watson Unit 5 and Daniel Units 1 and 2 for the various iterations are summarized in Table A-4.

Table A-4: *Sep 2019* - Final NPVRR Benefit (Cost) of Watson Unit 5 and Daniel Units 1 and 2, $millions

Analysis date	Aug 2018	Apr 2019 Analysis		Sep 2019
Base year	2019	2019	2022	2022
Watson Unit 5	($280)	($348)	($328)	$92
Daniel Units 1 and 2	$198	$136	$207	($129)

The December 2019 Revised Analysis

As noted above, the December 2019 analysis incorporated additional updated information related to the fuel price forecasts, budget forecasts, and transmission studies. A key finding was that retiring either Watson Unit 5 or Daniel Unit 1 prior to 2024 (assuming that Gulf Power retires Daniel Unit 2) would require $60 million in transmission investment to support system reliability, and this cost would be avoided by keeping both units in service until 2024. The December 2019 update therefore included a 2024 base year case.

Table A-5: *Dec 2019* - Step 1 Benefit (Cost) of Watson Unit 5 and Daniel Units 1 and 2 for Rank Ordering, $millions

Analysis date	Sep-19	Dec-19	
Base year	2022	2022	2024
Watson Unit 5	$92	$110	$15
Daniel Units 1 and 2	$34	$82	$51
Daniel relative value	**($58)**	**($28)**	**$36**

In looking at the values in Table A-5 for the 2022 and 2024 base years in the December 2019 analysis (Step 1), it is important to appreciate that the values shown represent the benefit of *retaining* the respective unit in the given base year. For example, looking at Watson Unit 5 alone, the analysis indicates that keeping the unit in operation between 2022 and 2024 provides about $95 million in net value ($110 million in value in the 2022 base year compared with $15 million in value as of the 2024 base year). This is largely because keeping Watson Unit 5 in operation until 2024 is estimated to provide nearly $80 million in benefit from avoided transmission investments. The same is true for Daniel Unit 1, but the difference in overall value between the two base years is much smaller ($31M = $82M - $51M) because keeping Daniel Unit 1 in operation between 2022 and 2024 would entail environmental and maintenance capital costs totaling around $60 million, which could be avoided if the unit were retired in 2022.

Table A-6: *Dec 2019* - Final NPVRR Benefit (Cost) of Watson Unit 5 and Daniel Units 1 and 2, $millions

Analysis date	Sep-19	Dec-19	
Base year	2022	2022	2024
Watson Unit 5	$92	$110	($76)
Daniel Units 1 and 2	($129)	($35)	$51

Again, the difference between the Step 1 values in Table A-5 and the Final values in Table A-6 is that the unit with the lower value in Step 1 has its capacity value substantially reduced in Step 2, because retaining that unit in addition to the higher-value unit creates excess capacity.

Based on the December 2019 analysis update, retiring Daniel Unit 1 in 2022 and retaining Watson Unit 5 through the remainder of its useful life is the case with the highest expected value: $110 million NPV. However, MPC reports that updated transmission studies indicate that retiring either Watson Unit 5 or Daniel Unit 1 prior to 2024 would likely require approximately $60 million in transmission upgrades to support system reliability. This would put the "Retire Daniel Unit 1 in 2022" case on a par with the "Retire Watson Unit 5 in 2024" case, at around $50 million net benefit. There remains some uncertainty

regarding the need for, and net cost to MPC customers of, the transmission upgrades. MPC has stated that retirement of Watson Unit 5 or Daniel Unit 1 prior to 2024 would likely increase operational risks, but not that NERC[22] reliability criteria would necessarily be violated. MPC also reports that no cost allocation has been determined for the transmission upgrade, so it is not known with certainty whether MPC customers would bear the full cost of the facility.

Additional Observations and Conclusions Regarding RMP Analyses

With respect to some costs and benefits, Watson Unit 5 and Daniel Unit 1 are quite similar. For example, they would provide a similar amount of capacity value on a standalone basis (i.e., as evaluated in Step 1 of the analysis). They also have comparable fixed O&M costs. However, there are significant differences with respect to other costs and benefits. For example, capital maintenance costs are expected to be nearly five times greater on an NPV basis for Daniel Unit 1 compared to Watson Unit 5. At the same time, Watson Unit 5 is expected to provide zero energy value under any of the nine Gas/CO_2 price scenarios, while Daniel Unit 1 is expected to provide some energy value in all scenarios, with substantial value in the high natural gas price - zero CO_2 price case, which causes the average energy value of Daniel Unit 1 to be over $100 million across the scenarios. Table A-7 summarizes the NPV for the 2022 base year of fixed cost categories where there is a significant difference between Watson Unit 5 and Daniel Unit 1.

Table A-7: NPV of Selected Fixed Costs in 2022 (difference in retention cost), $millions[23]

Cost category	Watson Unit 5	Daniel Unit 1
Maintenance capital		$175
Environmental		$27
Ad Valorem Tax		$26
Gas transportation	$85	
Transmission	$19	
Totals	**$104**	**$228**
Difference		$125

Retaining Daniel Unit 1 would entail greater fixed costs of about $125 million NPV compared to retaining Watson Unit 5 and retiring Daniel Unit 1 in 2022. Table A-8 shows the NPV net energy value for Daniel Unit 1 in the 2022 base year. As noted above, Watson Unit 5 is expected to provide no net energy value in any of the nine scenarios.

[22] North American Electric Reliability Corporation

[23] Derived from data response MPUS (BW) 4-1.

Table A-8: Daniel Unit 1 NPV Energy Value in 2022, $millions[24]

	$0 CO_2	$10 CO_2	$20 CO_2
High Gas	$495	$189	$87
Mod Gas	$146	$50	$30
Low Gas	$34	$14	$11
Average	**$117**		

In simplified terms, keeping Daniel Unit 1 in operation and retiring Watson Unit 5 would impose higher fixed costs, with certainty, than retiring Daniel Unit 1 and retaining Watson Unit 5, and this would be offset at least partially by expected generation value from the retained Daniel unit. It is important to note that the analysis methodology captures the energy value based on a simple average across the nine scenarios, with the unstated implication that each scenario represents an equally likely future. We do not believe this implication is realistic, and in particular our opinion is that the high gas / low CO_2 price case has very low probability.

Alternative Case Weighting

The scope of our review did not provide for developing an analytical basis justifying a particular alternative weighting of the cases evaluated in the RMP. However, we present results for an alternative set of probability weights that we find more plausible than the equal probabilities implicit in taking the simple average across nine scenarios. Table A-9 presents scenario weightings based on discrete probability assumptions for each of the CO_2 and Gas price cases considered.

Table A-9: Alternative Scenario Weighting

	CO_2 case weight:	10%	40%	50%
Gas case weight	**Combined Scenario weight**	**$0 CO_2**	**$10 CO_2**	**$20 CO_2**
10%	**High Gas**	1%	4%	5%
40%	**Mod Gas**	4%	16%	20%
50%	**Low Gas**	5%	20%	25%

Applying the resulting scenario probabilities in Table A-9 to the Daniel Unit 1 NPV net energy values in Table A-8 gives a weighted result of $44 million rather than $117 million based on simple averaging, and when combined with plant fixed costs and other benefits (also weighted according to the alternative

[24] *Id.*

probabilities), the result shows negative net benefits – i.e., retaining the unit rather than retiring it in 2022 would be expected to impose net costs on customers. The same result occurs if the alternative weightings are applied to the analysis for the 2024 retirement date; retaining Daniel would increase costs on an expected basis, reversing the result for 2024 summarized above in Table A-6.

We offer the following final observations and conclusions regarding the RMP analysis of costs and benefits:

1. As previously noted, the CO_2 price cases do not provide a full assessment of potential impacts on generation costs of Plant Daniel. There are more plausible future scenarios with higher effective CO_2 costs that would make Daniel even less cost-effective.

2. There are also risks of other, additional, environmental compliance rules and costs that could adversely affect Plant Daniel, and that are not reflected in the RMP analyses.

3. We conclude that the uncertainties of the analysis and the risks associated with an unknown future tend to reduce the value of retaining Daniel Unit 1 in operation.

4. Despite the reported cost differentials in the tens of millions of dollars, the differences are not great as a percentage of total customer costs. There is great uncertainty, and the net effect of getting the decision "wrong" about whether to retire Daniel Unit 1 rather than Watson Unit 5 would likely have a cost impact of less than 1%.[25]

[25] MPC's average of total electric O&M expenses over the five years 2014 through 2018 were about $750 million annually. Grown at inflation, this amounts to more than $10 billion in NPV over 30 years using the discount rate MPC applied in its analyses. A $100 million NPV delta would therefore amount to less than 1% of total O&M costs.