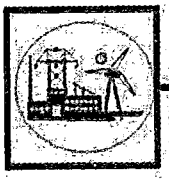
Final Redacted Report

Fuel Audit of

Mississippi Power Company

(Docket No. 2017-AD-043)

December 18, 2017



Vantage Energy Consulting, LLC

Management Consulting and Energy Services

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I. EXECUTIVE SUMMARY

Pursuant to Mississippi Code Annotated Section 77-3-42, the Mississippi Public Service Commission ("MPSC" or "Commission") retained Vantage Energy Consulting LLC (Vantage) to conduct a management review of Mississippi Power Company's (the "Company" or "MPC") fuel procurement and related practices. MPC is a wholly-owned subsidiary of the Southern Company. This Fuel Cost Recovery ("FCR") review, performed by Vantage addresses the processes of fuel procurement and related activities associated with those costs conducted by management for purposes of determination of economic efficiency

This report documents the results of the work performed under the contract and presents our findings, conclusions and proposed recommendations for improvement.

A. SCOPE OF AUDIT

State of Mississippi statutes require the Mississippi Public Service Commission (MPSC) to conduct an annual review of the costs and activities associated with costs recovered through fuel cost adjustment mechanisms of electric utilities subject to its jurisdiction on an annual basis. These reviews provide a determination as to whether the costs were properly identified and recorded in the appropriate accounts and records of the utility, and an assessment of the utility's management practices and procedures relating to the economical purchase and use of fuel and electric energy are appropriate. An Independent accounting firm was retained to review the proper identification and accounting of the costs, while Vantage was retained to review the utility's management practices and procedures relating to the economical purchase and use of fuel and electric energy.

The specific statute, subsection (2) of Miss. Code Ann. §77-3-42 provides that "the Commission is hereby directed to cause a continuous monitoring by the public utilities staff and a complete audit, as necessary but not less than annually, of all fuel purchases for which fuel adjustment clauses or riders have been placed in effect prior to and after the effective date of this section, which shall totally verify fuel costs as might be consumed in generating plants and all purchased energy of such electric utilities in Mississippi with said audit being based upon generally accepted auditing standards which would accurately provide detailed information as to the actual monthly utility fuel costs. Such audit shall be completely independent of any audit performed on behalf of such utility."

Such reviews should include a determination as to whether the costs were properly identified and recorded in the appropriate accounts and records of the utility, and an assessment of the utility's management practices and procedures should be made relating to the economical purchase and use of fuel and electric energy.

Specifically, Miss. Code Ann. §77-3-42(2) (c) requires that the audits include:

1. A determination if fuel and associated costs are properly identified and recorded in the appropriate uniform system of accounts
2. A determination if purchased energy and associated costs are properly identified
3. An assessment of a utility's practices for the economical purchase and use of fuel and electric energy
4. An assessment of the relevant contract terms and conditions and any variations from Contract terms

The Commission interprets the statute to require a determination regarding the prudency of the purchased power transactions, including, but not limited to, transactions with affiliates. Additionally, in accordance with an Official Opinion provided to Commissioner Brandon Presley, the Office of the Attorney General has interpreted the statute to require an examination of individual purchases of energy, with the appropriate sample of purchases to be determined by the auditor.

This report presents Vantage's management/performance audit of Mississippi Power Company for the Audit Period of October 1, 2016 through September 30, 2017.

B. REPORT LAYOUT

Chapter I – Executive Summary

Chapter II – Organization and Procurement Procedures

Chapter III – Fuel Procurement and Consumption Analysis

Chapter IV – Coal Related – Enterprise Risk Management

Chapter V – Power Purchases and Sales

Chapter VI – Coal Related Power Plant Operations

Chapoter VII – Plant Radcliffe – Natural Gas Procurement

C. OVERALL CONCLUSIONS

In general the organization associated with MPC fuel procurement is reasonable, and the utilization of a service company arrangement provides MPC with experienced and specialized fuel procurement services. The fuel procurement organization is staffed by competent, experienced personnel. We note that with the final resolution of the Kemper Plant, MPC may require changes to the procurement department organization. We also note that some of the processes and procedures at both SCS and MPC need to be more formalized and we provide a recommendation on this issue.

The conversion of Kemper to a permanent gas fired plant significantly alters the longer term gas procurement picture for MPC. Also, the increased planned consumption of natural gas by Kemper requires a reevaluation of gas procurement and hedging strategies. We also conclude that gas capacity, storage and transportation continue to be based upon sound, tested processes.

Southern Company has a well-structured risk management program, consistent with a company as large and complex as it is. MPC's fuel hedging is, by design, very conservative and limited to financial SWAPS only. MPC's fuel hedging program is a direct result of the MPSC Order in Docket No. 2000-UN-943 which established an Energy Cost Management Clause (ECM). MPC provides the MPSC a monthly report indicating the mark-to-market value of all existing hedge contracts that have been in place. We note that copies of Southern Company Auditor reports on fuel hedging and risk management for the years 2015 through 2017 were not available.

The Southern Company power pool, as governed by the Intercompany Interchange Contract, continues to be an effective tool for power exchanges, purchases, and sales by Mississippi Power.

The heat rates of the Plant Daniel coal fired Units 1 & 2 and the recently converted Greene County Units 1 & 2 have increased as a result of continued low load operation. Conversely, the heat rates of the Plant Daniel combined cycle natural gas Unit 3 & 4 have decreased due to operation at high capacity factors.

A review of Equivalent Availability Factors (EAF) over the last five years, with emphasis on the audit period revealed that the EAF of the Daniel Unit 3, 4 & 5 and the Greene County 2 have decreased significantly. This is an indication that the associated Units have been dispatched at a higher rate and are likely experiencing more frequent periods of unavailability. A review of major availability detractors over the last five years, with emphasis on the audit period revealed that there is no significant increase in forced outage rate during the audit period.

Due to continued low gas prices coupled with increase renewable energy sources the capacity factor of the coal fired Units at the Plant Daniel facility as well as the remaining generating Units continues to decline, and the associated unit heat rates have continued to increase.

Based on the September 20, 2017 walk down of the Plant Daniel facility we conclude the overall condition of the facility is good and within industry standards. The recent loss of the facility's Operations, Maintenance and Engineering Department Managers may have a negative impact on the overall long-term operation of the Units and needs to be addressed.

The coal pile inventory variance continues to exceed the top 3% threshold of the MPC reasonability program. The current as-burned coal flow measurement process may be a source of inconsistency in the coal inventory process.

The operating performance of the recently converted coal fired Units at the Greene County and Watson facilities has been negatively impacted as a result of the conversion.

Natural gas supply options for the Kemper Project are likely to change significantly in the near future. Depending on the final resolution of the Kemper Plant, MPC may need to alter its fuel procurement department.

D. RECOMMENDATION SUMMARY

The following are the thirteen recommendation summary statements developed in this report. Each recommendation statement below has priority based on the following: High Priority - An immediate impact to safety, reliability or significant cost savings; Medium Priority - Long-term cost savings, improved operability, or improved management capability; and, Low Priority - Overall improvement in operations, rate structure and communication of information. The numbering of each recommendation is sequential by Chapter. For example, III-R1 is the first recommendation in Chapter 3. Findings are similarly numbered.

II-R1 Initiate a review of the need for the Lignite Contract Director and 2 Fuel Analyst Senior positions at MPC if it is determined that the Kemper Plant will be operated as a combined cycle plant. (Priority: Medium)

II-R2 Develop and implement more formal procedures for key fuel related processes. (Priority: Medium)

III-R1 Update the fuel procurement, gas transportation and gas hedging strategies to reflect the permanent usage of purchased natural gas for the Kemper plant (Priority: Low)

IV-R1 Expand the information MPC provides in its annual EMC Report to the MPSC to include additional detailed information. (Priority: High)

VI-R1 Continue to operate the coal fired Plant Daniel Units 1 & 2 under a sliding pressure control strategy. The Greene County and Watson facility management team should continue to investigate modifications to the associated boilers to maximize Unit efficiency. (Priority: Medium)

VI-R2 Continue the current low load operating strategy at Plant Daniel and continue with aggressive preventive and predictive maintenance programs to assure dependable availability and reduced forced outages. (Priority: High)

VI-R3 Closely monitor the staffing of the Plant Daniel's leadership team to assure that the technical and supervisory skills are in-place to operate and maintain the Units at the current level of performance. (Priority: High)

VI-R4 Reduce the excess variance in the coal pile inventory process at Plant Daniel by performing density analysis on a more frequent basis. (Priority: High)

VI-R5 Improve the physical measurement of as-burned coal utilizing the current gravimetric coal feeders as an as-burner coal value. (Priority: High)

VI-R6 Develop a program to reduce the impact the recent conversion of the Greene County and Watson facilities has had on individual Unit performance. (Priority: Medium)

VII-R1 Develop and evaluate alternative gas supply options for the Kemper Plant. (Priority: High)

VII-R2 Initiate a review of the need for the Lignite Contract Director and 2 Fuel Analyst Senior positions at MPC if it is determined that the Kemper Plant will be operated as a combined cycle plant. (Priority: Medium)

II. ORGANIZATION AND PROCUREMENT PROCEDURES

A. SUMMARY

The purpose of this chapter is to identify and describe the departments in the organization charged with fuel procurement as well as list and describe relevant procedures utilized in the fuel procurement process. The appropriateness of the organization and the procedures are also addressed.

B. ORGANIZATION

SOUTHERN COMPANY

Southern Company is a public utility holding company. Mississippi Power Company (MPC) is a wholly-owned subsidiary of Southern Company, which is the parent company of MPC and three other traditional electric operating companies, as well as Southern Power, Southern Company Gas and other direct and indirect subsidiaries. The traditional electric operating companies – Alabama Power, Georgia Power, Gulf Power, and MPC – are vertically integrated utilities providing electric service in four Southeastern states. MPC provides electric service to retail customers in southeast Mississippi and to wholesale customers in the Southeast. Southern Power constructs, acquires, owns, and manages generation assets, including renewable energy projects, and sells electricity at market-based rates in the wholesale market. Southern Company Gas distributes natural gas through utilities in seven states and is involved in several other complementary businesses including gas marketing services, wholesale gas services, and gas midstream operations. The Southern Company Service (SCS), provides, at cost, specialized services to Southern Company and its subsidiary companies. [1]

Southern Company Services

The fuel procurement functions are centralized, with Southern Company Services acting as Agent for MPC as well as the other Southern operating companies. SCS' role includes completing the development of RFP's, receipt of responses, and initial evaluation of options that are available. The final decision authorizing purchase is made by the MPC Manager, Fuel Services, or the MPC Vice President and Senior Production Officer. [2]

The process is collaborative, with coal and oil procurement, coal and oil transportation, and specific contractual term development facilitated by SCS Fuel Services with continuous

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[1] VEC-DR-162-June 26, 2017, Meeting and Presentation

[2] VEC-DR-4 – Fuel Procurement Function

input by the MPC Fuel Staff.[3]

In the case of natural gas, the process essentially follows the same path, but MPC delegates daily authority to ensure reliable, cost effective supply for its units to the SCS Gas Team. [4]

The following describes how MPC and SCS operate with regard to power purchases and maintaining cost-effective and reliable power. MPC, through its Agent SCS, makes shorter-term wholesale power purchases for two reasons: (1) economics; and (2) reliability. Most purchases are made for purposes of economics; that is, the purchased power is reasonably expected to be more cost effective than relying on owned or controlled generation. For spot purchases (i.e., next-hour), system operators apply an incremental cost approach to determine the merits of a purchased power opportunity. Specifically, the cost of the purchase is measured against system incremental costs, and if the purchase is less, then the purchase represents a viable opportunity. Multi-hour purchase opportunities present more complex considerations. For example, a multi-hour purchase may allow operators to avoid the commitment of one or more generating resources. If that is the case, the change in production cost is factored into the analysis. That change considers a number of relevant inputs, such as start-up/shut-down costs, minimum run times, minimum operating limits, as well as the average production cost associated with the avoided generating resource or resources, rather than just system incremental costs. [5]

In situations where a wholesale purchase is being pursued for reliability purposes (i.e., changes in system conditions that present reliability concerns), system operators search for the most cost-effective option, and apply where feasible the analytical tools described above. Where the goal is reliability, however, price is a secondary consideration, and a purchase will be made if it is determined that the energy is necessary for the continued reliable service of system demand. [6]

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[3] VEC-DR-4 – Fuel Procurement Function

[4] VEC-DR-4 – Fuel Procurement Function

[5] VEC-DR-16 – MPC Fuel Department Goals

[6] VEC-DR-16 – MPC Fuel Department Goals

Exhibit II-1
Southern Company Services Fuel Organization

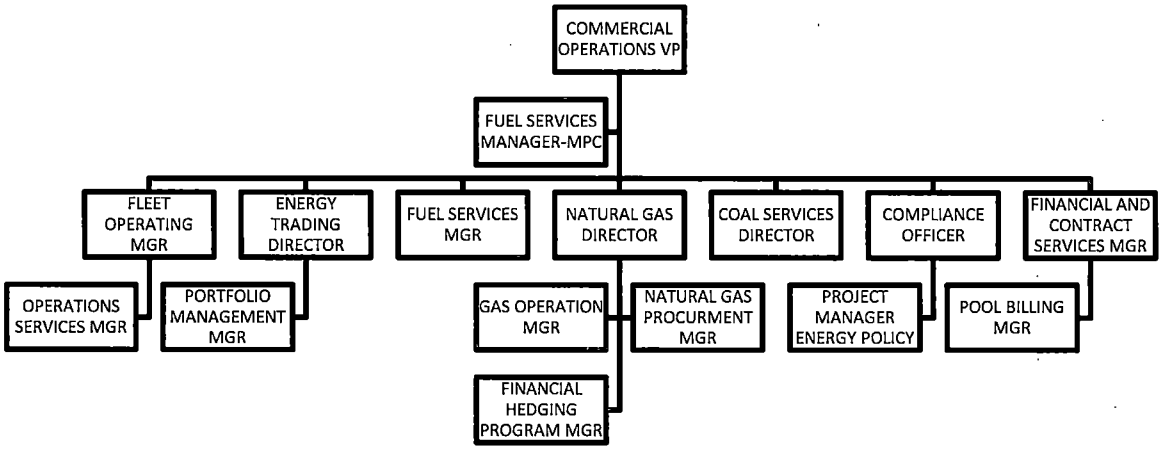


Exhibit above illustrates the SCS Fuel Organization with the exception of the Fuel Services Manager that is a position in MPC. However, the Fuel Services Manager position is a crucial link in the flow of information between SCS and MPC the operating company. The other operating companies also have similar relationships to facilitate the information flow. A brief description of the key positions in the SCS follows.[7]

Commercial Operations Vice President: This position provides executive leadership to Commercial Operations and Fuel Services.

Fleet Operating Manager: This manager is responsible for providing leadership and direction to the operation of the Southern Company Generation power system so as to operate the system at its lowest cost while maintaining the reliability and integrity of the system.

Energy Trading Director: This position is responsible for wholesale energy purchases and sales activities. This includes related support functions in the spot and term trading markets.

Fuel Services Manager: This position provides leadership and direction in the development of fuel budgets, updating fuel burn projections, and responding to fuel related presentation and data requests.

[7] VEC-DR-183-Attachment A – Job Descriptions

Natural Gas Director: The director is responsible for providing leadership and direction for all aspects of the gas supply program necessary to fuel the Company's natural gas filed generation fleet.

Coal Services Director: This director is responsible for leading the coal program for the Company.

Compliance Officer and Vice President: The position provides leadership and direction to the Operations Compliance program, the Southern Company business assurance program, generation energy policy activities and policy related matters associated with the Intercompany Interchange Contract.

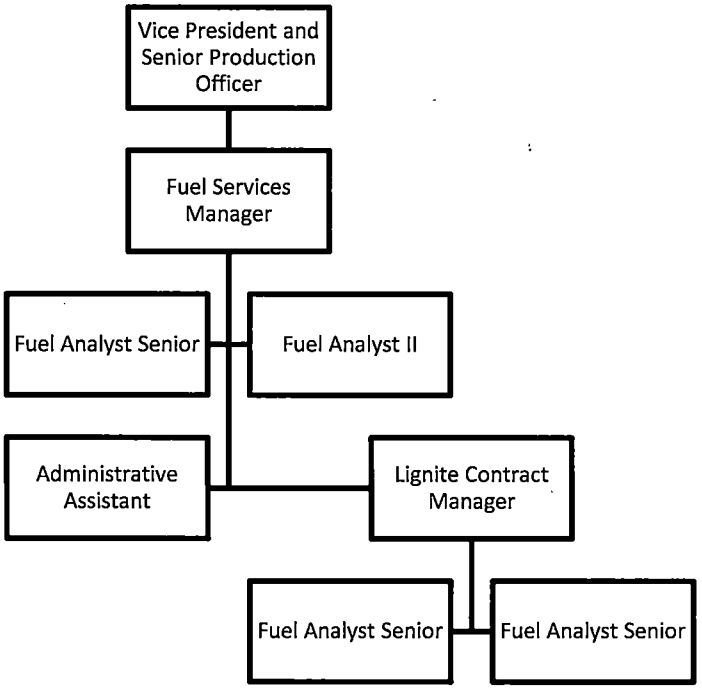
Financial and Contract Services Manager: The manager has responsibility for the billing settlement process as well as analysis of the Intercompany Interchange Contract, the wholesale contracts of the operating companies, and the Open Access Transmission Tariff.

Fuel Services Manager-MPC: This position provides oversight for the fuel program and its impact on the operating company, in this instance MPC. This position is responsible for working with the Fuel Procurement (coal, gas and oil) Planning, Railcar, and Coal Logistics Teams to assure that the fuel management process meets the needs of MPC.

MISSISSIPPI POWER COMPANY

The MPC fuel organization is supplemented by SCS and as a consequence there are fewer positions. The following Exhibit illustrates the MPC Fuel Organization.

Exhibit II-2
Mississippi Power Company Fuel Organization



Some of the key positions are described below.

Vice President and Senior Production Officer: This position has overall responsibility for the management and efficient operation of the MPC generating units. The current incumbent has held this position since 2010.[8]

Fuel Services Manager: A brief overview of this position is provided above, and this provides a broader description of the position and responsibilities.[9] This position is accountable for oversight of the planning, procurement, transportation, budgeting, contract administration, and quality control of the fossil fuel supply, as well as inventory levels, coal pile aerial survey, and public information/regulatory interface relating to fossil fuel for MPC. This position provides direction and leadership to MPC staff as well as SCS Fuels personnel.

Fuel Analyst Senior: The principal function of this position is to ensure reliable cost effective fuel supply to the MPC generating plants.[10] The position is responsible for supporting the development, administration, and oversight of MPC fuel supply and

[8] VEC-DR-50 – Attachment A – Reaves Bio

[9] VEC-DR-5 – Attachment A - MPC Job Descriptions

[10] VEC-DR-5 – Attachment A – MPC Job Descriptions

transportation agreements, recovery of fuel expense, energy budgets, regulatory audit, inventory management, fuel related support for MPC generating plants, and supporting MPC Fuel Services special projects.

Lignite Contract Manager: Currently, this position is responsible and accountable for administering all duties associated with the implementation, and management of the lignite supply agreement and fuel delivery for the Kemper County IGCC project and supporting MPC Fuel Services Group special projects.[11] It is expected that the responsibilities associated with this position will be changed upon a final resolution of the issues surrounding the Kemper IGCC plant.

C. FOSSIL FUEL POLICY

The Fossil Fuel Policy of SCS[12] is the primary document guiding fuel procurement activities. First and foremost, the Policy establishes the Fossil Fuel Committee. The Committee consists of a chairman who is a designated representative of SCS as well as designated representatives for each of the five Operating Companies. SCS, as a party to this Fossil Fuel Committee, is designated as Agent of the Operating Companies for purposes of implementing the policy and for administrative and coordination of related functions. The Agent performs these services and represents the Operating Companies collectively, or individually as required, in all duties performed by the Agent in the execution of and operation under fuel supply, storage and transportation services contracts, and under any other contracts in which SCS has been designated to act as Agent for the Operating Companies. The Operating Companies have agreed to operate their respective electric generating facilities and conduct their system operations pursuant to and in accordance with the provisions of the Intercompany Interchange Contract ("IIC"). The Policy further delineates specific details regarding natural gas long-term contracts, natural gas operations, fuel oil contract and operations, coal procurement and coal operations. Since the last audit the Minimum Gas Inventory Guideline Levels in the Policy were modified. The intent of the change is to provide greater winter coverage. The estimated impact of the increased inventory level is an increase in annual operating cost of $300,000.[13] MPC estimates its share of this cost to be $40,000.[14]

D. PERSONNEL RESOURCES AND PERFORMANCE MANAGEMENT

The personnel responsible for fuel and energy procurement are experienced and well established in their positions. These key managers have been in their current positions for

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[11] VEC-DR-5 – Attachment A – MPC Job Descriptions

[12] VEC-DR-20 - Attachment A – Fossil Fuel Policy

[13] VEC-DR-19 - Attachment B, page 5, Storage Policy Review

[14] VEC-DR-19 - Attachment B, page 5, Storage Policy Review

at least 2 years.[15] A review of the bios of the MPC Senior Production Officer and Vice President of Commercial Operations and the SCS Vice President, Commercial Operations indicate that the senior managers have extensive fuel related experience.[16]

The succession planning process is well conceived and results in positions being occupied by competent, experienced personnel. More specifically, the process identifies viable candidates based on the following[17]:

- Persons considered "ready now," in that they already possess the skills and experience necessary to rise to positions as they become vacant;
- Persons possessing significant capabilities and experience to rise to the positions involved, but whose readiness would be materially improved by one to two years of additional development; and
- Persons possessing important attributes, but requiring longer lead times to develop skills and experience commensurate with the positions involved.

Each of the employees involved with procurement and management of the Fuel and Purchased Power functions have an individual Performance Plan and Summary (PP&S). The PP&S outlines business expectations, behavioral expectations, a developmental plan and a career plan.[18] The expectations are based on corporate and departmental goals. For instance, the goals of the MPC Fuel Department are:

1. Develop and Implement Strategies to Effectively Manage the MPC Fuel Supply and Minimize Overall Customer Fuel and Lignite Mining Costs,
2. Support and Comply with All Relevant Plant, Environmental, Financial Controls, and Regulatory Initiatives,
3. Manage the Fuel Regulatory Review Process, and
4. Provide the Highest Quality Support to MPC Generation and MPC/SCS Departments.

The succession planning process utilized by SCS and MPC is similar to those used by other companies in the industry and appears to yield robust results.

In addition, all employees are expected to adhere to the Southern Company Code of Ethics.[19] The Code restates the Corporate values of safety first, unquestionable trust, superior performance, and total commitment. The Code guides employee behavior to be

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[15] VEC-DR-49 – Personnel Changes

[16] VEC-DR-50 – Attachment A – Reaves Bio

[17] VEC-DR-180 – Succession Planning Process

[18] VEC-DR-31 – Performance Plan and Summary

[19] VEC-DR-21 – Attachment A – Gas Procurement Strategy

consistent with the Corporate values. Annually, all employees must certify that they received, read and will abide by the Code.

E. PROCEDURES AND PROCESSES

The Fossil Fuel Policy[20] is the guiding document for procedures. The Fossil Fuel Policy and how it operates to accomplish fuel and purchased power objectives is discussed above. During the course of the audit numerous processes were identified and described. Some of the key processes include:

- Coal Procurement and Settlement Process[21] including procurement, inventory management, logistics, and quality and contract administration.
- Coal Procurement Procedures[22] including need determination, purchasing strategy, coal purchase solicitation and evaluation process, financial review procedures, coal purchase approval process, coal purchases documentation process, as well as other types of coal purchase processes.
- Natural Gas Services[23] including transportation, supply, storage, financial hedging, and emission allowance.
- Process for maintaining vendor lists.[24]
- Fuel inspection, sampling and weighing procedures[25] including inspecting sampling systems, cleaning scales, performing zero calibration tests, performing simulated load test, preparing mechanically collected samples for analysis, and ensuring samples are correctly shipped for analysis.
- Procedures for development of annual fuel budget, development of fuel supply plan, and procurement of fuel.[26]
- Pool Billing Process Timeline.[27]

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[20] VEC-DR-20 – Attachment A – Fossil Fuel Policy

[21] VEC-DR-10 - Attachment A – Gas Procurement and Settlement Process

[22] VEC-DR-17 - Attachment A – Coal Procurement Procedures

[23] VEC-DR-80 - Attachment A – June 28, 2017, Meeting, Natural Gas Overview

[24] VEC-DR-33 – Maintenance of Vendor Lists

[25] VEC-DR-35 – Attachments A through F – Fuel Inspection, Sampling and Weighing Procedures

[26] VEC-D -120 and Attachments A, B and C – Development of Annual Fuel Budget

[27] VEC-DR-157 - Attachment A – Pool Billing Process Timeline

Most of these procedures and processes are explained in more detail in the relevant sections of this audit report. However, it is interesting to note the difference in the level of detail and specification among the various procedures and processes. For instance, the fuel inspection, sampling and weighing procedures are very detailed and elaborate. At the other end of the spectrum is the pool billing process. We were informed a formal written process did not exist and in lieu of that we were provided a process timeline in the form of a flowchart. The interesting point here is that the pool billing accounts for a very significant portion of the Company's revenue and accordingly one expects more detail and specifications in the event of personnel absences, missing or inaccurate data and other unexpected events.

Findings

This section presents the findings with regard to organization and procedures.

II-F1 **The fuel procurement organization is appropriate and staffed by competent, experienced personnel.**

MPC and SCS have managed to "grow" the personnel into the relevant positions. As a consequence, the staffs have been able to acquire the necessary experience to perform the required functions. Our review of the bios of key positions indicated the managers had the background and experience necessary for their jobs. A testament to the fact that the fuel managers are experienced is the observation that the director with the least experience in their position had been in that position for 2 years.[28]

II-F2 **The utilization of a service company arrangement provides MPC with experienced, specialized fuel procurement services.**

SCS provides MPC and the other operating companies with experienced, specialized fuel procurement services. These services would be difficult to provide at the MPC level. Without consideration to the cost of the service, one can state that MPC is better off with the services of SCS.[29] As discussed above, MPC power procurement decisions are made by the Agent of SCS. MPC fuel decisions are made by MPC and then executed by SCS with MPC monitoring. There could be a concern that the Agent could make a decision that is not in the best interest of MPC but no instances were observed. In addition, the arrangement allows for MPC to be timely informed of these decisions and can express any concern. In conclusion, the SCS Agent arrangement provides MPC with excellent service with a process that allows decisions to be made in a timely, efficient and economical manner.

[28] VEC-DR-49 – Personnel Changes

[29] VEC-DR-4 – Fuel Procurement Function

II-F3 **The final resolution of the Kemper Plant, MPC may result in changes to the procurement department organization.**

Presently, the MPC fuel organization has a Lignite Contract Director and 2 Fuel Analyst Senior positions. If the Kemper Plant is going to be operated strictly as a combined cycle plant, these positions may not be necessary or at least they may need to be significantly modified.

II-F4 **Some of the processes and procedures at both SCS and MPC need to be more formalized.**

There are numerous procedures and processes needed to make certain that the generating units have adequate, reliable fuel available. However, there is a wide variation in the level of detail in some of the procedures and processes that were reviewed. For instance, the fuel inspection, sampling and weighing procedures are very detailed and specific. At the other end of the spectrum is the pool billing process. We were informed a formal written procedure did not exist and in lieu of that we were provided a process timeline in the form of a flowchart. A process as crucial as the pool billing process should be more formalized to allow for changing and unplanned circumstances such as missing or ill personnel, unusual data, or other unexpected events.

Recommendations

II-R1 **Initiate a review of the need for the Lignite Contract Director and 2 Fuel Analyst Senior positions at MPC if it is determined that the Kemper Plant will be operated as a combined cycle plant. (Priority: Medium)**

Although the final decision regarding the Kemper Plant is yet to be determined, MPC should begin a review to determine the need for the Lignite Contract Director and two Fuel Analyst Senior positions going forward. The review should include alternative scenarios about whether the plant is to be operated as an IGCC or as a combined cycle plant. This review will allow MPC to move forward more quickly once the final resolution of the Kemper Plant is determined.

II-R2 **Develop and implement more formal procedures for key fuel related processes. (Priority: Medium)**

Robust risk management practices dictate that procedures be carefully documented and give adequate consideration to "what if" scenarios. For instance, the Coal Procurement Procedures that were revised February 2017 give careful attention to identifying how specifically decisions are to be made and how to deal with various circumstances such as email/fax bids, unsolicited bids, late bids, etc.[30] Yet, the pool billing process that provides

[30] VEC-DR-17 Coal Procurement Procedures

the most significant portion of revenue is lacking in this level of detail. SCS and MPC should address this shortcoming as soon as possible.

III. FUEL PROCUREMENT AND CONSUMPTION ANALYSIS

A. SUMMARY PLANT DETAILS

This Chapter deals with fuel procurement and consumption at MPC gas fired power plants. For report purposes coal procurement, inventory and handling have been shifted to the report Chapter VI - Power Plant Analysis. The hedging of gas, including the processes used, is covered in the Chapter IV – Fuel Related - Enterprise Risk Management.

GENERATION FLEET

MPC has either full or partial interest in three coal-fired generating stations, as well as a number of gas fired units. These include:

- Watson Station located at Gulfport, Mississippi, consisting of two units wholly owned and operated by MPC: 250 MW Unit #4 and 500 MW Unit #5.
- Daniel Station located near Escatawpa, Mississippi and operated by MPC: MPC has a 50 percent ownership interest in each of the stations' 500 MW Units #1 and #2; Gulf Power Company owns the other 50 percent.
- Greene County Station is located near Demopolis and operated by Alabama Power: MPC has a 40 percent ownership in each of the stations 250 MW Units #1 and #2; Alabama Power owns the remaining 60 percent.
- As of this report writing, the Kemper IGCC facility will be operated on natural gas rather than gas produced via coal gasification.

The next set of Exhibits summarize various station characteristics and details. We focus on the Daniel Plan in particular since it is the largest coal operated station in the MPC system.

Exhibit III-1
Station Ownership and Characteristics

Generation Station Ownership

Station	MPC	Gulf Power	Alabama Power
Daniel	50%	50%	-
Greene	40%	-	60 %
Watson	100%	-	-

Station Characteristics

Station	Fuel	Rating, MW
Daniel #1	Coal	500
Daniel #2	Coal	500
Greene County #1	Coal	250
Greene County #2	Coal	250
Watson #4	Gas	250
Watson #5	Gas	500

Exhibit III-2
MPC Generating Plant Details

Mississippi Power Company								
Power Plants								
Power Plant Name	**Owner**	**Operator**	**Owned Existing Capacity (MW)**	**Operating Ownership (%)**	**Operating Status**	**Prime Mover**	**Fuel Type**	**Year First Unit in Service**
Chevron Oil	Mississippi Power Co.	Mississippi Power Co.	150.0	100.00	Operating	Gas Turbine	Natural Gas	1967
Eaton	Mississippi Power Co.	Mississippi Power Co.	73.6	100.00	Retired	Steam Turbine	Natural Gas	1945
Greene County	Mississippi Power Co.	Alabama Power Co.	198.8	40.00	Operating	Steam Turbine	Natural Gas	1965
Jack Watson	Mississippi Power Co.	Mississippi Power Co.	823.0	100.00	Operating	Steam Turbine	Natural Gas	1957
Jack Watson CT	Mississippi Power Co.	Mississippi Power Co.	41.2	100.00	Operating	Gas Turbine	Natural Gas	1970
Plant Ratcliffe (Kemper County IGCC)	Mississippi Power Co.	Mississippi Power Co.	823.6	100.00	Operating	Combined Cycle	Natural Gas	2014
Sweatt	Mississippi Power Co.	Mississippi Power Co.	92.0	100.00	Retired	Steam Turbine	Natural Gas	1951
Sweatt Jet	Mississippi Power Co.	Mississippi Power Co.	41.0	100.00	Operating	Gas Turbine	Natural Gas	1971
Victor J. Daniel Jr.	Mississippi Power Co.	Mississippi Power Co.	510.0	50.00	Operating	Steam Turbine	Bituminous Coal	1977
Victor J. Daniel Jr. CC	Mississippi Power Co.	Mississippi Power Co.	1085.0	100.00	Operating	Combined Cycle	Natural Gas	2001

Exhibit III-3
Daniel Plant Profile

Victor J. Daniel Jr. | Power Plant Profile

Owner	Ultimate Parent	Operating Capacity Ownership (%)	Planned Capacity Ownership (%)
Gulf Power Co.	Southern Co.	50.00	-
Mississippi Power Co.	Southern Co.	50.00	-

Operator
Mississippi Power Co.

Site Information	
County, State or Province	Jackson, MS
NERC Region and Subregion	SERC/SOU (100.00%)
ISO(s)	NA
Planning Area	Mississippi Power Company (50.00%) Gulf Power Company (50.00%)
Balancing Authority	Southern Company (100.00%)
Interconnected Utility	Mississippi Power Co.
Water Source	Municipality
Other Plants at Site	Victor J. Daniel Jr. CC

Plant Description	
Operating Status	Operating
Current Operating Capacity (MW)	1,020.0
Prime Mover	Steam Turbine
Primary Fuel	Bituminous Coal
Secondary Fuel	Subbituminous Coal
Additional Fuel Type(s)	Distillate Fuel Oil
Fuel Group(s)	Coal, Oil
Co-Fired Units?	Yes
Fuel Switching Units?	No
Year First Unit in Service	1977
Cogeneration?	No
Offshore?	No
Regulatory Status	Regulated

Summary Operating Data - 2015	
Operating Capacity (MW)	1,020.0
Net Generation (MWh)	2,439,887
Heat Rate (Btu/kWh)	10,706
Capacity Factor (%)	27.31
Total Operating & Maintenance Expense per MWh ($/MWh)	54.33

Total Plant Investment - 2015	
Cost of Land & Land Rights ($)	13,653,932
Cost of Structures & Improvements ($)	134,441,471
Cost of Equipment ($)	1,166,025,841
Gross Capital Expenditures ($)	1,338,294,585
Construction Cost/ Capacity ($/kW)	1,220.40

Source: S&P Global Market Intelligence | Page 1 of 2

Victor J. Daniel Jr. || Power Plant Profile

Unit Details

Unit Name	Generation Technology	Technology Detail	Unit Nameplate Capacity (MW)	Capacity (MW) Summer Net Capacity (MW)	Capacity (MW) Winter Net Capacity (MW)	Primary Fuel	Operating Status	Online Date
1	Steam Turbine (ST)	Subcritical	548.3	510.0	510.0	Bituminous Coal	Operating	Sep - 1977
2	Steam Turbine (ST)	Subcritical	548.3	510.0	510.0	Bituminous Coal	Operating	Jun - 1981

Project Summary

Phase	Project Type	Generation Technology Breakout	Technology Breakout	Current Development Status	New Capacity (MW)	Primary Fuel	Estimated Completion Date	Estimated Project Costs ($000)	Estimated Project Cost ($/kW)
1	Environmental	Steam Turbine (ST)	Retrofit of NOx Control	Terminated	1,020.0	Bituminous Coal	NA	NA	NA
2	Environmental	Steam Turbine (ST)	Retrofit of NOx Control	Completed	510.0	Bituminous Coal	2010	NA	NA
3	Environmental	Steam Turbine (ST)	Retrofit of NOx Control	Announced	1,020.0	Bituminous Coal	2022	NA	NA
4	Environmental	Steam Turbine (ST)	Retrofit of FGD Control	Completed	1,020.0	Bituminous Coal	Nov - 2015	660,000	647

Exhibit III-4
Daniel Plant Fuel Data

Victor J. Daniel Jr.													
Fuels													
Periods	Latest Calendar Year												
	01/16	02/16	03/16	04/16	05/16	06/16	07/16	08/16	09/16	10/16	11/16	12/16	2016 Y
Average Heat Rate (Btu/kWh)	11,914	10,661	-	15,348	13,885	12,096	11,668	11,761	11,940	11,700	11,500	12,482	11,942
Fuel Burned													
Primary Fuel Type	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	uminous Coal
Secondary Fuel Type	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	uminous Coal
Coal Burned (tons)	123,749	60,897	-	28,466	47,352	169,379	224,081	182,272	127,368	116,706	78,121	105,843	1,284,254
Gas Burned (mcf)	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil Burned (bbls)	6,660	1,197	-	1,853	1,063	1,078	1,071	152	1,574	1,652	416	2,017	18,953
Other Fuel Burned (mmBtu)	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel Delivered Cost													
Coal Cost, Delivered ($/ton)	45.34	-	-	-	-	-	42.47	49.65	54.66	54.03	54.35	56.57	52.43
Gas Cost, Delivered ($/mcf)	2.91	2.36	2.18	2.42	2.30	2.96	3.19	3.21	3.38	3.46	3.26	4.19	2.95
Oil Cost, Delivered ($/bbl)	43.10	46.37	-	60.16	-	65.59	61.34	55.14	62.66	68.85	65.09	69.68	54.05
Other Cost, Delivered ($/mmBtu)	-	-	-	-	-	-	-	-	-	-	-	-	-
Primary Coal Deliveries													
Type	Subbituminous	-	-	-	-	-	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal	Bits Coal
Region	Powder River	-	-	-	-	-	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal	Subbit Coal
Primary Transport Mode	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Transport Mode	-	-	-	-	-	-	-	-	-	-	-	-	-
Amount Delivered (1000 tons)	14,015	-	-	-	-	-	124,071	124,079	96,439	138,608	96,928	85,960	677,421
Heat Content (Btu/lb)	8,855	-	-	-	-	-	8,611	8,868	8,860	8,919	8,932	11,639	8,844
Sulfur Content (%)	0.23	-	-	-	-	-	0.23	0.26	0.26	0.26	0.28	0.43	0.25
Ash Content (%)	5.40	-	-	-	-	-	5.40	5.00	5.10	4.85	4.80	5.70	5.10
Delivered Cost ($/ton)	45.34	-	-	-	-	-	42.47	44.35	44.58	43.71	43.45	68.93	43.73
Transportation Cost ($/ton)	26.76	-	-	-	-	-	25.06	25.06	25.06	25.36	25.36	28.62	25.25
Secondary Coal Deliveries													
Type	-	-	-	-	-	-	-	Bituminous	Bituminous	Bituminous	Bituminous	Subbituminous	Bituminous
Region	-	-	-	-	-	-	-	Uinta Basin	Uinta Basin	Uinta Basin	Uinta Basin	er River Basin	Uinta Basin
Primary Transport Mode	-	-	-	-	-	-	-	-	-	-	-	-	-
Secondary Transport Mode	-	-	-	-	-	-	-	-	-	-	-	-	-
Amount Delivered (1000 tons)	-	-	-	-	-	-	-	36,614	73,877	97,915	73,645	83,281	368,011
Heat Content (Btu/lb)	-	-	-	-	-	-	-	11,501	11,635	11,685	11,617	8,878	11,632
Sulfur Content (%)	-	-	-	-	-	-	-	0.47	0.46	0.46	0.44	0.20	0.45
Ash Content (%)	-	-	-	-	-	-	-	7.20	6.30	6.10	6.30	5.50	6.20
Delivered Cost ($/ton)	-	-	-	-	-	-	-	67.60	67.81	68.64	68.70	43.62	68.45
Transportation Cost ($/ton)	-	-	-	-	-	-	-	28.40	28.48	28.62	28.62	25.38	28.71

Exhibit III-5
Daniel Plant Fuel Consumption

YEARMM	SUPPLIER	SHIP QTY	BTU	FUEL DOLLARS	QUALITY	TOTAL FUEL	TRANS	TOTAL	COAL/TON	RANS/TON
		Tons	per #	DOLLARS	DOLLARS		DOLLARS	DOLLARS		
2016/10	[redacted]									
2016/10										
2016/10										
2016/11										
2016/11										
2016/12										
2016/12										
2016/12										
2017/01										
2017/01										
2017/02										
2017/03										
2017/05										
2017/05										
2017/06										
2017/06										
2017/06										
2017/07										
2017/07										
2017/07										
2017/08										
2017/08										
2017/08										
2017/09										
2017/09										

Exhibit III-6
Daniel Plant Environmental Data

Victor J. Daniel Jr. | Plant Environmental

Periods: 2012Y,2013Y,2014Y,2015Y,2016Y

Emissions Control Equipment	
FGD Control Installed?	Yes
FGP Control Installed?	Yes
NOx Control Installed?	Yes
Mercury Control Installed?	Yes

Emission Allowances			
Emission Allowances	*Program Name*	*2017 Holdings*	*As Of*
SO2	Acid Rain	24,219	4/11/2017
NOx Ozone Season	CAIR NOx Ozone Season	NA	8/15/2016
NOx Annual	CAIR NOx Annual	NA	8/15/2016

	2012	*2013*	*2014*	*2015*	*2016*
Emissions					
CO2 Emissions (tons)	2,177,633	2,157,459	4,249,776	2,964,317	2,694,409
CO2 Emissions Rate (lb/MMBtu)	205.1999	205.2001	205.2015	205.2012	205.1997
NOX Emissions (lbs)	5,952,857	6,124,369	11,380,039	7,430,413	6,985,763
NOX Emissions Rate (lb/MMBtu)	0.2805	0.2913	0.2747	0.2572	0.2660
SO2 Emissions (lbs)	14,033,919	15,539,006	29,767,048	16,790,835	281,313
SO2 Emissions Rate (lb/MMBtu)	0.6612	0.7390	0.7167	0.5812	0.0107
Byproducts					
Fly Ash: Disposed or Sold Quantity (1000 tons)	63.3	60.6	130.0	53.5	NA
Bottom Ash: Disposed or Sold Quantity (1000 tons)	13.0	15.2	25.8	20.6	NA
Sludge: Disposed or Sold Quantity (1000 tons)	NA	NA	NA	NA	NA
Gypsum: Disposed or sold Quantity (1000 tons)	NA	NA	NA	1.5	NA
Other Byproducts: Disposed or Sold Quantity (1000 tons)	NA	NA	NA	NA	NA
Fly Ash Collection and Disposal Expense ($000)	1,819	1,340	2,027	1,674	NA
Bottom Ash Collection and Disposal Expense ($000)	387	286	499	893	NA
Water Pollution Abatement Collect & Disposal Exp ($000)	622	531	1,055	1,172	NA
Total Byproduct Collection Expense ($000)	1,240	525	1,108	1,214	NA
Total Byproduct Disposal Expense ($000)	1,624	1,657	2,493	2,532	NA

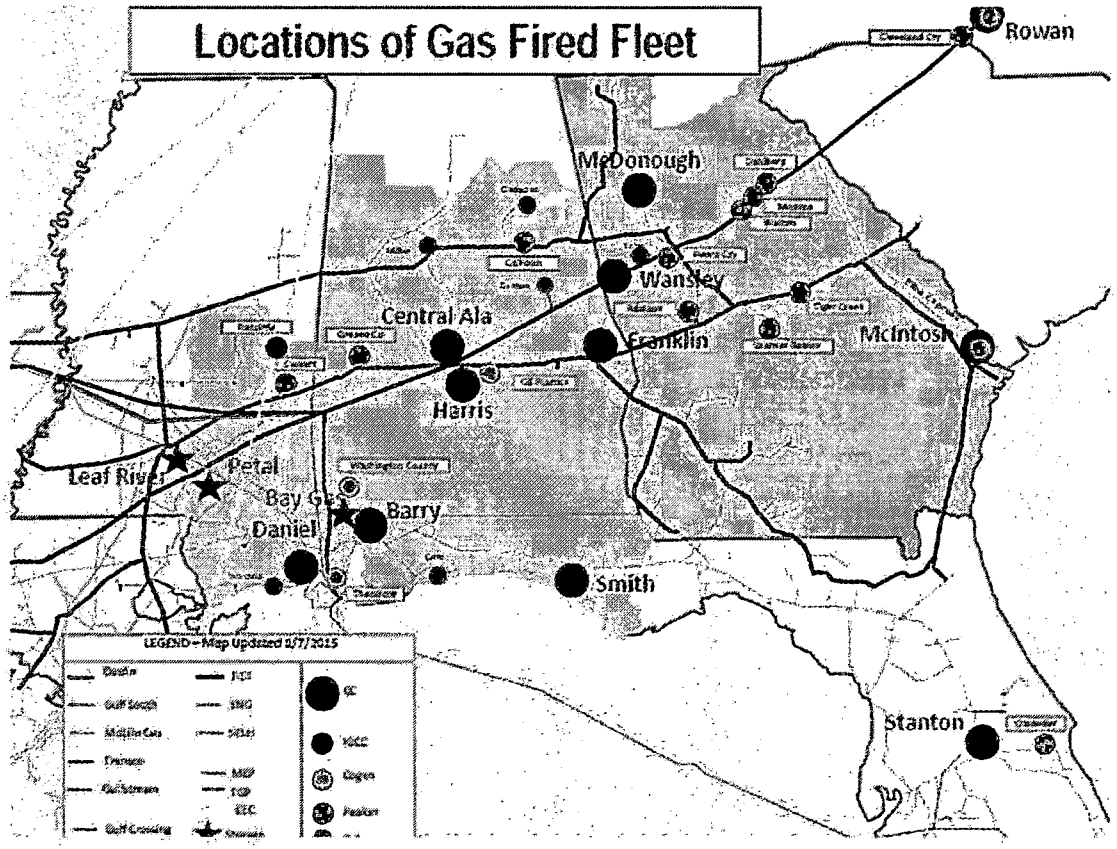
Source: S&P Global Market Intelligence | Page 1 of 2

Exhibit III-7
Natural Gas Power Plants[31]

Station Name	Unit	Type	Summer Net Rating
Plant Green County	Greene Co. 1	Peaking	258 Base/266 Peak
Plant Green County	Greene Co. 2	Peaking	258 Base/266 Peak
Daniel Electric Generating Plant	Daniel 3	Base	502
Daniel Electric Generating Plant	Daniel 4	Base	502
Watson Electric Generating Plant	Watson 3	Peaking	107 Base/113 Peak
Watson Electric Generating Plant	Watson 4	Peaking	236 Base /268 Peak
Watson Electric Generating Plant	Watson 5	Peaking	480 Base/516 Peak
Watson Electric Generating Plant	Watson CT	Peaking	33
Sweatt Electric Generating Plant	Sweatt CT	Peaking	15
Plant Ratcliffe Combined Cycle Units	Ratcliffe 1	Base	555 Base/696 Peak

[31] VEC DR-142 Attachment A

Exhibit III-8
Locations of Gas Fleet



Refinery Gas

MPC also has ownership interest in five cogeneration units in Pascagoula, Mississippi which utilize refinery gas. These are identified as Chevron 1 through 5. All are base load plants of 15-16MW (four plants) and 70MW.

B. GAS SERVICES

Gas Services Team

Gas Services is headed by the Director - Gas Services who reports to the Vice President of Operations. Reporting to the Director – Gas Services are four Direct reports responsible for the following areas:

- Term Supply and Transportation
- Gas Operations, Trading and Optimization
- Financial Hedging

- Trading and Optimization Manager[32]

Vantage has a Chapter in this report dedicated to organization where more can be found on this topic.

Southern Company Services as Agent for the Affiliated Companies

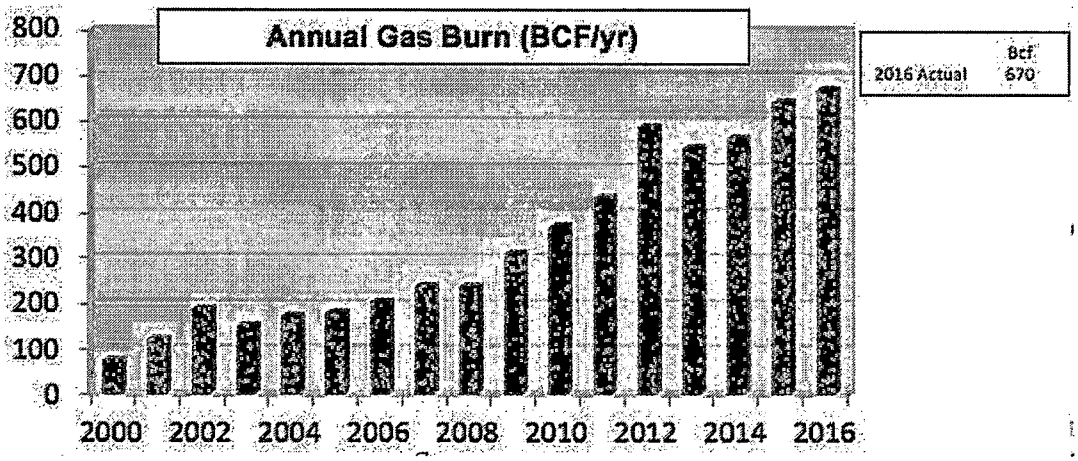
The SCS gas program mirrors the generation pool in that all transportation and storage assets are managed as one portfolio. With Fleet Operations' having flexibility to choose any unit means gas can go to a variety of different plants and operating companies as needs change. This means that:

- The five OPCOs serve as one entity for shipper-must-have-title
- Each OPCO is listed on the transportation agreement jointly as Shipper
- Each OPCO is listed on the gas purchase agreement jointly as Buyer
- OPCOs agree to be jointly and severally liable for all obligations
- SCS acts as agent

FERC initially approved the joint concept under the condition that a pipeline offered, to all parties, through its tariff. Natural gas pipelines are now obligated to offer multi-party contract options for firm transportation service if so requested by a shipper. This is available on Southern Natural Gas (SNG), Transco, Florida Gas Transmission (FGT), Tennessee Gas Pipeline (TGP), Gulf South and Elba Express.

Exhibit III-9
Gas Usage

Gas Usage



[32] VEC-DR-162 Attachment F

Exhibit III-10
Sweatt and Greene County – Southern Natural Gas Connections

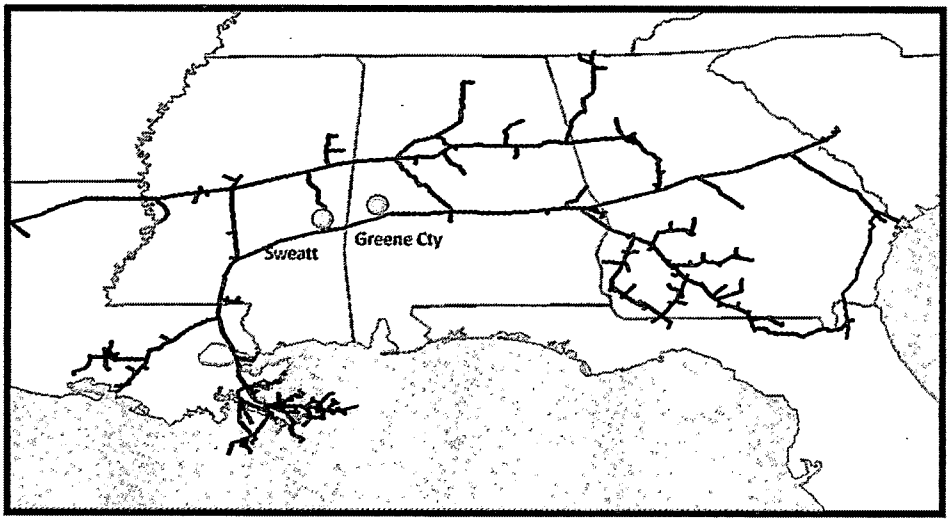


Exhibit III-11
Plant Ratcliff- Tennessee Gas Pipeline

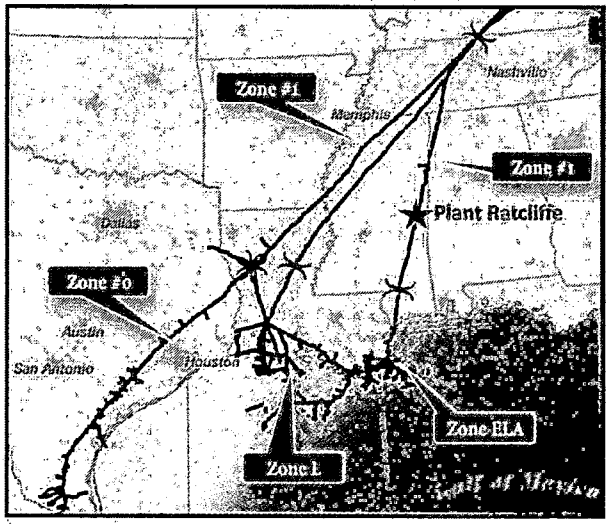


Exhibit III-12
Plant Daniel Pipeline Connections

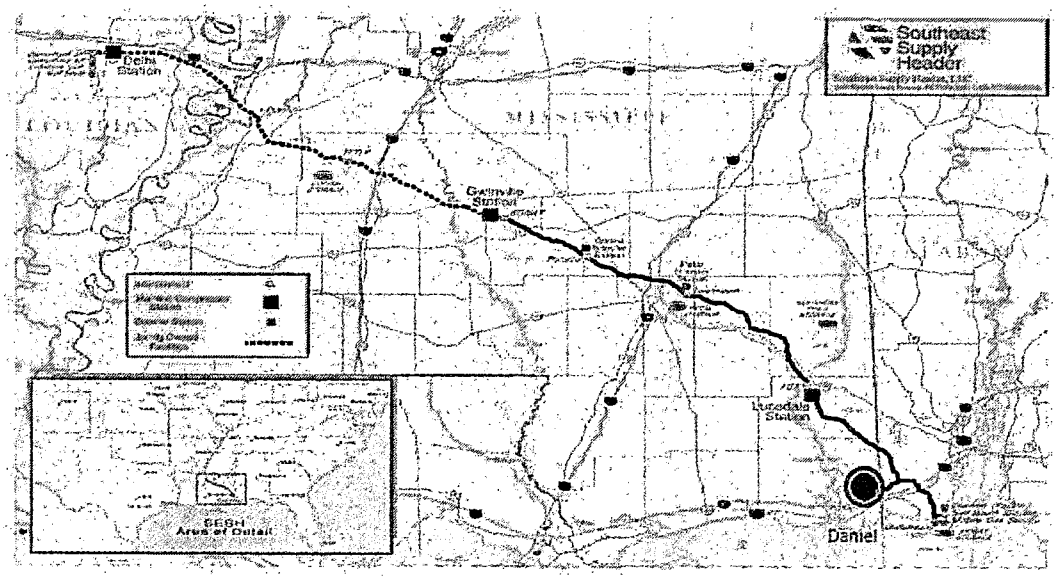
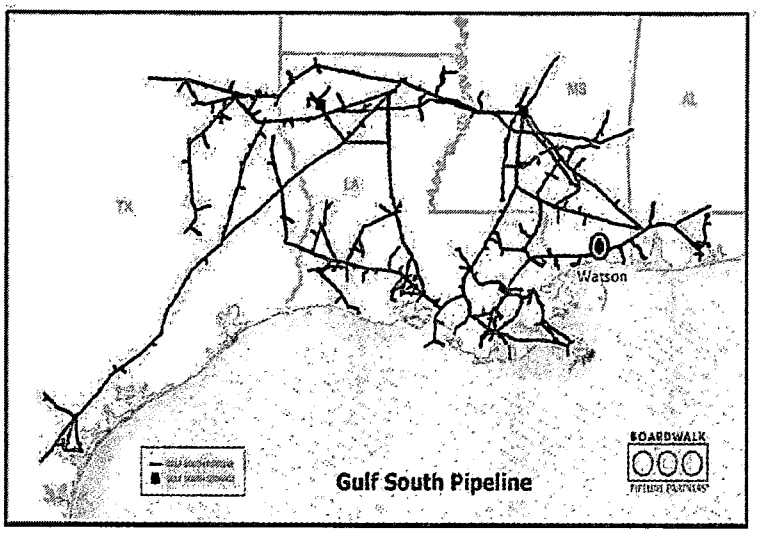


Exhibit III-13
Plant Watson – Gulf South Pipeline



C. FOSSIL FUEL POLICY

The Fossil Fuel Policy requires all generating assets to bring a similar degree of firmness to the pool. In structure it parallels the requirements of the Intercompany Interchange Contract. The Fossil Fuel Policy applies to the four retail Operating Companies and Southern Power's assets in the pool. The Policy covers all applicable fossil fuels which in

this case applies to gas, coal and fuel oil. The Policy is governed by the Senior Production Officers of each OPCO.

The Fossil Fuel Policy establishes firm transportation requirements for units recognized as providing capacity to the pool. This includes combined cycle and cogeneration units and combustion turbines when alternate fuel is unavailable. The Policy also covered the planned steam conversions from coal.

The Pool Combined cycle and cogeneration units also bring storage capacity equivalent to thirteen days of firm transportation. The Fossil Fuel Policy specifies how the transportation assets are to be utilized as follows:

- First for use by the plant paying for the firm transportation
- Second for use at another plant owned by the same operating company
- Third for use by another pool asset
- Last for market transactions; revenue credited back to the FT holder

Findings

III-F1 **The conversions of Kemper to a permanent gas fired plant significantly alters the longer term gas procurement picture for MPC.**

The Kemper County Energy Facility(Kemper), located in Kemper County Mississippi is a 582-MW plant which was originally designed to operate using TRIG™ Integrated Gasification Combined Cycle(IGCC) technology using Mississippi lignite from a nearby mine. The issues surrounding the gasification portion of the project are well publicized and documented and will not be repeated here. Rather, the issue becomes the impact on long term gas supply and transportation brought about by the use of purchased natural gas as a permanent primary fuel supply for Kemper. Kemper has been operating using natural gas since completion (except for testing periods). As such there are no operational or technical issues involved related to continuing to operate using natural gas with suspension of the gasification project.

III-F2 **The increased planned consumption of natural gas by Kemper requires a reevaluation of gas procurement and hedging strategies. (See Chapter-Risk Management)**

As noted, Kemper has been operating using purchased natural gas. However, the gas planning and hedging strategies have assumed a phase out and reduction in the purchase of natural gas for Kemper as the coal gasification began supplying the plant. The change to natural gas for the longer term does not require any changes in the process, but will require a change in the long-term gas procurement, and potentially hedging.

III-F3 **Gas Capacity, storage and transportation continue to be based upon sound, tested processes)**

The Fossil Fuel Policy (described elsewhere in this chapter) sets the criteria for pipeline and storage capacity contracts and for commodity supply for the entire Southern system fleet gas requirements. The policy undergoes annual review by the Fossil Fuel Committee, which includes the Senior Production Officers from each of the operating companies. SCS's Vice President of Fuel Services chairs the committee. Each operating company representative has one vote and all decisions must be unanimous. As described, this process essential mirrors the IIC process.

Committee meetings include presentations addressing the outlooks for the various fuels, and on issues that needed to be addressed. The committee process is the time tested and produces rigorous policies and procedures.

Recommendations

III-R1 **Update the fuel procurement, gas transportation and gas hedging strategies to reflect the permanent usage of purchased natural gas for the Kemper plant (Priority: Low)**

IV. FUEL RELATED – ENTERPRISE RISK MANAGEMENT

A. FUEL HEDGING AND RISK MANAGEMENT POLICIES

INTRODUCTION

This section addresses MPC's Scope of fuel hedging and risk management policies, organization, managerial oversight and performance. Much of risk management is process oriented: how are risks defined measured and mitigated? Who is responsible for establishing the company's risk appetite? Who will "independently monitor and control risk exposure? To be sure, risk management can be fraught with poor performance, ill designed programs, lack of attention and irresponsible behavior. Enron is the most noted example. And in many cases because risk management is a process designed to hedge against the uncertainty, under a range of conditions a well-planned and robust energy procurement program will rarely fully recognize the benefit of its risk management efforts. One can argue how much a house should be insured for and how much should be covered by the deductible, but unless there is a fire, the value of that policy can be difficult to appreciate.

MPC and SC's risk management program is comprehensive, adopts many best practices in terms of front, mid and back office functionality and appears to achieve its stated objective – to exchange or swap the risk of natural gas price uncertainty for a stream of fixed fuel prices. MPC's natural gas hedging protocol is about as conservative as it can get by limiting exposure to well defined risk parameters and prohibiting exposure to uncovered speculation. In large part, MPC's hedging program complies with the spirit and intent of the MPSC's initial gas hedging Order issued seventeen years ago.

Mississippi Power Company (MPC) manages its risk exposure to price, volumetric and counterparty uncertainty via a formalized energy risk management program that is integrated within the Southern Company Enterprise Risk Management protocol. MPC maintains responsibility for forecasting of natural gas and coal requirements, sets limits as to exposure to opened and covered positions and internally manages its energy transactions via a traditional front, mid and back office structure. Southern Company supports its retail utility systems, including MPC, by performing the actual procurement, storage and delivery of both physical products and the execution of financial derivatives that meet the individual needs of its associated systems.

The MPC organization includes a formalized Risk Oversight Committee structure that includes senior level officers responsible for the company's adherence to Southern Company's Energy Trading Risk Management Policy.

Vantage evaluated MPC's fuel hedging and risk management practices by performing the following tasks:

- Review of MPC's energy risk management policies and procedures, organizational structure, staffing qualifications, reporting and compliance with MPSC orders and directives, and recent hedging activities.
- Review of SC's Enterprise Risk Management program, the role of SC's executive management, the independence of the Risk Oversight Committee and the findings of Internal Auditing reporting.
- Interviews with principal representatives from MPC and SC to explore and address MPC's fuel hedging programs, functionality of Front, Mid and Back Office responsibilities and oversight responsibility of the Risk Management Officer and Risk Oversight Committee.
- Observation of the SC trading floor with a focus on separation of Front and Mid Office operations, visual risk metrics and security.

B. REGULATORY HISTORY AND FRAMEWORK

In 2000, the Mississippi Public Service Commission directed MPC per its Order in Docket No. 2000-UN-943 to establish an Energy Cost Management Clause (ECM) "as a means to mitigate the effects of volatile fuel prices and to better synchronize the cost recovery of fuel and energy transactions."[33] The MPSC provided specific guidance as to the extent that MPC can employ financial derivative – hedges – to mitigate fuel price volatility. Furthermore, the MPSC ordered the company to annually report on:

1. budgeted transaction costs for entering forward or financial contracts, such as option premiums for both gas and electricity futures contracts and budgeted gas transportation and electric transmission necessary to meet futures contract obligations;
2. amounts representing the difference between budgeted natural gas cost included in the Company's fuel cost recovery clause for the twelve-month application period, and the exercise price for any forward or financial instrument applicable to the same period and entered into by October 31st immediately preceding the calculation month.[34]

The MPSC also, annually, engages the services of an independent consultant to perform an Annual Fuel Audit, of which this Fuel Hedging review is just one component. For this 2017 Annual Fuel Audit, the Findings and Recommendation report prepared by Liberty Consulting Group in 2016 was also reviewed with a focus on its assessment of MPC's risk management and hedging performance.

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[33] MPSC Docket Number 2000-UN-943: Notice of Mississippi Power Company of intent to change rates to establish and adopt its energy cost management clause, Rate Schedule "ECM", pages 2 - 3

[34] Ibid, pages 8 - 9

C. APPLICATION OF FINANCIAL HEDGES TO MANAGE FUEL PRICE UNCERTAINTY

MPC and SC only apply financial hedges to its natural gas supply portfolio. Coal related risks focus on inventory management and longer-term supply contracts. SC Energy Trading Risk Management Policy[35] in Appendix C: List of Approved Instruments, includes:

- Futures
- Forwards
- Spot Transactions
- Options
- Swaps

During 2016 through 2017, MPC employed only one type of financial hedge - fixed-for-float swaps.

> *A fixed-for-floating swap is an advantageous arrangement between two parties (counterparties), in which one party pays a fixed rate, while the other pays a floating rate.*
>
> *A natural gas swap is an OTC contract in which two parties agree to exchange periodic payments for natural gas. In the most common type of natural gas swap, one party, such as a large natural gas consumer, agrees to pay a fixed price for natural gas on specific dates to a counter-party who, in turn, agrees to pay a floating price for natural gas that references a published price, such as the NYMEX natural gas futures. Natural gas swaps are generally financial transactions that do not involve the purchase or sale of physical natural gas. Natural gas swaps can be traded bilaterally (direct between two counter-parties), via an OTC broker or on an electronic platform such as ICE.*[36]
>
> *In summary, large natural gas consumers have a variety of options, no pun intended, to hedge their natural gas costs. The "best" hedging tools and strategies for your company will depend on numerous, company specific variables such as your goals and objectives, location, risk tolerance, anticipated volumes, financial/credit conditions, etc.*[37]

NATURAL GAS HEDGING OBJECTIVES

The implied objective of MPC's natural gas price hedging program is to limit the uncertainty of gas prices which can be volatile over time. There are a number of hedging strategies that MPC could employ that seek the same objective i.e. SWAPS, Collars and Contracts for Differences (CFDs); however, the most common among energy trader's is the SWAP for its simplicity, liquidity and cost. Functionally, at a given strike price, the buyer of

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[35] VEC-DR-71 Appendix A

[36] https://www.investopedia.com/terms/f/fixed_floatswap.asp

[37] Mercatus Energy Advisor (see https://www.mercatusenergy.com/)

a SWAP will receive a payment from the counterparty if the market price is above the strike price and pay the difference when it is below that level. The buyer gives up the opportunity for declining prices, in exchange for price certainty at a pre-agreed cost. Since, in MPC's case, variations from base prices flow through a fuel adjustment clause, the SWAP limits MPC's exposure to period swings in monthly rates. The duration of the SWAPs and the limits imposed by the MPSC as to amount of covered positions provides for some volatility and opportunity purchases to take advantage of declining market conditions.

D. PRIOR FUEL AUDIT FINDINGS AND RECOMMENDATIONS

The 2016 Annual Fuel Audit report offered two recommendations as it relates to the Company's fuel hedging program:

a) Develop a Hedging Plan containing clear statements of the objective that guide the gas price Hedging program, and the chosen strategies for attainment of those objectives; share the Plan with the Mississippi PSC Utility Staff (MPUS) and the Mississippi PSC,
b) Identify and report the measures used to assess the hedging Program's effectiveness in attaining specific objectives.[38]

While we found that the company's documentation and internal management of the fuel hedging program was appropriate, we did not entirely agree that the first recommendation was necessary as the Company routinely produces internal studies and reports that could be shared with the MPUS. For example, a June 28, 2017 Power Point SC report entitled Natural Gas Overview[39] was very informative. However, we agree with Liberty's second recommendation that MPC's annual and monthly fuel reports to the MPSC fail to offer specific guidance as to the magnitude, duration and performance of the hedging program during the prior period. In fact, we found, no internal reports that provided the granularity to demonstrate the effectiveness and cost of MPC's procured SWAPs.

We also added another recommendation which is a best practice employed by many other utilities. One of the most effective internal mechanisms to expose program deficiencies is the internal audit. Not only are internal auditors exposed to all aspects of the business organization, they generally report via a "dotted line" to the Board of Directors' Audit Committee.

[38] Page V-35

[39] VEC-DR-96

E. MPC RISK MANAGEMENT PRACTICES AND PROCEDURES

INTRODUCTION

Three primary sources were used to assess MPC's fuel risk management program and are considered as leading risk management resources for best applied practices.

- COSO is an organization dedicated to providing thought leadership and guidance on internal control, enterprise risk management and fraud deterrence.[40]

  Originally developed in 2004 by the Committee of Sponsoring Organizations of the Treadway Commission (COSO), the COSO ERM - Integrated Framework is one of the most widely recognized and applied risk management frameworks in the world. The Framework provides guidance to boards and management to manage risks from strategy setting through execution and recognizes the increasing importance of the connection between strategy and entity performance.
- The Committee of Chief Risk Officers (CCRO) is an independent non-profit corporation of member companies. The CCRO is dedicated to the advancement of a broad range of best practices in the field of risk management, and its many associated fields including finance, accounting, operations and audit. Meeting risk management challenges is at the core of the financial health and effectiveness of energy companies and of our energy industry overall. In its eleventh year of business, the CCRO is today recognized in and around the industry as a premier source for independent, expert practitioner knowledge and perspective.[41]
- The Professional Risk Management International Association (PRMIA) is a membership association with more than 50,000 risk professionals in its global network that aims to lead the Risk Management profession by setting the highest standards of ethics, education, and professional excellence. Over 2400 companies worldwide employ PRM holders, demonstrating that employers around the world realize that PRMIA's education programs prepares candidates with the specialized knowledge and skills necessary to succeed in the dynamic financial services industry.[42]

MPC and SC's fuel hedging and overall enterprise risk management was evaluated against accepted and best practices supported by the above cited authorities.

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[40] https://www.pwc.com/us/en/cfodirect/standard-setters/coso.html

[41] http://www.ccro.org/whoweare

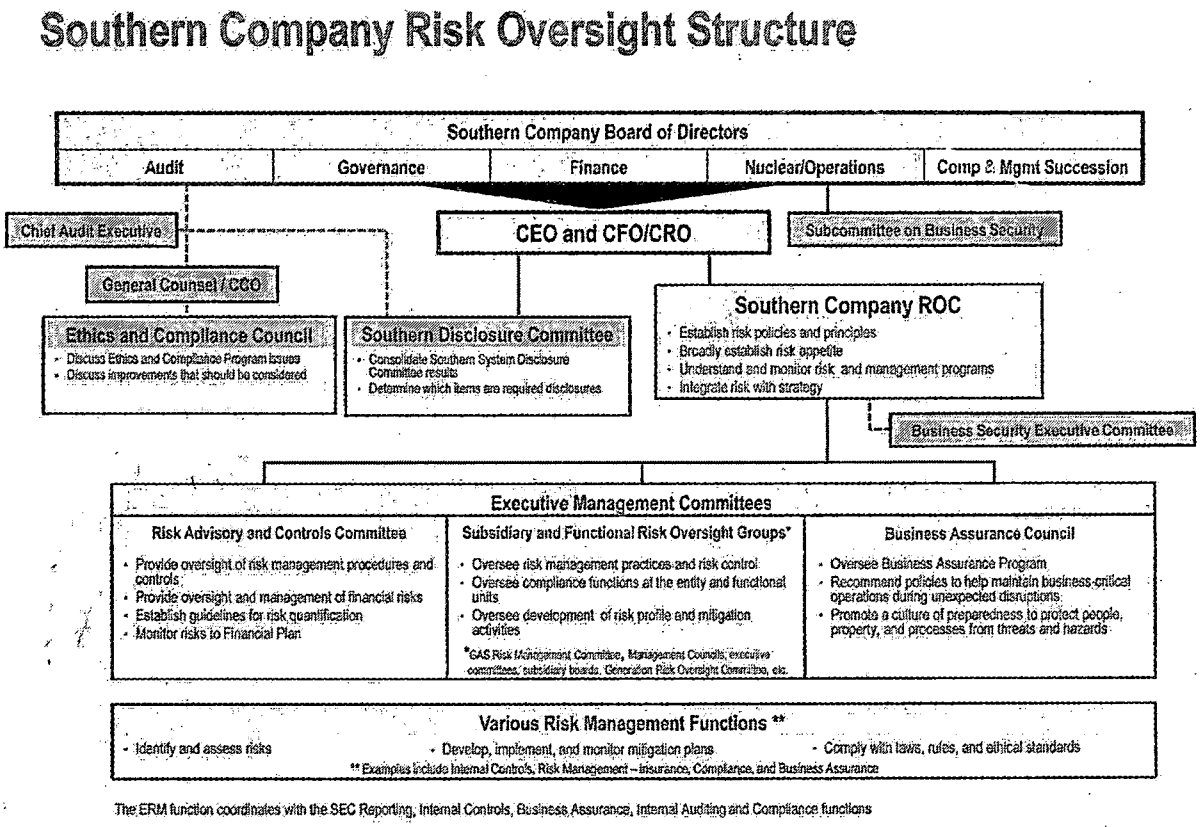
[42] https://prmia.org/

F. MPC RISK MANAGEMENT ORGANIZATION

Southern Company produces an Energy Trading Risk Management Policy[43] manual that is annually updated and approved by executive management. The following organizational responsibility chart depicts the structure by which the Company monitors and manages its risk exposure. In order to evaluate MPC's fuel risk management program, one must consider the entire integrated Southern Company organization from the Board of Directors to the individual operating company for several reasons. First, overall risk management policies are set by Southern Company and approved by its Board of Directors. Based on those policies Southern Company executive management including the CEO and CFO, who also serves as the Chief Risk officer through the SC Risk Oversight Committee (ROC), establishes risk policies including risk tolerance limits, monitor and manage risk exposure and integrate risk management within the company' strategic planning process. At the subsidiary level, MPC also forms an ROC which oversees risk management, control, and compliance.

[43] VEC-DR-77

Exhibit IV-1
Southern Company Risk Oversight Structure



Following our review of the Energy Trading Risk Management Trading Policy among other associated reports and documents, Vantage interviewed eight risk management specialists representing MPC and SC's fuel hedging program. Those individuals included:

- Risk Manager, Risk Control, Southern Company
- Enterprise Risk Management Director, Enterprise Risk Management, Southern Company
- Internal Audit Director, Internal Audit, Southern Company
- Project Manager, Energy Policy, Regulatory Affairs, Southern Company
- Vice President, Regulatory Affairs and Energy Policy
- Financial Hedging Program Manager, Fuel Services, Southern Company
- Fuel Analyst Sr., Fuel Services, Gas Procurement, Southern Company
- Manager, Fuel Services Mississippi Power Company

G. WRITTEN POLICIES AND PROCEDURES

Southern Company's Energy Trading Risk Management Policy is the "bible" for all employees involved in the risk management process. It not only enunciates the Company's

business objectives and risk management strategies, but also provides guidance and authorization in the following areas:

- Segregation of Duties
- Market Risk Identification, Measurement and Valuation
- Establishment of Market Risk Limits
- Credit Risk
- Operating Procedures and Systems
- Accounting, Tax, and Regulatory reporting
- Legal
- Monitoring and Reporting
- Compliance

The Appendices attached to the Energy Trading Risk Management Policy issues very specific guidelines as to:

- Market Risk Measures (Appendix F)
- Stress Test Methodology (Appendix G)
- Notification Levels (Appendix G). Here specific deviations in Mark-to-Market income changes require notification of specific corporate officers.

From a functional perspective, the operating companies follow the Fossil Fuel Policy[44] which describes the Fossil Fuel Committee charter. The Fossil Fuel Committee is made up of a Senior Production Officers from each of the four OPCOs plus Southern Power and is chaired by the Vice President of Fuel Services from Southern Company Services. This committee is responsible for:

- Developing concepts, terms and conditions for the Fossil Fuel Policy regarding commodity, transportation services, and storage for coal, natural gas and fuel oil
- Providing guidance and direction to the Chairman (referred to as the AGENT) regarding the implementation and administration of the Fossil Fuel Policy
- Other fuel matters that relate to the overall coordinated operation of the Southern Electric System.

The AGENT assumes the responsibility to manage the execution of fuel supply, storage and transportation contracts on behalf of all the OPCOs either collectively or individually. In summary, while MPC provides direction to the Fossil Fuel Committee as to projected needs, the procurement of the fuels and the management of transportation and storage services is performed by Southern Company Services on its behalf.

Fuel hedging programs are excluded from the auspices of the Fossil Fuel Policy. Each OPCO's fuel hedging program is the responsibility of each retail company's Chief Financial Officer or in the case of MPC, its Fuels Committee. While the AGENT routinely offers each

[44] VEC-DR-20

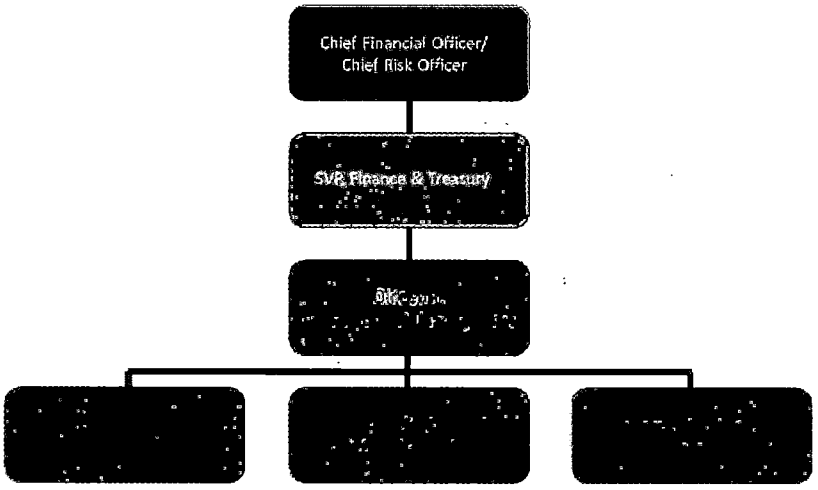
OPCO hedging recommendations on a regular basis, the OPCO maintains ownership of its respective hedging program and may accept, reject, or modify hedging recommendations of the AGENT. While all hedging recommendations must be approved prior to execution, the AGENT is responsible for the actual execution of those hedges.

H. ENTERPRISE RISK MANAGEMENT

Southern Company employs a comprehensive Enterprise Risk Management (ERM) program that identifies, tracks and measures potential impacts of business risks across the entire network of Southern systems and its affiliates. The Director of the ERM Program reports to the Senior Vice President, Finance & Treasury. [45]

Exhibit IV-2

Enterprise Risk Management Organizational Structure



VEC-DR-79

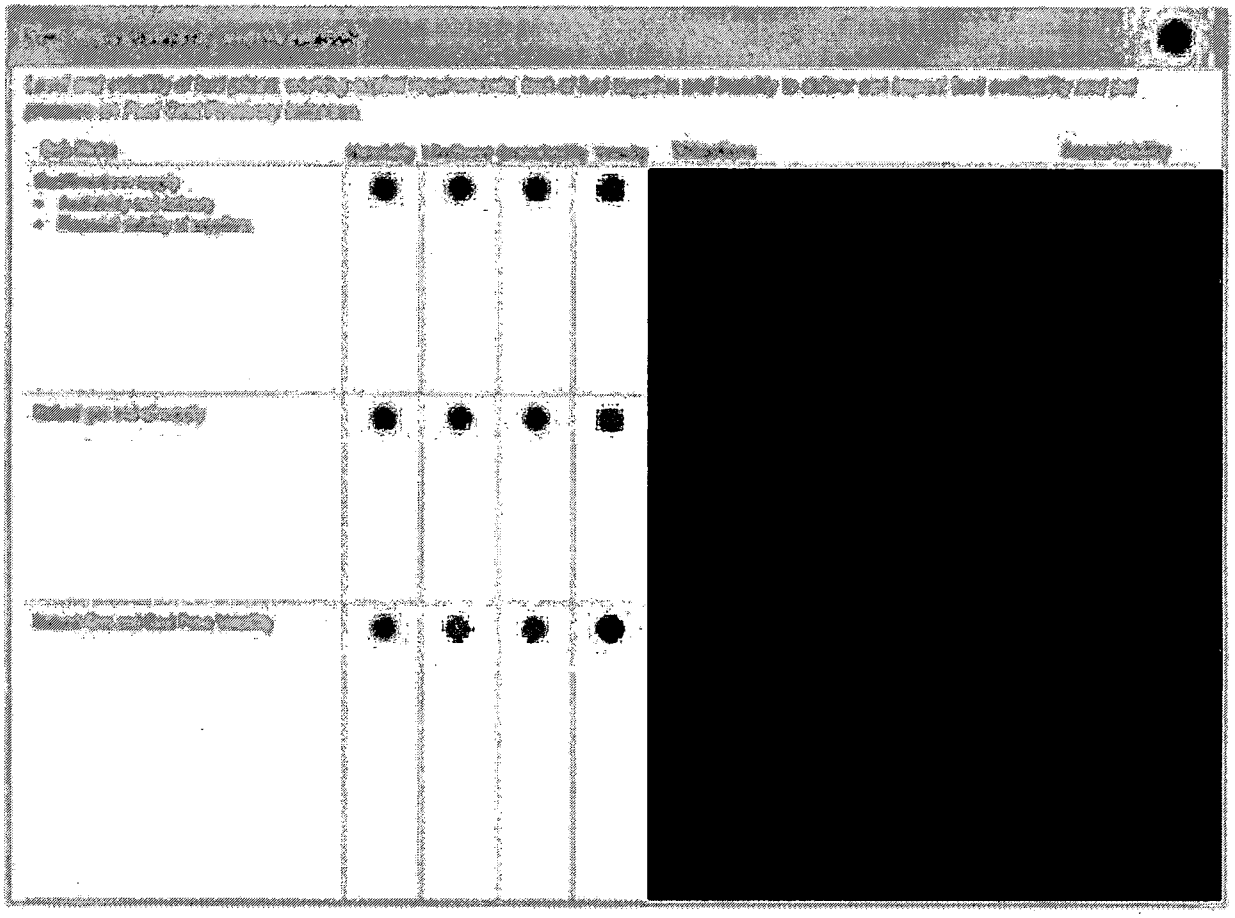
Furthermore, as a best practice, Southern' s ERM program is not a stand-alone program, but provides direct input into the Company's strategic planning process.

Fuel Price Volatility and Availability has been identified as an enterprise risk that is independently monitored by the Enterprise Risk Management program. Exhibit IV-3 is an

[45] VEC-DR-79

illustration of the ERM Risk Profile[46] which provides an example of the attention that the Company pays to its fuel price management.

Exhibit IV-3
Illustration of ERM Risk Profile



[46] VEC-DR-197

I. MPC RISK MANAGEMENT PERFORMANCE

REVIEW OF CURRENT HEDGING ACTIVITIES AND OBJECTIVES

MPC provided Vantage two presentation documents that offer a comprehensive insight into the company's fuel hedging program:

- Hedging Recommendations and Market Update[47]
- Natural Gas Overview[48]

The Hedging Recommendations report is prepared twice a year by SCS Fuels and is presented to the MPC Committee for their review. This fuels market review provides an analysis of current hedge positions and an assessment of the current market environment including fundamentals and pricing. On a quarterly basis, SCS Fuels also provides the MCP Committee with updated hedge strategy volumes and price targets for formal approval. SCS Fuels acting as MPC's AGENT executes on pre-approved hedges and MPC is notified upon execution.

HEDGE STRATEGY

The Company's Hedging Recommendations and Market Update offers a concise set of strategies that form the foundation of its natural gas hedging program.

- SCS is seeing approval to hedge additional volumes at updated price targets for years 2017 – 2020.
- Program continues to focus on hedging on price declined, or dips
- Flat forward curve allows opportunities to add positions with lower forward premiums (maintains a disciplined approach that layers in hedges over time)
- Emphasize that despite the low gas price environment, changes in natural gas prices are apt to occur very rapidly.

Basically, MPC/SC finds natural gas prices have been either holding steady or declining which impacts the premium cost of SWAPs as the upside risk to the financial counterparty is lower, while at the same time recognizes that although price volatility has been low since the end of 2014, the potential for rapid, unexpected rises, as witnessed in 2014 also needs to be reflected in the risk management program.

The Exhibit below, which was also extracted from the Hedging Recommendation and Market Update Report provides the volume and price of SWAPs executed from April 2016 through January 3, 2017. This confirms that the market is reflecting this information as

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[47] VEC-DR-196 Attachment A dated January 2017

[48] VEC-DR-96 dated June 28, 2017

average hedge prices purchased between April 4, 2016 through January 3, 2017 decline from $2.96 in 2018 to $2.86 in 2020.

Exhibit IV-4
MPC Hedging Activity

MPC Hedging Activity
Apr. 4, 2016 – Jan. 3, 2017

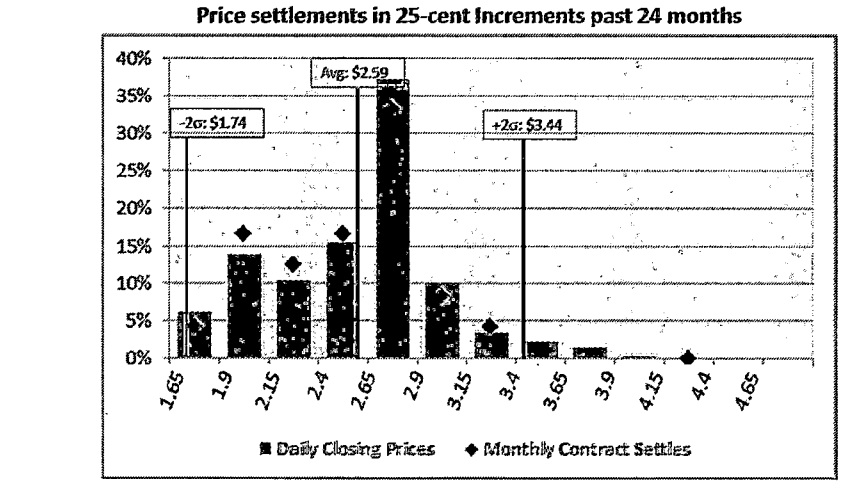
Hedge Period	Approved Volumes (Up to)	Executed at 1/3/17	Avg. Hedge Price
Calendar 2017	4.1	2.0	$2.87
Calendar 2018	9.1	8.8	$2.96
Calendar 2019	9.3	8.8	$2.95
May-Sep 2020	3.0	3.0	$2.86

Detail:

Swaps		
Year	Volume	Price
2017	2.0	2.87
2018	8.8	2.96
2019	8.8	2.95
2020	3.0	2.86
	22.5	$ 2.94

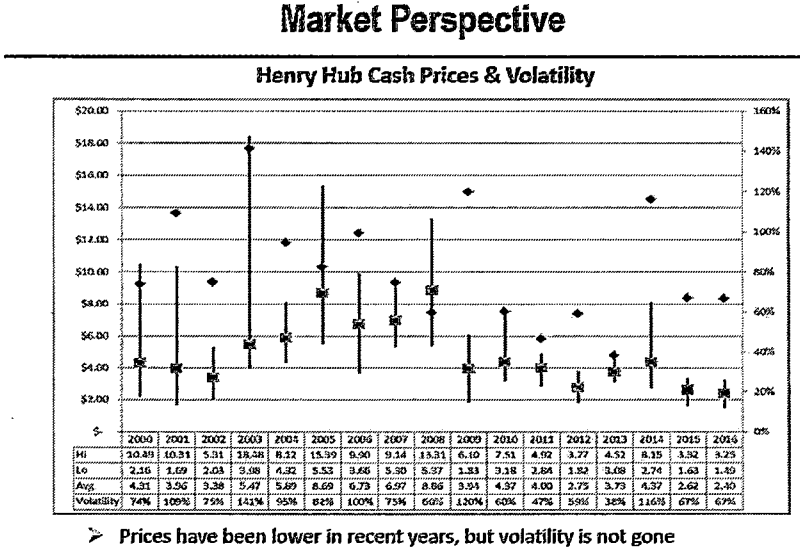
The Exhibit below illustrates the distribution of Daily Closing Prices over the past 24 months. It appears as if the distribution is normal with a mean of $2.59 and a range of $1.74 to $3.44 with 95 percent confidence (i.e., +/- 2 standard deviation). During this period, seven out of eight hedges settled within the 95% confidence band.

Exhibit IV-5
Price Settlements



The Exhibit below compares the range of natural gas prices for the years of 2000 through 2016. For each year the High, Low, and Average price (green box) is presented. Since 2009 the average prices have remained at or below $4 and volatility has remained at or below 60% for six of the eight years. In 2009 and 2014 volatility doubled to over 120%.

Exhibit IV-6
Market Perspective



We can see from the following Summary, as of January 2017, as MPC established its 2017 fuel hedging program after taking into account the price and volatility assessment established hedging limits that corresponded to forward expected prices.

Exhibit IV-7
MPC Hedge Summary

MPC Summary

			Year-End Hedge Target		Existing at 12/28/16		
Hedge Period	2017 Budget Volume	2017 Hedge Limits	Percent	Volume	Volume Hedged	Hedge %	Avg. Hedge Price
Calendar 2017	78.1	52.4	20-30%	15.6 – 23.4	12.5	16%	$3.98
Calendar 2018	77.3	48.4	20-30%	15.5 – 23.2	11.8	15%	$3.26
Calendar 2019	74.2	45.3	15-25%	11.1 – 18.5	8.8	12%	$2.95
Calendar 2020	67.7	41.8	5-15%	3.4 – 10.2	3.0	4%	$2.86
Calendar 2021	66.7	40.3	0-5%	0.0 – 3.4	-	N/A	N/A

All volumes shown above in million MMBtu

Beyond the metrics needed to implement an effective and cost-efficient fuel hedging program, an area of risk management is often overlooked or minimized. However good the metrics associated with the hedging strategy are, the quality and number of qualified counterparties can set the stage for whether those hedges are actually delivered. The larger the number of qualified and credit worthy counterparties, the lower the risk that any one will default. The higher the credit rating of each counterparty, the lower the likelihood that they will default.

MPC/SC lists in its January 2017 Hedging Market Update that they have 13 active counterparties. While there are no good "rules of thumb" for the proper number of counterparties, generally three is a minimum and six typical. Note that in some markets and for some forms of financial hedges, the market can be very thin and getting even one counterparty to bid is possible. However, 13 is very high.

A conservative hedging program will require each counterparty to be investment grade by at least two rating agencies. A bond rating at or above BBB- (Baa3 for Moody's) is the lowest rating and still investment grade. Twelve of the SCS' thirteen counterparties have an A or A+ rating.

Findings

IV-F1 **Southern Company has a well-structured risk management program consistent with a company as large and complex as it is.**

Southern Company's application of Enterprise Risk Management (ERM) as a means to track and mitigate risk as well as its integrating ERM into its strategic planning process, is a best practice. The breadth of its involvement of management from the Southern Company Chief Executive Officer and the Chief Financial officer who also serves as Chief Risk Officer to the management team at each operating company within the risk management process is also a best practice. Finally, the comprehensiveness of the Energy Trading Risk Management Policy is a best practice.

IV-F2 **MPC's fuel hedging is by design very conservative and limited to financial SWAPS.**

Those risks expose the company to billions of dollars of exposure. On the other hand, Southern Company's and more specifically MPC's natural gas fuel risk exposure is muted by comparison as average natural gas prices have remained steady and price volatility has been managed via the company's hedging program that employs SWAPs to exchange price variation for price stability. We define conservative as applying financial derivatives or hedges that have well managed goals, avoid speculation and prohibits exposure to uncovered positions.

IV-F3 **MPC's fuel hedging program is a direct result of the MPSC Order in Docket No. 2000-UN-943 to establish an Energy Cost Management Clause (ECM).**

The MPSC provided specific guidance as to the extent that MPC can employ financial derivative – hedges – to mitigate fuel price volatility. Furthermore, the MPSC ordered the company to annually report:

(1) budgeted transaction costs for entering forward or financial contracts, such as option premiums for both gas and electricity futures contracts and budgeted gas transportation and electric transmission necessary to meet futures contract obligations;

(2) amounts representing the difference between budgeted natural gas cost included in the Company's fuel cost recovery clause for the twelve-month application period and the exercise price for any forward or financial instrument applicable to the same period and entered into by October 31st immediately preceding the calculation month.

IV-F4 **MPC provides to the MPSC a monthly report indicating the mark-to-market value of all existing hedge contracts that have been in place.**

In December of each year, the MPSC also submits data requests for our forward monthly average gas price used in the filing submitted November 15th, and a comparison of the prior

year forecast vs. actual. However, after reviewing the company's filings for years 2012 – 2017, we have found that this information does not fully comply with the Commission's directive as outlined above. The Company's reports fail to provide:

- budgeted transaction costs for entering forward or financial contracts
- budgeted gas transportation and electric transmission necessary to meet futures contract obligations
- amounts representing the difference between budgeted natural gas cost, included in the Company's fuel cost recovery clause for the twelve-month application period, and the exercise price for any forward or financial instrument applicable to the same period and entered into by October 31st immediately preceding the calculation month.

In this regard, we agree with Liberty's second hedge recommendation that MPC's annual and monthly fuel reports to the MPSC fail to offer specific guidance as to the magnitude, duration and performance of the hedging program during the prior period. In fact, we found, no internal reports that provided the granularity to demonstrate the effectiveness and cost of MPC's procured SWAPs.

Recommendations

IV-R1 **Expand the information MPC provides in its annual EMC Report to the MPSC to include additional detailed information. (Priority: High)**

- budgeted transaction costs for entering forward or financial contracts
- budgeted gas transportation and electric transmission necessary to meet futures contract obligations
- amounts representing the difference between budgeted natural gas cost included in the Company's fuel cost recovery clause for the twelve-month application period and the exercise price for any forward or financial instrument applicable to the same period and entered into by October 31st immediately preceding the calculation month.

As illustrated below, the 2017 EMC Report fails to provide such required information as budgeted transaction costs, or exercise price for any forward or financial instruments.

Exhibit IV-8
Energy Cost Management Claims Activity

Mississippi Power Company MPSC Docket No. 2000-UN-943 Energy Cost Management Clause Activity For the period ended September 30, 2017						
	Current Month ECM Activity		Year-to-Date ECM Activity			
Current Month Gain/(Loss) on Financial Instrument Positions Closed	$ (856,068.06)		$ (6,854,714.71)			
Current Month Gain/(Loss) on Physical Gas Not Used	$ 430.73		$ (85,239.87)			
Mark to Market of Open Financial Instruments:	2017	2018	2019	2020	2021	Total
Quantity Hedged (mmBtu)	2,990,000	17,120,000	14,250,000	7,230,000	2,050,000	43,640,000
Market Value	$ 9,039,290	$ 57,258,690	$ 41,021,550	$ 20,114,190	$ 5,774,550	$ 133,208,270
Contract Value	$ 10,335,180	$ 59,087,505	$ 41,520,030	$ 20,508,030	$ 5,780,940	$ 137,231,685
	$ (1,295,890)	$ (1,828,815)	$ (498,480)	$ (393,840)	$ (6,390)	$ (4,023,415)

We would refer the Commission to the Southern Company presentation report entitled "Hedging Recommendation and Market Update" which provides a wealth of information sought under Order Docket No. 2000-UN-943.[49] For example, the information presented in the MPC Risk Management Performance section above, provides extracted information and assessments that would provide the Commission with a heightened understanding of MPC's fuel hedging strategy while mitigating the release of competitively sensitive information.

[49] VEC-DR-196 Attachment A for the January 2017 report

V. POWER PURCHASES AND SALES

A. BACKGROUND

Much of the basic structures and regulations governing power purchases and sales remain unchanged from previous audits. Southern Company is a utility holding company subject to the Public Utility Holding Company Act ("PUHCA"). The PUHCA required the operating companies to function as an integrated public utility system, operating in an interconnected and coordinated manner. This means that their assets are to be economically operated as a single interconnected and coordinated system.

To comply with PUHCA integration and coordination, Southern Company developed an instrument to govern these integrated and coordinated operations. This instrument is the Intercompany Interchange Contract ("IIC"). This agreement has been in place for over 50 years and remains fundamentally unchanged from the previous audits. The IIC last underwent changes in 2000 and 2007. The IIC governs the integrated operations of members as a single Southern Company power pool including pool operations, transactions, and billings among the operating companies. The IIC:

- specifies all system operation settlements
- provides for the sharing of benefits and burdens
- defines pool operations

Even with the repeal of PUHCA, the operating arrangement remains in place.

Southern Company's four operating utility companies and Southern Power Company comprise the pool participants. The operating companies include Alabama Power, Georgia Power and Gulf Power in addition to MPC. The Service area of Southern Company covers approximately 122,500 square miles with 27,000 miles of Transmission including 61 ties to neighboring utilities.[50]

Southern Power operates as a wholly-owned wholesale generation company. Southern Power and the IIC are subject to the jurisdiction of the Federal Energy Regulatory Commission ("FERC"). Southern Company Services (SCS) centrally operates the power pool in accordance with the IIC and acts as legal agent for the operating companies. These relationships and organizations are further discussed in the Chapter II.

An Operating Committee, comprised of a member from each of the five Operating Companies, directs power pool operations. Each operating company determines which of its own resources to commit to the power pool. The pool also makes purchases and sales in the wholesale market. Long-term power purchase agreements also get committed to the pool.

[50] DR VEC-162 Attachment A

The system-wide supply resources committed to the pool provide about 43,055 megawatts of generating capacity and 4,949 of purchased power agreements. The Pool generating capacity is shown in the table below. The primary change from previous audit is the large increase in the number of solar plants and associated MW. Although not shown in the chart, solar capacity has increased to over 1,000 MW in 2017 and is expected to continue to increase.

Exhibit V-1
Southern Company Generation by Plant Type[51]

Generation Type	Number of Units*	MW	Percent of Total
Coal	11*	14,457	33.6%
Combined Cycle	10	11,911	27.7%
Combustion Turbine	17*	4,948	11.5%
Nuclear	3	4,709	10.9%
Gas & Oil Steam	6	3,299	7.7%
Hydro	29	2,218	5.2%
Cogeneration	4	555	1.3%
Pump Storage	2	393	0.9%
Solar	14*	562	1.3%
Other	1	3	0.0%
Total	97*	43,055	100.0%
* Change from previous report			

[51] VEC-DR-162 Attachment B

B. INTEGRATED POOL PRINCIPLES

The Southern Company power pool, as governed by the IIC, works under specific operating principles and concepts that spring from the core concept of centrally coordinated planning and operations that are specifically defined in the IIC. The goals of the pool are reliable generation, minimized production costs and to optimize generating assets. SCS as agent jointly dispatches all committed supply resources of the operating companies. Unit commitment and joint dispatch optimize economies of scale and the benefits from load diversity among the operating companies. Essentially, the operating companies pool their customer requirements and allow SCS to determine the most economical means of fulfilling those requirements. All generation assets of the Operating Companies are also committed to the pool for joint security-constrained commitment and economic dispatch. The pool makes purchases from wholesale markets for economic and reliability purposes and will also make opportunistic sales. SCS also provides a single power pool marketing point of contact to coordinate and execute market power transactions. The pool participants engage in coordinated planning for new generation resources, energy budgeting, and scheduling generating unit maintenance. Each operating company has responsibility for building its own generating units, purchasing fuel, and operating the units, supported by SCS resources.

Energy Principles is one of the foundations for the Southern Company power pool operation. Energy Principles includes allocation of resources, cost minimization, centralized economic dispatch and security constrained unit commitment and economic dispatch process[52]. A fundamental premise of the IIC is that each operating company maintains adequate resources to serve its own obligations. The Production Officer of each operating company certifies the full load capacity of generation and peak load capacity annually. A key principle of the IIC holds that that each operating company retains its lowest cost resources to serve its own customers. Excess energy is then made available to the other operating companies to serve their loads, if economic (termed the "second call"). The pool then markets energy in excess of that needed to serve all the operating companies to the wholesale markets as external opportunity sales (termed the "third call").

The Pool also serves to provide for Integrated Resource Planning (across all companies), a coordinated energy budget and coordinated scheduled maintenance.

C. ENERGY PROVISIONS

Two primary types of energy transactions take place in the power pool. These are Interexchange Energy and Assigned Energy. Interexchange Energy includes both Associated Interchange Energy and Opportunity Interchange Energy. These can include capacity, energy or both. We describe these provisions in more detail below.

Interchange Energy – Interchange Energy is composed of two categories, Associated Interchange Energy and Opportunity Interchange Energy. Associated Interchange Energy is

[52] VEC-DR-182 Attachment A, IIC Sections 3.1, 3.3 and 3.5

energy purchased or sold to serve an Operating Company's obligations other than those related to opportunity sales. Opportunity Interchange Energy is energy purchased or sold to meet an Operating Company's responsibility for opportunity sales.

Interchange Energy - Associated Interchange Energy. This comprises that energy economically exchanged through coordinated system operation utilizing principles of centralized integrated system economic dispatch. This results in energy transfers among the Operating Companies that are accounted for on an hourly basis.[53] The hourly basis used is the Hourly Associated Interchange Energy Rate (AIER). This rate is based on the variable dispatch cost of the incremental resources serving the collective obligations of the pool.[54] These energy exchanges allow the operating companies to sell excess energy or to acquire more economic energy than would be available from their Operating Company generating assets were they operating independently of the pool. The IIC prices Associated Interchange exchanges at the incremental cost of providing the next megawatt hour above the aggregate loads of the five operating companies. Or, as stated in the IIC Manual Section 3.2, The Associated Interchange Energy Rate, as determined for each hour, is based on the variable dispatch cost of the incremental resource(s) that serve the collective obligations of the Operating Companies.

Interchange Energy - Opportunity Purchases and Sales - The IIC agreement gives the pool the exclusive right as Agent to enter shorter-term purchase and sales transactions for capacity and energy with external, non-associated companies. The pool's exclusive window for making such transactions with external companies extends from the current hour through midnight Friday of the following week. The operating companies may not act independently of the pool within this short-term window to buy or sell energy in the marketplace. Neither Southern Power Company nor any of the other Operating Companies can use Pool resources for its own benefit in those wholesale opportunity markets. [55]

Power pool traders arrange opportunity purchases from companies external to the pool when they expect the net economic effect to produce savings when compared to the pool's incremental generation rate. A calculation of the percentage of the purchase assumed to be beneficially used by each operating company, and the cost of the external purchases, drives cot and volume allocation to each operating company, using the Peak Period Load Ratio (PPLR) of each. MPC's PPLR measures its internal company load as a proportion of total system load at peak times. Hourly "spot" opportunity purchases are made based on the expected savings based on cost. System lambda, multi-hour Opportunity Purchases are often multi-hour (e.g., 16 hour strip). Savings on the multi-hour are based on an evaluation of production cost over the period of the purchase. These pool purchases are initially allocated to all Operating Companies based on peak period load ratios. Adjustments may then be made to address any inequitable effects of this process among the Operating Companies, with the intent being that none of the individual Operating Companies should

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[53] IIC-Section 8.1

[54] VEC DR-182 Attachment A, also IIC Manual Section 3.2

[55] IIC Section 9.4.2

be adversely impacted by a purchase that benefits the system as a whole. This sharing of both the benefits and burdens of sales and purchase transactions to and from external companies comprises a key principle of power pool operations.

The power pool acting as Agent also can arrange sales of the energy available to the pool to external companies of either capacity or energy or both. These sales can be at contract rates or rates as mutually agreed upon. The operating company whose generating assets generates the energy for off-system sales recovers its cost of generation. All operating companies then share in the remaining revenue and margins from these External Opportunity sales. The capacity and/or energy obligation for the sale, as well as the associated cost, is allocated to each Operating Company on a PPLR basis. Accordingly, all operating companies share in the economic benefits of their level of contribution (if any) to the supply resources supporting them. As with Opportunity Purchases, neither Southern Power Company nor any of the other Operating Companies can use Pool resources for their own benefit in those wholesale opportunity markets.[56]

Assigned (or Assignable) Energy – Assignable energy consists of energy derived from internal sources or from others at a cost that renders it unusable from an economic dispatch perspective. Such Assignable energy would cause additional system costs if delivered to the pool. Section 9.1 of The IIC provides for assignment of the additional cost of such energy to the operating company or companies responsible for the request (or for the purpose) for relying on it. This requires first identifying the beneficiary or beneficiaries of the assignable energy and then determining the appropriate share. Once assigned, Assignable Energy will not be delivered to the pool unless it becomes economically usable on the integrated system.

D. POOL BILLING AND PRICING

The Agent performs a series of after-the-fact power pool billing processes to identify and then assign or allocate the costs and revenues of pool operations. It is important to note that energy and capacity settlements under this process are independent. Capacity reserves have no energy entitlement. It is possible for an operating company to be providing capacity reserves and receiving energy in the same month. The processes of the after the fact billing process are defined in the IIC and the associated manual.

The billing process generates monthly invoices to the operating companies and to outside entities with whom the pool has had transactions or which require a 'true up" from previous billing. These processes determine the volumes and prices for associated interchange power between the power pool and each operating company. The billing rates for interchange energy are specified in Article III or the IIC manual. This includes the rate processes for Associated Interchange Energy, Opportunity Interchange Energy, Opportunity Interchange Energy under specific contract and obligations of the Operating Companies and other impacting factors such as fossil unit O&M costs, fossil fuel handling costs, emission allowances and others.

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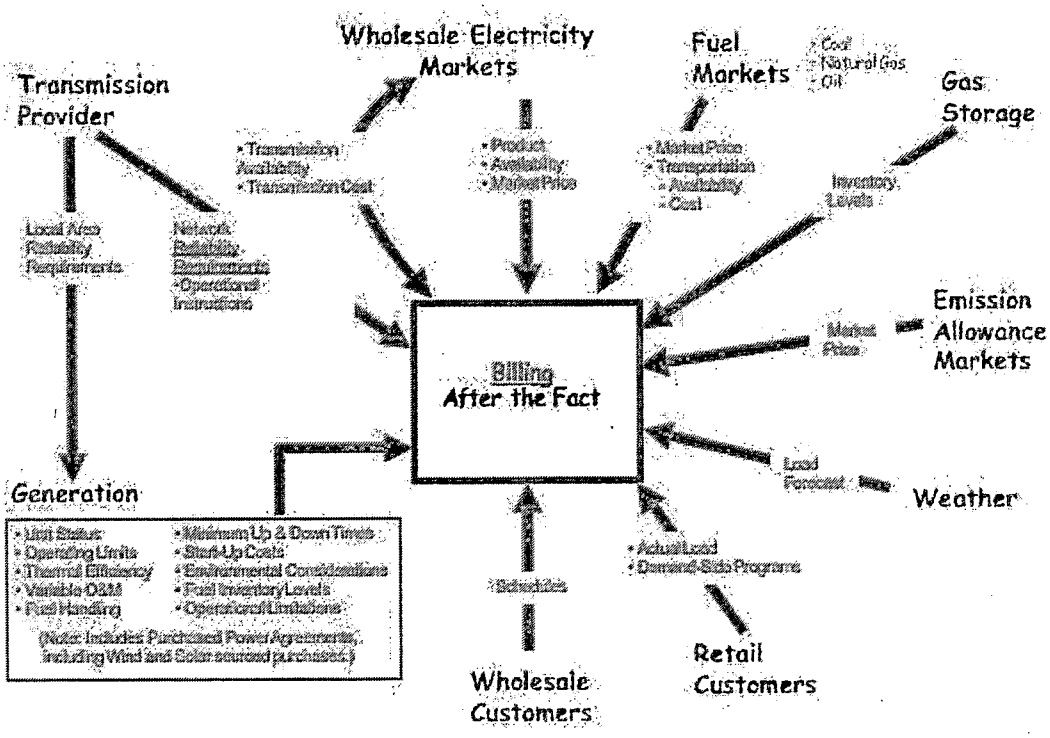
[56] IIC Section 9.4.2

Power pool billing calculations employ a "re-dispatch" process that mimics and examines actual pool operations on an hourly basis even though system economic dispatch occurs on a moment-by-moment basis. The re-dispatch process uses the hourly data to calculate the information required by the IIC for power pool billing.

The overview of the re-dispatch process is shown graphically below[57]:

Exhibit V-2
Southern Company Dispatch Process



The billing re-dispatch process applies the following sequence for each hour in a month:

- Build a resource stack for the Southern Company total system
- Build a resource stack for each operating company
- Build a sales stack for the total system
- Evaluate each transaction in the sales stack
- Calculate the net pool interchange energy for each operating company
- Calculate the interchange rate for on-system transactions.

[57] VEC DR-162 Attachment D – Pool Billing Overview-CONFIDENTIAL

The "resource stack" for the total system corresponds to hourly energy volumes produced and cost per megawatt hour for each generating unit used during the hour, placed in ascending order by cost. The resource stack includes the hourly generation output of all wholly-owned units, the owned percentage of jointly-owned units, the entire output of units contractually controlled and dispatched by the power pool, and purchases made by the energy traders. Generation with the lowest variable operating costs comprise the system resources at the "bottom of the stack".

The next step builds a resource stack for each operating company by assigning 100 percent of generating units wholly owned by each operating company to that company. Assignment of jointly-owned units follows ownership proportions. The step also assigns units run outside of the economic dispatch for reliability needs to the operating companies requesting or requiring this "assigned energy." The PPLR drives the allocation of system opportunity purchases from third parties. This step in the billing process builds an MPC resource stack (for these billing purposes) by assigning the lower-cost output of the MPC plants to the company, and filling the remainder of its hourly load requirements using resources from associated operating companies or external purchases.

Totaling these constructed resource stacks for all pool operating companies produces calculated "system requirements" for that hour. Resource volumes exceeding system requirements are assigned to sales ("External Sales") to third parties outside the system. The billing processes assign to these sales the most expensive energy resources from the top of the hour's calculated pool resource stack. Most of the sales arose during actual operations as "opportunity sales," arranged by energy traders with the expectation of earning a margin for the power pool.

Economic dispatch principles identify the units designated as providing the energy to support those sales, starting with the most expensive energy at the "top of the stack." A single, average-cost rate calculation gets assigned to these top-of-the-stack sales. The operating company or companies with units designated as sources for opportunity sales get reimbursement for the calculated costs associated with those sales. Costs and revenues associated with each such sale are allocated to the operating companies using the PPLR.

Findings

V-F1 **The Southern Company power pool, as governed by the Intercompany Interchange Contract, continues to be an effective tool for power exchanges, purchases, and sales by Mississippi Power.**

The power pool concept and specifically the IIC have been reviewed both internally and externally numerous times. Given such scrutiny and the fundamentally sound concepts behind the pool arrangement, it should come as no surprise that the power pool continues to be an effective tool for the Southern Companies.

The operation of the Southern Company power pool follows the objectives of the Intercompany Interchange Contract:

- The power pool has an objective of operating as an integrated power supply system with goals to optimize generation assets to minimize costs and insure system wide reliability.
- The pool is an effective arrangement for Integrated Resource Planning, Energy Budgeting and Scheduled Maintenance.
- The coordinated electric operations seek the minimum cost of power supply in the interconnected system at all times, consistent with service requirements and operating limitations.
- The Southern operating companies share appropriately in the benefits and burdens of pool operations.

VI. POWER PLANT ANALYSIS

A. GENERATING PLANT OPERATING PERFORMANCE

ANALYSIS OF OPERATING CHARACTERISITICS

Recognizing that the efficient and reliable operation of the MPC generation plants has a direct impact on the fuel and Unit dispatch costs, a review and analysis of the MPC generating plant operating performance was performed. A review of the following key operating parameters was conducted for each of the active generating facilities:

A five year monthly profile (January 2012 thru September 2016) for each operating parameter was analyzed to determine if there were any significant trends in associated Unit performance that could impact fuel related costs and establish a baseline for each parameter that is based on a five year average of each operating parameter. The baseline was then compared to the average of the operating parameters during the audit period (October 2016 thru September 2017). A summary of the comparison of these operating parameters is provided in Exhibits 3 thru 5.

- Capacity Factor (CF)
- Heat Rate (HR)
- Availability Detractors
- Equivalent Availability Factor (EAF)
- Equivalent Forced Outage Rate (EFOR)

Notes for the following Exhibits:

1. Baseline operating profile average of past 5 years data (January 2012 thru September 2016).
2. Audit period operating profile average October 2016 thru September 2017 data.
3. Kemper County baseline operating profile average August 2014 thru September 2016 data operated on natural gas combined cycle.
4. Source of above data the MPC response to VEC-DR-124, Rev. 1.

Exhibit VI-1
MPC Generation Heat Rate Analysis

Station/Unit	Rating (MW	Type	Fuel	Net Heat Rate			
				(BTU/KWH)			
				Baseline	Audit Period	Variance	Pecent Change
				(Note 1)			
Chevron 1	18.1	GT	NG	N/A	N/A	N/A	N/A
Chevron 2	18.1	GT	NG	N/A	N/A	N/A	N/A
Chevron 3	18.1	GT	NG	N/A	N/A	N/A	N/A
Chevron 4	18.1	GT	NG	N/A	N/A	N/A	N/A
Chevron 5	74.5	GT	NG	N/A	N/A	N/A	N/A
Daniel 1	510	ST	Coal	11,380	11,815	435	4%
Daniel 2	510	ST	Coal	11,286	12,081	795	7%
Daniel 3	540	CC	NG	7,102	7,047	-55	-1%
Daniel 4	540	CC	NG	7,081	7,001	-80	-1%
Greene Co. 1	200	ST	NG (CoalConv.)	10,848	11,674	826	7%
Greene Co. 2	200	ST	NG (CoalConv.)	10,113	11,139	1026	9%
Kemper Co. 1 (Note 3)	582	IGCC	Coal/NG	7,674	7,693	19	0%
Sweatt A	40	GT	NG	47,818	16,444	-31374	-191%
Watson 3	112	ST	NG	13,162	12,931	-231	-2%
Watson 4	250	ST	NG (CoalConv.)	12,176	11,610	-566	-5%
Watson 5	500	ST	NG (CoalConv.)	11,061	11,657	596	5%
Watson A	39.3	GT	NG	40,369	19,726	-20643	-105%

Exhibit VI-2
MPC Generation Net Capacity Factor Analysis

Station/Unit	Rating (MW)	Type	Fuel	Net Capacity Factor %			
				Baseline (Note 1)	Audit Period (Note 2)	Variance	Percent Variance
Chevron 1	18.1	GT	NG	86	74	-12	-16%
Chevron 2	18.1	GT	NG	90	65	-25	-38%
Chevron 3	18.1	GT	NG	91	90	-1	-1%
Chevron 4	18.1	GT	NG	89	81	-8	-10%
Chevron 5	74.5	GT	NG	91	88	-3	-3%
Daniel 1	510	ST	Coal	33	32	-1	-3%
Daniel 2	510	ST	Coal	32	26	-6	-23%
Daniel 3	540	CC	NG	86	86	0	0%
Daniel 4	540	CC	NG	89	83	-6	-7%
Greene Co. 1	200	ST	NG (CoalConv.)	52	21	-31	-148%
Greene Co. 2	200	ST	NG (CoalConv.)	52	20	-32	-160%
Kemper Co. 1 (Note 3)	582	IGCC	NG (CoalConv.)	76	74	-2	-3%
Sweatt A	40	GT	NG	4	2	-2	-100%
Watson 3	112	ST	NG	11	14	3	21%
Watson 4	250	ST	NG (CoalConv.)	39	22	-17	-77%
Watson 5	500	ST	NG (CoalConv.)	44	26	-18	-69%
Watson A	39.3	GT	NG	5	1	-4	-400%

Exhibit VI-3
MPC Generation Equivalent Availability Factor Analysis

Station/Unit	Rating (MW)	Type	Fuel	Equivalent Availability Factor (%)			
				Baseline (Note 1)	Audit Period (Note 2)	Variance	Percent Change
Chevron 1	18.1	GT	NG	[redacted]			
Chevron 2	18.1	GT	NG				
Chevron 3	18.1	GT	NG				
Chevron 4	18.1	GT	NG				
Chevron 5	74.5	GT	NG				
Daniel 1	510	ST	Coal				
Daniel 2	510	ST	Coal				
Daniel 3	540	CC	NG				
Daniel 4	540	CC	NG				
Greene Co. 1	200	ST	NG (CoalConv.)				
Greene Co. 2	200	ST	NG (CoalConv.)				
Kemper Co. 1 (Note 3)	582	IGCC	Coal/NG				
Sweatt A	40	GT	NG				
Watson 3	112	ST	NG				
Watson 4	250	ST	NG (CoalConv.)				
Watson 5	500	ST	NG (CoalConv.)				
Watson A	39.3	GT	NG				

Analysis

Based on a review of provided data request responses and interviews with managers and operators at Plant Daniel, it is determined that the facility management has made a significant commitment to monitoring the performance of the selected assets including the boiler, fan, pumps and turbines in an Avantis PRiSM performance monitoring system. At the Plant Daniel, a dedicated performance monitoring office is provided with access to the PRiSM System and the Distributed Control system (DCS). A dedicated Performance Engineer is assigned to the facility. This individual interfaces with the Southern Company Services Performance Engineer who directs the facility's performance monitoring program and provides technical advice to the facility performance engineer and management. Station heat rate is a major, highly visible performance goal for all facility employees and is continually monitored and displayed throughout the facility.

Due to the most recent reduction in the Plant Daniel's dispatch, the station has reduced load on a daily basis and the Units have been taken off line for economy shutdowns on weekends and holidays. This continued low load operation on facilities designed for base load operation results in additional thermal stress being placed on the boilers, turbines and auxiliaries. To reduce the negative impact of low load operation has on the boiler and turbine components, a sliding pressure control scheme has been put in place. This will reduce the impact of thermal stress and improve the heat rate of the boiler and turbine cycle.

To determine a broader Unit performance profile for each of the MPC generating Units, a review of the 5 year performance criteria was completed and outlined on Exhibit VI-3, above.

Findings

VI-F1 **The heat rate of the Plant Daniel coal fired Units 1 & 2 and the recently converted Greene County Units 1 & 2 has increased as a result of continued low load operation. Conversely, the heat rate of the Plant Daniel combined cycle natural gas Unit 3 & 4 has decreased due to operation at high capacity factors.**

A comparison of the Plant Daniel five year average heat rate data, and the heat rate data during the audit period indicates that the Unit 1 heat rate has increased by 4% and the Unit 2 heat rate has increased by 7%. This increase in Unit heat rate is largely due to the low load and cycling operation of the associated Units.

In addition, a comparison of the Plant Daniel 5 year average heat rate data and the heat rate data during the audit period indicates that each of the combined cycle, natural gas Units 3 & 4 heat rate has decreased by approximately 1%. This is largely a result of the Units being dispatched at a higher capacity factor.

VI-F2 **A review of Equivalent Availability Factors (EAF) over the last five years, with emphasis on the audit period revealed that the EAF of the Daniel Unit 2, 3 & 4 and the Greene County 2 have decreased significantly. This is an indication that the associated Units have been dispatched at a higher rate and are likely experiencing frequent periods of unavailability.**

Equivalent Availability Factor is the measure of the amount of time where the Unit is capable of generating at full capacity as a percentage of time during the measurement period. It measures the effectiveness and overall reliability of the associated Unit. A decrease in EAF is an indication that the reliable operation of the Unit is decreasing, which will result in the inability of the Unit to meet historical production capabilities.

Based on a comparison of the five year average EAF versus the EAF during the audit period, as detailed in Exhibit VI-2, above, it is noted that the following Units have experience a decrease in EAF:

- Daniel 2 – 10%
- Daniel 3 – 12%
- Daniel 4 – 20%
- Greene County 2 – 9%

This may be an indication that the increased dispatch of the Units has resulted in the degradation of a variety of components that have negatively impacted Unit overall availability, which could result in the need to dispatch higher cost facilities. It should also be noted that each of the above Units under went long planned outages during the audit period, which contributed to the reduced availability. The increased dispatch of these Units will likely increase the need to implement more frequent planned maintenance outages.

VI-F3 **A review of major availability detractors over the last five years, with emphasis on the audit period revealed that there is no significant increase in forced outage rate during the audit period.**

Major availability detractors are being reviewed in the fuel audit, to determine if changes in fuel use (conversion from coal to gas) are creating operational problems.

The last five years of MPC generating plant's major availability detractors and associate root cause analysis were analyzed to determine the impact that the associated detractors or events had on generating capability. This analysis was produced so that any a common themes could be identified and to determine if the Company had responded appropriately with a thorough root cause analysis. A summary of the past 5 year major availability detractors is outlined in Exhibit VI-1.[58]

Based on the analysis of the last five years of MPC generating plant's major availability detractors as compared to the audit period, other than the continued issues as associated

[58] Data is taken from the MPC response to VEC-DR-125

with the Kemper County gasifier, there is no common failure pattern. In addition, a review of the root cause analysis that was completed for each major forced outage, indicates that a thorough and comprehensive analysis was completed.

Exhibit VI-4
Major Forced Outage Profile Analysis

Major Forced Outage Profile Analysis					
Station/Unit	Rating (MW)	Type	Fuel	Generation Loss	Forced Outage Description
Chevron 1	18.1	GT	NG	[redacted]	
Chevron 5	74.5	GT	NG		
Chevron 5	74.5	GT	NG		
Daniel 2	510	ST	Coal		
Daniel 2	510	ST	Coal		
Daniel 3	540	CC	NG		
Daniel 4	540	CC	NG		
Greene Co. 1[59]	200	ST	NG		
Kemper Co. 1	582	IGCC	Coal/NG		
Kemper Co. 1	582	IGCC	Coal/NG		
Kemper Co. 1	582	IGCC	Coal/NG		
Sweatt A	40	GT	NG		
Watson 3[60]	112	ST	NG		
Watson 4	250	ST	NG		
Watson 5	500	ST	NG		
Watson 5	500	ST	NG		
Watson 5	500	ST	NG		
Watson 5	500	ST	NG		
Watson A	39.3	GT	NG		

VI-F4 **Due to continued low gas prices coupled with increase renewable energy sources the capacity factor of the coal fired Units at the Plant Daniel facility as well as the remaining generating Units continues to decline, and the associated Unit heat rates have continued to increase.**

Based on a review of the 5 year generating plant operating parameters average data it was determined that the capacity factor of all the MPC generating facilities, as for the most part declined through the audit period as compared to the previous 5 year average. When considering the impacts of both the dispatch dynamics and the condition of the associated generating systems, Plant Daniels Units 1 & 2 have experienced a steady decline in capacity factor. This is most pronounced on Plant Daniel Unit 2 that has experienced a 6% reduction in capacity factor from a 5 year average of 32% to 1 year average during the audit period of 26%. This is a direct result of the continued lower cost of natural gas, which has resulted in lower dispatch of the coal fired Units.

In response to this change in load pattern the Plant Daniel Managers have developed a low load operating procedure. During low load periods at night, on weekends and holidays, the low load operating procedures includes the removal of selected mills from service and the implementation of sliding pressure operating strategy. With this strategy the Operator maximizes Unit performance while reducing the thermal stress across the steam turbine.

As expected with the lower natural gas prices, the Plant Daniel Unit 3 & 4 continue to operate with a high capacity factor. The increased dispatch of both simple and combined cycle generating facilities Units that are typically designed for peaking and intermediate operation will directly impact the required facility maintenance. The facility's condition monitoring and preemptive maintenance programs coupled with the on-going System Ownership Program will be instrumental in maintaining the associated Unit's availability.

Recommendations

VI-R1 **Continue to operate the coal fired Plant Daniel Units 1 & 2 under a sliding pressure control strategy. The Greene County and Watson facility management team should continue to investigate modifications to the associated boilers to maximize Unit efficiency. (Priority: Medium)**

To maximize the performance of the Plant Daniel coal fired Units 1 & 2, it is advised that the facility managers continue to operate the Units under a sliding pressure operating mode during low load periods. In addition, the Greene County and Watson management team is advised to continue to identify modifications to the associated boilers and firing systems to improve overall Unit performance.

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[59] Greene County 1 converted to natural gas on April 16, 2016

[60] Plant Watson 4 &5 converted to natural gas on April 15, 2015

VI-R2 **Continue the current low load operating strategy at Plant Daniel and continue with an aggressive preventive and predictive maintenance programs to assure dependable availability and reduced forced outages. (Priority: High)**

Continue the application of the low load strategy at Plant Daniel. At Plant Daniel continue to closely monitor the high pressure turbine rotor stress during low load operations and when increasing Unit output. For the natural gas fired facilities continue to closely monitor the condition of the gas turbines hot gas passes and the schedule of major inspections.

B. GENERATING PLANT CONDITION, ORGANIZATION & STAFFING

Analysis

On September 20, 2017 Vantage Energy Consultants staff met with the Plant Daniel staff and toured the overall facility. Based on a walk down of the facility it appears that the plant is well maintained with close attention paid to housekeeping and visual preventive maintenance activities.

A review of the staffing profile of the facility indicates that the staffing profile appears to be consistent with industry standards for a facility of this vintage and configuration. However, based on a presentation provided by the Plant Daniel Plant Manager it was reported that the facility's Operations, Maintenance and Engineering Manager positions have recently been vacated. This loss of expertise and experience may have a significant impact on the operation and maintenance of the facility.

Findings

VI-F5 **Based on the September 20, 2017 walk down of the Plant Daniel facility, we conclude the overall condition of the facility is good and within industry standards.**

During Vantage's tour of Plant Daniel on September 20, 2017 a walk down of the plant grounds, coal handling area, mill floor and general plant indicates that the facility is well maintained with significant attention paid to housekeeping and general plant corrosion prevention and painting. The inspection of the facility indicates that the physical condition of the facility of this type and vintage is within industry standards. Based on this finding, it is assumed that the other MPC generating facilities are maintained at the same level.

VI-F6 **The recent loss of the facility's Operations, Maintenance and Engineering Department Managers may have a negative impact on the overall long-term operation of the Units.**

Based on a September 20, 2017 interview with the Plant Daniel management, it was noted that the facility's Operations, Maintenance and engineering Department Manager positions were recently vacated for a variety of reasons. The resultant loss of leadership and knowledge could negatively impact the reliability and performance of the facility.

VI-R3 **Closely monitor the staffing of the Plant Daniel's leadership team to assure that the technical and supervisory skills are in-place to operate and maintain the Units at the current level of performance. (Priority: High)**

Assure that MPC has a current and active succession planning process in place to assure that trained and qualified individuals are available for selected critical positions.

C. GENERATING PLANT COAL SAMPLING PROCESS

Coal is delivered to the Plant Daniel facility by seven leased unit trains, each of which consists of sets of 105 to 117 cars that are typically loaded 100 tons. The bottom-dump rail cars unload coal as the train passes over the trestle. The coal is then moved to one of the two storage piles by bulldozer. During the audit period the Plant Daniel maintained a separate stockpile of Power River Basin sub-bituminous and Colorado bituminous coal. Coal is reclaimed by bulldozer from either storage pile to one of the redundant supply conveyors (1B or 2B) that feed the Unit 1 and 2 storage silos. Each Unit is equipped with five silos that feed coal to a corresponding feeder and mill, which provide pulverized coal to boiler burner elevations.

To effectively manage the coal received, burned and stored at the Plant Daniel facility, a coal pile inventory is completed twice a year. The results of the inventory process are then utilized to calibrate the coal delivery and consumption processes.

A Thayer belt scale is provided on each of the supply conveyors. The belt scales continuously measure the as-burned quantity of coal that is provided to the silos. The belt scales are continually maintained, tested and certified by a third party contractor, Bulk Marine Resources. The belt scales are statically calibrated on a daily basis with a dynamic calibration done on a quarterly basis, as per the MPC response to data request VEC-DR-44. Based on a physical observation of the belt scale, the scale appears to be well maintained and free of any accumulated coal spillage. Brian Shefland, the Bulk Marine Resources Operator was interviewed to assess his knowledge and familiarity with the detailed operation, maintenance and calibration. His response was compared to the published belt scale operating procedures as outlined in the MPC response to data request VEC-DR-35.

Each of the supply conveyors is also provided with a Ramsey ASTM certified "cross-cut" coal sampler. The coal samplers are also continually maintained, tested and certified by a third party contractor, Bulk Marine Resources. As per facility procedures, the sampler must be in service whenever the associated supply conveyor is feeding coal to the facility. The coal sampler primary cutter takes a sample from the top of the running supply conveyor every 140 seconds. The primary sample is then crushed and sampled with a secondary cutter and is then transferred to sample bags. Two samples are accumulated and bagged. One bag is sent to the Alabama Power Company General Testing Lab. with the remaining sample bag stored for 60 days at the facility. On a daily basis, the General Testing Lab. completes an analysis of the facility provided, as-burned sample, which includes the following analysis:

- Total moisture

- Ash content
- Heating value
- Sulfur content

Based on a physical observation of the coal sampler it appears to be well maintained and free of any accumulated coal spillage. In addition to his responsibility associated with the operation of the belt scales, Brian Shefland, the Bulk Marine Resources Operator is also responsible for the operation and maintenance of the coal sampler. His responses were also compared to the operating and maintenance procedures that were provided to data request VEC-DR-35. While the sampler operating and maintenance procedures are consistent with industry standards, the actual certification of the samplers as per ASTM Bias Certification Procedures has not been completed for a number of years. The facility management decision to delay bias certification is based on the fact that the as-burned sample is not the governing or for payment sample. In addition, the APC - General Testing Lab does an informal comparison of the as-delivered versus the as-burned samples and provides feedback to the facility if there is a significant difference between the samples.

The facility management has developed a series of procedures to assure the accuracy of the coal scales and coal sampler that includes the following:[61]

- Coal scale inspection
- Coal scale cleaning
- Coal scale zero calibration
- Coal scale weights testing
- Coal sampler preparation
- Coal sample shipment

Findings

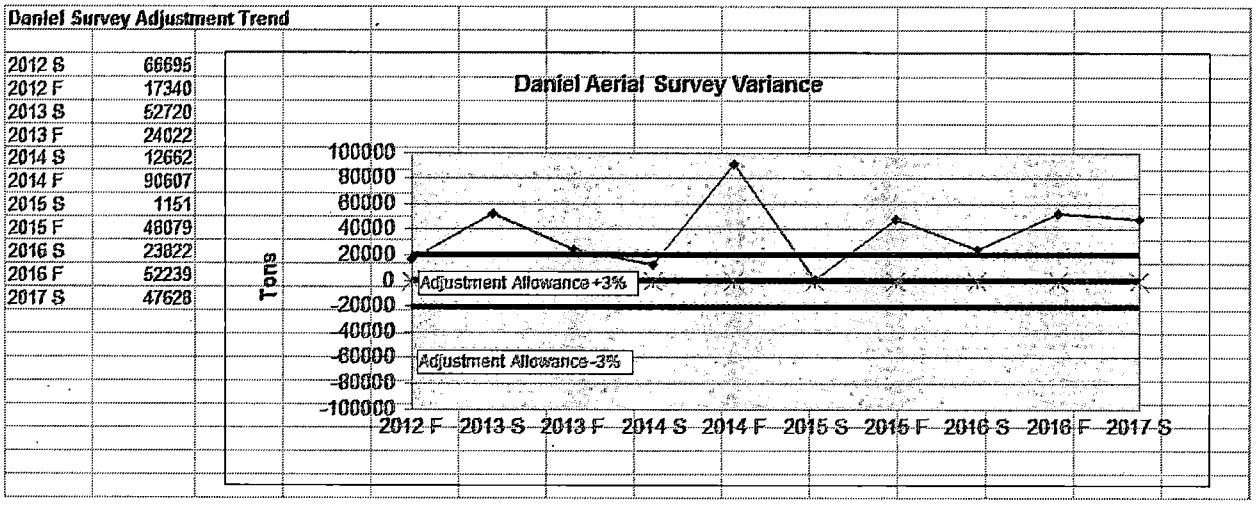
VI-F7 **The coal pile inventory variance continues to exceed the top 3% threshold of the MPC reasonability program.**

A coal pile inventory is performed twice a year in the spring and fall. Physical Inventory of the Plant Daniel coal inventory is performed bi-annually, normally in the spring and fall timeframe. The coal pile inventory is performed by an aerial survey contractor with corresponding coal pile density measurement inputs. The results of the coal pile survey are sent to the Mississippi Power Company Fuels group and the Southern Company Services field services group. The coal pile inventory results are compared to the MPC book coal inventory. The book coal inventory is the as-delivered coal minus the as-burned coal. The as-delivered coal is derived from totalization of the coal supply's scales, while the as-burned coal is derived from the totalization of the facility's belt scales. The accuracy of the coal inventory management process is determined through the calculation of a variance between the coal pile inventory and the MPC book coal inventory. If a variance is found greater than +/- 3% the MPC book inventory is then adjusted to either the top or bottom of the 3%

[61] VEC-DR-35

tolerance. The following is a summary detailing the Plant Daniel coal pile inventory variance for the past 5 years.

Exhibit VI-5
Daniel Plant - Aerial Coal Pile Survey Variance[62]



The coal pile inventory variance continues to exceed the top threshold, as detailed below. This exceedance indicates that there is more coal in inventory than what was reported as delivered by the suppliers, which indicates a return to MPC. However, it also indicates a systemic inaccuracy with the coal inventory process. Possible areas that could contribute to this continued variance are associated with the following inaccuracies:

- Coal supplier's as-delivered coal weighing process
- Coal pile inventory process
- As-burned coal weighing process

Coal Supplier's As-delivered Coal Weighing Process:

MPC relies on each coal supplier's coal weighing process to determine the as-delivered coal. To assure the accuracy of the supplier's coal weighing process, an Alabama Power Company Fuel Lab Field QA representative is assigned at each supplier's facility to monitor the accuracy of the coal weighing and quantification process. This is currently an accepted and effective industry practice.

Coal Pile Inventory Process:

MPC has utilized a 2012 coal pile density value to support the quantification of the coal pile inventory aerial survey. The application of this historical coal pile density factor may be the source of the variance. As per the procedure outline in the "ASTM D6542-2010 Standard Practice for Tonnage Calculation of Coal in a Stockpile" the inventory tonnage should be

[62] VEC-DR-128

corrected for moisture content of the density value. By using the historical density value the required moisture content in the pile during the inventory may not be accurate.

As-burned Coal Weighing Process:

The facility's belt scales are utilized for determining the as-burned coal quantities. While these scales are calibrated on a daily basis their inherent accuracy is poor at low coal flow rates. The facility has been operating at reduced capacity factors, which has resulted in the typical operation of the coal supply belts flow rate below their minimal accuracy range. In addition, the excessive amount of rain in the region could have resulted in a variance to the as-burned total. Facility personnel have assembled a team to investigate potential solutions to this issue.

VI-F8 **The current as-burned coal flow measurement process may be a source of inconsistency in the coal inventory process.**

The Plant Daniel Management, reported that the facility utilizes the main supply belt scales readings for calculating boiler performance. These belts feed the bunkers for either Unit 1 or 2 through a tripper system. They do not utilize the coal feeder quantities off their gravimetric feeders, which is a typical source of a fuel flow input signal to the combustion controls and performance monitoring system. An inconsistency in the fuel flow input would directly impact the accuracy of the associated Unit's heat rate and result in an error in the economic dispatch methodology.

Recommendations

VI-R4 **Reduce the excess variance in the coal pile inventory process at Plant Daniel by performing density analysis on a more frequent basis. (Priority: High)**

Coincidentally, with the semi-annual coal pile inventory process, conduct an ASTM D6347/D6347M approved density test. Assure that the moisture content in the pile at the time of the density test in included in the density calculation.

VI-R5 **Improve the physical measurement of as-burned coal utilizing the current gravimetric coal feeders as an as-burner coal value. (Priority: High)**

Based on input received from the facility managers, the Plant Daniel is equipped with Stock Gravimetric Feeders. The facility personnel have report that they have difficulty maintaining the calibration of the feeders to assure that an accurate and reliable coal flow input is provided to the combustion control system. They currently utilize the belt scale readings to determine an as burned quantity of coal being delivered for combustion. This belt scale derived as-burned value may negatively impact the fuel flow input to the boiler combustion control system and thus negatively impact the efficient utilization of the as-burned coal.

It is recommended that the Plant Daniel and MPC performance team implement a plan to improve the coal as-burned measurement process with the utilization of the existing coal feeders to provide the an accurate and repeatable as-burned measurement tool.

D. COAL CONVERSION PERFORMANCE IMPACT

In order to comply with EPA environmental standards and meet obligations under a settlement agreement with the Sierra Club, in August 2014 the Mississippi Power Company agreed to convert to natural gas, or retire several Units at Plants Watson and Greene County. A profile of the retired and converted Plants is outlined in the Exhibit below.

Exhibit VI-6
MPC Retire and Converted Plant Profile[63]

Station/Unit	Rating / (MW)	Type	Original Fuel	Status
Greene County 1	200	ST	Coal	Converted to NG, April 2016
Greene County 2	200	ST	Coal	Converted to NG, July 2016
Watson 1	75	ST	NG	Retired July 2015
Watson 2	75	ST	NG	Retired 2015
Watson 3	112	ST	NG	Limited operation
Watson 4	250	ST	Coal	Converted to NG, April 2015
Watson 5	500	ST	Coal	Converted to NG, May 2015

As typical, with facilities originally designed to fire coal, there is a negative impact on Unit heat rate and capability. This impact is somewhat offset by the reduced station service load associated with the coal handling and air emission control equipment. To determine the impact the coal conversion has had on individual Unit performance and capability, a summary of the following operational impacts is provided:

- Heat Rate
- Generating Capacity
- Emissions
- Maintenance Costs

[63] VEC-DR-128

Findings

VI-F9 **The operating performance of the recently converted coal fired Units at the Greene County and Watson facilities has been negatively impacted as a result of the conversion.** [64]

Heat Rate Impact

Since the conversion of the Units, the heat rate of the converted Units has increased. This is largely due to the lower heating value of natural gas versus coal, coupled with the original design characteristics of the associated boiler. In addition, the converted Units operate at a lower load point which is a lower point on the steam turbine efficiency curve. The resultant impact of Unit heat is as follows:

- Greene County 1 & 2 = 9,800 – 9,900 btu/kwh to 10,100 – 10,200 btu/kwh or a 2% increase.
- Watson 4 = 9,800 – 9,900 btu/kwh to 10,100 – 10,200 btu/kwh or a 2% increase.
- Watson 5 = 10,050 to 10,350 btu/kwh or a 3% increase.

Generating Capacity

The gross capacities of the converted Units were not negatively impacted by the coal conversion largely due to the modified design of the natural gas firing system and modifications made to the boiler heat transfer systems. However, the net capability of the converted Units was increased largely due to reduced station service load to as follows:

- Greene County 1 = 4 mw increase due to lower station service load.
- Greene County 2 = 4 mw due to lower station service and 11 mw due to the avoidance of lost capacity due to boiler tube leaks due to tube erosion while operating on coal.
- Watson 4 = 4 mw increase due to lower station service load.
- Watson 5 = 6 mw increase due to lower station service load.

Air Emissions

The air emissions, as associated with the operation of the converted Units, are significantly reduced largely due to the inherent properties of the two fuels and the associated reduced capacity factor of the converted Units to as follows:

- Greene County 1 & 2 = Conversion was completed in April 2016 no comparison data was provided.
- Watson Facility = A significant reduction in SO_2 emissions from 14,295.08 tons in 2015 to 2.4 tons in 2016.

[64] VEC-DR-132

- Watson Facility = A significant reduction in NOx emissions from 8,480.9 tons in 2015 to 864.1 tons in 2016.
- Watson Facility = Due to the chemical make-up of the fuels the CO_2 emissions of coal is 214 lb/mbtu versus natural gas at 117 lb/mbtu.[65]

Maintenance Costs

Since converting from coal to natural gas the staffing levels at each facility has been significantly reduced to as follows:

- Greene County Facility = A staffing reduction 23% and the associated reduced maintenance cost of 40%.
- Watson Facility = A staffing reduction 23% and the associated reduced maintenance cost of 40%.

Recommendations

VI-R6 **Develop a program to reduce the impact the recent conversion of the Greene County and Watson facilities has had on individual Unit performance. (Priority: Medium)**

It is recommended that the management of the Greene County and Watson facilities continue to analyze the performance of the associated Units and investigate modifications to the boilers to improve the heat transfer characteristics of the boiler to more efficiently capture the energy released during the natural gas combustion process and continue to investigate modifications to the turbine control valves to support a sliding pressure operating program. In addition, the facility management should continue to investigate opportunities to reduce auxiliary loads that can result in a lower net heat rate.

65 - EIA Carbon Dioxide Emissions by Fuel

VII. KEMPER PROJECT – NATURAL GAS PROCUREMENT

A. BACKGROUND

The Kemper Project as proposed would rely on syngas produced from lignite as the primary fuel source for generating electricity at the plant. However, if the gasifier portion of the Kemper Project does not come to fruition, MPC would run the Kemper Plant as a combined cycle plant fueled completely on natural gas. During the audit period, the natural gas for the Kemper Plant was provided under a Direct Energy agreement with Tennessee Gas.[66] This arrangement provided the maximum flexibility for the provision of gas at the Plant, and allowed MPC to deal with the uncertainty of when and how much syngas might be available. However, if it is determined that the gasifier portion of the Kemper Project is not going to be available, the current contractual arrangement may no longer be desirable. Other gas supply options need to be developed and evaluated to assess their potential operational and economic benefits.

The following Exhibit VII-1 provides some background gas usage and performance information for the Kemper Plant during the audit period. The information shows considerable variation in the fuel gas usage. The usage ranges from 1,930 MMCF in April 2017 to 2896 MMCF in August 2017. The variation is primarily explained by the availability of the gasifier. When the gasifier is not available, gas usage increase and vice versa.

We provide data from 2014 on, in order to give the reader a sense of consumption before the decision to cease gasifier operation was made.

[66] VEC-DR-80 - Attachment A – June 28, 2017, Meeting, Natural Gas Overview, page 25

Exhibit VII-1
Kemper County Generation Profile

Mississippi Power Corporation Kemper County Generation Profile (August 2014 thru September 2017 - Source Data)						
MPC Station/Unit	Period	Fuel Gas (MMCF)	NCF	NHR	EAF	EFOR
Kemper County 1	8/14	1,847.39	82.46	7,679	[redacted]	
	9/14	2,168.94	75.21	7,643		
	10/14	1,740.40	59.48	7,532		
	11/14	1,147.43	37.3	8,157		
	12/14	1,408.35	45.86	7,891		
	1/15	2,246.89	67.39	7,684		
	2/15	2,449.48	82.12	7,539		
	3/15	2,318.11	70.82	7,605		
	4/15	2,396.17	84.72	7,566		
	5/15	2,247.17	76.38	7,603		
	6/15	2,455.82	86.77	7,551		
	7/15	2,722.20	92.31	7,613		
	8/15	2,605.61	87.25	7,673		
	9/15	2,342.64	80.69	7,731		
	10/15	2,101.48	68.47	7,931		
	11/15	2,633.74	82.97	7,635		
	12/15	2,369.97	72.41	7,629		
	1/16	2,539.54	75.96	7,706		
	2/16	2,530.42	80.71	7,732		
	3/16	1,147.82	34.24	7,766		
	4/16	2,628.15	102.32	7,257		
	5/16	2,566.23	92.44	7,576		
	6/16	2,325.11	84.95	7,668		
	7/16	1,542.53	53.57	7,807		
	8/16	2,839.72	100.38	7,699		
	9/16	2,378.15	87.64	7,638		
Kemper County 1 Baseline		**57,699.46**	**76**	**7,674**		
	10/16	2,234.16	79.25	7,694		
	11/16	2,034.23	61.04	7,971		
	12/16	2,457.73	74.49	7,608		
	1/17	2,093.85	62.47	7,730		
	2/17	2,112.11	72.2	7,482		
	3/17	2,301.42	71.1	7,479		
	4/17	1,930.63	65.75	7,817		
	5/17	2,238.71	75.12	7,654		
	6/17	1,983.31	68.54	7,689		
	7/17	2,477.95	82.37	7,717		
	8/17	2,896.90	95.44	7,806		
	9/17	2,364.10	81.99	7,668		
Kemper County 1 Audit Period		**27,125.10**	**74**	**7,693**	[redacted]	

B. MPC FUEL DEPARTMENT CONSIDERATIONS

As discussed previously in this report, the MPC fuel organization has a Lignite Contract Director with 2 Fuel Analyst Senior positions that report to the Director. If the Kemper Plant is going to be operated strictly as a combined cycle plant, these positions may not be necessary, or at least they may need to be significantly modified.

Findings

VII-F1 **Natural gas supply options for the Kemper Project are likely to change significantly in the near future.**

The ongoing uncertainty surrounding the fate of the gasifier portion of the Kemper Project has provided a difficult scenario to develop and contract gas supply options. Although the current contract has been desirable from both an operational and economic perspective, it expired October 31, 2017. It may be desirable to continue this contractual arrangement until the issues surrounding the gasifier are resolved. However, it appears that the seemingly never ending regulatory and operational concerns of the gasifier are coming closer to resolution. MPC and SCS need to develop and evaluate alternative gas supply options for the Kemper Project.

VII-F2 **Depending on the final resolution of the Kemper Plant, MPC may need to alter its fuel procurement department.**

Presently, the MPC fuel organization has a Lignite Contract Director and 2 Fuel Analyst Senior positions that report to the Director. If it is determined that the Kemper Plant is going to be operated strictly as a combined cycle plant, these positions may not be necessary or at least they may need to be significantly modified.

Recommendations

VII-R1 **Develop and evaluate alternative gas supply options for the Kemper Plant. (Priority: High)**

MPC and SCS need to develop and evaluate alternative gas supply options for the Kemper Plant. It appears that the issues surrounding the gasifier portion of the Kemper Project are much closer to being resolved. Regardless of the final resolution of these issues MPC and SCS must be prepared to move forward with a plan that provides a reliable supply, at reasonable prices and minimal risk.

VII-R2 **Initiate a review of the need for the Lignite Contract Director and 2 Fuel Analyst Senior positions at MPC if it is determined that the Kemper Plant will be operated as a combined cycle plant. (Priority: Medium)**

Although a final resolution regarding the Kemper Plant is yet to be determined, MPC should begin a review to determine the need for the Lignite Contract Director and 2 Fuel Analysts that report to the Director. The need for these positions, at least as they are currently structured, becomes questionable if the Kemper Plant is to be operated as a combined cycle plant. A review at this time will provide MPC the opportunity to assess the ongoing need for the positions or possibly to transfer the personnel to other positions within the department or MPC. By performing the analysis now, MPC will be able to move forward more quickly once the final resolution of the Kemper Plant is determined.