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APR 15 2021

MISS. PUBLIC SERVICE COMMISSION

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April 15, 2021

VIA E-MAIL

Katherine Collier, Esq.
Executive Secretary
Mississippi Public Service Commission
501 North West Street, Suite 201A
Jackson, MS 39201

**Re: Mississippi Power Company's Notice of IRP Cycle Pursuant to Commission Rule 29
Docket No. 2019-UA-231**

Dear Katherine:

On behalf of Mississippi Power Company ("MPC" or the "Company"), please find attached the Company's 2021 Integrated Resource Plan for filing with the Mississippi Public Service Commission ("Commission") in the above referenced docket.

Pursuant to the Commission's Order of March 12, 2020, this filing is only being made electronically. Delivery of physical copies shall be made only upon further order of the Commission.

Thank you for your assistance in this matter.

Sincerely,

Leo E. Manuel

Leo E. Manuel

LEM:hr

Attachments

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cc: All Parties of Record
Ross Hammons, Esq. (ross.hammons@psc.ms.gov)
Sally Burchfield Doty, Esq. (sally.doty@mpus.ms.gov)
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APR 15 2021

MISS. PUBLIC SERVICE COMMISSION

BEFORE THE MISSISSIPPI PUBLIC SERVICE COMMISSION

MISSISSIPPI POWER COMPANY
EC-120-00097-00

DOCKET NO. 2019-UA-231

IN RE: **MISSISSIPPI POWER COMPANY'S 2021 INTEGRATED RESOURCE PLAN FILING**

MISSISSIPPI POWER 2021 IRP FILING

COMES NOW, Mississippi Power Company ("MPC" or the "Company") and, pursuant to RP 29 of the Mississippi Public Service Commission's ("Commission") Public Utilities Rules of Practice and Procedure ("Rules"), submits this its 2021 Integrated Resource Plan ("2021 IRP") and would show as follows:

1. The Company is a public utility as defined in Section 77-3-3(d)(i) of the *Mississippi Code of 1972, as amended*, and is engaged in the business of providing electric service to and for the public for compensation in twenty-three (23) counties of southeastern Mississippi, having its principal place of business at Gulfport, Mississippi. The Company's mailing address is Post Office Box 4079, Gulfport, Mississippi, 39502.

2. The Company holds a Certificate of Public Convenience and Necessity issued in Docket U-99, as supplemented, authorizing its operations in a specified area of the twenty-three (23) counties of southeastern Mississippi and is rendering services in accordance with its service rules and regulations and in accordance with a schedule of rates and charges, all of which are a part of its tariff that has been previously approved by the Commission.

3. The Company is a Mississippi corporation. A copy of its corporate charter, articles of incorporation, the names and addresses of its board of directors

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and officers, and the name of all persons owning fifteen percent (15%) or more of its stock are on file with the Commission and are hereby incorporated by reference.

4. On November 22, 2019, the Commission issued its Final Order Amending Rule 29 to Establish Integrated Resource Planning and Annual Energy Delivery Reporting Requirements. As required by the newly promulgated Rule 29, on December 23, 2019, MPC filed its Notice of IRP Cycle in this docket to establish the compliance schedule for MPC, which was approved by order of the Commission issued on January 6, 2020.

5. Pursuant to the approved schedule, an Initial Public Workshop was held in Jackson, Mississippi on February 28, 2020, with several stakeholders participating. A total of four interveners submitted comments following the workshop. In addition, a Technical Conference was held as scheduled on February 25, 2021, with several stakeholders participating remotely via video conference due to the ongoing threat of COVID-19. A total of four interveners submitted comments following the Technical Conference.

6. Enclosed herein in compliance with the provisions of Rule 29.104 is a copy of MPC's 2021 Integrated Resource Plan. As required by Rule 29.105(5), MPC is filing under separate cover Work Papers showing the key inputs used by MPC in developing the 2021 IRP. Certain Work Papers containing confidential and/or trade secret information are also being filed under separate confidential cover in compliance with the provisions of Rules 29.108, 4.100, 4.101 and 6.109.

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RESPECTFULLY SUBMITTED, this the 15th day of April, 2021.

MISSISSIPPI POWER COMPANY

BY: BALCH AND BINGHAM LLP

BY: Leo E. Manuel
LEO E. MANUEL

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CERTIFICATE OF SERVICE

I, LEO E. MANUEL, counsel for Mississippi Power Company in the foregoing filing on even date herewith do hereby certify that in compliance with Rule 6.112 of the Mississippi Public Service Commission Public Utilities Rules of Practice and Procedure, as modified and suspended by that certain Order Temporarily Suspending Rules and Encouraging Use of the Commission's Electronic Filing System issued on March 12, 2020:

(1) An electronic copy of the filing has been filed with the Commission via e-mail to the following address:

efile.psc@psc.state.ms.us

(3) An electronic copy of the filing was served via email only to the following parties of record:

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(4) MPC has complied with all other requirements of the Mississippi Public Service Commission's Public Utility Rules of Practice and Procedure.

Dated this the 15th day of April, 2021.

Leo E. Manuel

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Executive Summary

Mississippi Power's 2021 Integrated Resource Plan (IRP) represents the Company's first IRP filed with the Mississippi Public Service Commission (Commission) since the promulgation of the Commission's new Rule 29. This IRP is a culmination of the internal planning work conducted by Mississippi Power Company (MPC or Company) with the purpose of developing a plan for MPC to continue to provide safe, reliable, clean, and affordable energy. Rule 29 also allows for comment on the Company's planning process and inputs by interested interveners. Specifically, MPC hosted a public workshop on February 28, 2020 and a technical conference on February 25, 2021. In addition, interveners were permitted to submit comments following the initial public workshop and technical conference prior to completion of the Company's 2021 IRP analysis and report.

The iterative nature of the IRP process provides for continued refinement of input assumptions and process. The MPC 2021 IRP includes several significant and notable changes from previous planning cycles, including those that were of concern to several intervenors at the public workshop, which are summarized below:

- For the first time, solar and battery options were modeled as generic resources for selection by the models. Additionally, the solar options were added when the value of energy they produce was greater than the assumed PPA price (modeled as either $20/MWh or $25/MWh depending on the scenario) and not just when there was a capacity need.
- The 2021 IRP evaluates two new scenarios that assume that carbon pressure is applied sufficiently, either through mass-based or market-based mechanisms, that result in carbon emissions on a trajectory to meet net zero carbon by 2050.
- Two new scenarios in the 2021 IRP now address the impacts of either high electrification—electric vehicles (EVs) as well as other end uses—or high adoption of demand-side management (DSM) and distributed energy resource (DER) alternatives. As MPC transitions from the prescribed energy efficiency (EE) quick start programs to a self-directed DSM program, MPC will continue to take comments from intervenors and other sources in the industry into consideration in subsequent filings.
- MPC's 2021 IRP report is being filed as a completely public document. Many items that had been historically treated as confidential or were the subject of significant debate, such as propriety fuel forecasts, have been made public or effort has been taken to provide ranges that allow for comparison. For example, assumptions regarding generic resource costs are

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either public or a general range is noted to allow comparison with other sources of information. Likewise, even though the Rule calls for submitting work papers confidentially, MPC has endeavored to produce primarily public work papers with a minimum of confidential designations.

MPC's 2021 IRP follows a similar framework presented to the Commission in prior IRP proceedings. MPC's annual planning process evaluates and forecasts important planning variables such as fuel prices, environmental regulations and compliance cost, customer load, target capacity reserves, pooling arrangements, transmission planning constraints, and supply-side and demand-side resources with the goal of developing a range of planning scenarios. MPC's 2021 IRP evaluates a total of ten (10) planning scenarios that cover a broad range of different operational, economic, and carbon regulatory environments. These scenarios are then used to determine when capacity needs may arise, what types of technologies may serve that need, and/or if energy resources (solar PV) are economic so that a detailed resource planning and selection process can take place with sufficient time to ensure continued reliability of service to customers.

The primary conclusions from MPC's 2021 IRP are summarized below:

- MPC continues to project very little, if any, customer load growth due to continued energy efficiency gains, operational changes within the commercial class, and wholesale contract load projections.
- Over the last ten years, MPC has witnessed its portion of generation from natural gas increase from 49% to 92%, and, conversely, its portion of generation from coal decrease from 51% to 6%. Over this same time period, MPC has added a total of 158 MW_{AC} of utility-scale solar capacity through third-party PPAs.[1]
- For the last two to three years of analysis, MPC's fossil steam fleet has demonstrated only marginal economic value for customers. Given MPC's current capacity surplus and the Commission's directive to reduce "approximately 950 megawatts of generating capacity by year-end 2027"[2], MPC has adopted planned retirements for the majority of MPC's fossil steam fleet consistent with the following table.

[1] MPC receives the solar energy and renewable energy credits generated by these facilities, which it can use to serve its customers or sell to third parties for the benefit of customers. The PPA capacity indicated is the total of the alternating current (AC) nameplate ratings for each of the solar facilities under PPAs.
[2] Commission's Final Order in Docket No. 2018-AD-145, Reserve Margin Plan, issued December 17, 2020.

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Generating Unit	Net Capability	Planned Retirement
Watson 4	268 MW	Dec. 2023
Greene County 1	103 MW	Dec. 2025
Greene County 2	103 MW	Dec. 2026
MPC Daniel Coal[3]	502 MW	Dec. 2027
Total	**976 MW**	

- Despite the planned capacity retirements reported above, MPC is not projecting a capacity need until 2031 or later under the various planning scenarios considered. Thus, at this stage, detailed resource planning is not needed and only generic expansion plans were developed to complete the overall IRP process.

As explained above, for the first time, battery storage and utility-scale solar supply-side resources were available for selection by the planning model for the generic expansion plan. This development is proving impactful given that both technologies are being selected and incorporated in certain future planning scenarios. The inclusion of higher carbon pressure scenarios as well as scenarios that contemplate high EV adoption and end-use adoption or high EE and DER technologies, illustrate the potential impacts of the magnitude of a future need as well as the type of technology that may be best suited to serve that need. The key takeaway from the results of the generic expansion plan is that there is a large range of both fossil and renewable resources that may ultimately fill MPC's future energy and capacity needs. Given the selection of battery storage in several scenarios and MPC's lack of historical experience with this technology, MPC plans to gain operational experience with this technology through the Walnut Grove Solar/Battery Demonstration Project to allow MPC to effectively deploy this technology in the future if it proves to be the best resource to meet customers' capacity needs.

MPC continues to study and pursue DSM programs as MPC transitions from the prescribed Energy Efficiency (EE) quick start programs to a self-directed DSM program in order to ensure beneficial and cost-effective programs are being made available to customers. MPC plans to continue to develop and expand demand-side solutions by pursuing a balanced portfolio of programs developed through participation in industry research and feedback from a variety of sources and filtered through deliberate evaluation.

[3] MPC currently owns a 50% undivided share of coal-fired Units 1 and 2 at Plant Daniel. MPC and Gulf Power are expected to divide ownership of the units prior to 2024. "MPC Daniel Coal" refers to the unit, either Daniel 1 or 2, that will be 100% owned by MPC.

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Additionally, distributed energy technologies (DER) and other advanced energy management technologies are emerging as other avenues for future deployment. MPC is currently executing on several different demonstration projects to gain critical knowledge and experience in these emerging technologies. Examples include the Tesla Solar Shingle Roof Demonstration Home, the Walnut Grove Solar/Battery Demonstration Project, and the Smart Neighborhood Demonstration Project.

As noted above, MPC's 2021 IRP identifies the capacity excess currently projected and presents a resource retirement schedule in response. The Company intends to implement the retirement plan for the fossil steam units indicated. As such, MPC will align future budget filings to be consistent with the current retirement plan and work to minimize impacts to local communities and the employee base.

Lastly, MPC will continue to improve energy delivery, reliability, and resiliency, modernize existing infrastructure, and expand energy delivery to additional customers through strategic and cost-effective grid investments.

Introduction and Overview

Overview of Mississippi Power Company

Mississippi Power is an investor-owned electric utility, organized and existing under the laws of the State of Mississippi, and is a subsidiary of the Southern Company. In addition to Mississippi Power, the Southern Company is the parent of Alabama Power Company, Georgia Power Company, and Southern Power Company (collectively, the Operating Companies), as well as certain service and special-purpose subsidiaries. Mississippi Power has approximately 1,000 employees and is primarily engaged in generating, transmitting, and distributing electricity to the public in southeast Mississippi.

The Company has approximately 190,000 customers with territorial energy sales of 12.1 terawatt-hours in 2020 of which 17% was residential, 21% was commercial, 38% was industrial, and 24% was wholesale. Peak demand in 2020 was 2,291 MW. Mississippi Power has 8,422 miles of transmission and distribution lines and 220,800 poles. The Company strives to maintain cost-

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effective and reliable service to its customers. For the years 2018 through 2020, the Company had a service reliability of 99.99%.[4]

Mississippi Power has a mix of supply-side and demand-side resources including natural gas, coal, cogeneration, renewable power purchase agreements (PPAs), and DSM programs. The Company owns 3,516 MW[5] of generating capacity of which 52% is combined cycle, 41% is fossil steam, 4% is cogeneration, and 2% is combustion turbines. Renewable PPAs total 158 MW_{AC} and demand response programs total 76 MW[6]. Mississippi Power's generating fleet peak season Equivalent Forced Outage Rate (EFOR) has been consistently below 2% for the last 12 years.

System Pooling Arrangement

MPC is part of the broader Southern Company System (System) Pool[7] which provides benefits in the form of economies of scale and a large diverse set of loads and resources. The Southern Company Pool is a coordinated Pool, not a centralized Pool. Although the generating facilities of each Operating Company are committed to a centralized economic dispatch in order to minimize overall production costs, each individual Operating Company retains the right and the responsibility for providing the generation and transmission facilities necessary to meet the requirements of its customers and remains subject to each of its jurisdictional regulators to meet these responsibilities.

Using traditional concepts of economic dispatch, the Pool deploys available generation to satisfy the aggregate obligations of the System at any given time in an economic fashion within operational constraints and reliability considerations. Each Operating Company retains its lowest cost resources to serve its customers, and an Operating Company's excess energy is made available to the other Operating Companies at its incremental cost to serve their customers if the cost of the Pool energy is less than the cost of energy from their own resources. Energy in excess of that necessary to serve the Operating Companies' customers is marketed by the Pool to the

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[4] The average service availability index (ASAI) is the ratio of the total number of customer hours that service was available during a given time period to the total customer hours demanded. This is sometimes called the service reliability index.

[5] The generating capacity is the total of MPC's ownership share of the generating unit nameplate ratings.

[6] The demand response total is the Incremental Capacity Equivalent (ICE) of all interruptible service and standby generation contracts and is adjusted for expected availability and transmission and distribution losses.

[7] Operating Companies operate their respective electric generating facilities and conduct their system operations (generally referred to as the "Pool") pursuant to and in accordance with the provisions of an interchange contract among themselves.

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wholesale markets. Additionally, the Pool obtains wholesale market purchases when available at a cost lower than that expected from producing additional energy from the Pool.

While each Operating Company is responsible for planning and securing adequate capacity, including reserves, relative to its own load, the Pool provides for coordinated planning between the Operating Companies and for the sharing of temporary surpluses and deficits of capacity. This allows for coordinating scheduled maintenance to provide greater flexibility, including major maintenance requiring relatively long unit outages, as well as mitigating the cost impact (to customers) of these required outages. This arrangement also allows MPC to carry a lower generation planning reserve margin and shared operating reserve requirements. Additionally, MPC enjoys enhanced reliability of electric service through the use of transmission interconnections to provide backup service in case of emergencies as well as providing the ability to import lower cost energy when available.

In addition to the economies of scale enjoyed through participation in the Pool, Southern Company is exploring, along with 16 other entities, a potential new trading platform. If launched, the Southeast Energy Exchange Market (SEEM) would be a 15-minute energy exchange market, the first of its kind in the southeastern U.S., that would use technology and advanced market systems to better identify low-cost energy to serve customers across a wide geographic area. The platform would facilitate sub-hourly bilateral trading, allowing participants to buy and sell power close to the time the energy is consumed utilizing available transmission of the participating transmission providers. The new exchange would be an extension of the existing bilateral market and provide transparency to the lowest cost energy available across neighboring grids. SEEM participants maintain existing control of generation and transmission assets, and participation is voluntary.

IRP Process

The IRP process includes several sequential steps ultimately leading to the production of generic expansion plans and resulting marginal cost streams that are used for a variety of purposes within the business. First, a forecast of the aggregate annual peak demand of customers is developed. Second, an assessment is made of existing, planned, and committed resources. Third, a determination is made of how much capacity reserves are required to provide reliable service to customers. Fourth, an assessment of the amount and timing of capacity need is conducted. Fifth, a generic expansion plan to fill the capacity need is developed. Sixth, using the generic

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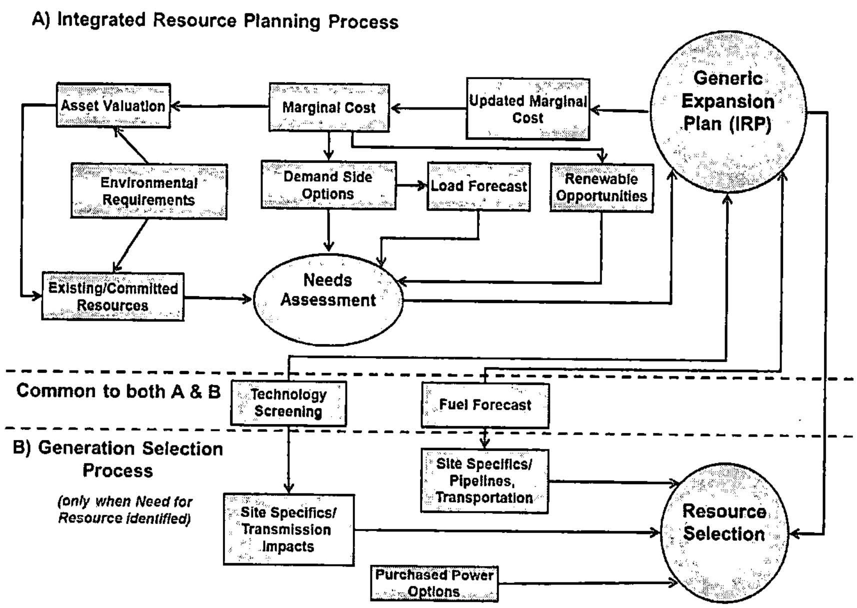
expansion, more detailed production cost modeling is conducted to produce hourly avoided costs for the planning period. If a need is identified in the timeframe required to plan and build the longest lead time resource, a separate generation selection is performed. Once resource decisions are made, those decisions then become inputs into subsequent IRP processes. This process is outlined in the flow chart in Figure 1.

Figure 1: IRP Process



Taking into account key uncertainties, various scenarios are constructed for how the future may unfold. The steps of the IRP process are conducted for each of the scenarios to produce a range of results that facilitate the determination of more robust solutions. This process is described in more detail in the sections that follow.

Existing Resources

Supply Side Resources

<u>Generating Fleet</u>

As of December 31, 2020, MPC wholly owned and operated, within the State of Mississippi, two steam electric generating units, Plant Watson Units 4 and 5. MPC is also an owner, along with Gulf Power Company, of Plant Daniel Units 1 and 2 which are located in Jackson County, Mississippi. Each Company owns a 50% undivided interest in these units and the facility is operated by MPC. MPC also owns a 40% undivided interest in Units 1 and 2 at the steam electric

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generating plant located in Greene County, Alabama. Alabama Power Company owns the remaining 60% interest in those units and operates the facility. The Company has combustion turbines at Plant Sweatt and Plant Watson. MPC also owns three combined cycle units, Plant Daniel Units 3 and 4 and Plant Ratcliffe. In addition, MPC owns and operates the cogeneration facilities located at and dedicated to the Chevron Refinery in Jackson County, Mississippi. MPC also has 76 MW of demand-side resources made up of customer-owned standby generation and interruptible service contracts as part of its capacity mix. The Company's total generating capability is approximately 3,500 MW as of December 31, 2020.

Table 1: Mississippi Power's Existing Generating Fleet

Unit	Unit Type	Year In Service	Winter Net Capability (MW)	Summer Net Capability (MW)
Daniel 1	Coal	1977	251	251
Daniel 2	Coal	1981	251	251
Daniel 3	Combined Cycle	2001	565	541
Daniel 4	Combined Cycle	2001	573	540
Watson 4	Gas Steam	1968	268	268
Watson 5	Gas Steam	1973	516	516
Watson A	Combustion Turbine	1970	41	33
Greene Co. 1	Gas Steam	1965	103	103
Greene Co. 2	Gas Steam	1966	103	103
Ratcliffe 1	Combined Cycle	2014	745	693
Sweatt A	Combustion Turbine	1971	41	33
Chevron 1	Cogeneration	1967	17	15
Chevron 2	Cogeneration	1967	19	18
Chevron 3	Cogeneration	1971	18	16
Chevron 4	Cogeneration	1971	18	16
Chevron 5	Cogeneration	1994	80	70

<u>Operation of Units</u>

The fossil steam units at Plant Watson, Greene County, and Plant Daniel generated 24% of Mississippi Power's energy in 2020. Over the last 10 years, gas prices have been progressively declining.

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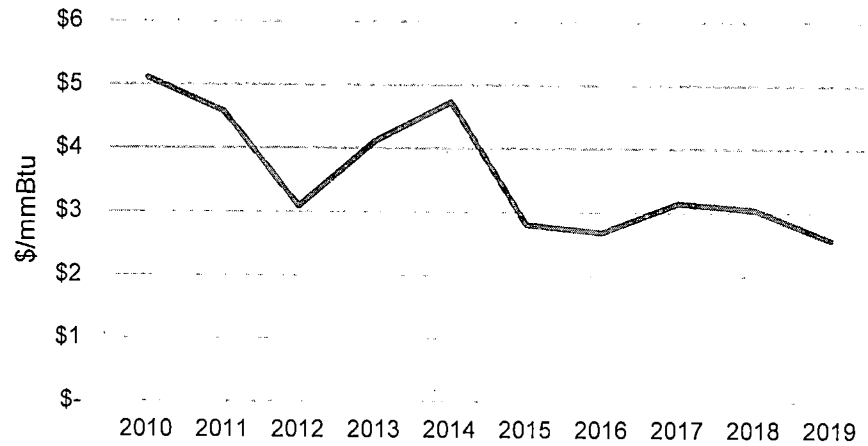
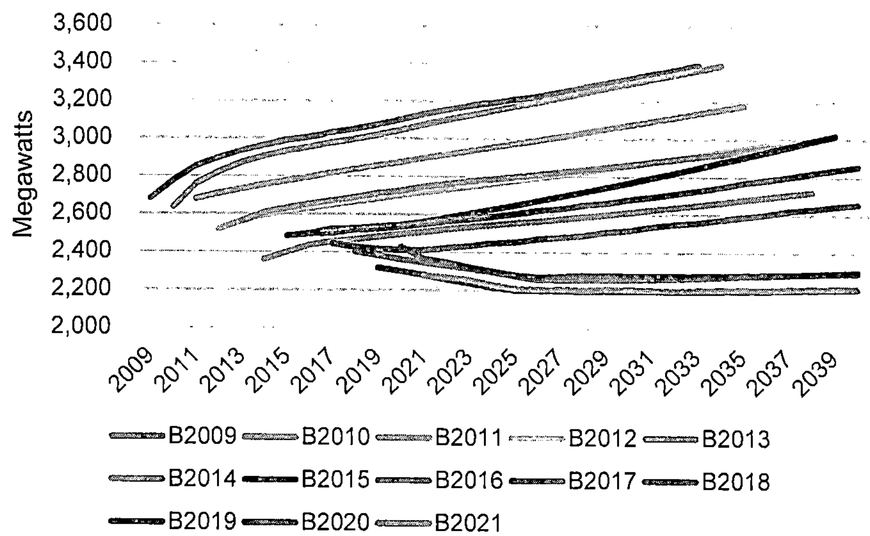
Figure 2: Henry Hub Natural Gas Spot Price



At the same time, load growth has been declining.

Figure 3: Forecasted Load Growth



Because of lower gas prices and lower load growth, natural gas combined cycle units (NGCC) have become a larger portion of MPC's energy production. These trends are projected to continue, resulting in high NGCC output and lower long-term energy value for fossil steam units.

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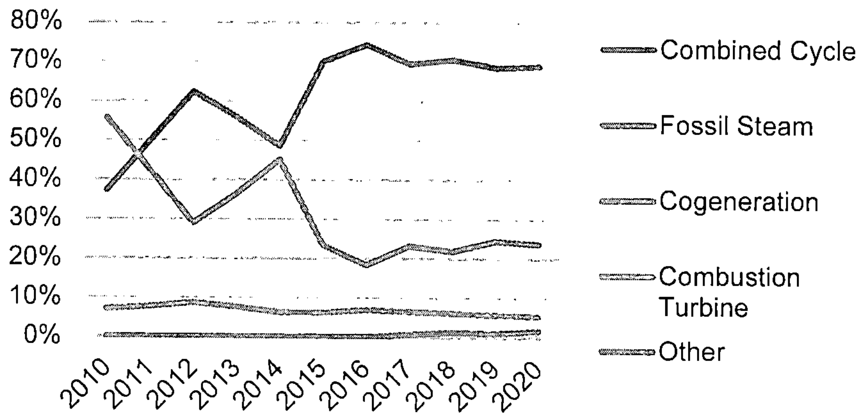
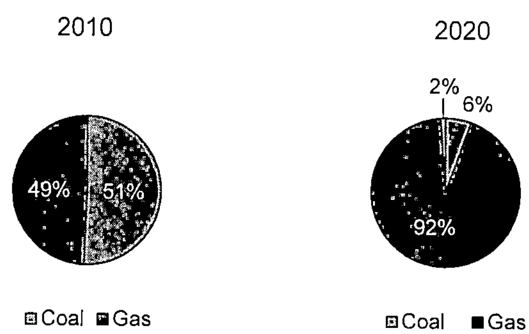
Figure 4: Energy Mix by Technology



In addition to NGCCs representing a larger portion of MPC's owned generation, MPC's portion of generation from natural gas has increased from 49% to 92%. Conversely, the percent of generation from coal has decreased from 51% to 6%.

Figure 5: Energy Mix by Fuel



This is due to several factors, including:

- **Coal-to-Gas Conversions:** While originally permitted and capable of burning both coal and natural gas, Watson 4 and 5 began operating exclusively on natural gas in 2015. The fuel burning capability of Greene County 1 and 2 was converted from coal to natural gas in 2016. These conversions were necessary to comply with the Mercury and Air Toxic Standards (MATS) rule without requiring expensive post-combustion control technologies. These conversions also helped avoid future compliance costs that would have been incurred due to continued coal operation.

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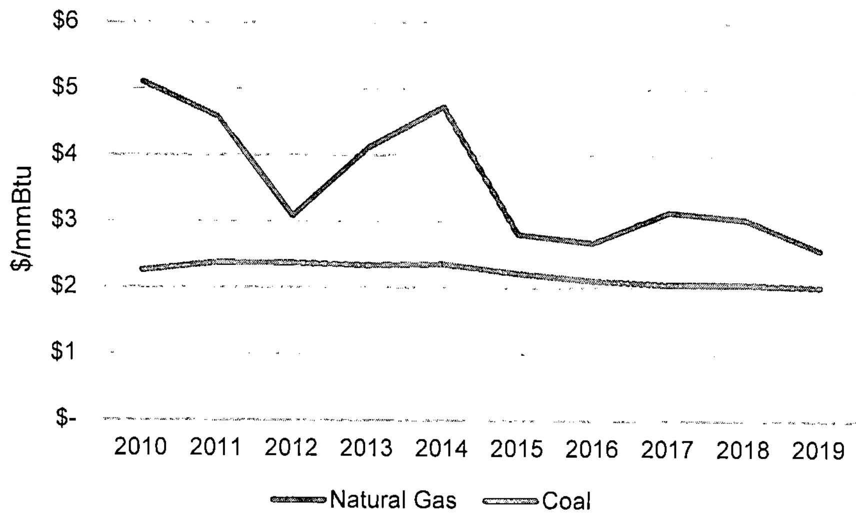
- **Fuel Prices:** Natural gas prices have declined over the past 10 years while coal prices have stayed relatively constant.

Figure 6: Historical Natural Gas and Coal Prices



This change in fuel price has led to lower operating costs of the natural gas fleet with heavy reliance on the more efficient combined cycle units.

- **Unit Efficiency:** NGCC units are more efficient than fossil steam units. The average heat rate and capacity factor in 2020 of each MPC operated unit is listed in Table 2.

Table 2: Generating Unit Heat Rate and Capacity Factors

Unit	Heat Rate (BTU/kWh)	Capacity Factor
Daniel 1	11,590	20%
Daniel 2	11,259	31%
Daniel 3	7,047	96%
Daniel 4	7,023	91%
Ratcliffe 1	7,141	88%
Watson 4	11,472	30%
Watson 5	10,790	38%
Watson A	15,975	1%
Sweatt A	15,369	3%

Combined cycle technology's higher efficiency, combined with lower natural gas prices, makes it more economical to dispatch NGCCs over fossil steam units. This has resulted in the increased capacity factor at NGCC units and a decreased capacity factor at fossil-steam units.

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Marginal Fossil Steam Units

On December 17, 2021, in the Reserve Margin Plan (RMP) docket[8], the Mississippi Public Service Commission ordered that "MPC's upcoming IRP filing should include the schedule of early or anticipated retirement of approximately 950 megawatts of generating capacity by year-end 2027" in order to bring MPC's reserve margin in line with planning targets. During the three years of this proceeding, MPC provided multiple analyses that indicated that the fossil steam units were the least economic units in MPC's generating fleet. MPC's initial analysis indicated negative economics for Watson 4 & 5 and Green County 1 & 2. The subsequent analyses comparing Watson 5 and Daniel 1 & 2 indicated that these units were economically marginal, but of similar economic value. In the most recent analysis performed using the 2021 IRP scenarios, Watson 5 had higher economic value than MPC's Daniel coal unit, primarily due to continued declines in long-term natural gas price forecasts.

Based on this analysis, MPC's plan to address the RMP Docket Order is a sequential, orderly retirement of 976 MW of generating capacity by the end 2027. This staggered approach is meant to position MPC to be successful in addressing the other real impacts referenced in the RMP Docket Order – namely local economic and employment impacts that are not included in traditional economic analyses performed when evaluating unit economics.

Planned retirements included in the 2021 IRP in compliance with the RMP Order are summarized in the following table:

Table 3: Generating Unit Retirement Plans

Generating Unit	Net Capability	Planned Retirement
Watson 4	268 MW	Dec. 2023
Greene County 1	103 MW	Dec. 2025
Greene County 2	103 MW	Dec. 2026
Daniel Coal	502 MW	Dec. 2027
Total	**976 MW**	

Power Purchase Agreements

In addition to the owned generating capacity listed above, MPC currently has four 25-year PPAs for the full output of four solar facilities—52 MW_{AC} with D.E. Shaw in Sumrall, MS; 50 MW_{AC} with Silicon Ranch in Hattiesburg, MS; 52.5 MW_{AC} with Silicon Ranch in Toomsuba, MS; and 3.29

[8] Docket No. 2018-AD-145

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MW_{AC} with WGL Energy in Gulfport, MS. These solar PPAs total 157.8 MW_{AC} of nameplate capacity and generated 320,473 MWh in calendar year 2020.

Demand Side Resources

MPC has long been promoting demand response programs, introducing a Time-Of-Use tariff for large commercial and industrial customers in 1996, implementing Interruptible Service in 2004, implementing a residential Direct Load Control pilot program in 2009, and proposing a Critical Peak Pricing pilot program in 2009. MPC will implement a Smart Thermostat Demand Response pilot program in 2021.

The Company was a pioneer in the Distributed Energy Resource arena, having offered a Standby Generation program for over 25 years. MPC's Standby Generation Program was one of the first of its kind for utilities, providing the ability to parallel customer-owned standby generating units to MPC's electric distribution grid, a feature uncommon among utility programs. Mississippi Power currently has 76 MW of demand response programs in place as shown in the following table:

Table 4: Existing Demand Response Programs

Program Type	Max. Hours/Year	Capacity (MW)[9]
Interruptible Service	200	33
Interruptible Service	100	17
Standby Generation	200	16
Standby Generation	60	10
Total		**76**

The Company is planning and currently conducting DER demonstration projects to gain critical knowledge and experience in emerging DER technologies:

- Tesla Solar Shingle Roof Demonstration Home – Hattiesburg, MS
- Solar/Battery Demonstration Project – Walnut Grove, MS
- Smart Neighborhood Demonstration Project – Lauderdale County, MS

In addition to these demonstration projects, the Company is managing the development and installation of a microgrid at the Naval Construction Battalion Center in Gulfport, MS. This project will provide valuable insight into the operation and benefits of microgrids.

[9] Capacity is expressed as the Incremental Capacity Equivalent (ICE) which is a measure of the contribution to reducing expected unserved energy as compared to that of a dispatchable combustion turbine, and is adjusted for expected availability, and transmission and distribution losses.

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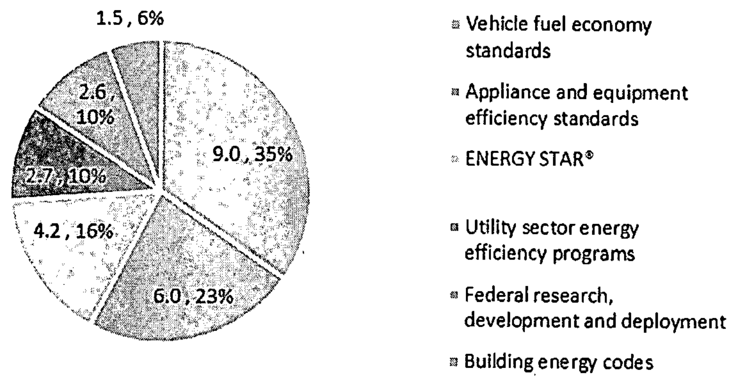
For the past 45 years, the Company has implemented dozens of effective energy efficiency programs that have helped our customers maximize their operating efficiencies. More recently, the Company has focused on "Quick Start" programs in accordance with the boundaries and guidelines of the Commission's Rule 29 adopted in 2013[10]. With the Rule 29 revisions adopted in 2019[11], Mississippi Power is now transitioning from the narrowly defined "Quick Start" approach to a broader strategy for evaluating and adopting EE programs. DSM programs have been beneficial to both the Company and its customers, and MPC continually assesses and considers new programs and improvements to existing programs.

There are many energy efficiency policies and programs that contribute to energy savings. Utility programs are important, making up approximately 10% of total energy savings (Figure 7) and approximately 21% of electrical energy savings (Figure 8). Other factors, such as appliance standards, the EPA's ENERGY STAR® program, and building codes, are making a significant impact in southeast Mississippi and are all reflected in MPC's load forecast.

Figure 7: Total Energy Savings by Policy (Quads)[12]



[10] The Commission entered its Final Order adopting Rule 29 regarding Conservation and Energy Efficiency Programs on July 11, 2013 in the Energy Efficiency docket (Docket No. 2010-AD-2).
[11] The Commission adopted a new version of Rule 29 regarding Integrated Resource Planning and Reporting on November 22, 2019 in the IRP docket (Docket No. 2018-AD-64).
[12] American Council for an Energy-Efficient Economy (ACEEE) article "Here are six ways we have slashed US energy use by a fifth", June 12, 2019, https://aceee.org/blog/2019/06/here-are-six-ways-we-have-slashed-us

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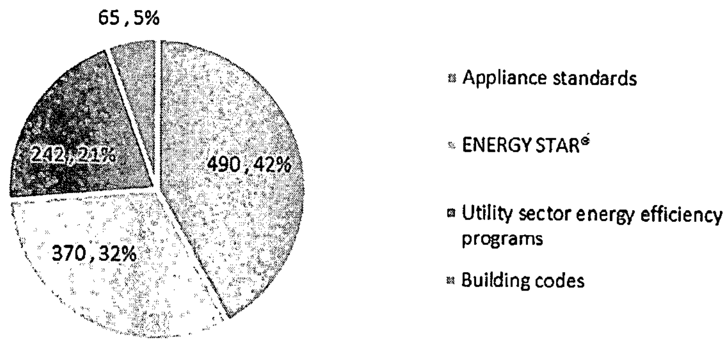
Figure 8: Electrical Energy Savings by Policy (Terawatt-hours)[13, 14, 15, 16]



MPC's philosophy is that helping customers use electricity wisely enhances satisfaction, and is, therefore, in the best interest of our customers and the Company. Our approach to demand-side management is to:

- Educate customers on ways to save energy;
- Provide incentives when cost-effective and needed to facilitate EE improvements on customer premises;
- Stay informed about changing technologies;
- Monitor evolving customer needs and preferences;
- Continually evaluate programs and technologies that appear to be feasible;
- Introduce new programs that benefit customers with minimal upward pressure on rates; and
- Annually evaluate the cost effectiveness of programs using the following tests: Total Resource Cost (TRC), Ratepayer Impact Measure (RIM), Utility Cost Test (UCT), and the Participant Cost Test (PCT).

More information about MPC's DSM programs and demonstration projects is provided in the Company's Energy Delivery Plan filed on November 1, 2020, in this docket.

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[13] Appliance standards value is from "Energy-Saving States of America: How Every State Benefits from National Appliance Standards" white paper by Appliance Standards Awareness Project (ASAP) and ACEEE, February 16, 2017, page 10 of 25, https://www.aceee.org/white-paper/energy-saving-states-america
[14] ENERGY STAR® value is from EPA's "ENERGY STAR® Overview of Achievements 2018", page 2 of 14, https://www.energystar.gov/sites/default/files/asset/document/ENERGY_STAR_Overview_of_Achievements_2018.pdf
[15] Utility value is from ACEEE's 2018 State Energy Efficiency Scorecard, page 25 of 186, https://www.aceee.org/research-report/u1808
[16] Building codes value is from ACEEE's Building Energy Codes Fact Sheet, February 2018, https://www.aceee.org/sites/default/files/pdf/fact-sheet/building-codes.pdf

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Target Reserve Margin

MPC customers expect and depend on high levels of service reliability. To provide the expected reliability, MPC must have an economically balanced level of generating capacity that both exceeds the peak load and meets a minimum reliability threshold. To do this, Southern Company Services (SCS), in coordination with MPC, conducts a Reserve Margin Study which is used to establish a Target Reserve Margin for the Operating Companies of the Southern Company Pool. The Target Reserve Margin Study is updated periodically to reflect changes as the Southern Company System evolves.

Reserve margins are necessary because of uncertainties in operational conditions, including but not limited to:

- Weather
- Economic Growth
- Unit Performance
- Market Availability

SCS uses the Strategic Energy and Risk Valuation Model (SERVM)[17] to understand and quantify the impact of these factors on customer reliability and costs. SERVM evaluates the ability of the System's capacity resources to meet load obligations every hour in a year for thousands of combinations of weather, load forecast error, and unit performance scenarios. The model quantifies two components of reliability-related costs. These costs are:

- Production Costs, including the cost of generation as well as energy purchases
- Reliability Costs, including the cost of customer outages, emergency purchases, operating reserve shortfalls, and non-firm load curtailments such as interruptible demand response.

The Production Costs and Reliability Costs are then compared to the Incremental Capacity Cost of additional generation reserves across a range of reasonable planning reserve margins. The objective of the study is an assessment of the capacity amount needed to maintain system reliability, with a goal to minimize total costs for customers, and includes a risk assessment of the cost to customers versus the increased reliability gained from increasing the reserve margin above the economically optimum level. This becomes the target reserve margin for the system.

[17] The SERVM model is industry accepted and used by a number of utilities and system operators for resource adequacy studies.

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Additionally, the Reserve Margin Study examines the reliability metrics across the simulations. One of the factors considered is the Loss of Load Expectation (LOLE). Common industry practice is to establish reserve margins that provide a LOLE not greater than 0.1 days per year which represents a system that should not expect a capacity shortfall more than once in a ten-year period. The Target Reserve Margin is adjusted if this criterion is not met.

The Reserve Margin Study evaluates the impact of over five decades of historical weather including temperatures as low as -3 degrees F. Included in the assessment is both the impact extremely cold temperatures have on load as well as the increased probability of generation forced outages. The Company develops a cold weather outage curve which models increased outage rates above the baseline EFOR when temperatures drop below 10 degrees F. Additionally, the assessment recognizes that natural gas constraints are likely during cold weather events as heating demand is high. While the probability of these events is lower than more moderate temperature events, the impact of such events is recognized and accounted for in the recommended Target Reserve Margin.

For Short-Term planning (inside three years), there is typically less economic uncertainty. For long-term planning (4 years and longer), a higher target reserve margin is needed to incorporate the additional economic uncertainty.

A benefit of coordinated planning and operations is that each Operating Company can carry fewer reserves than the System target due to load diversity. The 2018 Reserve Margin Study resulted in a recommended Target Reserve Margin for Southern Company of 26% in winter months and 16.25% in non-winter months. When considering the load diversity among the Operating Companies, MPC's long-term Target Reserve Margins are adjusted to 25.25% in winter months and 15.03% in non-winter months. Additionally, the Reserve Margin Study recommends reducing the long-term values by 0.5% for short-term targets. Current Target Reserve Margins are shown in the following table:

Table 5: Current Target Reserve Margins

	Summer		Winter	
	Short Term	Long Term	Short Term	Long Term
System	15.75%	16.25%	25.50%	26.00%
Operating Companies	14.53%	15.03%	24.76%	25.25%

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Scenario Development

As part of its integrated planning activities, the Company creates scenarios to aid in understanding key uncertainties. Key uncertainties that impact planning include the future price of natural gas, future environmental pressure, especially regarding carbon dioxide (CO_2), cost and performance of future generating technologies, and future load growth. To construct its scenarios, the Company identifies different plausible viewpoints in each of these four areas. These viewpoints are combined to create the scenarios. For MPC's 2021 IRP planning cycle, 10 scenarios were created.

Fuel Views

While prices are forecasted for all fuels used in our System – e.g. coal, natural gas, oil, etc., the fuel with significantly more price uncertainty and impact is natural gas. In developing scenarios for use in this IRP, the Company considered four different views of how the price of natural gas could evolve—namely, a lower path, a moderate path, a higher path, and a path consistent with significant pressure on CO_2 emissions. In past years, the U.S. Energy Information Administration (EIA) limited its assumptions to existing policies when developing fuel forecasts for its Annual Energy Outlook (AEO). In those years, the Company used Charles River Associates to develop fuel views that reflected likely policy changes. With EIA now including potential policy changes in its range of cases, it becomes a reasonable source of fuel forecasts to use in scenario development.

For its reference scenario, the Company adopted the natural gas price trajectory in the AEO's "Reference" case as its moderate price view. For its lower path view, the Company adopted AEO's "High Oil and Gas Supply" case. For its higher path view, the Company adopted AEO's "Low Oil and Gas Supply" case. AEO's "$35 carbon dioxide allowance fee" side case was adjusted to reflect a $50 per ton CO_2 fee and adopted as a path consistent with significant pressure on CO_2 emissions.

Greenhouse Gas Pressure

The Company has considered four different views of how pressure on greenhouse gas emissions could evolve. The Company's reference view assumes that the degree of pressure remains unchanged from where it is today ("$0" view). Two other views involve a fee imposed on each ton of carbon dioxide that the Company emits ("$20" and "$50" views). A fourth view involves

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annual limits on the amount of carbon dioxide that the Company could emit ("CO_2 Intensity"). These views have been chosen to span the range of plausible outcomes.

- The Company's "$0" view represents the lightest impact the Company considers plausible under the existing Clean Air Act. It involves no price on CO_2 emissions, but does require carbon capture[18] at all new gas combined cycle units beginning in 2040.
- The Company's "$20" view adds a price on CO_2 emissions that begins in 2025 at $20[19] per metric ton of CO_2 and grows at 5% above inflation through the modeling horizon. Carbon capture is required at all new gas combined cycle units beginning in 2035.
- The Company's "$50" view adds, instead, a price on CO_2 emissions that begins in 2025 at $50 per metric ton of CO_2 and grows at 7% above inflation through the modeling horizon. Carbon capture is required at all new gas combined cycle units beginning in 2035.
- The Company's "CO_2 Intensity" view adds, instead, a requirement that System's aggregate annual CO_2 emissions fall by 2050 to 10% of current levels.

Technology Cost and Performance

The Company continually evaluates established and emerging supply-side generating technologies as a starting point in developing a reference supply-side plan. The objective is to assess their cost, maturity, safety, operational reliability, flexibility, economic viability, environmental acceptability, fuel availability, construction lead times, and other relevant factors.

The evaluation process:

- Identifies and defines an expansive portfolio of conventional and new supply-side generation technology options;
- Reviews the complete portfolio of options for any limitations that hinder the viability of widespread deployment in electricity supply markets and in the service territory;
- Initiates a qualitative screening analysis based on characteristics such as scalability, repeatability, operational flexibility, site requirements, fuel availability, and environmental characteristics;
- Considers applicability to the service territory, including the potential to scale and be repeated in multiple deployments;

[18] The carbon capture rate assumed to be required is 90%.
[19] Fees for carbon dioxide fees, $20 and $50, are expressed in 2019 real dollars.

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- Performs a final quantitative screening analysis based on cost and performance characteristics based on (including but not limited to) power plant design work, engineering estimates, third party publications and assessments, modeling tools, and project experience; and
- Recommends the screened list of technologies as expansion candidate options.

If a candidate option has potentially desirable economic, environmental, and other characteristics but only under unique circumstances or if it is not persistently scalable and repeatable, then it will not receive a detailed economic evaluation nor become a generation mix candidate. Technologies that have desirable characteristics under unique application settings, such as specific customer requirements or geographic requirements, are retained separately to be evaluated for future projects should the right set of circumstances present themselves.

Expansion Plan Candidates for Reference Case

For Budget 2021 analyses, the technologies that screened as potentially cost effective included natural gas combined cycle with and without carbon capture and compression (CCC), natural gas combustion turbine (NGCT)[20] with and without selective catalytic reduction (SCR), nuclear, solar photovoltaic and battery storage.

- **NGCC:** The Company's view is that NGCC plants are available for fleet expansion without CCC only through 2039 (\$0 CO_2 view). Beginning in 2040, new NGCC plants must capture 90% of their CO_2 emissions. The timing of this requirement is based on the Company's understanding of the existing Clean Air Act and its statutory schedule for review of abatement technologies and requirements (New Source Performance Standards and Best Available Control Technology).
- **NGCT:** The Company's view is that NGCTs without SCR are available for fleet expansion through 2034. Beginning in 2035, new NGCTs must significantly reduce their nitrogen oxides (NO_X) emissions by being installed with SCR. The timing of this requirement comes from the Company's understanding of the existing Clean Air Act and its statutory schedule for review of abatement technologies and requirements.
- **Solar PV:** Solar photovoltaic with single-axis tracking is available as an expansion resource beginning in 2025. The Company's view is that its cost will continue to decline in real terms,

[20] Combustion turbines are capable of using fuel oil as a backup.

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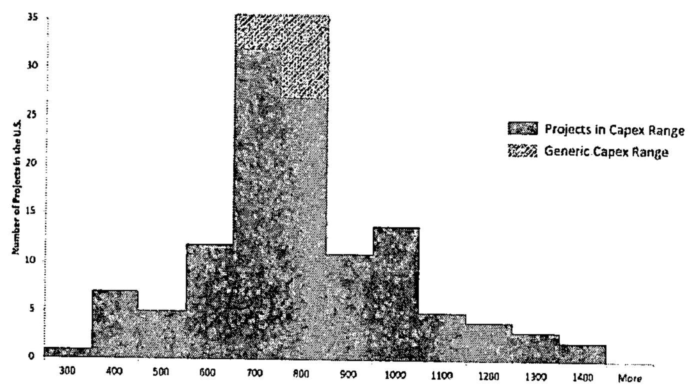
meaning it will become increasingly cost-effective throughout the study timeframe. The cost assumed in the model is based on a PPA price of $25/MWh.[21]

- **Battery storage:** Battery storage is available as an expansion resource. The Company's view is that its cost will continue to decline in the near term, be relatively flat in the intermediate term, and escalate in the later years of the planning horizon.

The cost estimates for each of the natural gas, battery storage, and nuclear technology options were developed based on proprietary sources of information. However, the cost estimates developed fall within the ranges of technology cost estimates that have been produced recently from a variety of sources as compared to the general range of the technology cost for combined cycle and combustion turbine estimates as shown in Figures 9 and 10. Since battery storage technology is much less widely deployed, estimates for recent battery storage projects are compared to the general range of the technology cost for the battery storage estimate in Figure 11.

Figure 9: Combined Cycle – Generic Estimate vs. Reported Cost (2020$/kW)



[21] $25/MWh in first year of PPA and escalated thereafter.

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Figure 10: Combustion Turbine – Generic Estimate vs. Reported Cost (2020$/kW)

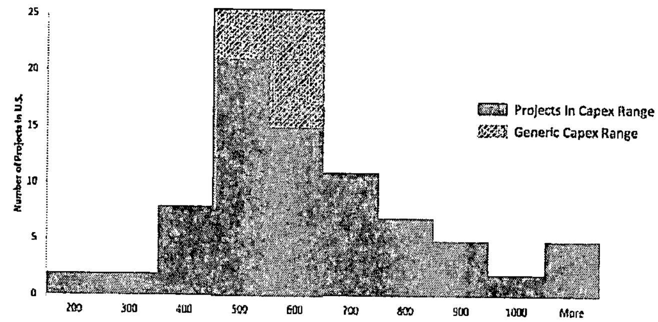
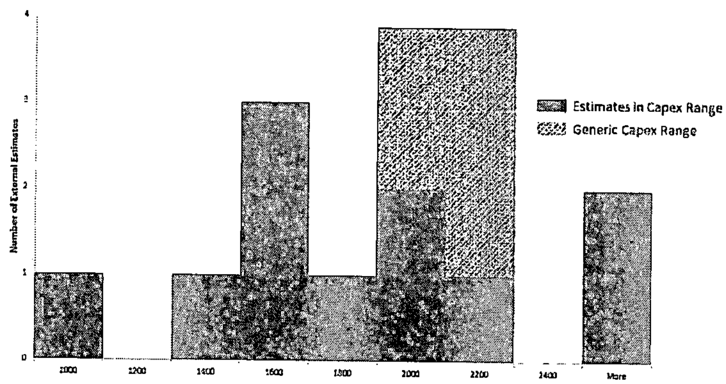


Figure 11: Battery Energy Storage – Generic vs. Reported Estimates (2020$/kW)



Expansion Plan Candidate Changes for Scenario Cases

For MPC's 2021 IRP, the technology costs in the reference case carried through many of the planning scenarios. However, for the planning scenarios that contained carbon cost pressure or for the lower carbon-free technology costs scenario, different technology cost assumptions were made.

- **NGCC:** In the scenario cases with other CO_2 views, the carbon capture requirement for new NGCC plants begins in 2035 as compared to 2040 as in the $0 CO_2 case.
- **NGCT:** No changes. See reference case.
- **Solar PV:** For the lower carbon-free technology costs case, the cost assumed in the model is based on a PPA price of $20/MWh[22] as compared to $25/MWh in the reference case.

[22] $20/MWh in first year of PPA and escalated thereafter.

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- **Battery storage:** For the lower carbon-free technology costs case, the rate of cost of decline in this technology is higher than what was assumed in the reference case.
- **Nuclear:** Next-generation nuclear technology cost and performance is included in the lower carbon-free technology costs case.

Load Forecast

Mississippi Power Company's energy sales and peak demand forecasts provide a forward view of customer usage for the Company. The process for this begins with the development of the economic projections for the two Metropolitan Statistical Areas, Gulfport/Biloxi/Pascagoula and Hattiesburg, along with county-level data for Lauderdale County by IHS Markit. The demographic and economic data are used as inputs to the subsequent customer and energy sales projections. Once this is completed, the short-term detailed monthly sales projections by rate and class are developed. This process uses many inputs including:

- Econometric modeling of rate category sales and use per customer;
- Specific customer intelligence from marketing segment managers for all major customers;
- Contacts with all wholesale cooperatives for information on their growth and local economic activity;
- Specific equipment trends from lighting services personnel for all outdoor lighting categories;
- Normal weather conditions; as well as
- Any other political, regulatory or economic development information that may have an impact on the short-term outlook.

Once the short-term outlook is completed, the results of that effort are used as the starting point for the longer term projections of annual sales by customer class. The primary tool used for these forecasts are the end-use models developed through the Electric Power Research Institute (EPRI). Residential and Commercial sales are developed using the LoadMap modeling tool. The basic premise of these end-use models is that electricity consumption is a function of the number of electric appliances or equipment available and the utilization of that equipment. These models use a variety of demographic, housing, commercial building square footage, appliance and equipment standards, economic, and weather data to estimate future sales. They provide projections of annual energy sales that are consistent with our expected economic conditions, customer mix and appliance saturations. Natural energy efficiency is incorporated into the load forecast by tracking the number of appliances used by customers and including an incremental

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energy efficiency improvement. The LoadMAP model uses a stock-turnover algorithm which replaces units when they reach the end of their useful life.

The final step of the sales and peak demand forecast process is the development of the peak demand forecast utilizing Metrix LT developed by Itron. The basic building block of this model is the rate category load shapes, which is used for all major rate categories. Using the previously developed sales projections, load shape information from our ongoing load research programs, and weather data, Metrix LT develops hourly end-use demands which are then accumulated to obtain calendar month sales, monthly peak demands and monthly territorial supply. Other model inputs include energy forecasts, transmission and distribution losses, and calendars specifying relevant seasons and day types. Model outputs include hourly system and class load curves, load duration curves, monthly system and class peaks, and load factor and energy requirements by season. This final step creates the reference load forecast for the IRP.

The load forecast is driven by a multitude of situations. Impacts from the COVID-19 pandemic have driven rapid changes in customer behavior and lower economic growth mainly affecting the commercial class. Additionally, high customer adoption rates in energy efficiency and technology improvements continue to depress customer usage trends in the residential and commercial classes. Finally, the continued transfer of load responsibility to Cooperative Energy through the Shared Services Agreement has caused a decrease in the load forecast.

To address the uncertainty of future electricity consumption across a range of scenarios, the Company produces specific load forecasts for each scenario as shown in Figure 12. The Company's reference load forecast uses annually updated forecasts of electricity consumption throughout the planning horizon assuming AEO's "Reference" gas price forecast and a $0 carbon view. The forecast is done separately for each of the three types of customers—residential, commercial, and industrial. For each scenario, this reference load forecast is adjusted to include the impacts of the changing fuel or carbon forecast used in that scenario.

Additionally, the Company produces two other load forecast views used in the scenarios.

- **Electrification-influenced load growth:** A view of future load growth that considers significant electrification of energy uses that are currently utilizing other fuels including transportation and space and water heating. This view has larger load growth than in the reference load forecast.

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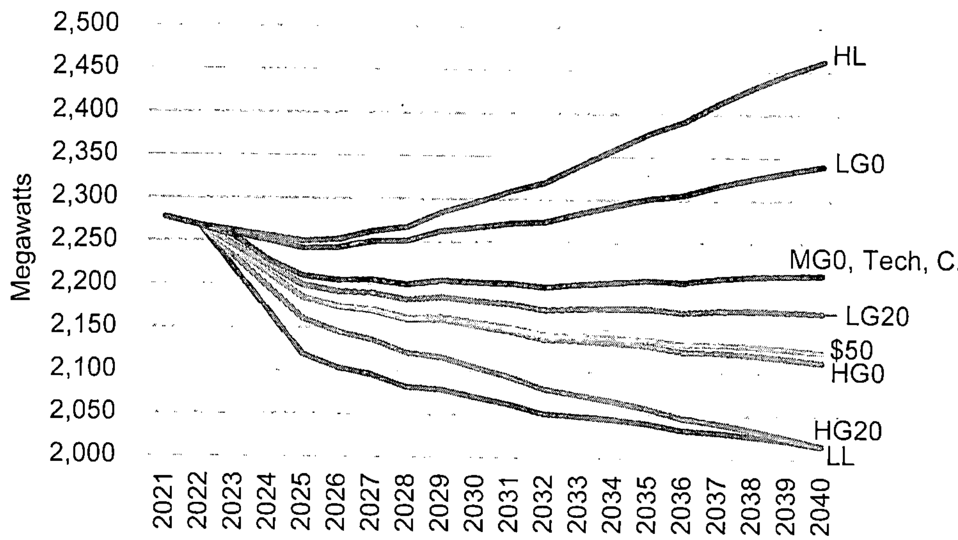
- **End-use efficiency and customer generation:** A view of future load growth that considers significant ongoing increases in end-use energy efficiency and an increasing role for customer-sited generation resources, e.g. rooftop solar. This view has smaller load growth than in the reference forecast.

Figure 12: Scenario Load Forecasts



Planning Scenarios

As described earlier, the Company considers multiple views of the future price of natural gas, multiple views of future pressure on the Company's CO_2 emissions, multiple views of future cost and performance of generating technologies, and multiple views of future electricity consumption. For the 2021 IRP, the Company assembled these multiple views in those four areas into 10 scenarios as summarized in the following table:

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Table 6: 2021 Planning Cycle Scenarios

Scenario	Natural Gas Price Path	Greenhouse Gas Pressure	Technology Cost & Performance	Load	Short Name
1	Moderate	$0 fee	Tech Application Stds[23]	Reference[24]	MG0
2	$50 CO_2	$50+ fee	Tech Application Stds	Reference + $50 delta	$50
3	Low	$0 fee	Tech Application Stds	Reference + LG0 delta	LG0
4	Low	$20+ fee	Tech Application Stds	Reference + LG20 delta	LG20
5	High	$0 fee	Tech Application Stds	Reference + HG0 delta	HG0
6	High	$20+ fee	Tech Application Stds	Reference + HG20 delta	HG20
7	Moderate	$0 fee	Tech Application Stds	High Electrification[25]	HL
8	Moderate	$0 fee	Tech Application Stds	High EE & DER adoption[26]	LL
9	Moderate	$0 fee	Low cost zero-CO_2 tech[27]	Reference	Tech
10	Moderate	CO_2 Intensity[28]	Tech Application Stds	Reference	CI

Scenario 1, for example, is defined by moderate future natural gas prices, no additional pressure on CO_2 emissions (relative to today), standard values for future cost and performance of technologies and the reference load forecast. This scenario's abbreviated name is MG0.

The Company's scenario development process identifies and examines the major uncertainties that would impact the type and scale of future resource decisions. There are other uncertainties that are considered either less impactful to this analysis, captured elsewhere, or are specific to a particular resource decision. Such a list could include non-CO_2 environmental requirements, tax rates, interest rates, inflation, the cost and timing of any transmission and distribution investments, weather, etc. Some—like weather—are handled to some degree in reliability analyses (see Target Reserve Margin section). For others that are resource decision specific, they are included in asset evaluations (see Asset Valuation section).

The purpose of the scenario planning process is to provide a framework for understanding and considering the impact of some key uncertainties in planning. Such analyses provide information that is useful for making decisions under considerable uncertainty.

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[23] Southern Company Technology Application Standards which contain assumptions on generating technology cost and performance benchmarks.
[24] Standard load forecasts produced by each Operating Company that serve as the reference forecasts.
[25] Higher load growth based on the EPRI electrification study.
[26] Lower load growth based on aggressive adoption of energy efficiency improvements and distributed resources.
[27] Lower costs for solar, wind, storage, and Next Generation nuclear technologies.
[28] The CO_2 intensity view reflects current legislative ideas that have the effect of imposing a shrinking annual cap on emissions.

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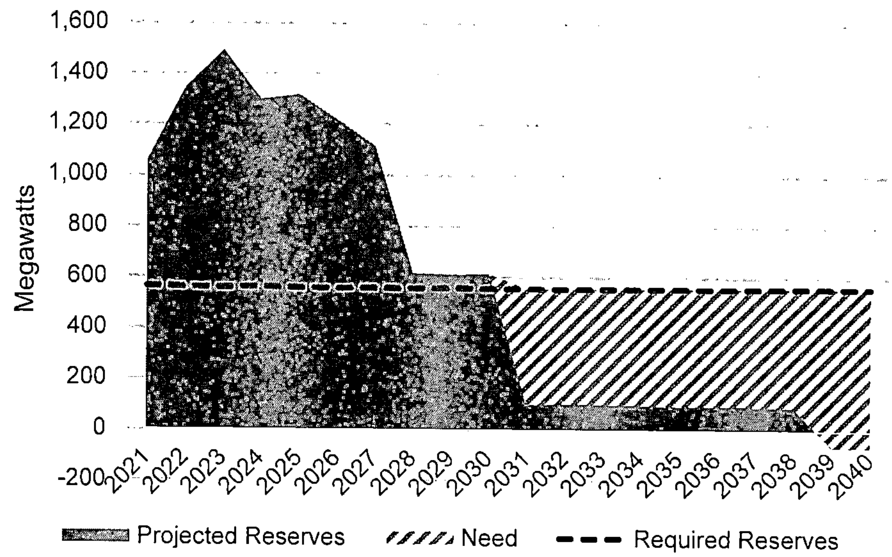
Needs Assessment

Emerging technologies are steadily improving in cost and performance and are projected to become economic in the next decade. In acknowledgement of this projection, the Company's planning assumptions include the retirement of its last remaining fossil steam unit at the end of 2030. While this is purely a planning assumption that may occur later, this assumption would create a capacity need as shown in Figure 13. By incorporating this planning assumption and creating a projected capacity need, expansion plan modeling can provide a window into the future of what technologies may be most economic to fill a need in that timeframe. This will be discussed further in the Generic Expansion Plan section.

Figure 13: Projected Reserves and Capacity Need



Generic Expansion Plan

Modeling Process

A primary purpose of the IRP is to determine the optimal mix of resources (generic expansion plan) to meet MPC's customers' capacity needs over the 2021 to 2040 period in each of the scenario views of the future. It is important to emphasize that generic expansion plans do not represent a decision by the Company, but rather are indicative of what may be optimal in various scenarios. MPC's capacity needs are determined by comparing MPC's forecasted demand and existing, planned, and committed supply and demand resources. Specifically, the capacity need

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is the difference in megawatts between existing, planned, and committed supply and demand resources and the forecasted annual peak and long-term planning reserve requirements.

The next step is the expansion planning process. The purpose of this process is to evaluate capacity and energy resource options to meet the capacity need across a wide range of potential future scenarios. This process utilizes programming techniques to minimize the net present value of the revenue requirements when deriving the least cost expansion plan (based on total production cost). To develop the expansion plan, the generation technologies that passed the detailed screening are further evaluated using the AURORA production cost model, which is widely used throughout the electric industry. AURORA employs a generation mix optimization module that includes the following major inputs: (1) future generating unit characteristics and capital cost; (2) the capital recovery rates necessary to recover investment cost; (3) capital cost escalation rates; and (4) a discount rate. The model considers all possible combinations of capacity additions on a yearly basis that would satisfy the reserve margin constraints. The combination of alternatives with the smallest production and capital cost over the planning horizon is the least cost plan.

The output of the model is used as the primary guide in developing the reference case System expansion plan for the retail Operating Companies. This System expansion plan identifies the capacity additions that serve as a guide for the type of capacity and energy resources that are most economical in a particular timeframe with the given assumptions. The optimization process is essentially a trade-off between fixed costs and variable operating costs for the various generating unit options.

Modeling Results

The long-term plan for each of the scenario cases, which is further described in the Scenario Planning section, varies depending on the assumptions for that case. A mix of gas technologies (CTs and CCs) and renewable technologies (solar and battery) was selected for the scenario cases through the planning period when capacity was needed to maintain reliability, meet growing customer needs, or to provide fuel-cost savings. Generic expansion plans for the ten scenarios are shown in the charts below. They provide a window into the future of what an expansion plan might look like that is the most economic for customers in each scenario. Figure 14 shows the cumulative expansion plans over the 20-year planning period. The results indicate that in addition to combustion turbine and combined cycle resource additions, there are a significant number of

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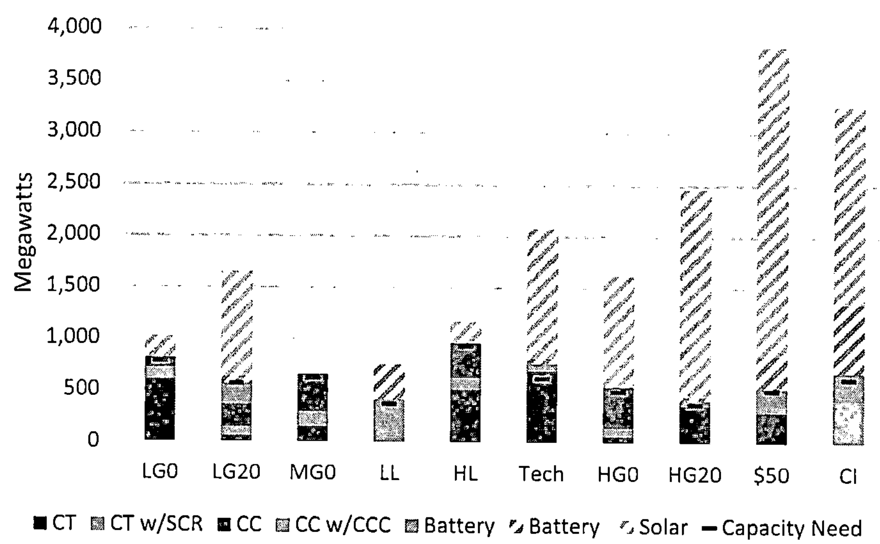
cases where battery storage is added to fulfill the capacity need. Furthermore, the cross-hatched bars indicate where added resources do not contribute to the capacity need. Given the Company is winter peaking, capacity needs are driven by the winter peak season, and the fact that solar PV has little output at the time of winter peak, generic solar PV is modeled with no capacity value. As such, solar PV is selected by the model if the energy benefit exceeds the PPA price and is not tied to a capacity need. For battery storage, there are two factors considered. First, the generic battery capacity is expressed as the Incremental Capacity Equivalent (ICE), which is a measure of the contribution to reducing expected unserved energy as compared to that of a dispatchable combustion turbine. Second, as more of the same duration batteries are installed, the relative value of such batteries to contribute to reliability (and therefore capacity need) is diminished. Given these two factors, multiple battery tranches were modeled with a declining capacity value as the penetration of batteries increases. To account for solar PV being modeled as energy only and the declining capacity values for battery, the crosshatched section represents the portion installed that does not contribute to the capacity need. Figure 15 shows a wide variety of technologies across the scenarios that might be most economic to fill a hypothetical capacity need in 2031.[29] Based on these results, battery storage may be a competitive solution along with traditional resources to meet the next capacity need. Additionally, solar PV additions may be added over this time period based on their economic energy contribution.

Figure 14: MPC Cumulative Additions 2021-2040



[29] It is important to note that while the expansion plans do provide a window into the future of the technologies that may be most economic to fill a hypothetical 2031 need, any future analysis of potential resources to fill such need could produce different results due to site-specific considerations, market projections, technology costs, and other factors.

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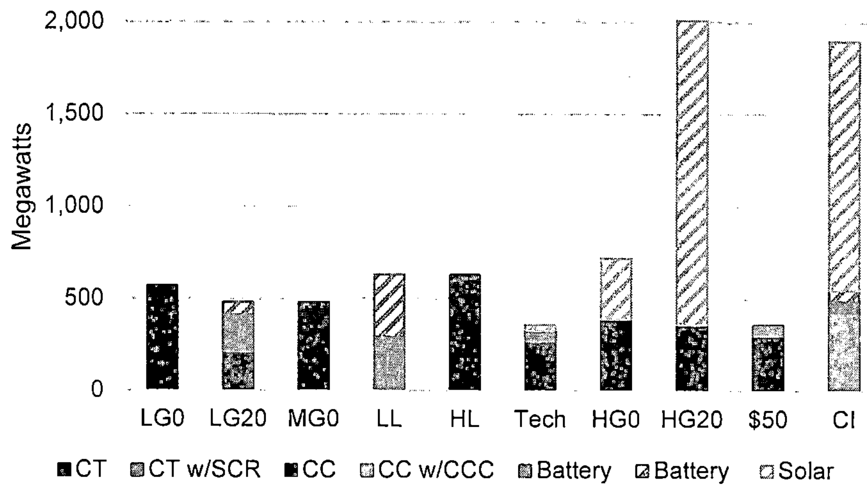
Figure 15: MPC Cumulative Additions in 2021-2031



These results of generic expansion plan modeling are combined with the existing fleet of resources as inputs to more detailed production cost modeling to produce hourly avoided energy costs[30] for each scenario. These avoided costs are used in asset valuations as described later in the document.

Transmission Considerations

Transmission Overview

Mississippi Power's transmission system consists of 2,230 miles of transmission lines operated at 46 kV, 115kV, 230kV and 500kV. MPC's transmission system has been designed around each of MPC's generating plants and our ties with neighboring utilities in a planned, integrated approach over many years to ensure reliability of the bulk electric system.[31] MPC's transmission lines move power from generating resources to MPC's distribution substations located across the service territory. The distribution substations convert the voltage to distribution voltage levels for delivery of electric service to the communities in our service area totaling 190,000 customers. MPC's transmission system is also used to provide nondiscriminatory transmission access to

[30] Avoided energy cost is the System marginal cost, or the marginal cost of the generating plant that meets the last MWh of electricity demanded. The system marginal cost is also referred to as the "system lambda."
[31] Reliable operation of the system is defined by NERC as operating the elements of the bulk power system within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements.

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wholesale suppliers and customers. MPC currently serves over 70 wholesale delivery points at transmission voltage levels.

MPC's circuit miles of transmission line by voltage class are provided in the following table:

Table 7: Circuit Miles of Transmission Line

Voltage Class	Circuit Miles
46 kV	255
115 kV	1,208
230 kV	690
500 kV	77
Total	**2,230**

MPC's transmission system is predominantly a networked system that has transmission ties to neighboring transmission systems and is part of the Southern Company Bulk Electric System (BES) and the Eastern Interconnection. MPC's ties to these surrounding transmission systems creates a robust transmission network.

Transmission Operations

MPC's transmission system is located within the Southern Balancing Area Authority (SBAA). The SBAA maintains real-time load-resource balance within the defined meter boundaries of the balancing authority and consist of a collection of generation, transmission, and loads. The SBAA works in conjunction with Southern Company's Bulk Power Operations and Fleet Operations to ensure that adequate generation is available. In addition, the SBAA monitors generation "reserves" in order to handle unforeseen changes in load or system-to-system transfers.

MPC performs the real-time monitoring of its transmission system from the Transmission Control Center (TCC) located in Gulfport, MS. The TCC is staffed 24/7 and works closely with the Power Coordination Center (PCC) located in Birmingham, AL which is responsible for the real-time management of the Southern Company BES. The PCC performs certain Reliability Functions set forth and strictly monitored by the North American Electric Reliability Corporation (NERC), including Balancing Authority, Reliability Coordinator, Interchange Authority, Transmission Planner (partial), Transmission Operator, and Transmission Service Provider (partial).

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Transmission Planning Process and Objectives

Southern Company's transmission planning criteria is based on NERC Reliability Standards to ensure the system will operate reliably over a broad spectrum of system conditions and following a wide range of probable contingencies, e.g. line and/or unit outages. The transmission planning process includes study requirements and the associated BES performance criteria that form the basis for the Planning Assessment, which covers a 10-year Transmission Planning Horizon. The Planning Assessment covers a broad range of system conditions and contingency events for planning transmission in the Southern BES.

The goal of the transmission planning process is to provide transmission customers safe, reliable, and affordable delivery from their resource choices to their customer loads through dependable long-term firm physical transmission service. Long-term firm transmission service is considered physical in that cost-effective options are identified to create sufficient physical transmission capacity to enable reliable physical delivery of the transmission customer's service under a wide range of system conditions. With this goal in mind, it is MPC's and the SCS Transmission Planning group's intent to fully meet or exceed NERC and SERC[32] reliability requirements and related reliability criteria applicable to transmission planning.

Transmission planning works closely with the real-time operation groups to minimize challenges in the operating environment, to the extent practical, by identifying potential operating constraints and mitigations in advance and planning a transmission system which reliably supports transmission customers' needs. The transmission planning process considers both the reliability requirements of the NERC planning standards and the broader scope of operational implications such as impacts on operating reserves, regulation/ramping needs, power quality, resiliency, restoration capabilities, and other operational needs. To address the uncertainties inherent in transmission planning inputs (such as load forecasts, resource changes, variable generation, and fuel forecasts), transmission planning assesses long-term firm physical delivery service needs and identifies cost-effective transmission expansion options considering a wide range of scenarios and operating conditions, providing not only a degree of margin in ensuring compliance with all applicable reliability standards, but also providing necessary operational flexibility in economically accessing firm network generation resources, scheduling maintenance/construction activities, and responding to significant system events.

[32] The Southeastern Electric Reliability Council (SERC) changed its name to SERC Reliability Corporation in 2006.

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In continually seeking to minimize costs to transmission customers, transmission expansion projects which are not in a construction stage are reassessed each year. Expansion projects may be deferred or removed if the reliability need is delayed or goes away. Expansion projects may be replaced if more economic solutions are identified. Expansion projects may need to be advanced if the reliability need is advanced. By timing completion to coincide with delivery service needs, transmission customers can commence their delivery service when requested, benefit from more cost-effective solutions that may arise during the interim and avoid premature carrying costs.

Viable Alternative Transmission Options

As part of the transmission planning process, the following non-wire alternatives are considered in developing the solution to address transmission system constraints.

Transmission Operating Guides

The SCS Transmission Planning department may identify Operating Guides as a non-wire alternative to a capital improvement project. Operating Guides are a set of policies, practices or system adjustments that may be automatically implemented or manually implemented by the system operator within a specified time frame, to maintain the operational integrity of the interconnected electric systems after considering other factors that could impact the overall reliability in a particular area in consideration. These actions may include, among others, opening or closing of switches (or circuit breakers) to change the system configuration, the redispatch of generation, and the implementation of direct control load management or interruptible demand programs.

Operating Guides are typically utilized as a short-term mitigation for transmission system constraints that are expected to be addressed by changing system conditions in the future or as a bridge to future transmission system projects.

Transmission Planning Study Results of Fossil Steam Unit Retirements

SCS Transmission Planning has performed a screening analysis for the 10-year study period based on the fossil steam generating unit retirement assumptions noted in Table 3 to identify any transmission system improvements that would be required due to ceasing operation of the units.

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The analysis identified $12.5 million in transmission upgrades associated with the retirements of those units on the dates specified.

Unsolicited Offers

Mississippi Power has not received any unsolicited written, term sheet offers for firm power of 50 MW or more within the last two years.

Asset Valuations

Asset Valuation History and Methodology

Asset valuations are incremental analyses intended to provide input for decision-making regarding the Company's portfolio of generating resources. During the development of the RMP, the Company conducted asset valuations of each generating unit using current budgets and forecasts. MPC's entire generating portfolio (with the exception of the Chevron Cogeneration Plant) was subjected to an asset valuation process, as described in greater detail below.

As the first step of this process, an asset screen was performed on each generating unit, individually comparing each unit to the same alternative to establish rank order of unit values on a $/kW basis. Second, successive reserve margin analyses were conducted to determine the appropriate capacity worth to apply to each unit with the assumption that the least valuable units would be the first units to cease operation. Next, an asset valuation was performed for each unit using the assumptions developed in the previous steps for a 30-year planning horizon. The study incorporated the incremental costs associated with continued operation of the facility. Unit characteristics combined with marginal replacement fuel cost, variable operations and maintenance (O&M) cost, and emissions costs were used to model projected energy benefits. The transmission improvements avoided due to the units remaining in service were included as a benefit. Costs associated with continued operation included projected fixed O&M, maintenance capital expenditures, environmental capital expenditures, ad valorem taxes, and firm gas transportation costs. From this information, the net present value of revenue requirements (NPVRR) of annual benefits and costs was determined for each unit.

The results of the initial RMP asset valuation indicated that the Company's six fossil steam units were economically challenged. The natural gas-fired fossil steam units – Watson 4 & 5 and Greene County 1 & 2 – indicated negative economics. The coal-fired fossil steam units – Daniel

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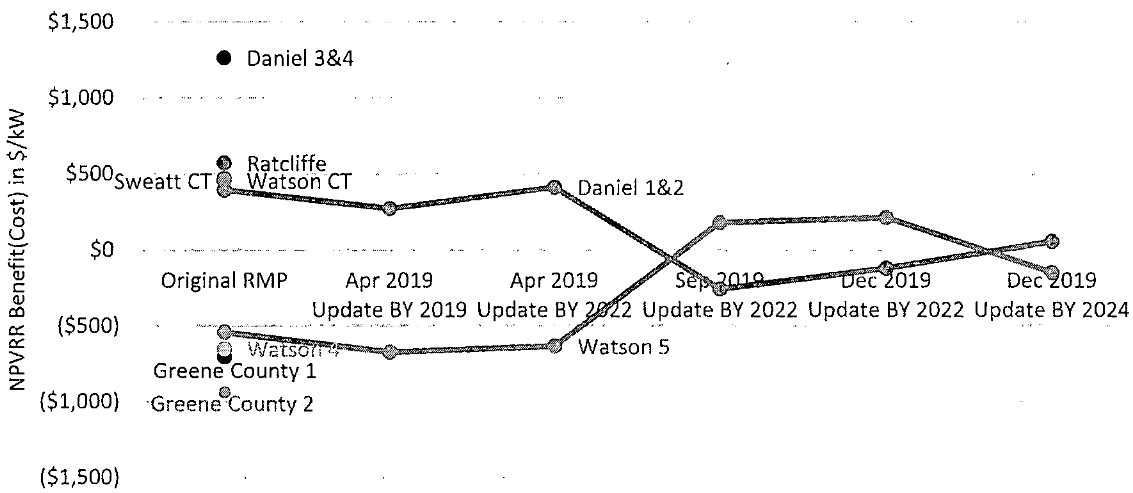
1 & 2 – were marginally economic. In the three subsequent RMP updates, the asset valuations focused on Watson 5 and Daniel 1 & 2. As shown in Figure 16, the results for Watson 5 and Daniel 1 & 2 converged in subsequent analyses primarily due to natural gas price forecasts continuing to decline in each subsequent planning cycle.

Figure 16: Reserve Margin Plan Asset Valuation Results



Asset Valuation Results

In the development of this IRP, the Company conducted asset valuations of Watson 5 and MPC's Daniel coal unit.[33] These asset valuations compared retirement dates of 2027 and 2042[34] for each of the units in all ten scenarios. The NPVRR of the units were compared to determine which unit would produce more benefit for customers by remaining in service. The results of the asset valuations indicate that Watson 5 remaining in service to 2042 and MPC's Daniel coal unit retiring in 2027 would result in a savings to customers in the range of $80 to $90 million. The results for each of the ten scenarios is shown in the following table:

Table 8: Asset Valuation Results – Savings(Cost) in $millions NPVRR

Unit	LG0	LG20	MG0	$50	HG0	HG20	LL	HL	Tech	CI	Median
Daniel Coal	($18)	($19)	($6)	($19)	$139	($19)	($5)	($3)	($10)	($17)	**($14)**
Watson 5	$74	$74	$73	$74	$72	$72	$73	$73	$72	$73	**$73**
Delta	**$92**	**$93**	**$79**	**$93**	**($66)**	**$92**	**$78**	**$76**	**$83**	**$90**	**$87**

This analysis is what led to the conclusion that retiring the Daniel coal assets was better than retiring Watson 5 to fulfill the balance of the required 950 MW in the Commission's order.

[33] In the RMP analyses, MPC's 50% ownership share of Daniel 1&2 was studied. In the 2021 IRP analyses, it is assumed that the ownership is divided between the units, and MPC's 100%-owned unit was studied.
[34] Retirement is assumed to be December 31st of the year indicated.

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Action Plan

Transition of Fossil Steam Units

The Company intends to implement the retirement plan for the fossil steam units indicated in this document. As such, MPC will align future budget filings to be consistent with the current retirement plan and work to minimize impacts to local communities and the employee base. The biggest anticipated challenge to minimize impacts will be associated with the 2027 retirement of MPC's Daniel coal unit. Current estimates indicate approximately 40 to 50 employees will be permanently impacted in 2027 due to the limited remaining opportunities for transfers in the anticipated smaller generation fleet. MPC will inform the MPSC if there is a material change in circumstance that would warrant a deviation from the current plan.

Technology Options

Current projections indicate that future additions may include emerging DER and storage technologies. The Company is currently planning and conducting the following demonstration projects to gain critical knowledge and experience in these technologies:

- Tesla Solar Shingle Roof Demonstration Home – Hattiesburg, MS
- Solar/Battery Demonstration Project – Walnut Grove, MS
- Smart Neighborhood Demonstration Project – Lauderdale County, MS

In addition to these demonstration projects, the Company is managing the development and installation of a microgrid at the Naval Construction Battalion Center in Gulfport, MS. This project will provide valuable insight into the operation and benefits of microgrids.

The Company's demonstration projects will provide insight, information, and experience that will be beneficial when resources are ultimately selected to fill a need.

Demand Side Management

MPC will continue to develop and expand demand-side solutions that benefit customers with the following actions:

- Pursue a balanced portfolio of programs focused on customer needs and available technologies while defining program parameters, communication and delivery channels to create a portfolio that maximizes cost effectiveness.

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- Ensure that program planning addresses low income customer needs that boost participation and create meaningful energy savings.
- Actively engage in DSM industry research and participate in trade organizations to stay informed of the most current trends in technologies and best practices for DSM programs and portfolios. Leverage best practices from resources within Southern Company.
- Consistently solicit feedback from customers and energy efficiency contractors and consultants to understand program offerings and designs that will produce the most beneficial results for customers in our service territory.
- Continually evaluate efficiency measures and seek innovative solutions in a deliberate and continuous manner. MPC will prioritize those projects that have the greatest opportunities to improve reliability, promote economic development and provide customer access to enhanced services.

More information about MPC's DSM programs is provided in the Company's Energy Delivery Plan filed on November 1, 2020 in this docket.

Transmission

MPC will improve energy delivery, reliability, and resiliency, modernize existing infrastructure, and expand energy delivery to additional customers through strategic and cost-effective grid investments. The Company will execute its reliability strategy by identifying, vetting, prioritizing, selecting, and executing reliability projects associated with strategic reliability programs based on available funding. This strategy will ensure MPC's customers are reaping the results of cost-effective reliability solutions. More information about MPC's transmission projects is provided in the Company's Energy Delivery Plan filed on November 1, 2020 in this docket.

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