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APR 15 2014

MISS. PUBLIC SERVICE
COMMISSION

Burns and Roe Independent Monitor's Prudency Evaluation Report
Errata Sheet
April 15, 2014

Page 3-4

Replace prudence guideline #2 with the following:

'13-UN- 189

BREI reviewed and evaluated the major decisions and actions of the Kemper Project team including MPCO's senior management which have taken place up to and including March 2013, including, among others, the decision to go forward with the Project after the Commission established its cost caps; the decision not to use a third party EPC contractor under a lump-sum, fixed-fee arrangement; decisions related to the level of contingency; and the decision to compress the construction schedule in order to achieve certain tax benefits after gaining the Commission's approval to proceed. BREI also evaluated MPCo/SCS management decisions after construction began to incur additional costs as they attempted to maintain the original commercial operation date (COD) and compressed schedule in the face of mounting evidence that it was not achievable. The scope of BREI's review was limited to the prudency of the actions and decisions of the MPCo Project team. While BREI noted the actions and decisions made by Southern Company executive management, including its decision to replace MPCo's Chief Executive Officer and its Vice President of Generation Development, it was not within the scope of BREI's review to evaluate decisions made by Southern Company's senior management.

Page 4

Insert new footnote with the following:

Commercial operation date refers to the date when a power plant has been commissioned, determined to be mechanically complete, has passed all required performance and emissions tests and is deemed ready to reliably supply electrical energy and capacity to the transmission grid.

Page 4 FN 10

Replace the first sentence with the following:

Executive management decisions involve many strategic considerations can be more readily evaluated after the Project is completed.

Page 14

Replace finding 14 with the following:

"Beneficial capital" is the term that is used by MPCo to categorize incremental capital costs that are expended to reduce the future costs resulting in a life cycle cost reduction of the plant. These types of costs are allowed to be recovered, even if above the certified cost cap, provided that they meet certain criteria that are defined in the Final Order on Remand. MPCo has provided documentation identifying ten items which it

considers to be beneficial capital. Without commenting on the compliance of SCS/MPCo's methods with the Commission's Final Order on Remand, BREI can confirm that the approach used by SCS/MPCo for selection of equipment included a best life cost analysis which, from an engineering perspective, was reasonable. That being said, specific to the combustion turbines, the Siemens combustion turbine selection and its procurement along with the gasifier design were finalized during the FEED process prior to certification, with the cost of the Siemens combustion turbine included in the certified cost. As a result, BREI does not believe that the beneficial capital cost of \$33,082,000 for the Siemens combustion turbine should qualify as beneficial capital. In regard to the other beneficial capital items, BREI defers to Larkin's evaluation and report.

- Page 15 Replace "\$853 million" in the fourth bullet with "\$85 million"
- Page 18 Replace "Southern Mississippi Electrical Power Authority" with "South Mississippi Electrical Power Association"
- Page 24 Replace "40% accuracy" with "50% accuracy"
- Page 27 Insert "not" in the last sentence of the fifth bullet. "While this practice is customary for FEED packages at this level of detail, the factors applied by SCS did not recognize the FOAK nature of the Project."
- Page 51 Insert "not" in the sixth sentence in the paragraph labeled "Design Change Control Process." However, the details on specific design changes, scope of the design change and the associated impact on the engineering, procurement or construction costs were not always well documented. It is also not known whether the DCN log provided for BREI's review captured all project DCNs.
- Page 68 Replace first in the conclusion with the following:

BREI concludes that the items proposed by MPCo as beneficial capital items were based on individual equipment selections based on a TELC. The cost analysis compared multiple vendor alternatives for each piece of equipment. The basis for the beneficial capital analysis provided by MPCo assumes that beneficial capital would apply if the life cycle costs for a more costly piece of equipment are lower relative to the lower priced alternative piece of equipment, not relative to the original proposal. Without commenting on the compliance of this method with the Commission's Final Order on Remand, BREI can confirm that the approach, from an engineering perspective, was used by SCS/MPCo in the evaluation and selection of the individual equipment was reasonable.

INDEPENDENT MONITOR'S
PRUDENCY EVALUATION REPORT

for the

KEMPER COUNTY IGCC PROJECT

in the

STATE OF MISSISSIPPI

prepared for

MISSISSIPPI PUBLIC UTILITIES STAFF

*Public
Version*

FILED

APR 15 2014

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BREI
←



Prepared by

BURNS AND ROE ENTERPRISES, INC.

800 KINDERKAMACK ROAD

ORADELL, NEW JERSEY 07649

April 15, 2014

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ATTACHMENT B: List of Interviewees for Prudency Review

ATTACHMENT C: Executive Summary: Independent Monitor's Report

ATTACHMENT D: 2012 Cost & Schedule Analysis Report (Redacted Public Version Filed Nov. 26, 2012)

ATTACHMENT E: MPCo Record of Decision (ROD-10-002)

ATTACHMENT F: Kemper Project Organizational Charts

ATTACHMENT G: Burns and Roe Team Experience

1.0 EXECUTIVE SUMMARY

Mississippi Power Company (MPCo or Company) is a wholly-owned subsidiary of the Southern Company. On January 16, 2009, MPCo filed a petition with the Mississippi Public Service Commission (Commission or MPSC) for a Certificate of Public Convenience and Necessity (CPCN) requesting its authorization to construct, acquire, operate, and maintain an Integrated Gasification Combined Cycle (IGCC) electric generating facility in Kemper County, Mississippi (Kemper Project or Project). The Commission issued its Order on May 26, 2010,¹ granting MPCo's request and, following an appeal process, the Commission issued its Final Order on Remand on April 24, 2012, granting a CPCN authorizing the Company to construct, acquire, operate and maintain the Kemper County IGCC facility.² In issuing its Final Order on Remand, the Commission concluded that its findings in the initial Order were appropriate and it confirmed those findings on remand.

In its Final Order on Remand, the Commission stated on page 40 the following,

Typically, in regulatory orders approving facilities for a utility, the Commission approves an estimate, the Company constructs the facility, and the utility seeks rate recovery for the facility following construction. At that time, the Commission is able to compare the actual costs of the facility to the estimated costs of the facility and determine whether the costs or any variances in the costs were prudent. Given the magnitude of the Project and MPCo's request for relief under the Baseload Act, the Commission determined that it would be appropriate to focus on the potential risks to both the Company and its customers and developed conditions, as described below, to appropriately mitigate such risks.

To balance the risk of the Kemper Project between MPCo and its ratepayers, the Commission established the maximum cost that the Company would be allowed to recover in the rate base. The cost cap was included to insulate ratepayers from possible large construction cost overruns even if the costs are found to be prudent. It was determined by the Commission based on testimony of its independent consultant, Dr. Craig Roach, that an ultimate cost cap (the "hard cap") of \$2.88 billion represented the breakeven point for an alternative natural gas-fired, combined-cycle combustion turbine (CCGT) facility. This cost cap included a 20% increase above the \$2.4 billion (or "soft cap") that MPCo's executives testified that the Project would cost. This amount was justified on the basis that the Kemper Project would remain the preferable generation alternative provided the project cost was less than \$2.88 billion. Thus, the Commission established the hard cap of \$2.88 billion above which the total construction cost of the Project would not be recoverable from ratepayers. This cap did not include the lignite mine and CO₂ pipeline development and installation costs; these are referred to as the "uncapped" costs.

¹ Order Granting a Certificate of Public Convenience and Necessity, Authorizing Application of Baseload Act, and Approving Prudent Pre-Construction Costs, Docket No. 2009-UA-014, May 26, 2010 (Order).

² Final Order on Remand Granting a Certificate of Public Convenience and Necessity, Authorizing Application of Baseload Act, and Approving Prudent Pre-Construction Costs, Docket No. 2009-UA-014, April 24, 2012 (Final Order on Remand). The Final Order on Remand has been challenged and is on appeal before the Supreme Court of Mississippi, Case No. 2013-TS-00043.

Given the highly technical and complex nature of the Project, the Mississippi Public Utilities Staff (MPUS or Staff) was authorized to hire an Independent Monitor (IM) to monitor the progress and status of the engineering, procurement, construction, start-up, and testing of the Kemper Project. MPUS engaged Burns and Roe Enterprises, Inc. (BREI) in February 2011 as Staff's IM. With the approval of MPUS, John T. Boyd Company (Boyd) and Larkin and Associates (Larkin) were retained by BREI as independent subcontractors to monitor the mine development and regulatory, financial and auditing aspects of the Project.

When BREI was engaged by the Staff in January 2011, it was requested to perform an Independent Monitor's Baseline Due Diligence Review of the Project and to assess the Company's planning and construction activities to date. In particular, BREI was instructed to perform the following tasks:

- Evaluate the completeness of engineering;
- Review technology and technology risk including the Transport Reactor Integrated Gasifier (TRIG) gasification technology and CO₂ separation and sequestration;
- Review the Front End Engineering and Design (FEED)³ package including project cost estimates and schedules;
- Review all major contracts including, but not limited to, the engineering, procurement and construction (EPC) contract with Southern Company Services (SCS), SCS's contract with Kellogg Brown & Root (KBR) for design of the gasification island and other process systems, CO₂ off-take agreements, technology licensing agreements for major gas cleanup process, major equipment purchase contracts, and the 17.5% shared ownership agreement with South Mississippi Electrical Power Association (SMEPA);
- Evaluate current and initial construction and engineering status;
- Review completeness and adequacy of operation and maintenance plans including operation and maintenance budgets and process development allowance budgets;
- Identify project risks, determine adequacy of the MPCo Risk Register and Risk Management Plan, and identify additional risk management steps if deemed necessary; and
- Based on this baseline evaluation, develop and execute a detailed construction, start-up and testing monitoring plan.

During the initial due diligence review, BREI began monitoring the Project's EPC progress on a monthly basis. A full time site monitor was added to the BREI team in January 2013. BREI's monitoring of the Project has also included approximately seven trips to SCS's offices in Birmingham and monthly visits to the plant site in Kemper County to monitor and review critical engineering, schedule and cost aspects of the Project, the

³ A FEED package is a group of drawings, equipment lists, equipment specifications and other scoping documents that defines the basis of design for a project, the project's conceptual design, cost estimate, basis of estimate, and project schedule.

review of quality assurance and quality control procedures and inspections, and other aspects of the Project which are further defined in the body of this report.

In May 2012, following MPCo's announcement that the Project's cost would exceed the \$2.4 billion soft cap, MPUS commissioned BREI to conduct an Independent Project Schedule and Cost Evaluation. BREI's findings and recommendations were reported to the MPUS and MPCo in November 2012; a copy of those findings is included as an attachment to this report.

In July 2013, in accordance with the Commission's Scheduling Order,⁴ and on behalf of the Staff, BREI was tasked to prepare this report and associated testimony assessing the prudence of the EPC decisions made and the costs incurred in connection with the Project. The review covers the period from late 2009 through March 31, 2013. This portion of the prudence assessment has been conducted by BREI. Boyd and Larkin have issued independent reports on the prudence of mine development and auditing/financial functions, respectively.

As reported in Cynthia Shaw's Direct Testimony on December 12, 2013 (Docket No. 2013-UA-0189), MPCo's capped costs attributable to the Kemper Project as of March 31, 2013, were \$2,377,297,304, and the uncapped Project costs totaled \$472,774,037. It was further stated by Mr. John C. Huggins in his Direct Testimony (Docket No. 2013-UA-0189 dated December 12, 2013)⁵ that MPCo now estimates that costs for the capped portion of the Project will total approximately \$4.017 billion and that MPCo will not seek to recover in excess of \$2.88 billion from its ratepayers. Therefore, the BREI assessment evaluated the prudence of the decisions associated with the approximate \$2.377 billion in capped Project expenditures as of the end of March 2013, plus the uncapped expenditures to design and install the CO₂ pipeline.

This assessment has been conducted by BREI's staff,⁶ who has been involved with the Project since February 2011.

The BREI team conducted this prudence review/evaluation based upon the following guidelines:

1. A prudence determination relates only to actions and decisions.
2. BREI reviewed and evaluated the major decisions and actions of the Kemper Project⁷ team including MPCo's senior management which have taken place up to and including March 2013, including, among others, the decision to go forward with the Project after the Commission established its cost caps; the decision not to use a third party EPC contractor under a lump-sum, fixed-fee arrangement; decisions related to the level of contingency; and the decision to compress the construction schedule in order to achieve certain tax benefits after gaining the Commission's approval to proceed.⁸ BREI

⁴ Scheduling Order dated July 26, 2013, Docket No. 2013-UA-189, Petition of Mississippi Power Company for Finding of Prudence in Connection with the Kemper County Integrated Gasification Combined Cycle Generating Facility.

⁵ Huggins Supplemental Direct at pp. 23-24.

⁶ Refer to Attachment G, Burns and Roe Team Experience, for a description of the qualifications of BREI's team.

⁷ See Project Management Plan Section 4 "Organization." Attachment F includes the SCS/MPCo Project Organizational Charts (before and after May 2013) and the Construction Organizational Chart for the Kemper County IGCC Project.

⁸ This latter decision resulted in the necessity to implement a just-in-time engineering approach, which created an array of challenges for the Project team.

also evaluated MPCo/SCS management decisions after construction began to incur additional costs as they attempted to maintain the original commercial operation date (COD)⁹ and compressed schedule in the face of mounting evidence that it was not achievable. The scope of BREI's review was limited to the prudence of the actions and decisions of the MPCo Project team.¹⁰ While BREI noted the actions and decisions made by Southern Company executive management,¹¹ including its decision to replace MPCo's Chief Executive Officer and its Vice President of Generation Development, it was not within the scope of BREI's review to evaluate decisions made by Southern Company's senior management.

3. The standard that BREI used for determining prudence or reasonableness in an action or decision consisted of the consideration of what a reasonable and informed manager at the appropriate level within a project team in the electric power industry would have done, in light of the conditions and circumstances which were known, or should have been known, at the time the decision was made or action taken. BREI did not simply base its findings upon whether or not the Project's costs were exceeded or were below MPCo's original estimates or expectations.
4. BREI examined the major decisions/actions taken by MPCo and SCS (who provided engineering, procurement and construction services to MPCo) in the execution of the Project to determine whether their decisions/actions fell outside of the bounds of reasonability.
5. Under no circumstances did BREI evaluate actions or decisions based upon "hindsight" in its prudence assessments and evaluations. The decisions/actions were judged purely upon what was known at the time or should have been known by the Project team at the time the decision was made or the action was implemented.

BREI relied on the following data and information in developing this prudence report: information gathered during the initial Project due diligence review in 2011, an independent review of the project schedule and project costs which it conducted in May through November 2012, its ongoing Project monitoring reviews, including monthly site visits conducted from early 2011 through March 2013, plus responses to approximately 325 requests for information (RFIs) provided by MPCo and SCS during the initial due diligence, ongoing Project monitoring work, and the prudence discovery process. However, since BREI's involvement did not include the initial development phase of the Project prior to February 2011, it conducted independent assessments of the major decisions and actions the Project team made from late 2009 through early 2011 via the use of RFIs and direct interviews of the key MPCo executives and SCS Project personnel.

⁹ Commercial operation date refers to the date when a power plant has been commissioned, determined to be mechanically complete, has passed all required performance and emissions tests, and is deemed ready to reliably supply electrical energy and capacity to the transmission grid.

¹⁰ Executive management decisions involve many strategic considerations which can be more readily evaluated after the Project is completed. Therefore, BREI reserves the right to revisit these decisions during the next prudence review.

¹¹ See Project Management Plan Section 2 "Managing Review Board and Executive Review Board."

FINDINGS

BREI's key findings and the facts identified during its independent reviews and this prudency discovery process are as follows:

1. The Project is a first-of-a-kind (FOAK) commercial design utilizing the TRIG gasification technology that was jointly developed by SCS, KBR and the United States Department of Energy. The use of this technology presents the Project with major issues and challenges since TRIG gasification technology has not yet been demonstrated in a commercial scale facility. In other words, the Kemper Project will be the first large scale commercial demonstration of TRIG technology, representing a significant scale-up¹² of the equipment tested by the Wilsonville, Alabama, Power Systems Development Facility (PSDF), a pilot scale development facility. At the early stages of BREI's involvement, MPCo had planned to build from the lessons learned from a TRIG IGCC installation in DongGuan, China. If developed and constructed according to the original plan, the DongGuan project would have been operational in 2012 and therefore lessons learned would have been available for the Kemper Project. MPCo stated that scale-up risk would be partially mitigated through incorporating lessons learned from this project. Unfortunately, the DongGuan project has not been completed or tested. While some engineering and technical lessons learned by KBR from its technology sales agreement have been incorporated into the Kemper Project, it is not judged to be sufficient enough to cover the technology scale-up risk. A block flow diagram of the Kemper Project's IGCC process is included in Attachment A. The diagram outlines the major systems and components which are considered to be either commercially proven or a FOAK application of the technology.
2. Under MPCo's engineering services agreement with its sister company, SCS, the Project was not executed on the customary industry basis of a lump sum or fixed turnkey EPC contract. This was due to the conceptual nature of the Project and the relatively low level of engineering completeness at the time the CPCN was issued and construction was started (with little detailed engineering and design completed). Instead, it was implemented under the existing SCS services agreement without specific guarantees and penalties on various key performance parameters including thermal performance (i.e., heat rate and output), availability, and schedule, which are customary in power industry EPC contracts. However, the Commission, recognizing these risks, in its various orders, including its Final Order on Remand, required that certain performance parameters be measured and achieved such as heat rate, availability (power generation level), operation and maintenance costs, and by-product revenue after the COD. As a result, the Commission has, in effect, required MPCo to meet specific performance requirements. This provides a level of protection for the ratepayer.
3. MPCo anticipated that the MPSC certification would be granted by late 2009 or early 2010, which would have allowed for a total of 4.5 years for the implementation of the Project. However, with certification taking place in May 2010, six months later than anticipated, only four years were available to implement the Project and meet a May 2014 COD. The May 2014 COD was driven by

¹² Scale-up refers to the increase in size or capacity when comparing what was demonstrated at the PSDF facility to that of the commercial scale Kemper Project facility.

many factors including, most importantly, the \$133 million 48A Phase I Investment Tax Credit established by the Energy Policy Act of 2005 that required a COD no later than May 11, 2014.¹³ MPCo's management decision not to move the COD at the time of certification in an effort to preserve the tax credit resulted in a compressed four year Project implementation schedule. Once the certification was received, MPCo decided to proceed with the engineering, procurement and construction in parallel, under what was considered a "compressed schedule" by Project team members.

- Although MPCo had executed major equipment purchase orders and had expended some funds at risk to progress engineering and design between the FEED completion and the May 2010 Commission Order, MPCo/SCS essentially started the detailed engineering and design and procurement processes in parallel with the start of construction. By committing to this approach, engineering and design changes which are a normal result of detailed engineering and design were occurring at the same time as, rather than ahead of, construction activities. Since the Project was a FOAK design, the number of design changes was significantly greater than that which would have been expected during the development of a conventional generation plant design. This did not allow all of the construction activities to be properly sequenced during the construction phase of the Project. As a result, a number of work-arounds¹⁴ and creative steps were required during construction by the Project team as it continued to try to meet the scheduled COD of May 2014.
 - This created additional challenges during the construction phase of the Project, in that the "just-in-time" approach to engineering and procurement (meaning that the engineering was often completed shortly before material procurement and construction activities) resulted in a greater number of construction work-arounds, congestion of construction craft labor in the field, inefficiencies and additional steps that became necessary during construction to cope with this just-in-time engineering, procurement and construction approach. The Project team, specifically the construction management team, continued to cope with both by trying to meet the scheduled COD of May 2014 and to reduce costs where it could.
4. MPCo conducted both internal and external reviews of the Project prior to certification to cross-check the readiness of the Project to proceed. MPCo commissioned an internal readiness review titled the Kemper County IGCC Readiness Review which was completed by Southern Company's internal audit group and communicated to MPCo Kemper Project management on March 16, 2010. The focus of the assessment was on the implementation readiness of the Project including areas such as governance and project management. Another was conducted by Black & Veatch (B&V),¹⁵ a

¹³ The planned COD has now been changed to fourth quarter of 2014.

¹⁴ "Work-around" is a term used to describe a new plan to circumvent or overcome a problem in the scheduling and executing of project work. It is a means of overcoming issues that may arise during a project.

¹⁵ Black and Veatch is an employee-owned international engineering, consulting, and construction firm with over 10,000 professionals and more than 110 offices worldwide. It is listed among Forbes' "500 Largest Private Companies in the United States." It specializes in several major markets including energy, water, telecommunications, federal, and management consulting. Its world headquarters is located in Overland, Kansas.

well-recognized international engineering and construction firm that was very familiar with the Edwardsport IGCC project, which was built ahead of the Kemper Project by Duke Energy in Indiana (Edwardsport).¹⁶ The B&V Readiness Review report was published in February 2010 and had some specific recommendations about the implementation of the Kemper Project. It should be noted that BREI's initial reviews, findings and conclusions were completely independent of the B&V Readiness Review report.¹⁷ While B&V's findings were generally favorable, several areas of concern were noted. In particular, the report expressed concern about:

- The aggressiveness of the construction schedule.
- The absence of schedule contingency¹⁸ which could make the Project subject to schedule overruns.
- The lack of manpower loading¹⁹ in SCS's detailed engineering schedule (B&V recommended the development of better procedures for measuring engineering and procurement progress).
- The cost estimate for the Project lacked fully estimated quantities for bulk commodities and in some cases employed outdated prices.
- The schedule was under development assuming that the inadequacies noted would be addressed in future schedule revisions.

The results of BREI's Independent Monitor's Baseline Due Diligence review, conducted during the period of March to October 2011, and which were conveyed to MPCo, identified similar shortcomings. The Executive Summary of that report is provided as Attachment C.

Separately, starting in the fourth quarter of 2010, MPCo and SCS representatives made site visits to Edwardsport and held phone conversations with the Edwardsport project team to gain insight on lessons learned from Edwardsport. Information was conveyed to MPCo and SCS senior management in late 2010

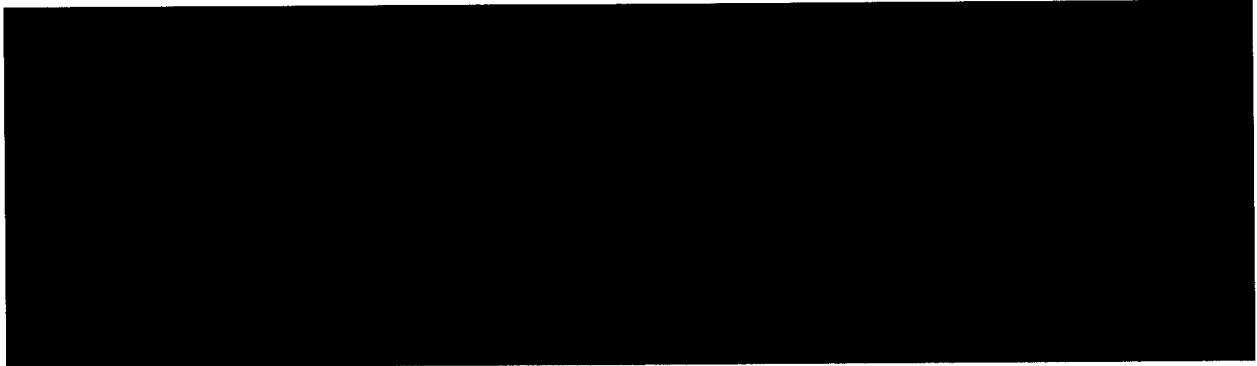
¹⁶ The Edwardsport Coal IGCC project is a 618MW project built by Duke Energy in Edwardsport, Indiana. A CPCN was issued by the Indiana Utility Regulatory Commission (IURC) in November 2007 based on an original price tag of \$1.985 billion. Construction began in 2008 and, as engineering and construction proceeded, cost increases became apparent. The IURC approved a revised estimate of \$2.35 billion in January 2009. Project costs increased further and in November 2009, Duke Energy requested IURC approval for a revised cost estimate of \$2.88 billion. It was reported in May 2012 that Duke Energy estimated current plant costs at \$3.3 billion. An agreement was reached between Duke Energy and IURC in May 2013 to cap project costs at \$2.595 billion. The Edwardsport IGCC project declared "commercial operation" in June 2013.

¹⁷ BREI was not made aware of the B&V Readiness Review report until September 2013.

¹⁸ "Schedule contingency" is the application of additional time assigned to a given scheduled task duration to account for uncertainties or unknowns in completing that task.

¹⁹ "Manpower loading" or "resource loading" is a technique used to assign man-hours to tasks in a baseline schedule. When tasks are completed, these man-hours are earned against the baseline plan. This allows for the Project team to measure progress against a plan based on milestone completion. When the measurement indicates that progress is less than the plan, management can react by assessing the cause and taking corrective actions.

and early 2011. Key findings and resulting issues that troubled the Edwardsport project were conveyed to the Project team. These included:



Some actions were taken by the Project team. However, it was communicated to BREI that the belief of MPCo/SCS at the time was that the Edwardsport project was not similar enough to the Kemper Project to warrant further concern.

5. The Project cost estimate developed during the FEED package preparation of \$2.4 billion (the certification estimate) was believed at the time of certification by the MPCo executive management team to be achievable.²⁰ This estimate had only a \$160 million contingency, or approximately 7% of the total plant cost estimate.²¹ This contingency consisted of roughly 10% on the gasification and gas cleanup processes and 2% on the combined cycle power plant. It should be noted that SCS was instructed by MPCo executives not to include a contingency in the estimates it provided to MPCo. MPCo developed the contingency of 7% and considered it to be adequate. It is BREI's opinion that the contingency allowance for the Project at the time of certification considering the level of FEED detail and FOAK aspects of the Project should have been on the order of 30% to 35% of the estimated total plant cost of \$2.237 billion (before contingency). This is due to the many complexities and difficulties the Project team was facing including a delayed start of the detailed engineering and the growth in commodities that are typically experienced in FOAK projects and potential additional costs that could result from the difficulties associated with the compressed schedule. During the certification hearings, an independent consultant advised the Commission that at a project cost increase of up to 20%, the Kemper Project would still be the most economical alternative, and thus, the \$2.88 billion hard cap was approved to protect the ratepayers given the FOAK nature of this first commercial demonstration of the TRIG IGCC technology. MPCo agreed to implement this Project recognizing the hard cap of \$2.88 billion.²² However, from an internal

²⁰ During prudency interviews, when Ed Day and Thomas Anderson were questioned on the project cost estimate and the associated contingency level, Mr. Day and Mr. Anderson expressed confidence that at the time of certification the Project could be executed at the contingency level proposed in the Commission's Order. They based their confidence on their experience in the execution of other Southern Company power projects they both had been involved in.

²¹ The basis for this level of contingency does not appear to have been formally documented by MPCo or SCS in a Record of Decision (ROD) based on the information reviewed by BREI.

²² MPCo Record of Decision (ROD-10-022) "Acceptance of a cost cap of \$2.88 billion (net of \$296 million of tax incentives)" is included as Attachment E to this report.

perspective, MPCo was tracking the cost of the Project against the soft cap certification estimate of \$2.4 billion. This later resulted in additional challenges to the Project team, as discussed below.

6. The MPCo executive management team at the time of certification apparently failed to understand how the complexities of the FOAK technology application combined with a compressed engineering, procurement and construction schedule could impact the growth in its estimated materials bulk quantities, associated labor installation man-hours, and ultimately the Project's cost and schedule.
7. During the period of June 2010 to March 2012, as the detailed design developed to accommodate the application of the FOAK technology, the commodities continued to increase. Based on the way the Project team was tracking commodities, the Project team did not appear to be "seeing" the added commodity growth and resulting impacts on the total project budget and schedule as it was tracked and measured against the original \$2.4 billion certification amounts. The method of tracking commodity quantities (concrete, steel, piping, cable, etc.) created challenges in the ability to forecast their impacts on costs, schedule and progress measurement. Quantity forecasts were adjusted based on SCS's three dimensional (3-D) model²³ updates and were tracked and reported in total. There were two issues with this. First, quantities were tracked in total and not tracked to a finer detail, by system. As a result, quantity increases above the baseline were only recognized when the 3-D model quantities exceeded the totals. Second, there were instances when process design changes influenced quantity growth early in the design process. These design changes should have triggered an adjustment in quantity forecasts when the process design changes occurred. Instead, quantity forecasts were only updated when the quantities were input into the 3-D model, a significant time lag from the time that the process design change was identified and approved. Since progress was measured against baseline quantities, this delay in identifying a growth from baseline quantities triggered a delay in the accurate measurement of the Project's progress. In May 2012, MPCo adjusted the forecast total EPC budget to \$2.76 billion. Later in 2012, this was changed to the \$2.88 billion hard cap amount. The COD of May 2014 was maintained.
8. The risk management process²⁴ utilized by the Project team as indicated by the project manager only seemed to evaluate risks affecting a rolling two quarters in a given period. This method of

²³ A three dimensional (3-D) design model consists of a computerized engineering design tool which is used to develop project design drawings. The advantage of this type of model is that it improves the engineer's ability to integrate the work of multiple engineering disciplines and companies into one system and allows for "interference checking" of the design. It also provides computerized generation of materials quantities (most importantly structural steel, piping and electrical cable) and the model updates these quantities in real time as the design of the plant develops and is integrated into the model. Previously, when drawings were developed in two dimensions, it was more difficult to check whether designers from different disciplines and different companies were designing systems or structures in the same space. This interference checking capability is especially beneficial in complicated and congested designs such as the Kemper Project. 3-D modeling capabilities have the ability to integrate all Project drawings into one system, including integrating design information from KBR.

²⁴ A risk management process is a method of identifying, assessing and developing mitigation strategies for project risks before they occur. It is a process that is employed throughout a project. During the process, the project team members will identify potential risks, assign a probability of the risk occurrence, and assess the consequences and severity factors (costs) to these risks if they were to take place. The project team then ranks risks and develops mitigation plans to lessen the chance of the risk occurring or the cost of its occurrence.

tracking risks and mitigation measures appeared to preclude the Project team from the ability to clearly see the approaching potential risks throughout the life of the Project to the end of the Project at COD. Thus, while the Project had a risk management process that was developed in general compliance with Southern Company procedures, the ineffectiveness of implementation restricted the Project team from seeing the long term risks, which could ultimately affect the project schedule and costs.

9. A particular area of difficulty for the Project team was the project planning and scheduling. The Project had identified early in 2010 an engineering and procurement schedule (which included major procurement activities), a separate construction schedule, and ultimately, separate testing, start-up and commissioning schedules. However, it was not until September 2011 (18 months after the start of detailed engineering and design and the start of construction) that a partially integrated computerized engineering, design, procurement, construction and testing, start-up and commissioning baseline²⁵ schedule was available for the Project team to oversee and manage the Project. This schedule was developed using the industry recognized Primavera²⁶ P-6 scheduling software, however, the Project team made a decision to manually resource load (i.e., construction labor and bulk commodity amounts) using a stand-alone spreadsheet; it did not utilize the fully-integrated resource loading module in the schedule (which Primavera P-6 provides for). The inadequacy of this resource loading method in the otherwise integrated schedule delayed the Project team in its ability to "see" and adjust both labor requirements and construction sequencing/planning which were required due to both increasing bulk commodity amounts and delays in commodity deliveries. These delays led to construction management inefficiencies which further delayed the Project, making it more difficult to meet schedule and cost targets during the period of 2010, 2011 and 2012. As a point of reference, when Kemper commenced construction, SCS projected a peak labor force of approximately 1,200 craft labor personnel. Currently, there are approximately 5,340 craft laborers on site. Construction labor forces peaked at about 6,540 in August 2013.
10. The Project schedule was re-baselined²⁷ in August of 2012. (The Project has been re-baselined three additional times since August 2012: in April 2013, July 2013, and again in November 2013, which are outside of the scope of this review). It should be noted that the number of re-baselines that have been required may have been reduced if a more efficient resource loading procedure had been adopted by the Project team. Of particular interest, it should also be noted that beginning in September 2012 the Project brought in a new Project Controls Lead person with extensive

²⁵ A baseline schedule defines the plan for work activities, schedule logic and associated resources (labor hours) for each task or groups of tasks to support the project plan. The baseline schedule is used by the project team as a benchmark against which it can measure its performance.

²⁶ "Primavera" is an industry recognized computerized scheduling software tool that is used extensively in the power and process industries.

²⁷ When many changes in the plan are made, whether from scope changes or extensive work-arounds, project performance measurements against the original plan may no longer provide meaningful information. At this point, a project team may find it necessary to construct a new baseline schedule; a "re-baseline." The re-baseline process is a good way to ensure that the project that is being used to measure progress is meaningful.

Primavera P6 experience, who between September 2012 and March 2013 replaced the existing personnel and fully re-staffed the Project Controls team for this Project. This has had a positive influence on the Project as a result of the increased scheduling proficiency and understanding of scheduling logic that the new team has brought to the Project.

11. As the detailed engineering and design phase of the Project progressed, the bulk commodities continued to grow in number causing a direct increase of the installation craft labor hours as a result of the complex FOAK nature of this Project. The projected craft installation labor hours grew from the certification amount of 5,140,288 to a forecast amount of 10,515,176 as reported by MPCo as of March 2013, which exceeds a 100% growth rate since the inception of the Project. This large increase of commodities and installation labor hours created severe labor congestion which is sometimes referred to as a "stacking of trades" in tight areas of the plant. This stacking of trades negatively impacted labor productivity which has required in some cases the need for more detailed and/or revised installation strategies, especially in the piping and electrical disciplines, to mitigate additional losses in schedule due to the congestion in tight work spaces. Since the inception of the Project, MPCo and SCS have developed detailed piping and electrical execution plans in an effort to more effectively manage this critical aspect of construction.

12. Project Contracting Approach

The Project was executed under an engineering, procurement and construction services agreement with SCS. Prior to the Commission's Order, MPCo stated that its plan was to bid the Project on a lump sum basis according to the following approach.

In the Direct Testimony of Kimberly Flowers on behalf of MPCo in 2009 it was stated that:

The project will ideally be bid on a lump-sum basis and performed by an independent contractor. This contracting arrangement places the least amount of risk on MPCo. The ability to contract the work in this manner, however, requires that the engineering for the work included in the inquiry package be substantially complete and that enough time be provided for the materials or equipment to be manufactured and for the construction activities to occur within the given schedule. If the engineering cannot be completed and/or if the available time frame to complete the project is short, then alternate contracting methods, which place more risk on MPCo, must be utilized.²⁸

During BREI's interviews of the MPCo and SCS staff, it was learned that MPCo revised these plans due to the schedule constraints and the fact that detailed engineering design would not be sufficiently advanced to support firm lump sum bidding of construction contracts. SCS developed a plan for contracting on the basis that it would obtain firm contracts for as much scope as possible with the remainder being handled on a reimbursable time and material cost basis. Since receipt of

²⁸ Docket No. 2009-UA-14, Direct Testimony of Kimberly D. Flowers on Behalf of Mississippi Power Company before the Mississippi Public Service Commission, p. 55 (July 25, 2011).

certification, the contracting strategy for the Project has been to execute construction via a series of contracts with multiple contractors. This has been due to the size of the Project, the demand for craft labor, the lack of detailed design at the time of the Commission's Order granting certification, and the desire to provide Mississippi companies with the opportunity to participate in the procurement and construction of the Project. Given the schedule constraints for the Project, this was a reasonable approach. It is unlikely that a different contract structure would have improved the situation since the late start and just-in-time engineering process would still have impacted the Project with the likelihood of significant change orders, due to the FOAK nature of the Project.

13. In light of the significant cost overruns that have been experienced in the Project,²⁹ MPCo and SCS have undertaken actions and decisions in an effort to better control costs and meet schedule milestones which have been difficult to achieve given the FOAK nature and complexity of this Project and its TRIG technology application. MPCo and SCS's actions and efforts in managing the various schedules and cost increases are notable and are summarized below:

- Hedges were developed on commodity pricing, e.g., on copper and on foreign-sourced equipment where both currency risk and materials costs risk were judged to be significant.
- Once the excessive cost overruns were verified, MPCo recognized that the senior MPCo executives in charge of the Kemper Project could no longer effectively manage the Project. In April 2013, Mr. Thomas Anderson resigned from MPCo as Vice President of Generation. In May 2013, Mr. Ed Day resigned as Chief Executive Officer and was replaced with Mr. Ed Holland. MPCo re-organized the senior project management team to both address the issues and to develop mitigation plans to minimize additional overruns.
- Once the Project team recognized in 2012 that the project schedule no longer reflected the progress and status, SCS re-baselined the project schedule. The schedule has been re-baselined at least three times since. In addition, SCS, recognizing the weakness in its scheduling team, replaced the scheduling staff, bringing in more experienced personnel starting early in 2013.
- The SCS policies and procedures that BREI reviewed appeared to be consistent with industry standards and similar to the policies and procedures it has reviewed and is familiar with on other similar projects. As discussed above, the issue with the procedures has been in their implementation.
- An experienced project management team was assigned at the onset of the Project. Additional staff personnel were added to the team as the schedule delays and complexities of the Project demanded it.

²⁹ While this evaluation does not look at expenditures beyond March 2013, MPCo now projects that the total cost for the capped portion of the Project will be approximately \$4.017 billion, which is \$1.14 billion in excess of the hard cap. So far, MPCo has agreed to write off over \$1.1 billion of costs.

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- Work-arounds were established in construction once the Project team realized the engineering or delivery of equipment and material would not support the schedule (COD May 2014). For example, the late delivery of the gasifier had crippling effects in the gasifier area of the Project. This coupled with other gasifier fabrication issues caused an approximate six month delay to the delivery and installation of the gasifiers, causing major impacts to the sequence of steel erection as well as the setting of other major equipment in the gasifier building resulting in critical delays to the project schedule. The construction group was forced to be creative in major work-arounds. Effective measures were set in place, such as the development and use of an integrated daily resource loaded schedule and daily accountability meetings to assure minimization of schedule loss for the gasifier fabrication.
 - The project implementation plan was designed to utilize Mississippi and nearby states' indigenous fabrication, supply and labor resources.
 - SCS has maintained a good project safety record considering the size and tight working areas of the Project. Based on BREI's reviews and continued site presence, there appears to be little project management tolerance for unsafe behavior or construction practices. The Kemper Project has a goal of 0.5 for Recordable Incident Rate (RIR). As of March 2013, its year-to-date RIR was 0.46 and the project-to-date RIR was 0.72. Based upon statistics from the Department of Labor's Bureau of Labor Statistics, the national average RIR for 2013 was 3.40, indicating that the Kemper Project is well below (i.e., better than) the national average.
 - The Quality Assurance and Quality Control (QA/QC) programs are compliant with industry standards and practices.
14. "Beneficial capital" is the term that is used by MPCo to categorize incremental capital costs that are expended to reduce the future costs resulting in a life cycle cost reduction of the plant. These types of costs are allowed to be recovered, even if above the certified cost cap, provided that they meet certain criteria that are defined in the Final Order on Remand. MPCo has provided documentation identifying ten items which it considers to be beneficial capital. Without commenting on the compliance of SCS/MPCo's methods with the Commission's Final Order on Remand, BREI can confirm that the approach used by SCS/MPCo for selection of equipment included a best life cost analysis which, from an engineering perspective, was reasonable. That being said, specific to the combustion turbines, the Siemens combustion turbine selection and its procurement along with the gasifier design were finalized during the FEED process prior to certification, with the cost of the Siemens combustion turbine included in the certified cost. As a result, BREI does not believe that the beneficial capital cost of \$33,082,000 for the Siemens combustion turbine should qualify as beneficial capital. In regard to the other beneficial capital items, BREI defers to Larkin's evaluation and report.
15. In the certificate proceeding, MPCo included in its \$2.4 billion cost estimate a \$46.5 million process development allowance (PDA) budget, which MPCo described as planning for future, post-
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operational capital spending, in order to improve the long term performance and availability of the plant. MPCo now contemplates devoting almost half (approximately \$22.2 million) of the PDA budget for five particular plant design modifications that are being implemented prior to commercial operation. Based on BREI's evaluation, from a technical perspective, the process changes for the five items which have been identified are considered reasonable. MPCo's decision to implement these changes during the construction phase of the Project rather than to have waited until the Project went into commercial operation was also reasonable because the changes are either less costly to implement now than to retrofit later, or were required to assure safety and plant operability at the time of COD compared to proceeding without making those changes. However, BREI is unable to conclude that those changes will improve the Project's performance, compared to the performance contemplated in the prior design, in terms of output value per unit cost. Rather, they appear to be directed towards assuring that the plant meets the safety and operability standards that MPCo had indicated would be achieved by the prior design at COD. Whether these changes qualify, in consideration of MPCo's timing in implementing them prior to COD, is included in Larkin's evaluation and report.

CONCLUSIONS:

After reviewing the many documents BREI requested, coupled with its initial baseline due diligence reviews, its cost estimate and scheduling reviews, BREI's participation in monthly progress meetings since March 2011 (and on a monthly basis starting in August 2011), its full time presence on site since January 2013, and BREI's interviews of key Project team personnel including executive level personnel at both MPCo and SCS, BREI has reached the following conclusions:

- The Project team faced challenges from the beginning due to the FOAK nature of the design and a compressed schedule which led to a just-in-time approach to engineering, design, procurement and construction. These initial challenges were further compounded by the use of a low contingency (of approximately 7%) in the original project estimate (of \$2.4 billion) which was used as the basis for monitoring quantities as the detailed design and the procurement proceeded. Despite these early challenges at the beginning of the Project, the Project team has generally responded in a creative manner based on the information that was available to it at the time. However, the information available to the Project team may have been in some cases incomplete or inaccurate due to the issues pointed out herein. In some cases, the Project team did effectively respond with work-arounds to mitigate the cost or schedule impacts to the Project.
- While BREI is of the opinion that the Project team responded generally in a creative manner to shortcomings and inadequacies in the implementation of the Project, these shortcomings and inadequacies led to inefficiencies which have increased the costs of the Project and have resulted in additional schedule delays. In BREI's opinion, several areas were not adequately addressed, executed or implemented in a reasonable manner. These areas include: project planning/scheduling, the development of a risk management program with sufficient detail and look ahead time horizon, the late development of the original integrated EPC schedule with adequate resource loading, commodity cost estimating and monitoring (which controlled the

project estimated cost to the certification estimate of \$2.4 billion until the original low contingency was depleted), and the implementation of SCS's and MPCo's internal procedures and policies (or failure to implement certain policies and procedures), and other areas discussed in this report.

- All of the areas listed above which were not addressed, executed or implemented in a reasonable manner raise serious doubt to BREI as to the appropriateness and reasonableness of those actions taken by MPCo in implementing this Project. MPCo needs to address and justify the reasonableness and appropriateness of these actions.
- The estimated costs associated with these inefficiencies, shortcomings and inadequacies through March 2013 have been estimated by BREI to be on the order of \$85 million to \$123 million. The basis for, and the methods employed to develop, this estimate are included in the body of the report.
- To put these costs into context, BREI estimated the probable cost of the Project absent these inefficiencies, shortcomings and inadequacies. Based on an update of the independent project cost estimate completed by BREI in the third quarter of 2012, using the actual quantities known today along with a higher contingency and using the labor productivity and other factors used by the Project in its 2012 estimate, BREI currently estimates that the cost to build the capped portion of the Kemper Project scope should have been approximately \$3.7 to \$3.8 billion. The Company's current estimate to complete the capped portion of the Kemper Project scope is \$4.017 billion. This confirms the Commission's decision to protect the Mississippi ratepayer interests by imposing both a hard cap on the total cost of the plant and performance metrics for its operation once it is placed in service.
- Given the challenges and inadequacies mentioned above, the MPCo Project team was and continues to be faced with significant hurdles in executing the Kemper Project. The impacts of early implementing actions taken by the Project team have had a cascading effect on the total cost of the Project and its schedule.

Having missed the originally planned COD with the consequential loss of the Section 148A Investment Tax Credit, MPCo now faces yet another critical date with the Internal Revenue Service deadline in order to qualify for bonus depreciation. To qualify for approximately \$200 million in associated initial tax savings, the Project must be placed in service by December 31, 2014.

To the credit of the Company and its parent, the Southern Company, they have taken many reasonable actions to mitigate the consequences to ratepayers of the Kemper Project's cost overruns, schedule delays and management decisions as those problems have come into sharper focus. These reasonable mitigation actions may be summarized as follows:

- To date, as reported in MPCo's Form 10K (Annual Report) for the period ending December 31, 2013, MPCo has written off over \$1.1 billion as a loss to be absorbed by shareholders and not the ratepayers. More importantly, Southern Company has made equity investments of approximately \$1 billion to MPCo during the same period, in the face of mounting losses.

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- After excessive cost overruns were verified, Southern Company replaced senior MPCo management executives who were responsible for the Project and reorganized the management team.
 - As problems were identified by the Project team, they were generally addressed promptly and in a reasonable manner in an effort to mitigate costs.

2.0 PROJECT BACKGROUND AND APPROACH

Mississippi Power Company (MPCo or Company) is a wholly-owned subsidiary of the Southern Company. On January 16, 2009, MPCo filed a petition with the Mississippi Public Service Commission (Commission or MPSC) for a Certificate of Public Convenience and Necessity (CPCN) requesting its authorization to construct, acquire, operate, and maintain an Integrated Gasification Combined Cycle (IGCC) electric generating facility in Kemper County, Mississippi (Kemper Project or Project). The Commission issued its Order on May 26, 2010,³⁰ granting MPCo's request and, following an appeal process, the Commission issued its Final Order on Remand on April 24, 2012,³¹ granting a CPCN authorizing the Company to construct, acquire, operate and maintain the Kemper County IGCC facility. In issuing its Final Order on Remand, the Commission concluded that its findings in the initial Order were appropriate and it confirmed those findings on remand.

In its Final Order on Remand, the Commission stated on page 40 the following:

Typically, in regulatory orders approving facilities for a utility, the Commission approves an estimate, the Company constructs the facility, and the utility seeks rate recovery for the facility following construction. At that time, the Commission is able to compare the actual costs of the facility to the estimated costs of the facility and determine whether the costs or any variances in the costs were prudent. Given the magnitude of the [P]roject and MPCo's request for relief under the Baseload Act, the Commission determined that it would be appropriate to focus on the potential risks to both the Company and its customers and developed conditions, as described below, to appropriately mitigate such risks.

To balance the risk of the Kemper Project between MPCo and its ratepayers, the Commission established the maximum cost that the Company would be allowed to recover in rate base. The cost cap was included to insulate ratepayers from possible large construction cost overruns even if the costs are found to be prudent. It was determined by the Commission based on testimony of its independent consultant, Dr. Craig Roach, that even with an increase of 20% above the Company's proposed \$2.4 billion estimate (i.e., a total cost of \$2.88 billion), the proposed Project would still be the preferred choice versus an alternative natural gas-fired combined-cycle combustion turbine (CCGT) facility. Therefore, the Commission established a soft cap of \$2.4 billion, and a hard cap of \$2.88 billion above which the total Project construction cost would not

³⁰ Order Granting a Certificate of Public Convenience and Necessity, Authorizing Application of Baseload Act, and Approving Prudent Pre-Construction Costs, Docket No. 2009-UA-014, May 26, 2010 (Order).

³¹ Final Order on Remand Granting a Certificate of Public Convenience and Necessity, Authorizing Application of Baseload Act, and Approving Prudent Pre-Construction Costs, Docket No. 2009-UA-014, April 24, 2012 (Final Order on Remand). The Final Order on Remand has been challenged and is on appeal before the Supreme Court of Mississippi, Case No. 2013-TS-00043.

be recoverable from ratepayers. This cap did not include the lignite mine and CO₂ pipeline development and installation costs, which are referred to as the “uncapped” costs.³²

Given the highly technical and complex nature of the Project the Mississippi Public Utilities Staff (MPUS or Staff) was authorized to hire an Independent Monitor (IM) to monitor the progress and status of the engineering, procurement, construction, start-up and testing of the Kemper IGCC Project. MPUS engaged Burns and Roe Enterprises, Inc. (BREI) in February 2011 as Staff’s IM. With the approval of MPUS, John T. Boyd Company (Boyd) and Larkin and Associates (Larkin) were retained by BREI as independent subcontractors to monitor the mine development, and regulatory, financial and auditing aspects of the Project, respectively.

Initially BREI was requested to perform an Independent Monitor’s Baseline Due Diligence Review of the Project and to assess the Company’s planning and construction activities to date. In particular, BREI was instructed to perform the following tasks:

- Evaluate the completeness of engineering;
- Review technology and technology risk including the Transport Reactor Integrated Gasifier gasification technology and CO₂ separation and sequestration;
- Review the Front End Engineering and Design (FEED)³³ package including project cost estimates and schedules;
- Review all major contracts including, but not limited to, the engineering, procurement and construction (EPC) contract with Southern Company Services (SCS), SCS’s contract with Kellogg Brown & Root, LLC (KBR) for design of the gasification island and other process systems, CO₂ off-take agreements, technology licensing agreements for major gas cleanup process, major equipment purchase contracts, and the 17.5% shared ownership agreement with South Mississippi Electrical Power Association (SMEPA);
- Evaluate current and initial construction and engineering status;
- Review completeness and adequacy of operation and maintenance plans, including operation and maintenance budgets and process development allowance budgets;
- Identify project risks, determine adequacy of the MPCo Risk Register and Risk Management Plan and identify additional risk management steps if deemed necessary; and
- Based on this baseline evaluation, develop and execute a detailed construction, start-up and testing monitoring plan.

During the initial due diligence review, BREI began monitoring the Project’s EPC progress on a monthly basis. This included monthly trips to the plant site in Kemper County. A full time site monitor was added to BREI’s team in January 2013. BREI’s monitoring has also included approximately seven trips to SCS’s offices in Birmingham to monitor and review critical engineering, schedule and cost aspects of the Project, the review

³² These costs were not capped because they were not included in the Company’s \$2.4 billion estimate. Instead, they were factored in to its fuel cost and by-product revenues assumptions.

³³ Front End Engineering and Design (FEED): A FEED package is a group of drawings, equipment lists, equipment specifications and other scoping documents that defines the basis of design for a project, the project’s conceptual design, cost estimate, basis of estimate document, and project schedule.

of quality assurance and quality control procedures and inspections and other aspects of the Project which are further detailed later in this report. BREI made a separate visit to the Power System Development Facility ("PSDF") (TRIG pilot test site) in Wilsonville, Alabama.

In May 2012, following MPC's announcement that the Project's cost would exceed the \$2.4 billion soft cap, MPUS commissioned BREI to conduct an Independent Project Schedule and Cost Evaluation. BREI's findings and recommendations were reported to the MPUS and MPCo in November 2012; a copy of those findings is included as Attachment D to this report.

In July 2013, in accordance with the scheduling order,³⁴ and on behalf of the MPUS, BREI was tasked to prepare this report and associated testimony assessing the prudence of the EPC decisions made and the costs incurred in connection with the Project. The review covers the period from late 2009 through March 31, 2013. This portion of the prudence assessment has been conducted by BREI. Boyd and Larkin have issued separate reports on the prudence of mine development, and auditing and financial functions, respectively.

As reported in Cynthia Shaw's Direct Testimony on December 12, 2013 (Docket No. 2013-UA-0189),³⁵ MPCo's capped costs attributable to the Kemper Project as of March 31, 2013, were \$2,377,297,304, and the uncapped project costs totaled \$472,774,037. It was further stated by Mr. John C. Huggins in his Direct Testimony (Docket No. 2013-UA-0189 dated December 12, 2013)³⁶ that MPCo now estimates that costs for the capped portion of the Project will total approximately \$4.017 billion and that MPCo will not seek to recover in excess of \$2.88 billion from its ratepayers. Therefore, the BREI³⁷ assessment evaluated the prudence of the approximate \$2.377 billion in capped Project expenditures as of the end of March 2013 plus the uncapped expenditures to design and install the CO₂ pipeline.

The BREI team conducted this prudence review/evaluation based upon the following guidelines:

1. A prudence determination relates only to actions and decisions.
2. BREI reviewed and evaluated the major EPC decisions and actions of the Kemper Project³⁸ team which have taken place up to and including March 2013. While BREI noted the actions and decisions of executive management,³⁹ it was not within the scope of BREI's review to evaluate them. The actions and decisions of executive management leading up to the start of construction include, among others, the decision to go forward with the project after the Commission established its cost

³⁴ Scheduling Order dated July 26, 2013, Docket No. 2013-UA-189, Petition of Mississippi Power Company for Finding of Prudence in Connection with the Kemper County Integrated Gasification Combined Cycle Generating Facility.

³⁵ Supplemental Exhibit CFS-1.

³⁶ Huggins Supplemental Direct at pp.23-24.

³⁷ A listing of the BREI staff involved in conducting this review is included in Attachment G of this report.

³⁸ See Project Management Plan Section 4 "Organization." (Exhibit____(JCH-2 Supp)). Also, attached are the Project Organizational Chart (before and after May 2013) and the Construction Organizational Chart in Attachment F.

³⁹ See Project Management Plan Section 2 "Managing Review Board and Executive Review Board." (Exhibit____(JCH-2 Supp)).

caps; the decision not to use a third party EPC contractor under a lump-sum, fixed fee arrangement; the decisions related to the level of contingency; the decision to compress the construction schedule in order to achieve certain tax benefits after gaining the Commission's approval to proceed.⁴⁰ Nor did BREI attempt to evaluate the prudence of executive management decisions after construction began to incur additional costs in order to maintain the original commercial operation date (COD)⁴¹ and compressed schedule in the face of mounting evidence that COD was not achievable, or the decision to replace MPCo's Chief Executive Officer and its Vice President of Generation Development. The scope of its review was limited to the prudence of the actions and decisions of the Project team.⁴²

3. The standard that BREI used for determining prudence or reasonableness of an action or decision consisted of the consideration of what a reasonable and informed manager at the appropriate level within a project team in the electric power industry would have done, in light of the conditions and circumstances which were known, or should have been known, at the time the decision was made or action taken. BREI did not simply base its findings upon whether or not the project costs were exceeded or were below MPCo's original estimates or expectations.
4. BREI examined the major decisions/actions of MPCo and SCS (who provided EPC services to MPCo) in the execution of the Project to determine whether their decisions/actions fell outside of the bounds of reasonability.
5. Under no circumstances did BREI evaluate actions or decisions based upon "hindsight" in its prudence assessments and evaluations. The decisions/actions were judged purely upon what was known at the time or should have been known by the Project team and executive management at the time the decision was made or the action was implemented.

BREI relied on the following data and information in developing this prudence report: information gathered during the initial Project due diligence review in 2011, an independent review of the project schedule and project cost which it conducted from May through November 2012, BREI's ongoing Project monitoring reviews including site visits conducted from early 2011 through March 2013 plus responses to approximately 325 requests for information (RFIs) provided by MPCo and SCS during its initial due diligence review, ongoing Project monitoring work, and the prudence discovery process. However, since BREI's involvement did not include the initial development phase of the Project prior to February 2011, it conducted independent assessments on the major decisions and actions the Project team made from late

⁴⁰ This latter decision resulted in the necessity to implement a just-in-time engineering approach, which created an array of challenges for the Project team.

⁴¹ Commercial operation date refers to the date when a power plant has been commissioned, determined to be mechanically complete, has passed all required performance and emissions tests and is deemed ready to reliably supply electrical energy and capacity to the transmission grid.

⁴² Executive management decisions involve many strategic considerations which are beyond the scope of BREI's current review and can be more readily evaluated after the Project is completed. Therefore, it reserves the right to revisit these decisions during the next prudence review.

2009 through early 2011 via the use of RFIs and direct interviews of the key MPCo executives and SCS Project personnel in Meridian and Gulfport.

To the extent possible, this report is organized to provide the reader with a review of the planning, engineering, procurement and construction of the Kemper Project in chronological order.

Project Timeline: The timeline is intended to give the reader an understanding of the information that was available at the time certain decisions were made.

FEED Phase: Starting in 2006, SCS developed a FEED package in support of the development of the Project and in support of the development of cost, performance and schedule estimates. This FEED package formed the basis of SCS's Project proposal and the Commission's subsequent Order in May 2010 granting certification. A review of its contents and cost estimate development is discussed.

Pre-Construction Planning and Internal and External Due Diligence Assessments: In the first quarter of 2010 and in anticipation of the Commission's Order, SCS conducted a series of internal due diligence assessments to assess the "readiness" of the Project for execution. In addition to these internal SCS assessments, a series of external independent assessments of the Project were performed by BREI and others. These assessments, both internal and external, included overall conclusions about the scope, cost and schedule development during the FEED phase, and the readiness of the Project to proceed at the time it was initiated. They also included an evaluation of the planning, scheduling, risk analysis procedures and cost and schedule control areas of the Project. Conclusions were formed on each area and specific recommendations were made where weaknesses were identified. This report provides summaries of each of these internal and external due diligence efforts.

Project Schedule, Cost Monitoring and Controls: This project function began in the FEED phase and is ongoing and will continue through project completion. It encompasses the upfront planning and scheduling, and addresses the types of data and information that are collected during the project execution phase to allow the Project team to measure its progress with respect to the original baseline plan. This function also includes the very important tasks of forecasting project cost and schedule, and risk assessment and analysis. In addition, it involves processes and procedures to collect information on the status of the Project so that informed decisions can be made by the Project team and so that project status and identified issues can be effectively presented to and assessed by MPCo, SCS and Southern Company management and other stakeholders. This report provides BREI's evaluation of the processes that were used and how well they functioned during each phase of the Project.

Project Execution: An evaluation of each Project phase and some of the key challenges that were experienced by the Project team on each phase of the execution of the Project are discussed. This report discusses how the Project team responded to individual challenges as they were experienced. Each of the major project phases, including engineering, procurement, construction, start-up and commissioning, are discussed.

The last part of the report addresses issues associated with MPCo's proposed capped cost exceptions including beneficial capital and process development allowance (PDA).

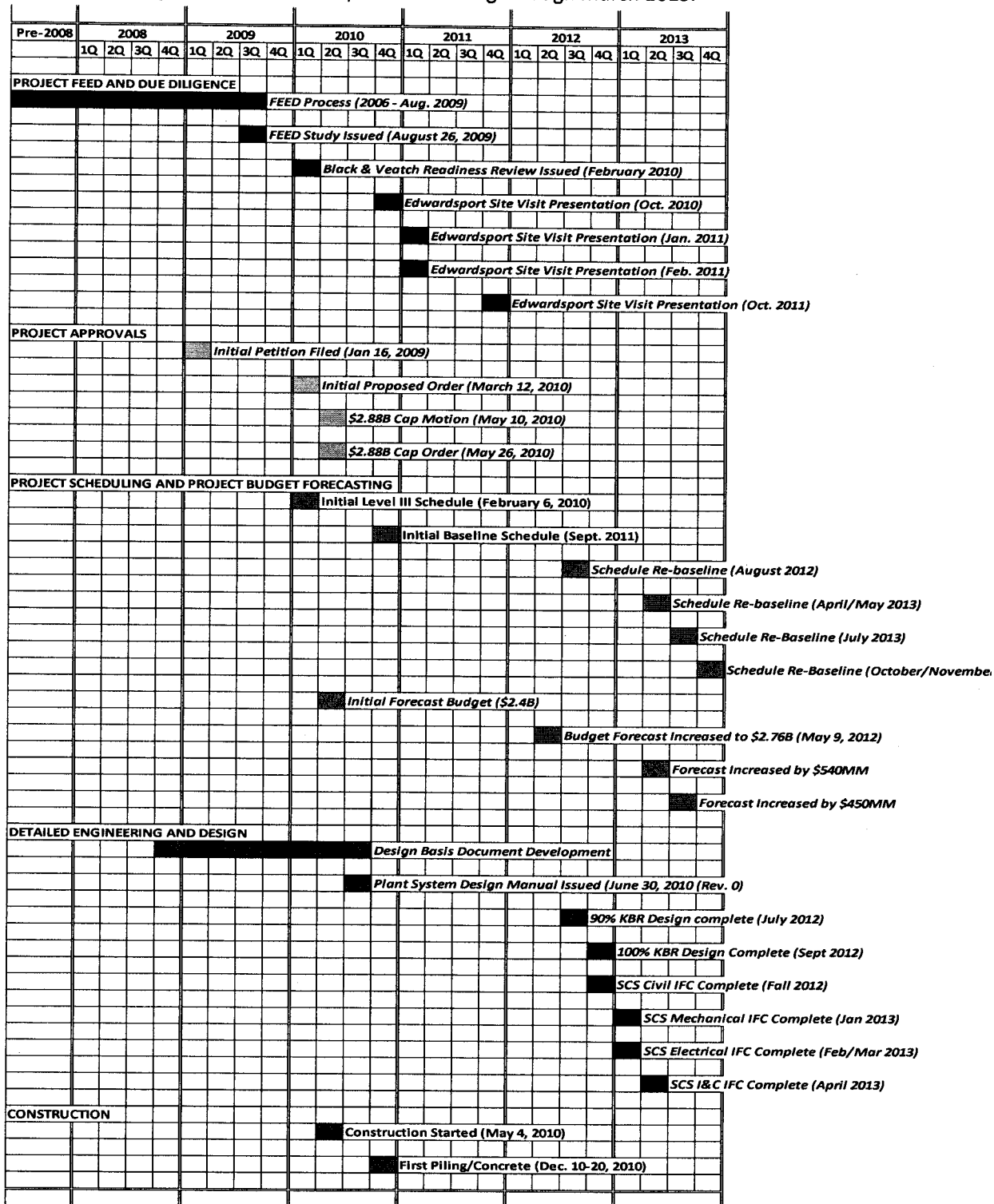
Beneficial Capital: The Commission's Final Order on Remand states that incremental capital costs above the hard cap will be allowed where MPCo can demonstrate that these costs result in increased efficiencies and/or reduced operating and maintenance cost, which provide a net benefit to the ratepayer when compared to the original proposal. MPCo has proposed a number of incremental beneficial capital costs which have been evaluated by BREI for inclusion in the Kemper Project's uncapped cost category.

Process Development Allowance: The certified budget filing contains a budget line item for PDA in the amount of \$46.5 million which was originally scheduled to be spent after the COD over the first five years of the Project's operation, in anticipation of additional required capital investments to improve operating performance or correct deficiencies in the original design. MPCo has implemented certain items it asks to claim under PDA prior to the COD due to safety and operability issues identified during design. BREI provides an analysis of this request.

Conclusions and Cost Analysis: Based on the facts that were collected during this prudence review process, BREI offers conclusions on the findings of this review and the resultant cost impacts when such conclusions create serious doubt as to the prudence of certain decisions and actions.

3.0 PROJECT TIMELINE

The table below (Kemper IGCC Project: Key Events Timeline) depicts the major project milestones and events beginning with the FEED study and continuing through March 2013.



4.0 FRONT END ENGINEERING AND DESIGN (FEED)

During the FEED phase of a project, an owner develops the process design of the plant and preliminary design drawings and equipment specifications, in order to have a clear understanding of the project's scope, layout, bulk material quantities (concrete, steel, piping, electrical cabling, etc.), probable costs, and schedule. The FEED study also identifies environmental requirements for plant air, water and solid discharges. The project team identifies plant interface designs with transmission systems, natural gas, water, and wastewater. It devises plans for various discharge streams, such as coal ash or other plant by-products, and also identifies site geology to assist with developing a preliminary foundation design for equipment and structures. It also conducts studies for the planning of delivery of large equipment and vessels.

Upon completion of this scope development effort, the project team develops a project cost estimate and schedule. The cost estimate is typically supported by a "basis of estimate" (BOE) document. The BOE document defines the manner in which the estimate is developed. It defines the equipment pricing that was obtained through firm quotes, budgetary quotes and internal databases. It defines the level of detail that was used to develop quantity estimates and specifically where factors were used in the absence of material quantity estimates. It also defines the assumptions for escalation of equipment and commodities prices, the basis for estimating indirect costs, and it defines the methodology used to calculate the project contingency. This type of record is a valuable tool to document and communicate the strengths and weaknesses of an estimate to management. FEED studies will typically define a project's cost within 20% to 50% accuracy,⁴³ as noted in the table below (Cost Estimate Classification for Process Industries (AACE, 2011)), depending on the FEED study's level of detail and the risk components of a project.

⁴³ American Society of Cost Engineers (AACE) defines the documentation that is necessary for different "class" estimates. Estimate classifications are defined based on the amount of engineering that is completed to develop the estimate and also "depending on the technological complexity of the project, appropriate reference information, and other risks (after inclusion of an appropriate contingency determination), ranges could exceed those shown if there are unusual risks." (AACE, 2011.)

Estimate Class	Primary Characteristic	Secondary Characteristic		
	Maturity Level of Project Definition Deliverables (Expressed as a % of complete of definition)	End Usage (Typical Purpose of Estimate)	Methodology (Typical Estimating Method)	Expected Accuracy Range (Typical variation in low and high ranges) [See Notes]
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment, or Analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget Authorization or Control	Semi detailed unit costs with assembly level line items.	L: -10% to -20% H: +10% to + 30%
Class 2	30% to 75%	Control or Bid/Tender	Detailed unit cost with forced detail take-off	L: -5% to -15% H: +5% to + 20%
Class 1	65% to 100%	Check Estimate or Bid Tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to + 15%

Notes: The state of process technology, availability of applicable reference cost data, and many other risks affect the range markedly. The +/- value represents the typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for a given scope.

The FEED study for the Kemper Project was led by SCS and supported by KBR. It consisted of developing a conceptual design which was used to develop the project scope, budget and schedule estimates forming the basis of the Kemper Project proposal to the MPSC. The FEED phase spanned from a period in 2006 through August 2009. The cost of the effort was documented by MPCo to be \$16.8 million, roughly 10.3% of the total planned engineering and design budget at certification and 7.8% of the projected engineering and design costs forecasted by MPCo in March 2013. FEED budgets typically range from 10% to 15% of the total engineering cost. While the Kemper Project's FEED was at the low end of this range, BREI considers the Kemper Project FEED to have been adequate based on the information that was available at the time. When the FEED phase started in 2006, it included a design of the IGCC plant with no CO₂ capture. The design then evolved to include 50% CO₂ capture and, by the conclusion of the FEED study in August 2009, the design evolved to 65% CO₂ capture to meet requirements in the IRS Section 48B Investment Tax Credit.

SCS managed the overall engineering and design of the FEED package. SCS Engineering subcontracted KBR to perform the process design of the gasification island and gas clean-up blocks. SCS was responsible for the

design of the balance of plant (BOP)⁴⁴ equipment in these process areas. KBR worked under the direction of the Southern Gasification Services (headed by Randal Rush) and was responsible for the basic process design of the gasification island including the gas cleanup system process design. It also performed the vessel design of the gasification vessel. SCS Gasification Technology group was responsible for the gasifier design. SCS Engineering Services was responsible for the remainder of the FEED package design.

The FEED phase consisted of the development of process flow diagrams (PFDs), piping and instrumentation diagrams (P&IDs), equipment lists, and the routing of the majority of large bore piping in a three-dimensional (3-D) design model.⁴⁵ During the FEED process, 70% to 80% of the large bore piping was routed in the 3-D model. While this level of piping detail is considered typical of other FEED studies that BREI is familiar with, SCS did not apply sufficient levels of piping contingency to account for the first-of-a-kind (FOAK) nature of the Project. Piping quantities between two inches and six inches were factored from large bore piping quantities and piping below two inches was factored from the total piping quantities greater than two inches, which was an appropriate approach at this stage of engineering.

A Process Hazards Analysis (PHA) for the FEED phase of the Kemper Project was conducted at the KBR office in Houston, Texas, from November 2 to November 20, 2009, and then continued from November 30 to December 11, 2009, at the SCS office in Birmingham, Alabama. A multi-disciplined team of engineers identified a total of 1,746 recommendations during the PHA. From these recommendations, a series of corrective actions were identified. SCS then considered the FEED package that was developed for the Kemper Project to be comprehensive. During the FEED package formulation, many improvements were made in the design of the Project. The intent of these design improvements was to improve project life cycle costs.

The FEED was concluded in August 2009 with the development of a cost estimate that was the continuation of a cost estimating effort that was started in 2008 (August 2009 FEED Package). The basis for the FEED cost estimate was defined in the August 2009 FEED Package as follows:

- The combined cycle cost estimate was based on Southern Company's combined cycle reference plant (2008). The reference plant estimate was updated based on site specific factors including air, steam and fuel gas integration with the gasification island and major equipment pricing updates.

⁴⁴ BOP equipment and systems pertain to scope which is not part of the major process systems. It includes equipment in the plant which supports the operation of the major process equipment and systems. Equipment and systems such as compressed air and closed cooling water are examples of BOP systems.

⁴⁵ A 3-D design model consists of a computerized engineering design tool, which is used to develop project design drawings. The advantage of this type of model is that it improves the engineer's ability to integrate the work of multiple engineering disciplines and companies into one system and allows for "interference checking" of the design. It also provides computerized generation of materials quantities (most importantly structural steel, piping and electrical cable), and the model updates these quantities in real time as the design of the plant develops and is entered into the model. Previously, when drawings were developed in two dimensions, it was more difficult to check whether designers from different disciplines and different companies were designing systems or structures in the same space. This interference checking capability is especially beneficial in complicated and congested designs such as the Kemper Project. 3-D modeling capabilities have the ability to integrate all project drawings into one system, including entering design information from KBR. In addition, construction commodity quantities can be easily assessed within a 3-D model.

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- The gasification island and gasification BOP costs were based on the FEED as of the second quarter of 2008.
 - Costs for major equipment was obtained from formal inquiries, budget costs from vendors or estimated equipment costs of recently procured equipment of comparable sizes.
 - An estimated cost for 65% CO₂ capture was included.
 - Escalation was applied to the base 2008/2009 dollars to the projected point of expenditure.
 - Typical of most FEED packages, only large bore pipe quantities were estimated. Medium and small bore piping were “factored” from prior designs. While this practice is customary for FEED packages at this level of detail, the factors applied by SCS did not recognize the FOAK nature of the Project.

A BOE was not developed or, if it was developed, it was not made available to BREI. If a more detailed BOE had been developed for the Project during the estimating phase or later in the middle of the detailed engineering and design of the Project, and if this BOE had been communicated to management, then management would have been better informed as to the strengths and weaknesses of the cost estimate, and the areas of cost growth which were likely or possible to occur. For example, a system-by-system contingency analysis could have been performed to establish the level of design certainty that existed at the time of completion of the FEED. The areas of FOAK design risk and scope growth risk could have been more clearly communicated and specifically addressed in the contingency budget.

The ultimate decision concerning the contingency provision to be included in the cost estimate appeared to follow a “top-down” management decision. According to the interviews BREI conducted, SCS was instructed by MPCo to provide an estimate not including contingency. It appears that SCS and MPCo management (together) established the level of contingency that would be used on the Project. The final estimate had a \$160 million contingency, or approximately 7% of the total project cost estimate.⁴⁶ This contingency consisted of roughly 10% on the gasification and gas cleanup processes and 2% on the combined-cycle power plant. BREI considers this contingency to have been low considering the FOAK nature of both the gasifier and the combined cycle plant features which require air, steam and fuel integration and interface with the gasification plant.

In interviewing MPCo’s management concerning the contingency, it was determined that MPCo’s standard practice is to not add contingency to a project budget at the engineering level. MPCo’s position was that Southern Company had a history of finishing projects on or under the project budget, so additional contingency was not necessary. MPCo management felt that Southern Company’s experience on other projects combined with the level of engineering completed during the FEED study was sufficient to justify this approach. MPCo management also claimed that Southern Company’s fifteen combined cycle units and eleven simple cycle units engineered and installed by SCS between the year 2000 and 2007 consistently led to installed costs per kW of new facilities significantly below national averages. It should be noted that the Kemper Project is by its nature neither a traditional combined-cycle plant nor a scrubber. Instead, it is a process plant with a combined cycle power plant that is significantly integrated with it and that is attached

⁴⁶ The basis for this level of contingency does not appear to have been formally documented by MPCo or SCS in a Record of Decision (ROD) based on the information reviewed by BREI.

to the tail end of the process. Even the combined-cycle plant by itself has many FOAK features, including air and steam integration with the gasification block and combustion turbine modifications that are required due to the nature of the syngas fired.

Conclusion:

The Project team developed a comprehensive FEED package for the Project between 2006 and 2009 which formed the basis of the BOE development. Considering the comprehensive list of design deliverables that was developed as part of the FEED, the documentation was sufficient to produce an estimate of an AACE Class 3 or Class 4 accuracy level which could have resulted in an accuracy level of -15% to +30%.⁴⁷ As noted by AACE, the accuracy of the cost estimate would then be influenced by outside risk factors. For the Kemper Project, these risk factors would include the FOAK nature of the Project, the fact that appropriate reference plant design and cost information was not available and the fact that the Project would be executed within a constrained project schedule.

In addition, the initial BOE was developed in 2008 based on the FEED work completed at that point in time and then adjusted for scope changes through August 2009. As a result, the 2009 FEED cost estimate may not have fully benefited from engineering development that was completed between 2008 and August 2009. The August 2009 estimate also was updated to include quantity take-offs and the latest equipment specifications and associated pricing consistent with the August 2009 FEED Package scope which added uncertainty to the estimate.

Considering the FOAK nature of the Kemper Project, the level of detail of the FEED study, and the coordination between the August 2009 cost estimate and the August 2009 scope, it is BREI's opinion that a contingency on the order of 30% to 35% would have been more appropriate. The expressed belief of MPCo executive management at the time of certification that the Project could be completed at the capped amount apparently resulted from its failure to fully appreciate how the complexities of the FOAK technology application with a compressed EPC schedule could impact the growth in its estimated materials bulk quantities, associated labor installation man-hours and ultimately the Project's cost and schedule.

5.0 TRANSPORT REACTOR INTEGRATED GASIFIER (TRIG) TECHNOLOGY AND POWER SYSTEM DEVELOPMENT FACILITY (PSDF) TESTING

The Project is a FOAK commercial design utilizing TRIG gasification technology that was jointly developed by SCS, KBR and the United States Department of Energy. The use of this technology presents the Project team with major issues and challenges since TRIG gasification technology has not yet been demonstrated in a commercial scale facility.⁴⁸ It will be the first large scale commercial demonstration of TRIG technology representing a significant scale-up of the equipment tested at the PSDF in Wilsonville, Alabama. Attachment

⁴⁷ See Cost Estimate Classification for Process Industries (AACE, 2011) table in Section 3 of this report.

⁴⁸ As of the date of this review, SCS has operated and conducted extensive process testing at Southern Company's Wilsonville, Alabama, National Carbon Capture Center (NCCC), formerly named the Power System Development Facility (PSDF). The facility is designed to operate at a 48 ton per day coal feed capacity. The Kemper Project will operate at a 6,900 ton per day capacity, a significant scale-up factor of approximately 150 times the pilot unit size.

A provides a block flow diagram of the Kemper Project's IGCC process including the combined-cycle power plant which outlines the major systems and components which are considered to be either commercially proven or a FOAK application of the technology at this scale.

Before and in parallel with the FEED effort, some of the technologies for the Kemper Project's IGCC plant were being tested at the PSDF. During this time frame, there were numerous test campaigns focused on the gasification system and certain components while operating on Mississippi lignite.

The FOAK design of the Project introduces technology scale-up risk. Technology scale-up introduces unique project risks including technology risk (the risk that the technology will not work fully as intended), and design quantity growth risk. Design quantity growth is the risk that a FOAK design will introduce unanticipated scope as the detailed design evolves. An example of this occurring on the Kemper Project is the nitrogen plant. Its size and capacity were significantly increased as detailed design proceeded to meet the needs of the TRIG gasification technology and support systems. Prior to the Commission's Order, the integrated operation of a pilot scale gasification system was tested on Mississippi lignite during a series of test campaigns starting in 2007 (TC-22) and continued through 2010 (Test Run 04). The key TRIG technology components that were developed at the PSDF were demonstrated on Mississippi lignite during the Mississippi lignite test campaign (TC-25). Each of these technologies was documented to operate reliably under pilot plant conditions with the exception of the pressure decoupled advanced coal feeder (PDAC). The coal feed system control and feed stability was found to be an issue with the PDAC feeder during the TC-25 testing that was conducted in the summer of 2008. This specific technology development risk existed at the pilot scale when the initial proposal was made to the Commission in January 2009. This risk was in addition to the scale-up risk already discussed. Following the initial proposal, this risk was partially mitigated with further testing of the PDAC feeder in February 2009 and April 2010 and improvements in coal feed stability were documented.

Conclusion:

While the TRIG technology scale-up risk remains, especially considering the failure of the DongGuan, China, project⁴⁹ to achieve commercial operation, SCS took appropriate steps where possible to demonstrate the more risky technologies at the pilot scale prior to the Commission's Order. Technologies such as the PDAC feeder which had pilot scale demonstration issues prior to MPCo's initial filing with the Commission were further tested and feed stability was improved just in time to support the detailed engineering and design phase. This step taken by Southern Gasification Services was an appropriate risk mitigation measure which was undertaken to reduce project technology risk.

6.0 TECHNOLOGY DEVELOPMENT DUE DILIGENCE

MPCo and SCS performed a series of internal and external due diligence reviews to gauge the commercial readiness of the TRIG gasification technology, IGCC technology in general, and the adequacies of SCS/MPCo's internal processes and capabilities to move forward with the implementation of the Kemper

⁴⁹ The first attempted commercial TRIG IGCC project was in DongGuan, China, but was delayed and has not been built to date. See Attachment C, Executive Summary: Independent Monitor's Report.

Project. These reviews included the engagement of Black & Veatch in 2009 to conduct an independent audit of SCS and MPCo's development work plans to date, and ongoing meetings with the Edwardsport project management and engineering staff for the purpose of obtaining "lessons learned."⁵⁰ MPCo also conducted an internal audit to evaluate its own and SCS's ability to execute the Project.

6.1 BLACK & VEATCH "READINESS REVIEW"

Black & Veatch (B&V)⁵¹ was hired by SCS to perform an independent assessment of the Southern Company's preparation for the Kemper Project. As the Independent Monitor for the Indiana Utility Regulatory Commission (IURC) on the Duke Energy Edwardsport IGCC project,⁵² B&V had firsthand knowledge of the most recent IGCC project built in the United States. The results of B&V's review were published in a report titled "Kemper County IGCC Project Readiness Review" issued in February 2010 (Black & Veatch, 2010). The assessment was a high-level review, intended to evaluate the project plans and resultant readiness to complete the conceptual design and proceed with the subsequent detailed design, procurement and construction. The following summary provides the scope of the review, the overall conclusion as to "readiness" and specific recommendations that were made. The scope of the review was intended to:

- Assess the engineering plan for potential risks. Review the status of engineering and assess the readiness to proceed to the detailed design phase.
- Review the equipment procurement and construction contracting plans in order to identify potential risks and shortcomings in the procurement schedule and approach, as well as, the contracting strategy for the Project.
- Review the construction plans including the reasonableness of the construction schedule and assess the readiness to begin construction.
- Review the potential risks in the start-up plan including the status of start-up preparation and planning.
- Review the overall Project critical path⁵³ schedule and schedule approach, including identification of potential areas that could impact SCS's ability to meet the overall schedule objectives.
- General review of the cost estimating and cost control procedures and their appropriateness for controlling the overall cost of the Project.
- Complete a Budget Risk Assessment including the potential adequacy of escalation and contingency levels.
- Review the PDA in relation to planned operating availability.
- Assess the likelihood of obtaining fixed price contracts and the associated pros and cons of doing so.

⁵⁰ See Section 6.1 of this report for a discussion of the Black & Veatch Readiness Review.

⁵¹ Black and Veatch is an employee-owned, international engineering, consulting and construction firm with over 10,000 professionals and more than 110 offices worldwide. It is listed among the Forbes "500 Largest Private Companies in the United States." It specializes in several major markets including energy, water, telecommunications, federal and management consulting. Its world headquarters is located in Overland, Kansas.

⁵² See Section 6.2 of this report for a discussion of the Duke Energy Edwardsport IGCC project.

⁵³ A schedule's "critical path" is an identification of sequential activities within a schedule that determine minimum time required to complete the project. A delay of any activity in the critical path will delay the project unless work-arounds or other mitigating actions are implemented to accelerate the remaining work.

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- Review the site plan and external infrastructure.

B&V concluded in its Readiness Review that:

B&V finds that SCS has completed significant effort in preparing for the execution of the Kemper County Project and, as a consequence, is well-prepared to begin the detailed design phase of the Project. SCS also has the requisite procurement processes and procedures in place to carry out and manage the procurement phase of the Project. Finally, SCS is currently assigning the construction leadership and commencing the appropriate initial construction planning activities. (Black & Veatch, 2010, p. 1-3.)

B&V also made recommendations in its report for areas of weakness which should be addressed. A summary of the pertinent areas of review are as follows:

FEED Study: It was noted through the review of the engineering discipline that, overall, the Project had completed a fairly comprehensive FEED package to support subsequent project execution. The weak areas of the FEED included the Project's water balance. B&V noted that "SCS should consider increasing the level of detail of the gasifier water mass balance to match that of the power block water mass balance" (Black & Veatch, 2010, p. 5-11) and update the water balance to reflect the range of ambient conditions and operational scenarios.

Following the B&V recommendation, it was SCS's opinion that the FEED package contained the appropriate level of detail with regard to the gasification system water balance. No further actions were taken in developing a more detailed project water balance. (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 3-1.)

FEED Cost Estimate: B&V further commented that the cost estimate developed during the FEED study was "based on equipment pricing that is now close to two years old. The commodities were not fully estimated in the original estimate, but included many factored (estimated) items"⁵⁴ (Black & Veatch, 2010, p. 10-2). In addition B&V stated that "SCS has also advised that the quantities were developed earlier in the conceptual design and advised that updates have been made to the cost estimate without the basis of quantity takeoffs" (Black & Veatch, 2010, p. 5-31). B&V recommended that a new project cost estimate be developed using new equipment pricing and quantity takeoffs if there was time before certification to do so (Black & Veatch, 2010, p. 10-5).⁵⁵

⁵⁴ A cost estimate can be developed using a detailed accounting of all equipment and commodities, or can be developed using a factoring approach or any combination thereof. A factoring approach relies on knowing the cost of an individual component or system and then using industry accepted scale-up factors to adjust the cost of the component or system as required.

⁵⁵ B&V also noted that "[a] detailed review of the cost estimate was beyond the scope of this review, as was assessment of the ranges of accuracy for the various cost estimate components...As such the overall appropriateness of the level of contingency from an independent point of view cannot be assessed." (Black & Veatch, 2010, p. 1-11.)

Following the B&V recommendation, SCS noted that it "reviewed the project cost estimate within the first quarter of 2010 to identify the associated risks and develop a risk mitigation plan." (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-19.)

Engineering Schedule: Recommendations were made to resource load the engineering schedule and develop a progress measurement to track engineering progress which B&V found lacking in SCS's then current schedule (Black & Veatch, 2010, p. 5-27). B&V noted that "the use of manpower loading of engineering schedules can serve as a reference for the lead engineers and as an early indication of potential issues in engineering early to project management" (Black & Veatch, 2010, p. 1-10). A recommendation was made to list the vendor design submittals that were required to support SCS design inputs in the Project schedule. This recommendation was made to create a transparent expectation on when vendor documentation is needed even before a contract is placed. This sets expectations between vendor document submittal and SCS engineering in the planning phase of the project (Black & Veatch, 2010, p. 5-28).

Following the B&V recommendation, SCS reported that it would implement an engineering progress measurement system and that was done. SCS also reported that it would include a more detailed list of engineering deliverables, which were eventually added as needed. (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-6.) The progress measurement that was ultimately used to measure engineering progress is discussed further in Section 9 of this report.

In response to the B&V recommendation, SCS reported that it was defining the "need dates" for vendor documentation in each vendor inquiry in a "document submittal schedule." (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-17.)

Schedule and Project Controls: B&V observed that an overall schedule margin or float had not been included in the project schedule. The schedule was noted by B&V to be tight and, without overall margin or contingency, the Project would be susceptible to unplanned or unexpected schedule events (Black & Veatch, 2010, p. 1-10). The constraints for start date and end dates dictated the aggressiveness of the schedule and SCS noted that these project constraints had precluded the ability for SCS to include margin in the project schedule to account for delays and unexpected issues (Black & Veatch, 2010, p. 1-9). Recognizing that the Project was constrained by a fixed start date and a fixed end date, B&V recommended that SCS evaluate the impacts to the Project if schedule overruns or delays were to occur, and to consider contingency plans in such cases (Black & Veatch, 2010, p. 1-10).

B&V also noted that SCS should develop a progress measurement procedure containing guidelines for the home office and construction, along with a scheduling guideline.

Following the B&V recommendation, SCS acknowledged that the schedule was constrained by start and end dates and reported that it would make an attempt to build float into the project schedule by accelerating the EPC activities as much as possible during the project execution. (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-18.)

Schedule Resource Loading and Progress Measurement: B&V noted that “SCS does not typically use manpower loading for engineering activities and was not planning to do so for the Kemper Project” and that “[i]ncluding manpower loading for engineering should help establish goals and expectations for engineering as well as facilitate analysis of staffing and resource planning throughout the course of the Project” (Black & Veatch, 2010, p. 1-10). B&V also observed that there were no procedures or guidelines observed for progress measurement for engineering or procurement. SCS noted that quantity tracking would be used to monitor construction progress during the construction phase of the Project (Black & Veatch, 2010, p. 1-10).

In lieu of manpower loading, SCS reported that engineering progress would be measured at the “level of effort” activity level for each drawing type. (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-6.) BREI confirmed that this level of effort progress measurement was implemented. The implementation of the procedure and validity of the information that was ultimately reported from this procedure is discussed in Section 8.2 of this report.

Progress Measurement: The review of the draft SCS project controls procedure PC-02⁵⁶ indicated that the procedure is generally consistent with industry standards, but did not include a procedure for progress measurement (Black & Veatch, 2010, p. 9-5).

SCS reported that an engineering progress measurement procedure was currently under development. (SCS, Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness, 2010, p. 2-6.) BREI confirmed that this procedure was ultimately issued and was implemented. The implementation of the procedure is discussed in Section 8.2, below.

Conclusion:

B&V concluded that the Kemper Project team was well prepared to begin the detailed design phase of the Project and that its procurement processes were in place to carry out the procurement phase of the Project. However, it also made certain findings of concern and noted that certain recommendations should be considered to strengthen the project execution phase. Many of these findings and recommendations were well-founded and, in fact, were independently recommended for implementation during BREI’s due diligence effort in 2011.⁵⁷ These included:

- The aggressiveness of the construction schedule.
- The absence of schedule contingency which could make the Project subject to schedule overruns.
- The lack of manpower loading⁵⁸ in SCS’s detailed engineering schedule; B&V recommended the development of better procedures for measuring engineering and procurement progress.

⁵⁶ This SCS procedure (PC-02) establishes the process for the development and implementation of a project schedule for Southern Company Generation E&CS and defines its use in development of earned progress curves. The weakness identified was that the procedure did not explain how progress would ultimately be measured.

⁵⁷ BREI was made aware of the B&V Readiness Report in September of 2013.

⁵⁸ “Manpower loading” or “resource loading” is a technique used to assign man-hours to tasks in a baseline schedule. When tasks are completed, these man-hours are earned against the baseline plan. This allows for a project team to measure progress against a plan based on milestone completion. When the measurement indicates that progress is less than the plan, management can react by assessing the cause and taking corrective actions.

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- The cost estimate for the Project lacked fully estimated quantities for bulk commodities and in some cases employed outdated prices.
 - The schedule was under development assuming that the inadequacies noted would be addressed in future schedule revisions.

SCS implemented some but not all of the B&V recommendations. It elected not to directly resource load the project schedule using the capabilities included in the Primavera software package. As BREI notes in Section 8.2, SCS performed resource loading and earned value measurement separately from the project schedule in an elaborate Excel spreadsheet that was developed for this purpose. The effectiveness of its implementation is discussed in Section 8.2.

6.2 EDWARDSPORT LESSONS LEARNED

Starting in the fourth quarter of 2010, MPCo and SCS representatives made site visits to the Duke Energy Edwardsport IGCC project⁵⁹ site and held phone conversations with the Edwardsport project team to gain insight on lessons learned from the Edwardsport IGCC project. Cost and schedule-related information resulting from those contacts was conveyed to Company management in multiple presentations. There was a series of four presentations that were made to MPCo and SCS management with the first made in October 2010 (SCS, Presentation: Edwardsport Debrief, October 21, 2010), the second in January 2011 (SCS, Edwardsport Debrief, January 25, 2011), the third in February 2011 (SCS, Presentation: Edwardsport – Plant Ratcliffe Comparison, 2011) and the last made in October 2011 (SCS, Presentation: Edwardsport Visit (October 13, 2011).

As part of the first presentation on October 21, 2010, it was communicated to MPCo management that [REDACTED]

[REDACTED]

[REDACTED]

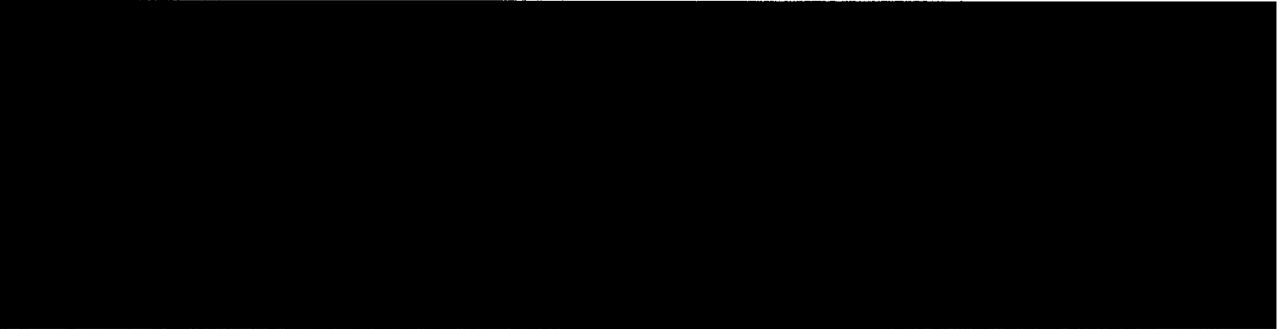
[REDACTED]

[REDACTED]

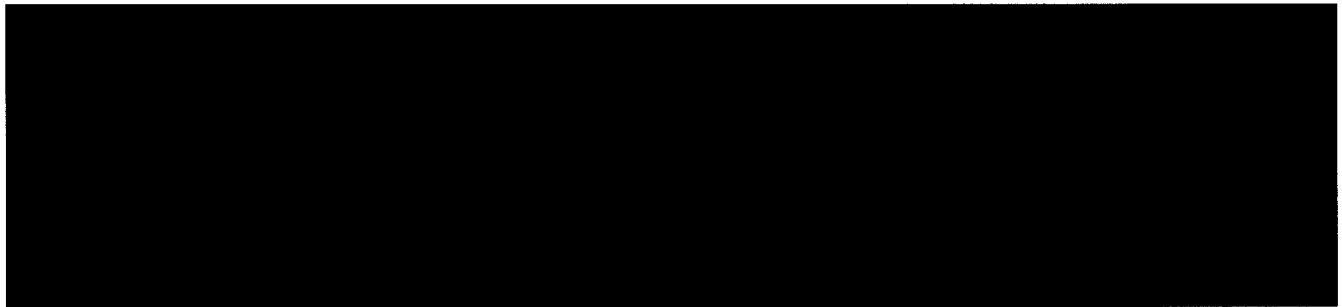
The MPCo/SCS presentation made in January 2011 concluded that there were no valuable comparisons to make between the two projects due to different engineering approaches, different FEED timing, different infrastructure and regulatory environments. It was concluded that “[t]he scope changes that happened at Edwardsport are not applicable to Kemper” and “[t]here is nothing we have seen that warrants any further detailed comparisons of the two projects.”

⁵⁹ The Edwardsport Coal IGCC project is a 618MW project built by Duke Energy in Edwardsport, Indiana. A CPCN was issued by the IURC in November 2007 based on an original price tag of \$1.985 billion. Construction began in 2008 and as engineering and construction proceeded, cost increases became apparent. The IURC approved a revised estimate of \$2.35 billion in January 2009. Project costs increased further and in November 2009, Duke Energy requested IURC approval for a revised cost estimate of \$2.88 billion. It was reported in May 2012 that Duke Energy estimated current plant costs at \$3.3 billion. An agreement was reached between Duke Energy and IURC in May 2013 to cap project costs at \$2.595 billion. The Edwardsport IGCC project declared “commercial operation” in June 2013 and has had continuing operational problems.

The presentation that was made on February 4, 2011, included a side-by-side comparison of the two projects which illustrated that the projects employed different technology and employed a different contracting approach. The take-aways from that presentation were similar to the take-aways from an earlier October 2010 presentation on the same subject, citing:



In the last presentation made on October 13, 2011, the SCS staff communicated the following Edwardsport lessons learned to SCS management:



At the time of these reviews, SCS apparently believed that, based on its FEED study, the knowledge gained at the Wilsonville PSDF and SCS's project execution capability (based on multiple combined cycle and scrubber projects) that SCS had addressed or would overcome these challenges, and that the Project would not face the same problems.

Conclusion:

Like the decision to hire B&V to conduct an assessment of the readiness of the Project, the action taken by the Kemper Project team to engage in discussions with the Edwardsport team was a reasonable approach to gain understanding the issues faced by the Edwardsport project team. The intent was to understand and apply the lessons learned to the Kemper Project. Based on its interviews of the Project team and MPCo senior management, BREI is of the opinion that SCS/MPCo fully understood the issues that the Edwardsport team faced.

Irrespective of the fact that SCS and MPCo discounted the relevance of the Edwardsport project experience to the Kemper Project, the SCS and MPCo teams appeared to learn some lessons from the Edwardsport visits and took actions to apply them. [REDACTED]



[REDACTED]

There were also lessons that could have been learned from the Edwardsport visits but that apparently were thought not to be applicable to the Kemper Project. The most significant issues which appeared to be common to both Edwardsport and the Kemper Project were those related to the [REDACTED]

[REDACTED]

[REDACTED]

The Kemper Project team did not appear to evaluate this option in great detail until after March 2013. When this topic of discussion was raised in prudency interviews with Ed Day (former President, Chief Executive Officer of MPCo, formerly Senior Vice President of Engineering and Construction Services at Southern Company Generation) and Thomas Anderson (former Vice President of Generation Development at MPCo), they indicated that their opinion at the time was that [REDACTED] would have lowered expectations and further exacerbated cost and schedule issues. This decision was ultimately made without the benefit of a detailed analysis such as an integrated cost and schedule forecast and scenario planning.

6.3 MPCo INTERNAL READINESS AUDIT

In addition to the B&V audit and the Edwardsport lessons learned, MPCo and SCS conducted a separate internal audit in December 2010 which focused on determining whether SCS and MPCo had sufficient internal procedures and processes to manage the Kemper Project. The audit also identified and highlighted several key risk factors including:



⁶⁰ The MPCo FEED effort may have been more comprehensive than the FEED completed by Edwardsport. However, the level of contingency that existed on the Kemper Project did not leave much room for scope growth and FOAK design issues.

7.0 EXTERNAL DUE DILIGENCE

As noted earlier, BREI was commissioned by the Staff in February 2011 to perform an independent due diligence review of the Kemper Project, to file a report and develop an on-going monitoring plan. Later, in 2012, after MPCo announced significant cost overruns, the Staff commissioned a review of and report on MPCo's cost estimate and project schedule. The following sections provide details of these reviews.

7.1 BREI BASELINE DUE DILIGENCE EVALUATION

When BREI was retained by the Staff in 2011, it conducted an overall independent engineering due diligence evaluation to baseline the status of the Project. BREI's scope of work included the review and analyses of the technical and financial aspects of the Project and lignite mine including engineering and design, procurement and construction, mine development, cost estimates, schedules, contracts, permitting, and accounting procedures. The lignite mine development, operating plans and cost forecasts were reviewed independently by Boyd, and the Project's regulatory accounting policies and procedures were reviewed independently by Larkin. The BREI team also identified Project issues and developed a recommended monitoring plan for the project execution including engineering, construction, start-up, and performance test monitoring. This effort was based on a detailed review of the information provided by MPCo in response to BREI's RFIs and requests in meetings, during the period March through November 2011. BREI's baseline findings relevant to this prudence review included the following:

Technology: BREI raised concerns about the TRIG technology at the commercial scale in the report and key points are summarized below:

- Scale-up of the TRIG gasification process including dry syngas cooling, particulate filters, and pressure let-down/solids (ash) removal systems represents the single largest technical challenge. Operation and reliability have not been demonstrated at the commercial scale required for the Project. BREI recommended that MPCo develop a methodology to identify the potential problems and their causes that could be experienced with this FOAK technology, and that contingency and mitigation plans be developed which could be implemented should problems be experienced.
- The DongGuan project, the planned first commercial TRIG IGCC implementation, was delayed and has not been built. As a result, information with regard to the scale-up and operations of the TRIG gasification process was not available. BREI opined in the report that based on the limited information provided, a 2012 completion date at DongGuan would be hard to achieve as both the Kemper and DongGuan projects were at a similar stage of completion. That delay had limited the value of any initial operating data in validating the Kemper Project design and consequently failed to reduce the scale-up risk of the Kemper Project as was originally planned.⁶¹

⁶¹ BREI noted at the early stages of its involvement that MPCo had planned to build from the lessons learned from a TRIG IGCC installation in DongGuan, China. BREI later noted that the Kemper Project was not likely to learn from any lessons of the DongGuan project because it was not sufficiently ahead of the Kemper Project, and it appeared to have stalled.

Contracts: Below is a summary of BREI's findings on project agreements:

- BREI reviewed the EPC agreement between MPCo and SCS and noted that SCS would be providing these services to MPCo "at cost" without fee. However, the agreement does not contain a not-to-exceed price cap or guarantees for scheduled COD, IGCC plant thermal performance, or plant availability. The EPC agreement contains no liquidated damage provisions, thereby exposing MPCo to additional costs should SCS fail to meet the required May 2014 COD, or should the TRIG gasifier fail to meet its performance or availability targets.
- SCS has in turn let multiple sub-contracts for process engineering support, technology licensing (for key process technologies) and construction services. BREI reviewed key sub-contracts with respect to their commercial terms, guarantees, liquidated damages, liability limits and other pertinent factors. Of most significance is the KBR Engineering and Ancillary Support Services contract. KBR is responsible for the detailed design and engineering for the gasification process and gas cleanup blocks. While the contract is a fully reimbursable time and material based contract, there is a "not to exceed" price cap that cannot be surpassed without the development of a mutually agreed upon change order. In addition, the KBR contract contains customary liquidated damage provisions for its failure to meet certain schedule milestones. However, as co-developer of the TRIG gasifier with SCS, KBR has no guarantee or liability obligations for the performance of the gasifier, including lignite to syngas conversion, efficiency, or syngas production rate.

Schedule: The following summary presents BREI's observations about the September 2011 baseline schedule which was being used by the Project team:

- BREI determined that the September schedule is not a fully developed or integrated baseline schedule.
- BREI believes that the key metrics and performance indicators utilized in the schedule need to be adjusted and validated for accuracy and consistency with the baseline schedule plan.
- MPCo's Earned Value Management System needs to be examined in detail and possibly expanded to include all phases of the Project, specifically, procurement to integrate actual construction work in progress (CWIP) which should be incorporated into the monthly progress reporting process.
- The CO₂ pipeline schedule shows substantial negative float (i.e., an activity that is behind schedule). Additional review of the status of this activity is required.
- A more detailed analysis of the schedule to develop an accurate critical path is recommended. This analysis should include the integration of engineering, procurement activities, construction, and start-up. This integration is not apparent in the schedules that BREI has reviewed.
- It appears possible that engineering may need to be accelerated to assure that engineering progress will not delay construction. This needs to be evaluated further with corrective actions developed, if necessary.

Schedule Resource Loading: BREI reviewed the overall schedule logic and activity durations. Both the logic and durations appear appropriate for a project of this magnitude. However, of significance is the fact that the project schedule was not yet resource or commodity loaded (i.e., craft man-hours or commodity

installation such as linear feet of pipe or cubic feet of concrete to be installed, etc.) which is unusual for a project of this magnitude and complexity. Without resource loading, it is difficult to confirm the correctness, on a task specific basis, of the assigned task durations or the schedule logic. SCS stated that it tracks progress through a separate process, not through resource loading of the project schedule.

Project Cost Estimate: BREI received a detailed project cost estimate from MPCo in April 2011, and reviewed the document for accuracy and omissions in comparison with the summary level estimate that was used in the certification proceedings. BREI has determined that there are several concerns regarding MPCo's ability to complete the Project at this level of expenditure considering MPCo's projected project craft and engineering labor hours, and the level of contingency included in the MPCo estimate. BREI considers the total field craft labor hours to be low for a project of this size compared to other projects with which it is familiar, and considering the FOAK nature of the TRIG gasifier. The total contingency for the Project is also below what would be expected for a project of this nature, and the cost estimate does not include any indication of overhead and profit costs for the general contractor or specialty contractors that will perform the construction of the Project. Additionally, there is the possibility of increases in the estimated bulk material quantities since engineering is only 51% complete.

Conclusion: BREI found that there were several areas, including status of engineering completion and an aggressive construction schedule, which may impact both the project schedule and cost estimate. BREI recommended that the status in these areas should be monitored closely as the Project progresses to determine whether MPCo needs to develop contingency or work-around⁶² plans, should delays or the need for significant engineering modifications be identified.

7.2 BREI INDEPENDENT PROJECT SCHEDULE AND COST EVALUATION

BREI was tasked by MPUS in May 2012 to perform an independent review of the project schedule and project cost estimate after cost overruns were first announced by MPCo.⁶³ BREI issued a report titled "Independent Monitor's Project Schedule and Cost Evaluation" in November 2012, thirteen months after the initial due diligence review was completed. BREI concluded the following:

Completion Status: During the audit, BREI found that "the Project had achieved an engineering/design completion status of 87% and a construction completion status of 30%" (BREI, 2012, p. 4).

Baseline Cost Estimate: BREI developed a baseline cost estimate using SCS's May 11, 2012, cost outlook data, which was presented in the September 2012 monthly monitor's meeting (reflecting status through July 31, 2012). This data included additional procurements, materials quantities, installation unit rates, labor rates, engineering, indirect cost, and other costs. Appropriate contingencies were developed based on project status and applied in areas where risk remained. Cost category confidence levels were developed and a statistical analysis was conducted to estimate the most probable completion cost using Monte Carlo

⁶² "Work-around" is a term used to describe a new plan to circumvent or overcome a problem in the scheduling of and executing project work. It is a means of overcoming issues that may arise during a project.

⁶³ In April 2012, MPCo advised that it could no longer meet the \$2.4 billion cap, and that its "current view" of the Project's capped cost would be \$2.76 billion.

statistical risk analysis methods. BREI's estimated baseline cost range for the Kemper Project was \$3.0 billion to \$3.15 billion, or a variance of approximately 7% to 8% above MPCo's then current estimate of \$2.88 billion, which is also the MPSC's hard cost cap. The baseline cost range was based on a 90% level of confidence. (BREI, 2012, p. 4). This estimate was contingent upon MPCo's success in meeting the May 2014 COD.

Estimated Completion Date: BREI executed two independent critical path and schedule risk analyses to determine a most probable completion date and to validate its findings. One analysis focused on the critical path schedule developed by SCS. The other analysis used a schedule that was developed independently by BREI. BREI identified completion dates with confidence levels at 20%, 50%, and 80% using Monte Carlo risk analysis in Primavera P6. Below is summary:

Completion dates with confidence levels⁶⁴ at 20%, 50%, and 80% are identified in the table below. Based on the completion date evaluation, it was BREI's opinion that the most probable completion date would be December 20, 2014, based on an 80% confidence level. BREI conducted a similar Monte Carlo analysis of the SCS schedule with completion date estimates as defined below. (BREI, 2012, p. 5).

Confidence Level	Estimated Completion Date
20%	11/06/2014
50%	11/29/2014
80%	12/20/2014

Estimated Project Delay Costs:

Based on the indirect cost data provided by the Company, BREI estimated that a project schedule overrun allowance of \$8.0 million to \$12.0 million per month would cover the cost of additional construction management, construction equipment and operators and other associated indirect cost items, depending on when the delay occurs during the construction ramp-down. It was estimated that an allowance of \$3.0 million to \$5.0 million would cover additional costs resulting from an extension during the start-up phase that goes beyond the anticipated project completion date to cover the cost of additional staff, stand-by construction labor, and materials. (BREI, 2012, p. 5).

Conclusion:

A summary of BREI's findings follows:

Through the course of BREI's monitoring of the Kemper Project and attendance at the monthly independent monitor's site meetings, as first reported to MPUS following the August 2011 site meeting, and as verified through this evaluation, BREI determined that SCS, in the execution of the Kemper Project, was not utilizing

⁶⁴ The confidence levels presented in the analysis represent the likelihood that the Project will achieve the indicated completion date. For example, a 50% confidence level indicates that the Project has an equal chance of being completed early as it has in being completed late.

some basic project management and project controls tools and techniques that are available and customarily used in the industry for a project of this magnitude. Although SCS has such tools available within its corporate tool kit of Project Management Procedures, SCS has advised that it has opted not to utilize several of its standard corporate procedures for the Kemper Project. In addition, these early project decisions appear to have made it difficult at the present stage of the Project for SCS to effectively monitor, track and manage the logistics of complex tasks such as pipe spool fabrication, and installation. (BREI, 2012, p. 7)

In November 2012, MPCo was forecasting a project cost estimate of \$2.88 billion and a COD of May 2014. At the same, BREI completed the cost and schedule analysis and concluded that the baseline cost range for the Kemper Project was \$3.0 billion to \$3.15 billion for the capped portion of the Project (based on a 90% level of confidence) and a range of CODs from November 2014 (50% confidence level) through December 2014 (80% confidence level). Based on its findings, BREI made specific recommendations to SCS, MPCo and MPUS to resolve issues and mitigate risks identified.

8.0 PROJECT APPROACH AND EXECUTION

BREI evaluated the following functional areas with regard to MPCo/SCS's project approach and execution. These fall into six categories as follows: (1) project contracting approach, (2) project scheduling, project cost monitoring and controls, (3) engineering and design, (4) procurement, (5) construction and (6) processes and procedures.

8.1 PROJECT CONTRACTING APPROACH

In 2009, in MPCo's certificate petition for the Kemper Project (Docket No. 2009-UA-14), Kimberly Flowers described MPCo's planned contracting approach in her direct testimony:

The project will ideally be bid on a lump-sum basis and performed by an independent contractor. This contracting arrangement places the least amount of risk on MPCo. The ability to contract the work in this manner, however, requires that the engineering for the work included in the inquiry package be substantially complete and that enough time be provided for the materials or equipment to be manufactured and for the construction activities to occur within the given schedule. If the engineering cannot be completed and/or if the available time frame to complete the project is short, then alternate contracting methods, which place more risk on MPCo, must be utilized.

When the Commission's Order was issued, schedule issues had already begun to challenge the Kemper Project team. MPCo anticipated that the MPSC certification would be granted by late 2009 or early 2010, which would have allowed for a total of 4.5 years for the implementation of the Project. However, with certification taking place in May 2010, six months later than anticipated, only four years were then available to implement the Project and meet a May 2014 COD. The May 2014 COD was driven by many factors including, most importantly, the \$133 million 48A Phase I Investment Tax Credit established by the Energy Policy Act of 2005 that required a COD no later than May 11, 2014. MPCo's decision not to move the COD at the time of certification in order to attempt to preserve the tax credit resulted in a compressed four year Project implementation schedule. As a result, it was decided to kick off the Project by starting construction

at roughly the same time that the detailed engineering design and procurement was started in order to meet the requirements of the compressed EPC schedule.

During BREI's interviews with the MPCo and SCS key Project staff, it was learned that MPCo revised the plans described above by Ms. Flowers due to the schedule constraints and the fact that detailed engineering design would not be sufficiently advanced to support firm lump sum bidding of construction contracts. Instead, SCS became the general engineering, procurement and construction contractor,⁶⁵ and developed a contracting plan based on obtaining firm contracts for as much scope as possible with the remainder being handled on a reimbursable time and material cost basis. Therefore, the basic contracting strategy for the Project has been to execute construction via a series of contracts with multiple contractors. This has been necessary due to the size of the Project, the demand for craft labor, the lack of detail design at the time construction began, and the desire to provide Mississippi companies with the opportunity to participate in the procurement and construction of the Project.

Conclusion: Given the schedule constraints for the Project and the Commission's protective measures for ratepayers, this was a reasonable approach. After the idea of an overall lump sum EPC contract was abandoned, it is unlikely that a different overall contract strategy would have improved the situation since the late start and just-in-time engineering process would still have impacted the Project. Once the decision was made to compress the schedule to meet the May 2014 COD, SCS had little choice but to adopt the strategy described above due to the FOAK nature of the Project.

8.2 PROJECT SCHEDULING, PROJECT COST MONITORING AND CONTROLS

Integrated Baseline⁶⁶ Schedule: The development of an integrated engineering, construction and procurement schedule is one of the most important activities undertaken by a project management and controls team following a notice to proceed. The accepted industry practice is to develop an integrated resource loaded project schedule within 60 to 90 days following the project notice to proceed. An integrated resource loaded project schedule allows for the tracking of delays and progress measurement. It is a tool that can be used for critical path analysis and to understand how delayed task completion affects other activities. Resource loading of the schedule, specifically with bulk quantities (piping, concrete, electric cabling, etc.), and required construction craft labor man-hours allows the project management team to assess the adequacy of activity durations in the baseline schedule and to assess project progress against the baseline. An integrated resource loaded project schedule is the instrument which guides the management

⁶⁵ As previously noted, there was no formal engineering, procurement and construction contract between SCS and MPCo. Instead, the existing SCS services agreement with MPCo is the relevant contract for the Project. As such, it does not have specific guarantees or penalties for failure to perform including, most importantly, technical and project performance, cost and schedule guarantees. However, the Commission via various orders, including the Final Order on Remand, required cost caps on the Project and that certain operational performance parameters be measured, reported and achieved, including availability factor, heat rate, lignite heat content, and by-product revenue, which in BREI's opinion mitigate many of the shortcomings in the SCS/MPCo contracting plan. These measures protect the ratepayers' interests from cost overruns and operational risks.

⁶⁶ A baseline schedule defines the plan for work activities, schedule logic and associated resources (labor hours) for each task or groups of tasks to support the project plan. The baseline schedule is used by the project team as a benchmark that is used to measure actual project progress and performance against the baseline.

of labor resources, allows management to set priorities in completing various tasks and evaluate actual versus planned progress. The longer a project is executed without this tool and the information that it provides, the less ability the project team has to make informed decisions based on the project's status and progress, measured both on an absolute basis and against the baseline schedule.

An integrated project schedule ties tasks between disciplines: engineering to procurement, procurement back to engineering (in the case of vendor drawings), procurement to construction and construction into start-up and commissioning. The ability to issue critical drawings needed for construction is typically constrained by engineering progress and the availability of vendor drawings and documents. Without an integrated project schedule, the critical path for the project becomes fragmented into each separate project phase (engineering, procurement, construction, start-up and commissioning).

The SCS procedure for project scheduling (PC-02) calls for project schedules to be integrated among the various engineering disciplines and among the various phases of the project. The SCS procedures are vague with respect to the timing of the issuance of the first, or "baseline," schedule. However, they do identify that period to be in the pre-planning stages of the project, and when the project manager deems it necessary to do so. SCS procedures also call for manpower and bulk quantity (e.g., concrete, steel, piping, cabling, etc.) resource loading in the integrated engineering and construction schedule.

At the time of the Project's kickoff, the Project team had an engineering and procurement schedule (which included major procurement activities), a separate construction schedule, and also a separate testing, start-up and commissioning schedule. Specific engineering deliverables were not included in the engineering schedule. A more "packaged approach" was used, allowing for multiple design deliverable release points for bidding purposes and performing the work. It was not until September 2011 (1.5 years after the start of detailed engineering and design and the start of construction) that a partially integrated engineering, design, procurement, construction and testing, start-up and commissioning "baseline" schedule was available for the Project team to oversee and manage the Project. However, even this schedule was not kept up to date and had to be re-baselined several more times.⁶⁷

Schedule Float: It is common industry practice to employ schedule float,⁶⁸ especially when the project is challenging. The Kemper Project was widely accepted to be a challenging project due to its magnitude, FOAK nature, and an aggressive schedule. The Project team was aware that the project start date had slipped by six months while the COD had not. As stated in the B&V Readiness Review, the project schedule at the time of review (prior to October 2010) had no contingency. A recommendation was made by B&V at that time to include some schedule contingency. SCS responded by stating that schedule contingency was inherently included in the project schedule since it was possible to work seven days per week and overtime as necessary to meet the schedule. SCS responded to the B&V report that it would make an effort to expedite

⁶⁷ The Project schedule was re-baselined in August 2012. (It should also be noted that the Project has been re-baselined three additional times, in April 2013, July 2013, and again in November 2013, which are outside of the scope of this review).

⁶⁸ "Float" is a contingency which has been added to the duration of individual activities to account for unknowns and delays that may occur when completing an activity.

the engineering, procurement and construction of the Project to create schedule float during the execution phase.

Schedule Resource Loading: A decision was made at the project level to not directly resource load the integrated project schedule in Primavera P-6.⁶⁹ SCS's position on this issue has been that it was in fact loading the schedule by the use of a non-integrated Excel spreadsheet and that approach allowed it to more expeditiously resource load its schedule. However, with this approach, the resource loading was not directly linked to or integrated with the P-6 schedule. This implementation deficiency prevented the Project team from monitoring the status of the Project in real time and from timely realizing the changing commodity requirements and manpower needs and their effect on the schedule. This resulted in significant lags and delays in understanding how commodity growth, manpower and schedule activity duration needs were being affected by engineering development. The inadequacy of resource loading in the integrated P-6 schedule ultimately did not allow the Project team to "see" the labor requirements which it needed to meet to maintain schedule and cost targets during the period of 2011, 2012 and 2013. Start-up integration took place much later in the Project, which is customary.

Earned Value Measurement: Earned value measurement⁷⁰ (EVM) is a tool used to measure the performance and progress of a project on a periodic basis. Implementation of a performance measurement system is critical since it allows for the measurement of and communication of each portion of the project's progress to project management. Normally, an EVM system is defined at the start of a project. Activities in the project schedule are assigned planned resources (i.e., man-hours, dollars, quantities). In a deliverable based EVM system, when a particular activity is completed, the project earns these planned resources. When the amount of earned resources is summed in a given month and divided by the total planned resources for a project for that time period, the project's progress or percent complete is determined. The percent complete or progress rate can be determined on a system level, by contractor or by construction discipline depending on how the schedule and EVM system is structured. The system provides for a methodical way to identify where there may be problem areas in a project so that management can respond to issues as they arise and make adjustments. MPCo, SCS and KBR procedures require measurement of performance based on an EVM system. However, as mentioned above, B&V noted in the October 2010 Readiness Review that a procedure for how to implement an EVM system did not exist and should be developed.

At the inception of the Project, there were no written instructions or procedures on the EVM system for either SCS's engineering or construction schedules. SCS ultimately implemented an EVM system which was based on types of project deliverables. However, EVM for engineering was more of a level of effort task⁷¹

⁶⁹ Primavera is scheduling software which is licensed by Oracle. It is the leading industry standard scheduling software used by power and process industries. The software has the capability to create project schedules, plan and track resources such as costs, labor hours and construction commodity quantities and conduct schedule and cost scenario analysis.

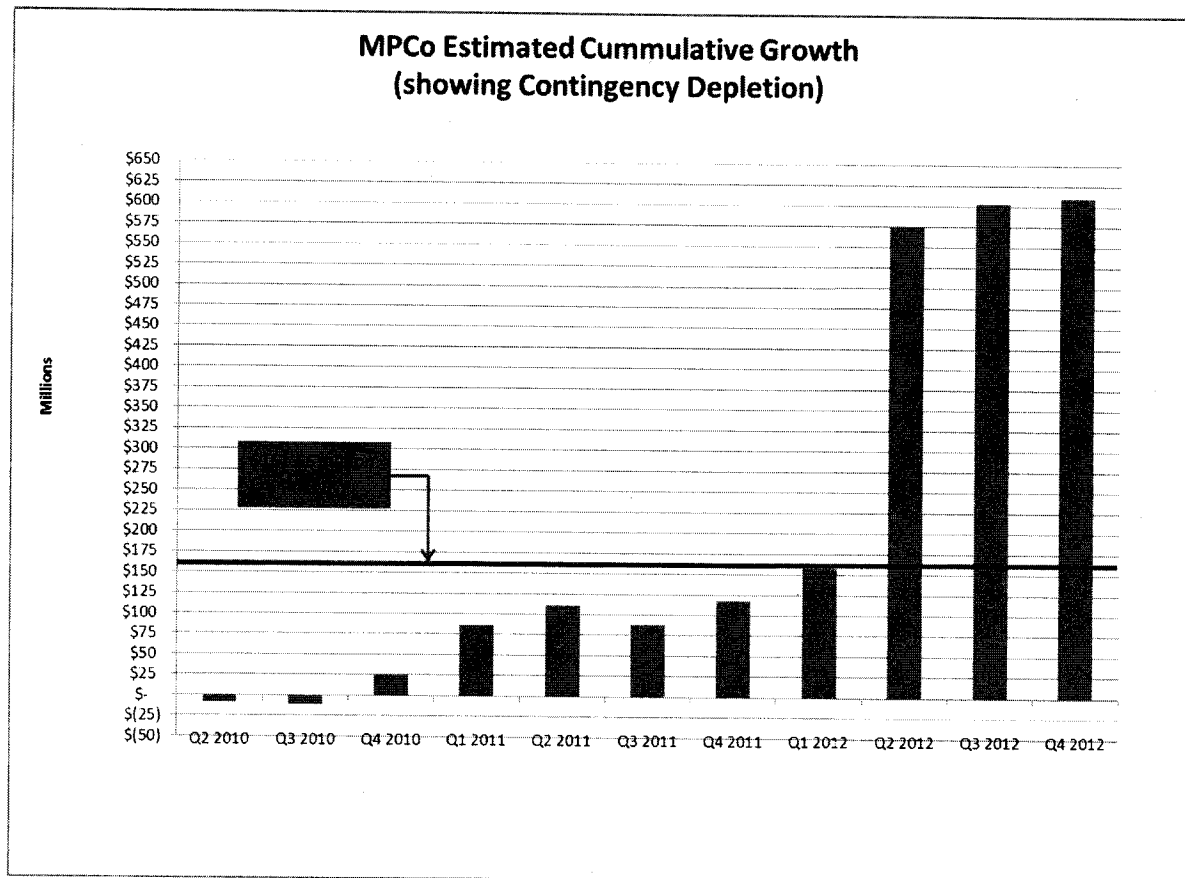
⁷⁰ EVM is a project management technique for measuring project performance and progress. It has the ability to combine measurements of scope, schedule and cost in a single integrated system. It is able to provide accurate forecasts of project performance problems, which is an important metric for project management.

⁷¹ A level of effort task is a support type of activity that must be done to complete other project work activities. It usually consists of short duration repetitive activities that continue over long periods of time.

rather than a deliverable based task. While engineering progress percentage was measured, it was not measured against a baseline planned percentage. This meant that before a baseline schedule and progress plan existed, progress rates could not be measured against the plan. This was a result of the fact that the schedule and progress measurement were independent of each other instead of being integrated.

SCS Construction implemented an EVM system and reported on the percent complete of the construction of certain portions of the Project. However, there were apparent errors in the implementation of the EVM system. The percent complete for "level of effort" tasks associated with administrative support was earned based on actual man-hours expended when it should have been earned based on planned man-hours. By measuring these tasks in this way, the system has the potential to misrepresent (overstate) the actual percent complete. The earning method for percent complete for the heat recover steam generator (HRSG) contract and steam turbine contract, which were implemented on a fixed price basis, also had flaws which incorrectly measured percent complete. The method for earning man-hours for these contracts should have been based on the planned man-hours or the hours included in the baseline schedule. Instead, SCS re-forecasted the required man-hours, and used these re-forecasted man-hours to determine percent complete without re-baselining the schedule. With the system that was employed, it was possible to, and the HRSG did, achieve greater than 100% completion. This error was not corrected until the project schedule was re-baselined.

Quantity and Cost Forecasting: The method for tracking commodity quantities (concrete, steel, piping, cable, etc.) created challenges in the ability to forecast their impacts on costs, schedule and progress measurement. Quantity forecasts were adjusted based on SCS's 3-D model updates and were tracked and reported in total. Up until the second quarter of 2012, the Project team was tracking costs in accordance with SCS procedure "Kemper Desktop Instruction 2.0 – Project Procurement Plan." Project cost forecasting during that period was reported weekly at Kemper Project procurement meetings and monthly production team meetings, as well as, to the IMs on a monthly basis. However, through this period, changes in scope and associated costs were managed and tracked against the original \$2.4 billion estimate until the original contingency account was depleted. As a result, MPCo was not tracking or forecasting a growth in cost, but rather managing the project cost to the original \$2.4 billion cost estimate, losing sight of the underlying cost trends until contingency was depleted. It was not until the second quarter of 2012 that the Project cost was re-estimated based on the latest known quantities from detailed design. The Project's cumulative growth in projected costs as reported to MPCo management is summarized in the chart below.



Project Controls Team: In September 2012 the SCS Project management brought in a new Project Controls Lead with extensive Primavera P6 experience, who, between September 2012 and March 2013, replaced much of the project scheduling staff and Project Controls team with a team more experienced in the use of the Primavera P6 scheduling software.

Risk Management: Risk management is a structured process for identifying risks and assessing the potential consequences of such risks. This typically includes procedures and appropriate measures for identification, tracking, assessment of possible consequences, avoidance, reduction, transfer, mitigation, or prevention of the identified risks. It is considered standard practice within the industry that an initial risk assessment should be conducted at the start of a project, but not later than at thirty percent engineering and design completion, and should be continued throughout the project.

The Kemper Project team employed a risk register at the start of the Project, which was mentioned in the B&V Readiness Review report. The risk register was intended to identify all project risks at the start of the Project. From that point, it was to be continuously updated by adding new risks, modifying existing risks and removing old risks that were no longer an issue. The risk register and mitigation measures were discussed frequently and were regularly addressed by the Project team. The risk management process that was used by the Project team evaluated risks affecting a rolling two quarters in a given period. This method of tracking risks and mitigation measures in the short term was suitable to track "near term" risks but appeared to preclude the Project team from the ability to clearly see longer term potential risks throughout

the life of the Project. Furthermore, the Project team did not complete a fully effective cost or schedule risk analysis to determine levels of confidence in the cost estimates, the schedule dates and the activity durations that were being used. Additional areas of risk which were not fully evaluated, in BREI's opinion, included labor availability and productivity and overall schedule durations and resources. These risk areas were noted in the B&V Readiness Review as risks that should be identified, logged and tracked. Thus, while SCS and MPCo had a risk management process, the effectiveness of its implementation restricted the Project team from seeing the long term risks, which would ultimately affect the project schedule and budget.

Conclusion:

SCS's inability to gauge project progress against a meaningful project baseline schedule was a particular area of weakness for the Project. This was largely due to its failure to develop a fully integrated, baseline schedule until September 2011.

SCS intentionally included no float in the Project schedule due to its compressed nature. It claimed that float was implicitly available in its schedule since the planned work week was only five days and could be expanded to seven days, if necessary.

The inadequacy of the resource loading method used by SCS impaired the Project team's ability to timely see increases in commodity quantities and craft labor requirements and to adjust both the labor requirements and construction sequencing and planning accordingly. Such adjustments were required due both to the increasing bulk commodity amounts and to the delays in commodity deliveries. These factors led to construction management inefficiencies which further delayed the Project and made it more difficult to meet schedule and cost targets during the period of 2010, 2011 and 2012.

The failure of SCS to implement an effective EVM system made it difficult, if not impossible, to accurately determine the completion status of the Project.

SCS's 3D construction model was an inadequate means of forecasting quantity requirements because it did not track requirements by system in sufficient detail and because of a significant time lag between the time when design changes were approved and when they were actually entered into the model.

The decision in September 2012 to bring in a new Project Controls Lead with extensive Primavera P6 experience was a positive development given some of the challenges that were being experienced in this area.

SCS's risk management process was flawed because of its short term focus which prevented the Project team from appreciating the longer term potential risks through the life of the Project. Furthermore, its risk assessments were not comprehensive enough with respect to its cost estimate and schedule.

8.3 ENGINEERING AND DESIGN

During the engineering and detailed design phase, SCS managed the overall engineering and design of the effort. SCS Engineering subcontracted KBR to perform the process design of the gasification island. KBR

worked under the direction of the SCS Gasification Technology group and was responsible for the basic process design of the gasification island including the gas cleanup system process design. KBR also performed the vessel design of the gasification vessel. SCS Gasification Technology group was responsible for the gasifier design and was responsible for the remainder of the detailed design.

Engineering and Design Process: The detailed engineering and design was completed in a 3-D model which was controlled by SCS and reliant on input from KBR for its portions of the scope. The 3-D model was used during the FEED phase of the Project and was continuously updated through detailed design. Quantities were updated every month by SCS and KBR Engineering as the design was entered into the 3-D model and these quantities were supplied to SCS's Project Controls team as engineering proceeded. As noted above, this 3-D model was also used during construction to support construction planning.

During the evolution of the detailed design, SCS conducted numerous Hazard and Operability Analysis (HAZOP)⁷² reviews. One of the HAZOP reviews was an 8 to 10 week review which identified 2,000 action items from the review. Resolutions to these action items were incorporated during the detailed design process.

During the Project, SCS and KBR made an effort to conduct "value engineering" and "cost containment" efforts to reduce the cost of the plant during detailed engineering and design. Layout improvements were made to reduce the amount of solvent (Selexol) volume in the acid gas removal system. SCS eliminated the top level of the combined cycle electrical building by relocating electrical equipment. This resulted in cost savings of approximately \$250,000. During the design of the material preparation area, an alternatives evaluation was conducted using screw conveyors instead of elevators in the material preparation area resulting in savings of approximately \$1.1 million. Utilizing dynamic analysis allowed the reduction of the surge drums by 20% and saved approximately \$400,000.

Engineering and Design Timeline: Based on BREI's interviews with key SCS and MPCo Project staff, the detailed engineering and design phase kickoff coincided with the Commission Order issued in May 2010. However, MPCo advised BREI verbally that it spent over \$38 million after completion of the FEED study and prior to certification. The intent of this effort was to improve the project design, demonstrating the commitment of MPCo to the Kemper Project.

The design basis for the detailed design phase was established from the FEED package and issued in June 2010. The baseline schedule called for engineering to be complete between February and November 2012. Actual completion was between July 2012 and March 2013, a delay ranging from four to fourteen months, with the most significant delays in the mechanical engineering area.

⁷² A HAZOP review is a structured and systematic examination of a process design or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation.

Discipline	Planned Completion	Actual Completion
Process	December 2012	April 2013
Civil/Structural/Architectural	February 2012	Fall 2012
Mechanical	December 2011	January 2013
Electrical	November 2012	March 2013
Instrumentation and Control	November 2012	March 2013

Field construction work was initiated in January 2011. With any large construction project, BREI would have expected to see engineering at a minimum of 50% to 60% complete before the onset of construction. Engineering was reported at about 29% complete at the time, and construction was reported at about 2% complete. This resulted in a just-in-time engineering process for the Project, meaning that the engineering was often completed shortly before material procurement and construction activities. Furthermore, many engineering activities and vendor design documents that are required in support of engineering completion were on the critical path. When delayed, activities that are on the schedule's critical path impact other successive critical path activities, causing a direct impact on the project's completion date. When this is recognized, the construction team must develop alternative construction plans (work-arounds) to circumvent the problem and make an effort to prevent any delays to the overall project completion date. It was recognized that delays in SCS engineering and equipment vendor design information caused the development of construction sequence work-arounds. When recognized the need for additional engineering resources to assist with meeting schedule challenges, SCS subcontracted certain additional work to KBR and subcontracted the detailed design of the coal handling area to B&V.

Design Changes and Scope Growth: Following the FEED phase, there were a few significant scope changes that contributed to the growth in scope and cost of the Project. The first of these was on the ammonia recovery system. The original FEED package assumed that the ammonia system would be designed to meet 99.5% of ammonia purity. During the detailed design, [REDACTED]

[REDACTED] This required an additional process column and associated additional equipment, piping, foundations, cable and supporting infrastructure. The other significant change in the process flow diagrams for the plant was that the nitrogen quantities increased substantially during detailed design, as more and more areas within the coal preparation and process areas were determined to require nitrogen blanketing. A membrane system was initially selected to supply nitrogen based on the relatively small amount of nitrogen required, according to the preliminary quantity estimates which were developed during the FEED phase. The increased nitrogen demand was due primarily to the coal drying system selected, which required significantly more nitrogen than previously anticipated. Additional nitrogen requirements for the purging of the systems were also identified following the completion of the HAZOP review of P&IDs. Due to the growth in nitrogen quantity requirements, the nitrogen supply system design was changed from the membrane system to a much larger cryogenic system. BREI would characterize each of these design changes as scope changes attributable to FOAK designs and considers it unlikely that these issues would be recognized before they were encountered. Only adequate project contingency can address situations like these.

As in the case of many conventional power projects, there were some scope changes as a result of site conditions which were different from those previously assumed. For example, the original FEED estimate assumed a piling depth of 40 feet. The deep foundation design was developed from a geotechnical report (dated May 2009) in support of the August 2009 FEED Package and the certification estimate. Following site work activities and during detailed design, it was determined through pile load testing that a pile depth of 80 feet was necessary. This resulted in a cost increase in piling activities. This was done because the soil conditions were different from those anticipated in the initial design. The compacted fill area had different characteristics than assumed in the original geotechnical report.

Design Change Control Process: Design changes are a normal part of the engineering process. A FOAK project will typically experience more design changes than a conventional project due to the greater amount of unknowns that can arise. These types of changes are typically documented, managed and controlled through a "design change control" process. SCS has a specific design change control process which is titled a "Design Change Notice" (DCN). A DCN log was provided by SCS which showed the design changes that were entered into the system by SCS. However, the details on specific design changes, scope of the design change and the associated impact on the engineering, procurement or construction costs were not always well documented. It is also not known whether the DCN log provided for BREI's review captured all project DCNs. KBR also had a design change control process that it follows which is termed a "Project Deviation Notice" (PDN). The procedure is used on other projects within KBR's control and management. A PDN log was provided by KBR. The log identified a number of project design changes and their associated costs for the increased scope.

A specific KBR PDN was provided showing the engineering and design scope and cost change related to a design change of the ammonia system (ammonia purity was increased). The PDN indicated the cost related to the engineering services scope change as a result of the design change but did not indicate the overall construction cost change and associated commodity increase as a result of this change. Commodity growth was only tracked once the design was entered into the 3-D model.

Impact of Scope Growth on Construction and Construction Planning: In March 2012, as the detailed design became further developed, SCS engineering began to recognize the growth in scope of the BOP equipment and construction bulk quantities (structural steel, piping, cable, instruments, etc.). In addition, vendor documents were sometimes delayed as a result of SCS and KBR design changes and some vendors experienced internal delays, as well. SCS used expeditors in procurement to follow-up with vendors in an effort to obtain late vendor documentation.

Conclusion:

Overall, the Project team's design process was conducted according to industry standards. The Project team conducted the design in a 3-D model which has not only aided the design process but has been used and has contributed to construction planning efforts in the field. The Project team has conducted appropriate HAZOP reviews of the design and has conducted value engineering efforts to reduce the life cycle cost of the Project.

The engineering phase experienced delays which appeared to be mostly due to the FOAK design issues that arose. Where design changes were encountered, and in the case of the geotechnical work, it appears, based

on a review of a sampling of issues, that the Project's engineering team employed reasonable means to resolve the issues. The weakness was that the planning of the engineering phase was not well integrated with the procurement phase. This weakness was exacerbated by the compression of the overall schedule of the Project and the resulting just-in-time engineering. Vendor design documentation that was needed to complete engineering became a critical path activity and influenced project delays. As previously indicated, it would have been beneficial to the Project if SCS had indicated the need for vendor documentation on the integrated EPC schedule and linked the engineering documentation release dates to vendor purchase order placement. SCS had an alternative approach to track the need for vendor documentation separately in individual procurement inquiries and contracts. Since it was not integrated with the schedule, this created challenges. It was also noted from BREI's reviews that late design changes made by SCS and KBR resulted in the inability for many vendors to provide design documentation on time.

Geotechnical risk is inherent in any project. When a site must undergo a lot of cut and fill operations and requires compacting of the structural fill, it is likely that the geotechnical conditions will vary from initial preliminary design assumptions and that the Project team will be required to adequately address the design of the foundations given the change in project assumptions.

SCS and KBR had change control procedures which allowed the Project team to document and approve changes during the design process. Each company employed its respective design change control processes. The weakness of the design control process that was employed by SCS was that bulk quantity growth was not identified when the process designs were changed. As a result, quantity growth was not seen by the whole Project team until the quantities were entered in the 3-D model. For example, the PDN that was reviewed for the ammonia system change indicated only the additional cost of KBR engineering. Its shortcoming was that the design change process did not capture or indicate the total capital cost increase as a result of this design change or indicate an approximate quantity increase for commodities. Given the warning signs from the Edwardsport lessons learned meetings, specifically to [REDACTED]

[REDACTED] Initial estimates on projected quantity increases could have been identified much earlier in the process design phase and then followed by identification of firm quantities in the 3-D model. This would have allowed better cost tracking and adjustment of the construction work plans and progress metrics.

8.4 PROCUREMENT

Procurement is responsible for delivering equipment and materials to the construction team in a timely manner to support the construction sequence as designated in an integrated project schedule.

The procurement process was impacted by overall Project decisions, constraints and by the late engineering completion and the FOAK design. The necessity to begin the construction phase of the Project before an adequate degree of design completion had been achieved placed stress on the procurement phase of the Project. Procurement was immediately required to expedite vendor documents in support of engineering and expedite the delivery of equipment to support the construction activities. Finally, there were also some unique challenges which had to be overcome by fabricators of some of the FOAK components, such as the syngas coolers and the gasifiers.

As was done in the engineering and design, SCS made efforts to contain costs in procurement. As an example, SCS divided the scope of the Coal Feed Lock and Dispense Vessel between two vendors instead of one. This saved approximately \$1.2 million over awarding the work to a single low bidder. MPCo provided an Owner Controlled Insurance Program (OCIP) for certain construction contracts. Through this measure, MPCo provided certain construction insurance coverage to contractors and subs, in lieu of contractor provided coverage. The OCIP enveloped or “wrapped-up” the construction project in a master insurance program and saved approximately \$8.6 million. In an effort to minimize added cost for the procurement of bulk commodities, SCS combined purchases of materials for the Kemper Project with other SCS projects. This process involved purchasing similar commodities in bulk across the SCS network of projects in order to achieve better pricing for that given commodity. Due to the continual increase in commodity pricing, hedges in purchasing structural steel, copper (cabling) and European fabricators were frequently evaluated and executed in an effort to save money which were all positive actions taken by SCS.

As discussed in the engineering section, there were scope additions which were introduced during the detailed design phase. These equipment scope additions had an impact on the procurement process causing additional time slippage as well as additional cost for the Project. Three examples are shown below with associated causes and costs for the added scope:

Samples of Scope Additions

Description	Budget	Bid Price	Delta	Cause
Syngas and Ammonia Scrubbers	\$1,502,074	\$6,978,520	\$5,476,446	The Syngas Scrubbers were added during the detailed design phase with the addition of CO ₂ capture to remove the chlorine as a better method to saturate the syngas with moisture.
CO ₂ Compressor	\$15,817,506	\$21,303,190	\$5,485,684	The increase in costs from 25% to 67% CO ₂ capture was underestimated due to lack of experience with this application at this scale.
Nitrogen System	\$13,590,698	\$43,643,000	\$30,052,302	Substantial nitrogen demand increased after FEED study. Technology changed from membrane based air separation to distillation process. ASU/Start-up Compressors were not in FEED estimate. Liquid Nitrogen Storage was increased.

The project execution plan and sequence of component fabrication and manufacturing were impacted by other iterations and decisions. One such impact was discovered during a surveillance performed at the Andritz Facility. Andritz AG⁷³ (Andritz) was contracted to manufacture and supply the fluid bed dryer along

⁷³ Andritz AG is an Austrian plant engineering group and equipment supply company headquartered in Graz, Austria.

with the associated heat exchangers. Andritz intended to use the services of Suzhou Hailu Heavy Industry Company in Zhangjaigang, China, as a sub-supplier to manufacture heat exchanger tubes for the fluid bed dryers (approximately 270 miles of tubing). During a surveillance visit to the Suzhou Hailu Facility, it was determined that the shop was unacceptable to supply the quality workmanship needed for the welding of the tubes. It was later discovered that the KBR Quality Group had also rejected Suzhou Hailu on two occasions from supplying components to the DongGuan IGCC project. Andritz was instructed to find another supplier, which it did, however the supplier indicated there would be a six month delay in the delivery process. This was also rejected by SCS which instructed Andritz to use the services of multiple suppliers. In order to avoid the threat of liquidated damages in the range of \$3.2 million, Andritz agreed to the original schedule.

Due to major issues with the installation of refractory material by CFI (the manufacturer of the components), CFI was forecasting a six month delay in delivering the gasifiers. SCS placed a dedicated task manager at the facility to oversee the daily work activities. After development of a detailed Level 3⁷⁴ fully resource and commodity loaded schedule and instituting a regimen of daily accountability meetings, the delay was lessened by two months.

The late delivery of the pipe, valves, pipe supports, and especially pipe hangers created major impacts in the sequence of the steel erection in all buildings of the facility, adding labor hours to perform the required work-arounds needed to accomplish the piping installations. These delays were a direct result of the detailed design completion taking longer than scheduled, thereby causing delays in the procurement process for these components. In March 2013, the SCS procurement department had already expanded the pipe fabrication effort to include PCI and Shaw, and it also had established onsite pipe fabrication for small bore, non-code piping.

The shortage in the supply of pipe hangers and pipe supports also became a specific procurement issue which impacted construction and triggered construction work-arounds. The procurement of this equipment was awarded to a single supplier, Lisega. KBR designed and engineered pipe supports for larger pipe components and Lisega was given access to the 3-D model for the remainder of bulk pipe supports. Lisega designed hangers and supports for specific applications and also supplied off-the-shelf type bulk supports. There were 59,000 pipe supports, and Lisega was planning to issue 700 pipe supports per week. Delays in hanger deliveries, and Lisega's inability to match its hanger and support delivery schedule to meet the changing construction requirements, has caused construction work-arounds and delays in installing certain pipe spools. In many cases, piping was installed temporarily using wire ropes and slings until the correct support became available. This level of coordination was not planned for and resulted in construction planning difficulties and subsequent pipe hanging delays. Reliance on one supplier for such a large quantity of pipe supports is now recognized by the Project team as a mistake and a lesson learned.

Conclusion: Due to the late engineering completion and the early start of construction, the procurement process was under pressure. FOAK equipment components placed even more pressure on the procurement process. The scope growth during the FOAK engineering phase translated into increased BOP equipment

⁷⁴ A Level 3 Schedule provides a level of detail necessary to complete the project and also to finalize remaining requirements for the balance of the project with sufficient detail to measure performance.

and commodity costs. In light of this, the procurement team made efforts to reduce costs where possible as the procurement process unfolded. SCS combined purchase of materials for the Kemper Project with other SCS projects to obtain cost savings through common equipment and material procurement. MPCo and SCS periodically evaluated and executed hedges on commodity pricing (e.g., on copper and on foreign-sourced equipment) where both currency and materials costs risk were judged to be significant.

When problems were encountered with FOAK technology components, SCS made an effort to resolve the issues by requiring detailed scheduling and negotiating with suppliers, as in the case of the Andritz fluid bed coal dryer heat exchangers. However, it is BREI's opinion that due to the FOAK nature of the manufacturing process of the gasifiers, SCS should have placed a dedicated full time task manager at the gasifier supplier's facility sooner or even from the onset of the manufacturing process to avoid lost time in the delivery of these critical components.

While there were many good decisions made by the Project team and implemented by the procurement department, the impacts to the schedule delays had already resulted in the loss of time causing additional costs to the Project. However, based on its observations, it is BREI's opinion that the SCS procurement process has not been used effectively for the procurement and delivery of pipe hangers and supports, which are integral elements of the piping systems. The late delivery of pipe hangers and supports, required to complete piping installation, have become a critical path issue in completing the piping installation. The decision to increase the pipe fabricator supply capabilities has only mitigated a portion of the pipe installation delays.

8.5 CONSTRUCTION

The construction portion of the Project progressed from the initial land clearing (cleaning and grubbing) phase in March 2011 to the beginning phases of the mechanical and electrical installations in March 2013. The majority of the underground installations were complete and the major structures were nearing completion at this time. The mechanical equipment installed as of March 2013 was:

- Combined Cycle area 72% complete
- Gasifier area 56% complete
- Gas Cleanup 54% complete

The above-ground commodity installations as of March 2013 were:

- Concrete approximately 100,000 of 107,000 cubic yards
- Cable approximately 1.5M of 11.8M linear feet
- Piping approximately 150,000 of 720,000 linear feet
- Steel approximately 29,000 of 38,000 tons

Based upon the August 31, 2012, baseline schedule, the percent completions as of March 2013 were:

- Engineering/Design 96% against a plan of 97%

-
- Construction 53% against a plan of 58%
 - Start-up 42% against a plan of 47%
 - Overall EPC 58% against a plan of 63%

Total man-hours expended as of March 2013 were 8,968,605 for the total Project.

The major commodity growth during the Project had increased as shown in the chart below:

Major Commodity Growth

Commodity	Unit of Measure	Certification Quantity	Forecast as of March 2013	Delta
Concrete	Cubic yards	50,181	106,960	56,779
Steel	Tons	28,168	37,810	9,642
Plant Piping	Linear feet	605,946	855,957	250,011
Cable	Linear feet	3,218,675	11,860,997	8,642,322

The total construction craft man-hours grew from the certification amount of 5,140,288 to SCS's March 2013 forecasted amount of 10,515,176 to complete the Project, which exceeds a 100% growth rate. All of the above increased quantities and man-hours were being added without a change to the COD of the facility, which remained at May 2014 as of March 2013.

As a point of reference, when the Kemper Project commenced construction, SCS projected a peak labor force of approximately 1,200 craft labor personnel. Currently, there are approximately 5,340 craft laborers on site. Construction labor forces apparently peaked at about 6,540 in August 2013.

Impacts on the construction and installation of equipment from the design phases of the Project are demonstrated by understanding that a typical power/process detail design is developed by designing on a "system/discipline" basis, while the construction/installation process is performed on an "area installation" concept of bulk materials and equipment. As previously explained, SCS started the detailed engineering and design and procurement processes in parallel with the start of construction. With the construction/installation processes beginning at such an early phase and occurring in parallel, difficulties were encountered in issuing and receiving construction ready drawings in sufficient quantities including those specifically required to support the normal construction installation sequence. This issue caused crippling effects to the overall construction execution plan and resulted in the numerous work-around scenarios. This was a contributing cause of the Project's increased costs and schedule delays.

As a result of the normal detailed design progress, design changes were occurring in parallel with, rather than appropriately ahead of construction activities. This did not allow all of the construction activities to be properly sequenced during the construction phase of the Project. As a result, a number of work-arounds were required to be taken by the Project team during construction as it continued to try to meet the scheduled COD of May 2014 while at the same time attempting to reduce costs where it could. As the detail design phase of the Project progressed and its scope grew, the bulk commodities quantities also grew causing a direct increase in the installation craft labor hours. This large increase of commodities and installation labor hours created severe labor congestion and the need for more detailed installation strategies. This was especially true in the piping and electrical disciplines, to mitigate even more losses of schedule due to the congestion of workers in numerous contested work spaces. MPCo and SCS have developed detailed piping and electrical execution plans in an effort to more effectively manage this critical part of the Project.

The project execution plan and sequence of component installations were impacted by numerous other events and decisions. Additional efforts were made by SCS to mitigate the loss of schedule. It has upgraded the second shift responsibilities from a simple support role to a more enhanced and direct role in the installation process. The numbers of craft workers are increasing and longer hours are planned to offset the growth of commodities and associated installation man-hours. Both first and second shifts are routinely scheduled for weekend work activities to compensate for poor weather.

Some of the more challenging impacts to the construction phase of the Project have been the late delivery of specific engineering designs resulting in the late delivery of major equipment and materials. The late delivery of the gasifier had a significant impact on construction in the gasifier area of the Project. The fabrication of the gasifiers consisted of 12 sections on each of the two gasifiers. Major delays were experienced primarily due to an issue with the installation of acceptable refractory material. This coupled with other fabrication issues caused an approximate six month delay to the delivery and installation of the gasifiers. The delay caused major impacts to the sequence of steel erection as well as the setting of other major equipment in the gasifier building which resulted in critical delays to the project schedule. The construction group was forced to be creative in developing major work-arounds for the installation of these other critical components, causing additional costs, as well as, major delays to the project schedule. In an effort to mitigate additional loss of schedule time, SCS assigned a full time project manager to work with the supplier of the gasifier. Effective measures were set in place, such as the development and use of an integrated daily resource loaded schedule and daily accountability meetings to assure minimization of schedule loss.

The late delivery of the pipe, valves, pipe supports, and pipe hangers created major impacts in the sequence of the steel erection in all buildings of the facility, creating additional man-hours to perform the required work-arounds needed to accomplish the piping installations. The work-arounds also required the workers to "drift" or "swing" piping into place on a given elevation of a building after the steel has been erected as opposed to installing the piping as the steel is initially erected. This required additional man-hours for implementation.

The delay of available piping to be installed in accordance with the schedule was initially caused by the late design of the piping systems and the delays in developing the detailed shop fabrication drawings. This caused a rippling effect in the succeeding activities in procurement, fabrication, construction, and the start-up phases, thus creating the field work-arounds and some additional loss of schedule time. SCS attempted to mitigate the impacts by using four fabrication suppliers as opposed to only one, which was the original fabrication plan.

The actual delivery of major equipment to the site caused major delays and impacted the sequencing of the construction and installation of the equipment. One of the major causes of the delays was the difficulty encountered in delivering this major equipment (absorbers, compressors, tanks, heat exchangers, etc.) from the barge slip to the site due to failure to reach timely agreements with companies and utilities that either controlled or owned the restraining overhead lines in the communities between the site and the barge slip. These lines consisted of various power, cable, and telephone lines which spanned across the roadways between the barge slip and the site impeding the transportation of the equipment to the site. SCS, after an exhaustive effort to coordinate the various entities to remove or raise the lines to allow clearance of equipment, designated a full time task manager, who negotiated, paid additional fees, attended numerous coordination sessions with each of the companies and utilities and eventually achieved success in coordinating a resolution in raising and/or removal of the impediments.

Any power project's success depends upon the constructor's ability to hire a sufficient number of skilled craft labor to perform the necessary work, primarily in the piping and electrical areas. This appeared to have always been a major concern to the management team, causing it to perform detailed Labor Availability Studies early in the planning stages of the Project. However, availability of sufficient qualified craft labor has become a more significant issue due to the significant growth in quantities, predominantly pipe and electrical cable which require proportionally more craft labor to install. Attraction of qualified skilled craft labor did not appear initially to be a major contributor impacting the Project; however, attrition has become a major issue as craft are leaving at an accelerated rate for other projects in the southeast. In an effort to slow the attrition, SCS has provided additional incentives in the form of monetary bonuses if craft remain for the duration of the Project.

The additional commodities and the late delivery of components and equipment, coupled with the COD remaining constant, has caused major congestion of workers in specific work areas resulting in poor performance, low worker productivity and excessive down time. The Project experienced up to 10% to 12% absenteeism for the skilled crafts, while the industry average is in the 3% to 5% range. SCS has directed subcontractors to stagger start and quit times for workers, and to increase per diem allowances in efforts to improve this issue.

Major power, process and industrial projects depend upon various key factors for the success of such projects. Two of these critical factors involve a well-developed and managed risk management program, which allows the project team to evaluate and remedy issues prior to their occurrence. The second critical factor for success is a well-developed and detailed construction execution plan, which details the approach established for all aspects of the construction phase of a project. As in Section 8.2, the MPCo Risk Management Plan was flawed in that it had only a two quarter forward looking time frame. The construction

execution plan was not revised as often as it should have been to recognize the Project challenges including the just-in-time execution and excessive work-arounds that were being experienced. MPCo and SCS did eventually realize, however, that a more detailed piping and electrical execution plan was needed for the Project, but only after they had experienced some crucial harmful events, which may have been avoided, had a greater degree of attention been paid earlier.

Conclusion:

By starting the engineering and procurement process in parallel with the start of construction, engineering and design changes which are a normal result of detailed engineering and design development were occurring in parallel with, rather than in series ahead of, construction activities. Since the project was a FOAK design, the number of these design changes was significantly greater than that which would have been expected during the development of a conventional generation plant design. This did not allow all of the construction activities to be properly sequenced during the construction phase of the Project. While work-arounds are common in all construction projects, this just-in-time approach resulted in a significant increase in the number of work-arounds and creative steps were required during construction by the Project team as they continued to try to meet the scheduled COD of May. In BREI's opinion, the lack of a more user-friendly project schedule with integrated resource loading severely restricted the site supervision personnel in their ability to manage the Project effectively. It also restricted the ability of senior management to establish credible methods to measure productivity of the work being performed and to be able to make necessary adjustments to the Project to achieve project goals or to mitigate greater impacts to those goals. The lack of a fully integrated and resource loaded schedule prevented the supervision and management personnel from recognizing earlier in the construction period that they would be facing the stacking of trades and congestion in numerous work areas creating losses of productivity and efficiencies.

Based on BREI's review of the project planning and execution sequence during the early stages of the Project, it is evident that the primary challenges of the Project team were three-fold:

- The first resulted from the decision to begin the construction phase of the Project before an adequate degree of engineering and design completion had been achieved.
- The second critical factor was the inability to execute the development of the detailed design prior to construction in accordance with the originally planned sequence due to the compressed project schedule.
- Third, the failure to develop a fully integrated and resource loaded project schedule early in the project kickoff phase significantly delayed the identification of issues with the engineering schedule delays and scope growth.

These three primary factors, coupled with other contributing issues, caused many of the inefficiencies and losses of productivity that the Project has and continues to see. When confronted with these issues, the construction team implemented work-arounds, assigned additional resources and changed its work plans in an effort to recover schedule time and contain costs as much as was possible. This was witnessed in the development of detailed piping and electrical execution plans in an effort to more effectively manage this critical part of the Project and in the decision to assign a full time project manager to work with the supplier

of the gasifier. In addition, as the Project team recognized the loss of craft labor to other nearby projects, as well as, high absenteeism for the skilled crafts, the Project team increased per diem allowances to remedy this issue.

8.6 PROCESSES AND PROCEDURES

Based upon BREI's general review of the approximate 240 procedures used for management of the Kemper Project, BREI finds the procedures to be reasonable and adequate to support the Kemper Project. However, as in all projects, the interpretation and understanding of each procedure varies between individuals and companies in the power and process construction industry. It is BREI's opinion that generally, the implementation and use of SCS Corporate procedures for the Kemper Project is in line with other SCS projects where those projects were executed by SCS. The adequacy of those procedures, their implementation by the Project team and their impacts on the Project are discussed in detail in Sections 6.1 (Black & Veatch Readiness Review), 8.2 (Project Scheduling, Project Cost Monitoring and Controls), 8.3 (Engineering and Design) and 8.5 (Construction) of this report.

For completeness, the following provides a list of the major SCS processes and procedures which are being used in the Kemper Project and those which were reviewed in detail by BREI. Except for some limited instances, the procedures being used by the Project team are SCS Corporate Procedures rather than project specific procedures developed specifically for the Kemper Project.

Procurement Procedures

There are approximately 18 key SCS procedures related to the procurement process. The procedures cover all aspects of the procurement process from the initial request for pricing to the final delivery and storage at the site. Procedures which have been reviewed in detail during BREI's monitoring of the Project are identified in the list below.

Procurement Procedures	
Procedure Number	Procedure Description
SQAR-2	Supplier Quality Assurance Requirements
SQAR-1	Supplier Quality Assurance Requirements for Design and Procurement Services
PR-01	Supplier Quality Evaluation of the Southern Company Generation Vendor Database
PR-02	Supporting Procurement Activities
AD-CS-21	Vending Guidelines
3-B	Vendor Deviation Request
PR-05	Vendor Document Submittal Schedule (VDSS)
ED-05	Vendor Documents
3-C	Vendor Transmittal Form

Procurement Procedures	
PR-03	Warehouse Inventory and Control
PR-07	Receipt, Storage, and Handling of Products
CO-CS-3F	Purchasing and Requisitioning
QA-05	Project Quality Assurance
PR-06	Project Quality Surveillance Plans
1-H	PIMS Document Center Structure Overview
1-B	PIMS Form User Guides
CO-CS-01	Contractor Quality Programs Oversight and Control
CO-01	Contract Packages

Engineering, Construction and Quality Assurance / Quality Control (QA/QC) Procedures

Early in the development of the Project, MPCo and SCS made the decision to use the SCS E&CS Corporate Project Procedures for management of all engineering and construction activities for the Kemper Project. Additionally, there was a single site specific procedure developed for the project, "Site Specific QA/QC Procedure" (GEP-A-00). As of March 2013, it was updated to Revision Three. The balance of the key engineering and construction procedures include:

Construction, Engineering and QA/QC Procedures (Detailed Reviews)	
Procedure Number	Procedure Description
1-A	PIMS Overview Guideline
2-H	Construction Miscellaneous Correspondence Form
4-A-A	Construction Management Variance
MT-CS-06	Construction Services Survey Control
OR-CS-01	Quality Plan Overview
PC-01	Change Management
PC-02*	Project Scheduling – and Primavera P6 Instructions
PC-03*	Project Cost Tracking and Forecasting
PC-05*	Project Cost Estimating
PM-01	Project Initiation
PM-03	Lessons Learned
QA-02	Quality Audits
QA-05	Project Quality Assurance
SP-01	Process Control
SU-03	Start-Up Scheduling and Budget
SU-04	Turnover Package Tracking
SU-06	Acceptance Testing

Construction, Engineering and QA/QC Procedures (Detailed Reviews)	
CO-01	Contract Packages
TR-CS-01	Training

The procedures marked with an asterisk were judged by BREI to be either inadequate for the requirements of the Kemper Project or inadequately implemented by the Project team. The specific inadequacies and the resulting effect on the Project are discussed in detail in Section 8.2 (Project Scheduling, Project Cost Monitoring and Controls) of this report. It should also be noted that during the early phases of construction, SCS did not have detailed piping and electrical installation plans. When this deficiency was identified in late 2012, SCS developed and implemented these plans and has been following their requirements since that time.

Project Scheduling, Project Cost Monitoring and Controls Procedures

The pertinent SCS procedures that govern project controls, planning and scheduling include the following.

Procedures (Detailed Reviews)	
Procedure Number	Procedure Description
PC-01	Change Control
PC-02	Schedule
PC-03	Cost
Primavera Usage Instructions	Issued by Project

In this category, as well as with the engineering and construction procedures, BREI met with the Project team to address specific BREI questions with regard to procedure implementation, corporate or project specific policies for revising and updating the procedures and the Project team's means to assure compliance with the processes and procedures. The scheduling and project controls procedures for the most part deal with the development of various levels of schedules and the appropriate implementation of each. In the case of subcontractors for the Kemper Project, each used its own procedures, which needed to be within the scope of the SCS governing procedures. For example, KBR procedures are different from those used by SCS. Except as noted, the SCS procedures address generic and not project specific project controls functions. The procedures also define responsibilities of other Project team members outside the Project Controls team who support project controls functions. The implementation of the SCS procedures and the adequacy of the scheduling capabilities are discussed in detail in section 8.2 (Project Scheduling, Project Cost Monitoring and Controls) of this report.

9.0 BENEFICIAL CAPITAL AND PROCESS DEVELOPMENT ALLOWANCE

There are certain costs which are determined to have specific classifications of either beneficial capital or part of a specific budget line-item termed process development allowance." BREI and Larkin have evaluated the suitability of these costs for these purposes.

9.1 BENEFICIAL CAPITAL

MPCo presents costs which are above the certified cost cap which are termed beneficial capital. The Commission's Final Order on Remand specifies four exceptions where the Commission will consider the approval of costs exceeding the cost cap. Two of the four reasons pertain to these types of costs and are defined below:

The commission, in its discretion, will approve MPCo's request for an increase in the recoverable amount for any or all of the following reasons.

- i. The company demonstrates that the purpose and effect of the construction cost increase is to produce efficiencies that will result in a neutral or favorable effect on the ratepayers, relative to the original proposal.
- ii. MPCo accompanies its proposed cost increase with an equal or greater revenue requirement decrease associated with one (1) or more of the other estimates (e.g., operational performance, sales of by-products) in its original proposal.

As initially discussed in the Direct Testimony of Thomas Anderson in Docket No. 2013-UN-39 (February 26, 2013), MPCo has included as an exception to the construction cost cap, an estimate for a cost item which the Company refers to as beneficial capital.

In support of these beneficial capital items, SCS stated that procurement of equipment that has a higher initial capital cost than the lowest bid but has a lower Total Evaluated Life-Cycle Cost (TELC) results in beneficial capital. TELC includes the net present value of the revenue requirements for the capital purchase, estimated operation and maintenance costs, and/or the cost of running the equipment (station service) over the life of the asset. SCS defines beneficial capital as the difference between the purchase price of a selected item and the purchase price of the alternative item with the lowest capital cost.

SCS provided an explanation of the process used to determine when beneficial capital applies in the procurement of equipment and how it is valued. The evaluation of the bids and the recommendation to purchase is performed by the project engineer. These recommendations are presented to and approved by MPCo in the weekly procurement meeting. The amount of the beneficial capital is defined at the time the decision is made to proceed with the specific piece of equipment. After an equipment choice is made, there may be additional change orders, design changes, etc. These change orders are not included in the beneficial capital calculation or the beneficial capital amount. Simply put, MPCo stated that beneficial capital results from the purchase of a more expensive piece of equipment in the present, but that will ultimately cost less in terms of operation and maintenance costs and/or the cost of running the equipment over its useful life when compared with the competing equipment bid.

In his Direct Testimony, Mr. Anderson identified 11 specific pieces of equipment as qualifying for a determination of beneficial capital which totaled \$48.695 million⁷⁵ and for which MPCo is seeking approval. As explained in the response to data request Larkin 1-1a, MPCo stated that since the filing of Mr. Anderson's testimony, it had determined that one piece of equipment originally considered did not qualify as beneficial capital and that another piece of equipment had been recalculated, which resulted in the revised estimate of \$47.579 million for the 10 pieces of equipment listed in the table below.

Beneficial Capital Equipment		
Vendor	Description	Amount
██████████	Generator Step-Up Transformers - Lower Station Service	\$ 823,243
██████████	AGR CO2 Recycle Gas Compressor - Lower Station Service	\$ 319,050
██████████	Gasifier Island Candle Filters - Lower O&M Life-Cycle Costs	\$ 1,106,866
██████████	Recycle Gas Compressor - Lower Station Service	\$ 41,576
N/A	Meridian Main Waste Water Chlorine Gas System Upgrade - Lower O&M Life-Cycle Costs	\$ 75,000
██████████	Fluid Bed Dryers - Lower O&M Life-Cycle Costs and Station Service	\$ 8,574,450
██████████	Makeup and Wastewater Treatment Plant - Lower O&M Life-Cycle Costs	\$ 3,194,046
██████████	Condenser with Vacuum Pumps - Lower Equipment Degradation	\$ 256,800
██████████	Roll Crusher - Lower O&M Life-Cycle Costs and Station Service	\$ 106,932
██████████	Combustion Turbines - Lower O&M Life-Cycle Costs and Improved Plant Performance	\$33,081,511
Total Beneficial Capital		\$47,579,474

MPCo provided an analysis of how each amount of beneficial capital noted in the table above was calculated. Specifically, for each piece of equipment, a Vendor Recommendation Form (VRF), which included a discussion of items such as (1) the bidders (vendors) for each piece of equipment; (2) the recommended vendor and the reason and/or benefits for that recommendation; (3) scope of the project; (4) the budget; (5) cash flow; (6) contract value; and (7) schedules which reflect the calculations that resulted in each beneficial capital amount noted above. A summary of MPCo's analysis is shown in the table below.

Vendor	Description	Lowest Bid	Bid Selected	Beneficial Capital	Contract Value
██████████	Generator Step-Up Transformers	\$ 7,425,330	\$ 8,248,573	\$ 823,243	\$ 8,332,353
██████████	AGR CO2 Recycle Gas Compressor*	\$ 6,544,830	\$ 6,863,880	\$ 319,050	
██████████	Recycle Gas Compressor*	\$ 6,109,762	\$ 6,151,338	\$ 41,576	\$ 13,141,080
██████████	Gasifier Island Candle Filters	\$ -	\$ 1,106,866	\$ 1,106,866	\$ 1,166,215
██████████	Meridian Main Waste Water Chlorine Gas System Upgrade	\$ 94,000	\$ 169,000	\$ 75,000	\$ 408,798
██████████	Fluid Bed Dryers	\$ 37,873,300	\$ 46,447,750	\$ 8,574,450	\$ 41,514,815
██████████	Makeup and Wastewater Treatment Plant	\$ 45,135,546	\$ 48,329,592	\$ 3,194,046	\$ 51,804,298
██████████	Condenser with Vacuum Pumps	\$ 3,761,800	\$ 4,018,600	\$ 256,800	\$ 4,141,500
██████████	Roll Crusher	\$ 837,768	\$ 944,700	\$ 106,932	\$ 926,946
██████████	Combustion Turbines	\$ 127,700,000	\$ 160,781,511	\$ 33,081,511	\$ 123,328,538
Total		\$235,482,336	\$283,061,810	\$ 47,579,474	\$ 244,764,543

* There is one contract for these two items since ██████████ is the supplier for both

As shown in the table above, the contract value associated with the 10 pieces of equipment totals approximately \$244.8 million. Each piece of equipment was included in the original certificated construction

⁷⁵ The information was filed in conjunction with Mr. Anderson's Direct Testimony, which provided a breakout of the beneficial capital items totaling \$48.695 million. Docket No. 2013-UN-39, February 26, 2013.

budget with the exception of two. The two pieces of equipment that were not in the construction cost cap included the BHS Gasifier Island Candle Filters and the Meridian Main Waste Water Chlorine Gas System upgrade. The Company explained that the Gasifier Island Candle Filters were added subsequent to the FEED study, so they were not included in the certificated construction budget. With respect to the Meridian Main Waste Water Gas System upgrade, MPCo stated that while chlorination of the treated effluent leaving that facility had always been contemplated, it was not included in the certificated construction budget. Nevertheless, SCS evaluated competing vendor bids using a Total Evaluated Life Cycle Cost Analysis and selected vendors based on this analysis.

The Siemens combustion turbine is a unique situation. As it relates to the Siemens Combustion Turbines, SCS evaluated the GE versus Siemens combustion turbine proposals and also completed a Total Evaluated Life Cycle Cost Analysis. The evaluation compared the total life cycle costs which included the projected fuel, operation and maintenance, and total capital costs associated with the selection of each combustion turbine. The total capital associated with the selection of the Siemens combustion turbine also included \$37.7 million as a "gasifier re-design cost." However, the Siemens combustion turbine formed the basis of the August 2009 FEED package, plant performance estimates and project capital cost estimates; also was the basis of the cost estimate approved in the Commission's Final Order on Remand. The Final Order on Remand contained capital cost caps and performance metrics which were derived from this FEED package. The performance of the Siemens combustion turbine (w/ gasifier redesign) should have already been accounted for in the capped project costs and performance metrics for the plant. In addition, the life cycle cost analysis submitted in support of the beneficial capital analysis compares the overall life cycle costs of the Siemens combustion turbine relative to the GE alternative, not relative to the original Commission proposal.

Conclusion:

BREI concludes that the items proposed by MPCo as beneficial capital items were based on individual equipment selections based on a TELC. The cost analysis compared multiple vendor alternatives for each piece of equipment. The basis for the beneficial capital analysis provided by MPCo assumes that beneficial capital would apply if the life cycle costs for a more costly piece of equipment are lower relative to the lower priced alternative piece of equipment, not relative to the original proposal. Without commenting on the compliance of this method with the Commission's Final Order on Remand, BREI can confirm that the approach, from an engineering perspective, was used by SCS/MPCo in the evaluation and selection of the individual equipment was reasonable.

In the case of the beneficial capital item specific to the Siemens combustion turbine, BREI does not view the incremental cost associated with the Siemens combustion turbine eligible for this type of treatment. Selection of the Siemens combustion turbine (and gasifier re-design) was made during the development of the FEED and costs associated with this turbine (including gasifier re-design) should have already been included in the capped costs agreed to in the Final Order on Remand and therefore are not eligible for treatment as allowable "costs exceeding the cap."

9.2 PROCESS DEVELOPMENT ALLOWANCE

The certificate filing contained a budget line-item for PDA in the amount of \$46.5 million which was originally scheduled to be spent over the first five years of the Project's operation. Thomas O. Anderson of MPCo explained in his testimony in Docket No. 2009-UA-0014 (Appendix N of TOA-1), that:

PDA is a common method, borrowed from the petro-chemical industry, used to account for expected modifications to improve plant performance. The PDA is an acknowledgement that systems design changes, equipment modifications, or other changes will be necessary to optimize the operation and maintenance of the Kemper IGCC. The PDA is a risk mitigation factor used in conjunction with the ramped availability to allow process and design improvements during the Project's early years.

MPCo now contemplates devoting almost half (approximately \$22.2 million) of the PDA budget (\$46.5 million) for five particular plant design modifications that are being implemented prior to commercial operation. See below Kemper County IGCC Project, Process Development Allowance Items Summary (March 6, 2013) (PDA Summary).

Item	Cost
Sour Water Stress Corrosion Cracking Protection	\$13,610,000
CCAD Cooler Efficiency Improvement	\$4,521,000
Fluid Bed Dryers N2 Deluge System	\$2,210,000
Reactor Skin Temperature Monitoring System	\$1,550,000
Un-crushable Lignite Removal System	\$300,000
Subtotal of Identified PDA Scope	\$22,191,000

Sour Water Stress Corrosion Cracking Protection: The PDA Summary notes that more than half (\$13.6 million) of this spending consists of equipment for "Sour Water Stress Corrosion Cracking Protection," and explains:

Following detailed design, during the development of comprehensive operating procedures for all start-up and operational scenarios, the potential for stress corrosion cracking was identified with the sour water system that could adversely impact plant availability and safety. Stress corrosion cracking is a possibility due to the presence of oxygen in the gas stream that was not known at the time of the original design. Modifications to the sour water system (material changes and overlays) are needed to ensure safe and reliable operation during commissioning, initial and long term reliable operation of the plant.

Continuous Coarse Ash Discharge (CCAD) Cooler Efficiency Improvement: Another PDA cost item is the "CCAD Cooler Efficiency Improvement," costing \$4,520,976. SCS learned from the detailed design of the DongGuan project in China that changes to the CCAD cooler design were required to improve the erosion and fouling potential and increase equipment life and reliability.

Fluid Bed Dryers N₂ Deluge System: Another PDA cost item is a "Fluid Bed Dryers N₂ Deluge System" costing \$2.21 million. Hazard analysis of the coal and ash system identified modes for failure requiring fire protection which was not in the original design. This system was recommended as an effective means of fire suppression in an enclosed, unoccupied area. The recommendation also includes venting with filters to ensure the reliability of the Fluid Bed Dryer System.

Reactor Skin Temperature Monitoring System: The fourth listed cost item is a "Reactor Skin Temperature Monitoring System," costing about \$1.55 million as installed and supplied by LIOS Technology. The purpose of the Reactor Skin Temperature Monitoring System is to monitor surface temperatures of the gasifier components for early indication of possible refractory failures. Undetected refractory failures would lead to excessive shell temperatures and significant reactor damage, even to the point of reactor blow-through, compromising personnel safety and plant reliability.

Un-crushable Lignite Removal System: The fifth listed cost item is an "Uncrushable Lignite Removal System," costing \$300,000. The presence of un-crushables in lignite seams that could adversely impact the coal feed system, which in turn would cause a unit de-rate or shutdown, necessitated additional due diligence and changes to this process design. Investment in research, engineering, planning, conceptual design, specification preparation, and other needed engineering or operations actions will minimize any impacts if un-crushables were to create start-up or operational risks. The potential that some of the mine lignite would be un-crushable and have to be removed from the fuel stream was a known possibility during the certification process.

Conclusion:⁷⁶ BREI considers the use of process development allowance a standard industry practice to account for project scope changes and scope additions which occur during the detailed design and construction of a new process technology.

The sour water system material changes and fluid bed dryer system (additional N₂ deluge system) are safety related design changes that resulted from MPCo's ongoing HAZOP studies and the FOAK nature of the Project. The TRIG reactor skin temperature monitoring requirements were the result of further detailed engineering and operational analysis of the TRIG Technology and also designed to improve the safety and operability of the Project. FOAK design changes also included the CCAD cooler design and were designed to improve the reliability of this system. The need for the un-crushable lignite removal system resulted from an examination of the first coal mined from the Liberty Mine. While not unusual for lignite to contain deposits of petrified wood, its existence at the Liberty Mine was not identified until the first large scale mining of lignite began.

⁷⁶ BREI draws these conclusions solely from a technical perspective and offers no opinion on the accounting of such costs as it is related to the "rate base" or the application of de-escalation to the costs since they would be spent earlier than planned.

From an engineering and technical viewpoint, BREI believes it to have been a reasonable decision on MPCo's part to implement these changes during the construction phase of the Project rather than to have waited until the Project went into commercial operation. This is because the changes are either less costly to implement now than to retrofit later, or were required to assure safety and plant operability at the time of COD compared to proceeding without making those changes. However, BREI is unable to conclude that those changes will improve the Project's performance, compared to the performance contemplated in the prior design, in terms of output value per unit cost. Rather, they appear to be directed towards assuring that the plant meets the safety and operability standards that MPCo had indicated would be achieved by the prior design at COD. However, there are other considerations that should be addressed before deciding when these costs should be recognized. These considerations and the recommendation as to whether or not these proposed changes should be allowed as exceptions to the Commission's cap are included in Larkin's report.

10.0 COST INEFFICIENCY ANALYSIS AND EXPECTED FINAL PROJECT COST OUTLOOK

An analysis was conducted to evaluate the cost of inefficiencies that have been previously identified in this report and to estimate the probable project costs at completion.

10.1 COST INEFFICIENCY ANALYSIS

As noted in this report, MPCo and SCS did not adequately address, execute or implement several aspects of the Project which have led to project execution inefficiencies and resulting additional project costs. These issues relate primarily to project planning and scheduling, including the use of a risk management program with insufficient detail and forward-looking time horizon; the delayed development of the original integrated EPC schedule with adequate resource loading and failure to maintain it; the inadequacy of commodity cost estimating and monitoring;⁷⁷ and the failure to implement certain processes and procedures.

BREI determined that these planning and scheduling shortcomings resulted in additional costs in the areas of engineering; project support, controls and scheduling; and construction. BREI's evaluation of these costs and the methods utilized to quantify them is detailed below.

Engineering

Inefficiencies resulted from the just-in-time engineering, design, and construction activities occurring simultaneously on the Project. These challenges were created when the design team was faced with a

⁷⁷ The Project team attempted to control actual cost against budget by reference to the \$2.4 billion certification budget until the original low contingency was depleted which impaired its ability to foresee major cost overruns.

compressed engineering schedule⁷⁸ for delivery of approved designs and drawings to support construction. The issues, resulting from the compressed schedule, were exacerbated by the typical challenges associated with the FOAK nature of this Project. A large percentage of the delays in issuing design and construction drawings resulted from the FOAK nature of the design as well as typical and customary errors and omissions in design work. As a consequence, the SCS engineering and design group lost a significant amount of time in trying to support and maintain a sufficient inventory of "Issued For Construction" design documents to avoid impacting or delaying construction activities in the field. This caused much of the work to be performed out of the normal sequence of designing the plant, thus creating inefficiencies. The more notable of these inefficiencies are discussed below:

BREI reviewed all available four week look-ahead schedules through the March 2013 window (roughly 12,000 activities from the integrated project schedule). These schedules were distributed by MPCo monthly,⁷⁹ and provided a basis for estimating the inefficiencies that the engineering group experienced. From this evaluation, BREI has categorized the more significant areas where engineering inefficiencies were incurred through the period ending March 2013 as follows:

- Late receipt of vendor drawings led to partially complete drawings being issued in an attempt to maintain the construction schedule and priorities. This resulted in multiple revisions and delays in the issuance of critical drawings including gas cleanup equipment layouts, LDF facility foundation, electrical, and steel drawings, gasifier and gasifier piping isometric drawings and inline instrumentation drawings.
- Redesigns due to changes in engineering assumptions: BREI sampled multiple structural steel, mechanical and electrical drawings in critical plant areas including the gasifier, gas cleanup and pipe rack areas. From these reviews it was determined that, due to the late receipt of vendor drawings and information, engineering assumptions were made to complete the drawings, and those assumptions frequently turned out to be inaccurate because of the FOAK nature of the design. This resulted in additional upgrades and equipment being incorporated on a just-in-time basis. This chain of events resulted in the need to validate or change the original assumptions resulting in additional drawing revisions and engineering costs.
- For related reasons, the engineering budget and schedule duration were completed much later than planned. Additional engineering management and support resources were required to deliver engineering work and work-arounds in time to accommodate construction priorities. These engineering work-arounds were exacerbated by the FOAK nature of the Project. They were also the direct result of inefficiencies resulting from the Project team's decision to schedule design work based on the timing of construction needs rather than on efficiently delivering completed engineering. The engineering schedule delays that resulted from these decisions were: process, electrical and I&C disciplines (4 months each), civil (6 months) and mechanical (14 months).

⁷⁸ This schedule was compressed in order to meet the May 2014 COD.

⁷⁹ The four week look-ahead schedule is a Primavera generated report that shows progress achieved to date plus the expected plan and schedule for the next four weeks.

BREI has estimated that the incremental engineering costs related to the inefficiencies identified above are in the range of \$11 million to \$14 million.

As a check on this estimate, BREI compared the original certification engineering budget of \$157.6 million to the March 2013 forecasted engineering budget of \$196.7 million, a growth of approximately 25%, or \$39 million. This increase can be attributed to unknowns associated with the FOAK nature of the Project and to the inefficiencies discussed above. As a rough but conservative estimate based on its knowledge of the Project, BREI believes that approximately 30% of the \$39 million increase is attributable to the inefficiencies noted above. This estimation yields an estimated cost of engineering inefficiencies on the order of approximately \$12 million, which is within the range noted above.

Project Support/Controls and Scheduling

The project support and controls area of the Project also experienced inefficiencies due to poor initial planning and execution. As discussed elsewhere in this report these issues included:

- Timely development of an effective integrated baseline schedule
- Inadequate implementation of SCS project controls procedures which required the development of a resource loaded and integrated project schedule
- Inadequate forecasting techniques
- The lack of an adequate risk management plan

While these issues were significant, the actual incremental cost incurred by the project controls function, as a result of these deficiencies, was minimal. However, these deficiencies were a major contributing factor in both the engineering and construction cost inefficiencies discussed herein.

Construction

Many of the construction inefficiencies, shortcomings, and inadequacies were the result of poor planning to meet the aggressive schedule necessitated by the planned COD. The initial execution of the Project included limited critical procurement releases (with the exception of certain long lead time equipment) and an insufficient amount of the appropriate detailed engineering and design. This had a direct negative effect on the development of a reasonable and cost efficient construction plan, particularly for timely component and equipment delivery and installation. The initial schedule was poorly integrated, the baseline schedule was established late, and activities were not effectively resource loaded. These deficiencies impaired the Project team's ability to accurately forecast additional commodity quantities needed and the related craft labor requirements. These limitations further compounded the challenges ahead.

The construction team generally responded with viable work-around measures to lessen additional schedule impacts, thereby mitigating some of the lost time and related costs. Even with that mitigation, however, the cost and schedule impacts were significant.

BREI also considered the impact of late engineering and design drawing releases, partial drawing releases, re-issuing of construction drawings, and the resulting delays to construction. BREI reviewed all project schedules through the March 2013 window (over 20,000 activities). These schedules and the four week look-ahead schedules were also reviewed to identify specific reasons for the construction delays and construction challenges that were being reported. Many activities listed on the schedule included a notation stating "need design information." In addition, BREI reviewed logic ties from the engineering and procurement schedules and was able to identify additional delays to construction. Only the significant delays judged to have a material impact on project costs were considered in this analysis.

BREI evaluated bulk commodity installation rates⁸⁰ to identify the commodities most affected by delays and inefficiencies. To do this, BREI compared planned installation rates against the March 2013 actual rates to determine the delta. This difference in installation rates is a measure of inefficiencies resulting from lack of engineering support, lack of materials availability, and craft labor congestion. BREI specifically evaluated commodity installations (piping, steel and concrete) that were well under way during the period up to and including March 2013. Specifically, concrete, steel and piping installation rates through March 2013 were running approximately 30% to 40% higher than plan. It should be noted that in this analysis, BREI did not penalize the Project for the incremental labor costs due to the growth in commodities.

BREI compared the original pipe spool fabrication strategy which would have used a single offsite fabricator to the actual need to use multiple fabricators to meet the production needs imposed by the compressed schedule and piping quantity growth. The coordination, oversight, expediting, extended fabrication duration, and other difficulties in managing multiple fabricators resulted in inefficiencies which added to the project cost.

Poor and late planning of required offsite electric utility lines relocation (required for transport of large components to the site) added to construction delays and added to the cost to complete the utility line relocations. The incremental utility line relocation costs reported by MPCo are attributed to poor and late planning of this required work.

Scaffolding material and labor costs were carefully considered by BREI. The decision was made to erect, remove and re-erect scaffolding as needed, rather than erecting it once in a given area. This approach was inefficient and added unnecessarily and significantly to scaffolding costs resulting from duplication of efforts and the dismantling and re-erecting of scaffolding multiple times. Indirectly, this strategy also added to the cost of piping erection resulting in additional work-arounds when craft labor could not access certain work areas.

BREI reviewed the heavy rigging plan, specifically the plan to move large cranes around the site. The delays in delivery of major equipment required changes in the heavy rigging plan and the need to delay removing several large cranes from the job site, especially the Lampson Crane which was required to be onsite roughly five months longer than planned, to complete installation of the gasifiers and gasifier structure.

⁸⁰ Bulk commodity installation rates refer to the craft labor requirements expressed in man-hours to install a given unit of material, such as linear feet of piping or cubic yards of concrete. As such, it is a measure of labor productivity.

The May 2012 cost outlook, presented by MPCo and based on actual costs reported through March 2012, announced a \$250 million cost increase which was attributed to construction. MPCo stated that approximately 80%, or \$200 million, of that increase was due to commodity growth and that approximately 20%, or \$50 million, was due to schedule compression and construction work-arounds. In an RFI, BREI has requested MPCo to estimate the added costs of work-arounds from the beginning of construction through March 31, 2013. Once the information is received, BREI will re-evaluate its estimate of the cost of construction inefficiencies, including work-arounds. Depending on the level of detail provided by MPCo in its response, it may be necessary for BREI to conduct a more exhaustive independent audit of these costs.

Based on incomplete information that is presently available, BREI has estimated that the incremental construction costs related to the inefficiencies identified above are in the range of \$74 million to \$109 million through March 31, 2013.

As a check on this estimate, BREI also evaluated the impacts, challenges and resulting construction inefficiencies that were incurred by comparing the certification construction budget (labor plus bulk materials) of \$1.22 billion to the March 2013 forecasted budget of \$2.3 billion, an increase of approximately \$1.08 billion. As a rough but conservative estimate based on its knowledge of the Project, BREI believes that approximately 7% to 10% of the growth in construction costs were due to inefficiencies similar to those noted above. Using this percentage on the construction labor budget growth, and giving credit for costs associated with quantity growth, BREI developed a construction cost inefficiency estimate of approximately \$76 to \$108 million, which is consistent within the range identified for the total inefficiencies identified above.

10.2 FINAL PROJECT COST OUTLOOK

BREI estimated the probable project completion cost absent these inefficiencies, shortcomings and inadequacies identified above. This estimate was based on an update of the independent project cost estimate completed by BREI in the third quarter of 2012. This update assumed a 4Q 2014 COD, using the actual bulk quantities known today along with a higher contingency and the labor rates and productivity and other factors used by the Project in its 2012 estimate. BREI is of the opinion that if MPCo had recognized the need to extend the schedule to reflect a 4Q 2014 COD at that time, then the 2012 projected labor rates and productivity factors could have been maintained by mitigating the negative effects of labor congestion, reduced peak labor requirements, productivity losses due to congestion, and stacking of trades that have resulted from the compressed schedule. This would also have allowed engineering progress to catch up with the design deliverables required to support construction without the inefficiencies of just-in-time engineering and resulting construction work-arounds.

BREI currently estimates that the cost to build the capped portion of the Kemper Project scope, considering that the improved efficiencies that could have been achieved as noted above, could have been as low as \$3.7 to \$3.8 billion compared to the Company's current estimate to complete the capped portion of the Kemper Project scope at \$4.017 billion. This confirms the Commission's decision to protect the Mississippi

ratepayer interests by imposing both a hard cap on the total cost of the plant and performance metrics for its operation once it is placed in service.

Works Cited

Direct Testimony of Kimberly D. Flowers on Behalf of Mississippi Power Company, 2009-UA-14, Mississippi Public Service Commission (July 25, 2011).

Final Order on Remand Granting a Certificate of Public Convenience and Necessity, 2009-UA-014, Mississippi Public Service Commission (April 24, 2012).

AACE (November 29, 2011), AACE International Recommended Practice No. 18R-97, *Cost Estimate Classification System As Applied in Engineering, Procurement and Construction for the Process Industry*.

Black & Veatch (2010), *Kemper County IGCC Project Readiness Review*.

BREI (November, 2012), *Independent Monitor's Project Schedule and Cost Evaluation*.

SCS (2010), *Kemper County IGCC Project E&CS Summary Response to Black & Veatch EPC Readiness*.

SCS (October 21, 2010), Presentation: Edwardsport Debrief 10-21-2010.

SCS (January 25, 2011), Edwardsport Debrief 1-25-2011. *Presentation on Edwardsport Site Visit*.

SCS (February 3, 2011), Presentation: Edwardsport – Plant Ratcliffe Comparison.

SCS (October 19, 2011), Presentation: Edwardsport Visit (October 13, 2011).

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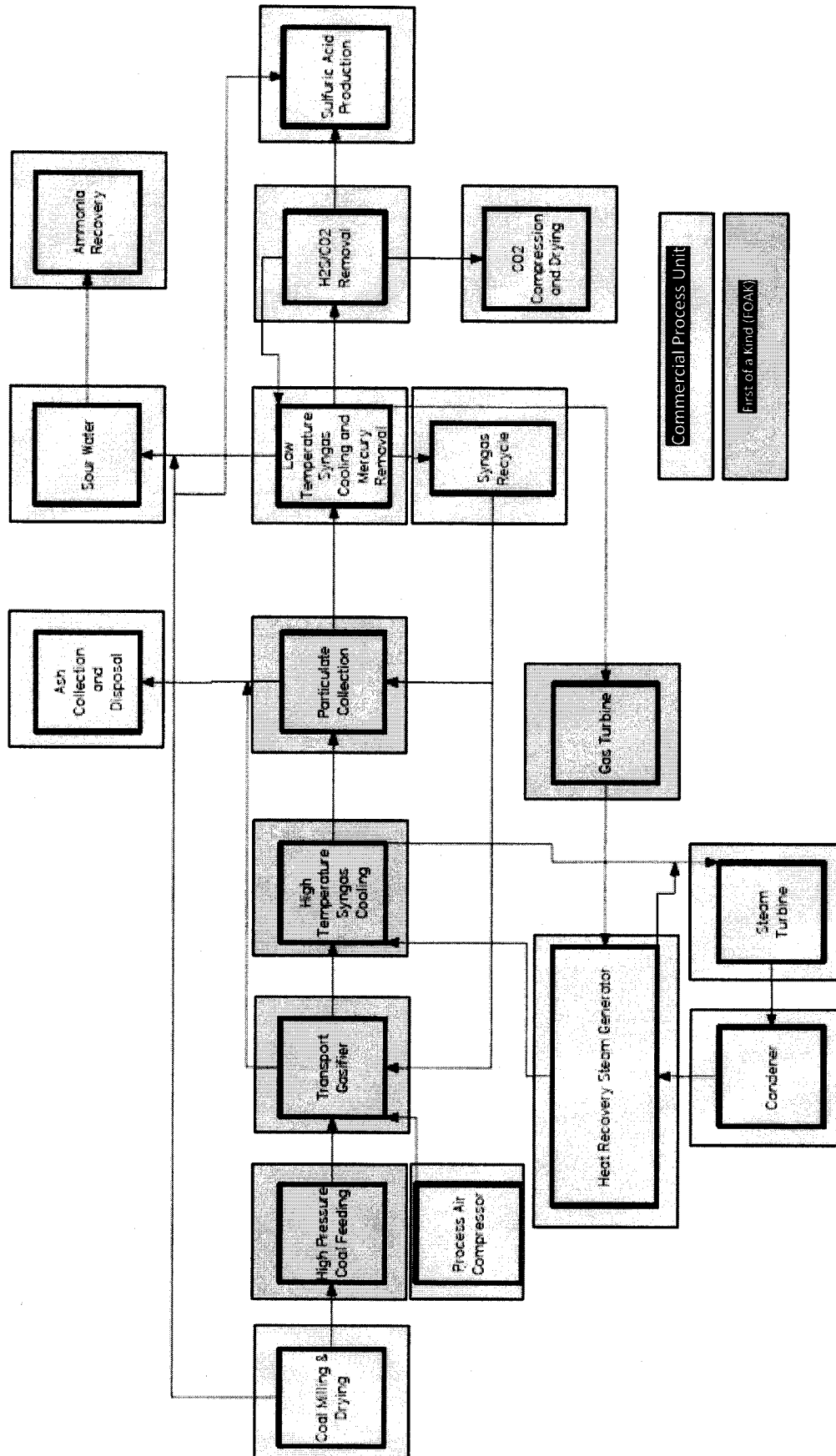
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**ATTACHMENT A: KEMPER BLOCK FLOW DIAGRAM NOTING FIRST OF A KIND AND
COMMERCIAL PROCESS UNITS**



ATTACHMENT B: LIST OF INTERVIEWEES FOR PRUDENCY REVIEW

LIST OF PROJECT PERSONNEL INTERVIEWED BY BREI NAMES AND TITLES

MPC:

Ed Day. CEO and President of MPCo thru May 2013

Thomas Anderson. Senior Vice President and Project Sponsor for MPCo thru April 2013

Aaron Abramowitz, MPCo Project Manager

John Huggins. Senior Vice President, MPCo

Stacy Miles. Engineering Manager, MPCo

Leo Manuel (Balch & Bingham), Outside Legal for MPCo

SCS:

Steve Owen. Senior Program Director, Southern Company Services

Brett Wingard. Engineering and Procurement Manager, Southern Company Services

Randal Rush, General Manager Gasification, Southern Gasification Services

David Empfield, Site Construction Director, Southern Company Services

Kelli Williams, Project Manager, Combine Cycle Area, Southern Company Services

KBR:

Prasad Koneru. Project Manager, KBR

Herbert Springer

**ATTACHMENT C EXECUTIVE SUMMARY: FROM INDEPENDENT MONITORS
BASELINE REPORT**

INDEPENDENT MONITOR'S BASELINE REPORT

for the

**KEMPER COUNTY IGCC PROJECT
INDEPENDENT MONITORS REPORT**

in the

STATE OF MISSISSIPPI

prepared for

MISSISSIPPI PUBLIC UTILITIES STAFF



Prepared by

**BURNS AND ROE ENTERPRISES, INC.
800 KINDERKAMACK ROAD
ORADELL, NEW JERSEY 07649**

Final Report – Revision 1

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EXECUTIVE SUMMARY

KEMPER COUNTY IGCC PROJECT INDEPENDENT MONITORS REPORT

Introduction

Mississippi Power Company ("MPC" or "Company") is a wholly-owned subsidiary of the Southern Company ("SC" or "Southern"). On January 16, 2009, MPC filed a petition with the Mississippi Public Service Commission ("Commission") for a Certificate of Public Convenience and Necessity authorizing MPC to construct, acquire, operate, and maintain an Integrated Gasification Combined Cycle (IGCC) electric generating facility in Kemper County, Mississippi. The Commission subsequently issued its Order on May 26, 2010 authorizing MPC to construct, acquire, operate, and maintain the Kemper IGCC facility.

Burns and Roe Enterprises, Inc. ("BREI") has been retained by the Mississippi Public Utilities Staff ("Staff"), as their Independent Monitor, to conduct an evaluation to baseline the status of the Kemper Project ("Phase I"). Following the completion of the Independent Engineering Due Diligence baseline report and development of recommended actions, BREI will provide ongoing monitoring, status reviews, prudence reviews, and will provide expert testimony as required ("Phase II"). BREI has retained two specialty consulting firms to support this effort in the areas of lignite mine development, mine operating plans and lignite production cost forecasts: John. T. Boyd Company ("Boyd"); and Regulatory Accounting Policies and Procedures: Larkin & Associates, PLLC ("Larkin"), collectively the "BREI Team".

This executive summary provides a brief summary of the BREI Team's findings, conclusions, and recommendations. The Project consists of an Integrated Gasification Combined Cycle (IGCC) power generation facility as well as an adjacent lignite mine that will supply fuel to the plant. The project is located in Kemper County, Mississippi, at latitude 32° 38' N and longitude 88° 46' W. The Project site covers approximately 1,650 acres. Site construction began in the fourth quarter of 2010. The adjacent lignite reserve is being developed and will be operated by the Liberty Fuels Company, LLC (LFC), a subsidiary of North American Coal Corporation (NAC), a contractor to MPC, and will be used as the primary feedstock for the Project's IGCC Plant. The IGCC plant will utilize state-of-the-art emission controls and will be owned and operated by MPC, which will also own the lignite mine and lignite reserves.

This Project has a nameplate electrical capacity of 800 MW gross. The Project's net output is 582 MW (summer peaking), and the net heat rate is 11,708 Btu/kWh at 582 MW. This heat rate corresponds to a net Project efficiency of approximately 29.2%, which is in the range expected for an air blown IGCC such as the Kemper Project. The Project will utilize the Transport Integrated Gasifier (TRIG) gasification technology developed by Kellogg Brown & Root (KBR) in cooperation with Southern Company, to convert the lignite fuel to a synthesis gas (syngas) for use as the main fuel in a combined cycle power block. The Project will be the first commercial application of this technology in the United States, and, possibly, in the world. KBR and Southern Company developed and tested the TRIG gasifier on Mississippi Lignite at the Power Systems Development Facility (PSDF) in Wilsonville, Alabama. The Project will also include carbon capture technology to remove 65% of the CO₂ releases from the gasification process, and

deliver and sell the CO₂ to oil producers in southern Mississippi for Enhanced Oil Recovery (EOR).

A portion of the Project's external funding will come from the Federal Clean Coal Power Initiative (CCPI), Investment Tax Credits (ITC) from the Energy Policy Act of 2005, and state and local incentives. In order to preserve its qualification for ITC, the Project's commercial operation date (COD) must be by May, 2014. MPC has also applied for a Loan Guarantee from the United States Department of Energy (DOE). MPC's loan guarantee application is currently under review by the DOE.

In addition to utilizing indigenous Mississippi lignite in an efficient and environmentally friendly manner, the plant will improve MPC's fuel diversity, locate base load generation away from the coast storm risk, improve reliability of electricity supply to critical loads, and contribute to the Kemper County economic development.

Scope of Report

BREI's scope of work includes the review and base-lining of the technical and financial aspects of the IGCC Project and lignite mine including the engineering and design, procurement and construction, mine development, cost estimates, schedules, contracts, permitting, and accounting procedures. The lignite mine development, operating plans and cost forecasts have been reviewed by Boyd, and the Project's Regulatory Accounting Policies and Procedures have been reviewed by Larkin. The BREI Team has also identified Project issues and developed a recommended monitoring plan for the project execution including the completion of engineering, construction, startup, and performance test monitoring. The results of the BREI Team's efforts are documented in this Report, which identifies potential issues and problems related to the technical, financial and accounting aspects of the Project, and provides recommendations for their resolution including recommended improvements, as necessary.

This report is based on a detailed review of the information provided on the MPC ShareSite and in meetings through the November 8, 2011 Monthly onsite Progress Meeting. It is noted however that the information provided in the monthly meetings is as of 6 to 8 weeks prior to the date of the meeting. Therefore the information provided at the November 8th meeting updated the Burns and Roe team of the project status as of September, 2011. At the time of the report issue, several review items remain outstanding including meetings with MPC to discuss project scheduling methodology and the status of the DongGuan, China IGCC project which could provide process startup and performance data to support the Kemper project startup.

Project Overview and Significant Findings

MPC, a wholly owned subsidiary of Southern Company, has contracted Southern Company Services (SCS) to complete the engineering, design and construction of the IGCC facility, as well as the construction of the IGCC plant, mining facility, and CO₂ pipeline. North American Coal and KBR have been contracted to complete the engineering and design of the lignite mine and TRIG gasifier respectively. MPC is responsible for all land purchases, easements, environmental permitting, and compliance activities necessary for obtaining authorizations to construct and operate the plant. MPC has the overall responsibility to oversee and manage the

completion of the Project. Under this agreement, SCS is providing these services to MPC at cost without mark-up or fee in an effort to minimize the cost to MPC. However, the Agreement does not contain a not-to-exceed price or guarantees for a scheduled commercial operation date, IGCC plant thermal performance or availability. These are typical guarantees for Engineering Procurement and Construction (EPC) contracts. Inclusion of such guarantees would have reduced MPC's exposure to potential loss, but likely would have increased the cost of the EPC contract. The related project issues are discussed in more detail later in the executive summary and in the body of the report.

MPC will own and operate the Kemper County IGCC plant (and adjacent lignite mine), which is expected to go into commercial operation in May 2014. South Mississippi Electric Power Association (SMEPA) will have a 17.5% undivided ownership interest in the project subject to satisfying the conditions precedent in the Joint Ownership and Operating Agreement. The life of mine (LOM) permit boundary or "area of interest" comprises 31,000 acres with an estimated 600 million tons of lignite reserves. The 40 year mine plan will cover 10,000-13,000 acres of the LOM area (plus 2-3,000 acres for facilities) and will produce approximately 173.4 million tons (according to the most recent plan) or roughly 13 million tons more than required for 40 years of operation. The permitted area is much larger than required, providing a significant lignite resource margin. MPC has obtained the rights to the majority of the properties in the mining area of interest. Lignite from the mine will be delivered to the IGCC facility by mining trucks, which will fill a covered truck dump hopper located adjacent to the IGCC site. The development of the lignite mine, estimated lignite reserves, and lignite production costs are discussed in detail in the body of this report, and are summarized in this executive summary.

The lignite delivered to the IGCC facility will be sized, dried, and stored before it is gasified in the TRIG gasifiers. The Kemper Project will possibly be the first commercial facility to utilize TRIG gasification technology on a commercial scale. Issues attendant to scale-up and the use of new technology are discussed, along with mitigation suggestions, in both this executive summary and in the body of the report.

The product of coal gasification, known as syngas, will be cleansed of impurities and used for power generation in a 2x1 combined cycle power block. The syngas will be combusted in two (2) Siemens combustion turbines, with the hot turbine exhaust flowing through heat recovery steam generators (HRSGs), where its thermal energy will be used to produce high pressure steam. Additional steam will be generated both by supplemental combustion of natural gas in the HRSG and in the cooling sections of the TRIG gasification block. All the steam generated will flow to a single (1) steam turbine to generate additional electrical power. The 2x1 power block has a nameplate electrical capacity of 800 MW gross, 218 MW will be consumed by the IGCC plant with a net peak power output of 582 MW. Sixty-five percent of the Project's CO₂ emissions will be extracted from the syngas stream, compressed and piped to southern Mississippi to be used for Enhanced Oil Recovery (EOR). MPC has executed contracts with Denbury and Tellus (Treetop LLC) for the off-take of CO₂. The issues and concerns associated with long term reliable CO₂ off take and sequestration are discussed later in this executive summary and in the body of this report.

In addition to electricity, the Project will produce various secondary saleable byproducts, such as sulfuric acid, anhydrous ammonia, and CO₂. The Project is also being designed for zero waste water discharge. Included in the Project is the construction of the lignite mine, two new electric transmission lines, gas and water supply pipelines, and a CO₂ export pipeline.

The IGCC Plant consists of the following major subsystems:

- Lignite Mine
- Air Separation Unit for nitrogen generation
- Lignite feedstock preparation including delivery, conveying, milling, drying and pressurization
- TRIG Gasification Island
- Gasification Air Compression System
- Raw syngas scrubbing with water
- Water-gas Shift Reactor
- Syngas Cooling
- Mercury Removal
- Gas purification system with sulfur removal/recovery and CO₂ separation
- Combined Cycle Power Block including:
 - Two Siemens SGT6-5000F combustion turbine-generators (CTGs)
 - Two Heat Recovery Steam Generators (HRSG)
 - One Toshiba steam turbine generator (STG) TCDF-40" 366 MW
- Natural Gas conditioning skid
- Condenser / Cooling System
- Water and Waste Water Systems
- Ash and Waste Handling Systems
- Electrical Interconnections, Substations, Transmission Lines
- CO₂ Compression and Transportation System

These systems are described in detail in Section 2 of this Report. MPC expects, and is required under the Commission Order, to achieve a mature overall annual availability of 89% for the Project. MPC expects their initial availability during the first year of operation to be 59%, which will ramp up to the mature availability of 89% after five years of operation. BREI has reviewed MPC's detailed availability analysis and projections, and while the 59% initial availability target is reasonable and realistic, it may be difficult to achieve the final 89% goal as discussed in this report.

Clearing and site grading was completed in the fourth quarter of 2010 with construction of the IGCC Project itself beginning in February, 2011. BREI visited the project site in March, 2011 and then has attended MPC hosted progress meetings on a monthly basis beginning in July, 2011. Since July, when the construction progress was reported to be approximately 6% complete, MPC now reports construction to be 9% complete. BREI has provided the MPUS with monthly reports, which describe the findings and conclusions from each of these meetings. These monthly reports, through November 2011, have been submitted as stand-alone documents.

SCS has developed plans and procedures for the completion of construction, which were reviewed by BREI. All construction work on the Site will be performed on a merit shop basis, which allows both the non-union and the union contractors to participate in the Project. Based on our reviews and multiple interviews of key construction and Project personnel, BREI is of the opinion that this approach for the construction effort is adequate. However, BREI notes that the Construction Execution Plan is not developed to a sufficient degree of detail at this phase of the Project to allow for a complete analysis. Nevertheless, the conceptual plans are sufficient to determine that SCS can develop these concepts into quality construction plans. The SCS Project execution model combines the Southern Company construction expertise with that of other major contractors, their own engineering expertise along with the engineering expertise of KBR, thus providing a solid construction team approach for the entire Project. Implementing a rigorous construction monitoring program from this point forward is critical to advise the MPUS of project status, developments, and issues. BREI's detailed recommendations for ongoing Phase II construction monitoring are summarized in this executive summary and are included in Section 3.5 of this report.

MPC has entered into multiple contracts for the completion and operation of the Project including those previously mentioned with SCS, NAC LFC, and KBR. MPC also signed an Asset Purchase Agreement with SMEPA, in which SMEPA has agreed to purchase a 17.5% interest in the Project. MPC has also completed CO₂ off-take agreements with Denbury and Tellus, and is in the process of completing a sulfuric acid off-take agreement, an ammonia off-take agreement, fuel supply agreements, a Project labor agreement, a combustion turbine Long Term Service Agreement (LTSA), a water supply agreement, multiple site purchase/lease agreements for the IGCC and mine site, leases, easements or right-of-way agreements for the various pipeline and transmission line requirements, and an electrical interconnect agreement. Many of these agreements are not yet completed or are under negotiation. The completion status of these agreements will need to be monitored closely during Phase II monitoring to assure they do not jeopardize the project schedule or the May, 2014 commercial operation date.

Four individual MPC Project schedules have been developed to cover the entire scope of the Project. These schedules are organized by a work breakdown structure (WBS) through activity codes, outlining Engineering, Procurement, and Construction. Project schedules are classified by their level of detail with a "Level Three" schedule being the most detailed. Level three schedules are required to plan, execute and monitor large and/or complicated projects. Level one and two schedules are less detailed with a level one schedule providing the least information. The project schedule was statused and baselined at the end of September 2011. The schedule has sufficient details particularly in Engineering and start up. The following summary presents our observation about the September 2011 baseline schedule:

- A Baseline schedule by definition is a schedule where the planned project status equals the earned project progress which equals the actual progress achieved by inspection. BREI has determined that the September Schedule is not a fully developed baseline schedule.
- BREI believes that the key metrics and performance indicators utilized in the schedule need to be adjusted and validated for accuracy and consistency with the baseline schedule plan.

- MPC's Earned Value Management System needs to be examined in detail and possibly expanded to include all phases of the project; specifically Procurement to integrate actual Construction Work in Progress which should be incorporated into the monthly progress reporting process.
- The CO₂ pipeline schedule shows substantial negative float (i.e. an activity that is behind schedule). Additional review of the status of this activity is required.
- A more detail analysis of the schedule to develop an accurate critical path is recommended. This analysis should include the integration of Engineering, Procurement activities, Construction and Start-up. This integration is not apparent in the schedules that BREI has reviewed.
- It appears possible that engineering may need to be accelerated to assure that engineering progress will not delay construction. This needs to be evaluated further with corrective actions developed if necessary.

A high level of schedule and progress monitoring is suggested over the next nine to twelve months to assure a full understanding of the schedule and project status.

BREI also reviewed the overall schedule logic and activity durations. Both the logic and durations appear appropriate for a project of this magnitude. However, of significance, is that the project schedule is not yet resource or commodity loaded, (i.e. craft man hours or commodity installation such as feet of pipe, cubic feet of concrete to be installed, etc.) which is customary for a project of this magnitude and complexity. Without resource loading, it is difficult to confirm the correctness, on a task specific basis, that the assigned task durations or schedule logic are accurate. MPC has stated that they track progress through a separate process. As of the date of this report, BREI is conducting meetings with MPC to gain a better understanding of their schedule logic and project status.

BREI received a detailed project cost estimate from MPC in April 2011, and reviewed the document for accuracy and omissions in comparison with the summary level estimate that was developed to certify the Commission Order \$2.4 million capital cost cap. Each commodity listed was provided with information on unit of measure, total quantity, total man-hours, total labor cost, total material cost, subcontract cost and total cost. With this information BREI was able to evaluate the cost estimate document in detail. BREI has determined that there are several concerns regarding MPC's ability to complete the project at this level of expenditure considering MPC's projected project craft and engineering labor hours, and the level of contingency included in the MPC estimate. BREI considers the total field craft labor hours to be low for a project of this size considering other familiar projects, and the first-of-a-kind nature of the TRIG gasifier. The total contingency for the project is also below what would be expected for a project of this nature, and the cost estimate does not include any indication of overhead and profit costs for the general contractor or specialty contractors that will perform the construction of the project. Additionally, there is the possibility for increases in the estimated bulk material quantities (steel, concrete, piping, cabling, etc.), since engineering is only 51% complete. BREI recommends that capital cost sensitivity cases considering BREI's findings as identified in Section 9 of this report be evaluated.

BREI has reviewed the O&M budgets included in the MPC Project Financial Model ("Proforma") and finds them within the range expected for a large IGCC project. However the budgets are considered preliminary at this time and many of the long term O&M agreements are still being developed or negotiated. The O&M budgets and finalized O&M long term service agreements should be reviewed during Phase II to determine whether the initial budget targets are being met or exceeded, and whether sufficient O&M coverage is being provided.

BREI has reviewed the status of all the applicable permits to the Project, including those regarding the IGCC facility and the mine, as well as the complete Final Environmental Impact Statement. Boyd has completed a separate evaluation of the mine only permitting to supplement BREI's reviews. BREI also utilized information from the MDEQ, Kemper County Government, and FAA to complete our review. Major permits for air emissions and water discharge have been obtained and are consistent with the design of the Project. However, the Solid Waste Management and Mining Permits are not complete at this time. While the Solid Waste Management Permit is attainable, there is a possibility of a delay in the issuance of the Mining Permits because of current opposition to the Project from the Sierra Club. The Sierra Club currently has an outstanding lawsuit against the project, and could continue pursuing litigation, which could delay the process.

It should be noted that as of the date this report was completed, the Lignite Mine Surface Coal Mining and Reclamation Permit had been approved. This approval was granted by the MDEQ on Thursday, December 15, 2011.

IGCC Plant Conclusions and Recommendations

BREI draws the following conclusions based on the BREI Team's participation in a Project Review Meeting sponsored by MPC in Jackson, Mississippi on February 7 & 8, 2011, review of Project documents in the electronic data room, subsequent meetings held with the Project Sponsor MPC, the EPC contractor (SCS), and the EPC Contractor's Engineer for the gasification island (KBR) in Birmingham, Alabama. BREI has also attended site inspections and construction progress meetings in March and continually on a monthly basis beginning in July, 2011 to verify construction status. Site inspections will continue on a monthly basis throughout the duration of construction, commissioning and start-up. In addition to the significant findings outlined in previous sections, BREI has reached the following conclusions and developed the following recommendations to address issues identified:

1. The Project, as configured, has been thoroughly conceived and planned. Development, engineering, procurement activities and permitting have progressed to a degree of completeness consistent with a project at this stage of development. However, there are several areas including status of engineering completion and an aggressive construction schedule that may impact both the project schedule and cost estimate. Status in these areas will need to be monitored closely as the project progresses to determine whether MPC may need to develop contingency or work around plans should delays or the need for significant engineering modifications be identified as the project progresses.

2. With the exception of the TRIG gasification process, a majority of the balance of the syngas treatment systems, lignite preparation, drying, and handling facilities, CO₂ separation technology, and the combined cycle power block are well proven in the petrochemical and power generation industries and should allow the project to meet the stated goals for the power production, CO₂ sequestration, and generation of additional saleable products.
3. Scale-up of the TRIG gasification process including dry syngas cooling, particulate ("candle") filters, and pressure let-down/solids (ash) removal systems represent the single largest project technical challenge. While these components have been thoroughly demonstrated at the PSDF pilot scale facility in Wilsonville, Alabama, their operation and reliability have not been demonstrated at the commercial scale required for the project to meet its production and/or availability goals. BREI has discussed its concerns with MPC and SCS, specifically their development of contingency plans or design retrofits should problems be experienced with this equipment during initial operations or during the first 5 years of commercial operation (the reliability ramp period). MPC has advised that no such plans have been completed or are envisioned. BREI recommends that MPC develop a methodology to identify the potential problems and their causes that could be experienced with this first of a kind technology, and that contingency and mitigation plans be developed which could be implemented should problems be experienced.
4. The first commercial TRIG IGCC was to be located in DongGuan, China. The 120 MW DongGuan IGCC Power Plant will be the first phase of the total 920MW Sun State IGCC Power Project being developed by Beijing Guoneng. It was scheduled to be commissioned by February 2011. Data from initial operations of the 120 MW DongGuan gasifier were to be an important step in scaling up the TRIG technology providing SCS with information to validate full scale-up of TRIG for the Kemper application. SCS and KBR are also contracted to provide commissioning and start-up support. MPC advised BREI during the February, 2011 project review meeting that the DongGuan project had been delayed due to permitting problems. In June, 2011 MPC provided BREI with information that the project was in the early stages of construction. The information also indicated that progress on the project had slowed. MPC reported that SCS was to visit the DongGuan site in July, 2011 for a project review meeting. However, MPC has not provided a detailed report on the GuanDung project status since that time. However,, MPC has advised that as November, 2011 that:
 - The project is currently under construction
 - All critical equipment has been ordered and fabrication of the gasifier is 70% complete
 - Detailed design is approximately 50% complete
 - Construction is approximately 5% complete
 - The scheduled completed date is Summer 2012

The project's completion date is now more than a year behind schedule and it is BREI's opinion that based on the limited information provided, a 2012 completion date will be hard to achieve as both the Kemper and DongGuan projects are now at a similar stage of

completion. This delay has limited the value of any initial operating data in validating the Kemper design. When DongGuan becomes operational, progress on the Kemper County Project may be too far along to add any substantial value from the lessons learned during the DongGuan start-up.

5. MPC has entered into an Engineering, Construction, and Procurement (EPC) agreement with Southern Company Services (SCS) providing these services to MPC "at cost" without mark-up or fee. However, the agreement does not contain a not-to-exceed price cap or guarantees for scheduled commercial operation date, IGCC plant thermal performance, or plant availability. The SCS EPC agreement contains no Liquidated Damage provisions, thereby, exposing MPC to additional costs should SCS fail to meet the required May 2014 commercial Operation Date, or should the TRIG gasifier fail to meet its performance or availability targets.
6. SCS has in turn let multiple sub-contracts for process engineering support, technology licensing for key process technologies and construction services. BREI has reviewed key sub-contracts with respect to their commercial terms, guarantees, Liquidated Damages (LD's), liability limits and other pertinent factors. Of most significance is the Kellogg Brown & Root LLC (KBR) Engineering and Ancillary Support Services. KBR is responsible for the detailed design and engineering for the gasification process and gas cleanup blocks. While the contract is a fully reimbursable time and material based contract, there is a "not to exceed" price cap that cannot be exceeded without the development of a mutually agreed upon change order. In addition, the KBR contract contains customary LD's for its failure to meet certain schedule milestones; however, it should be noted that as co-developer of the TRIG gasifier with SCS, KBR has no guarantee or liability obligations for the performance of the gasifier including lignite to syngas conversion, efficiency, or syngas production rate.

Further, it is noted that as co-developers of the TRIG gasification technology both KBR and SCS plan to market and license the TRIG technology in both the petrochemical and power generation markets, with SCS having exclusive licensing rights in the power generation segment. This provides SCS and KBR with an incentive to demonstrate success with the Kemper project, but also has implications for MPC's ability to hold either SCS or KBR accountable for the successful performance of the technology.

7. The 89% availability target for the facility after 5 years is optimistic considering that the Project may be the first commercial application of a TRIG gasification technology and is higher than that achieved to date by other operating IGCC facilities. This target is also above a majority of the US coal fired generation fleet, which fall into the 85% to 90% availability range. MPC notes that the 89% availability target is consistent with that of the Southern Company's coal fleet, and that they expect the mature plant availability of the Kemper IGCC plant to be similar. Due to the higher complexity of an IGCC plant, it will be difficult for the Kemper Plant to achieve an availability rate equivalent to that of the present Southern Company coal fleet. MPC and SCS have conducted a rigorous availability review; however it is BREI's opinion that it is based on a best case reliability, maintenance and unplanned down time scenario for all plant systems; and assumes that

required major maintenance intervals for the combustion turbines and TRIG gasifiers will be similar allowing simultaneous maintenance of these components. In addition there are several major equipment components, most notably the gasifier air and CO₂ compressors, that are not included in the SCS availability calculation. There are no spare units and these are of the largest of their kind commercially available. A failure rate and repair down time analysis for these compressors should be completed and included in MPC's availability calculations. In addition it is recommended that MPC evaluate the impact on availability should it not be possible to conduct major combustion turbine and TRIG gasifier maintenance simultaneously.

8. BREI has reviewed MPC's detailed cost estimate developed to justify the \$2.4 billion capital cost cap included in the Commission Order. BREI finds the estimate, which does not include the lignite mine, CO₂ pipeline nor ash disposal facilities, to be complete and thorough. BREI is of the opinion that field labor hours may be underestimated and that engineering man-hour estimates may be high. MPC has advised that their estimate includes a contingency rate of 2% for the combined cycle power plant and a contingency rate of 10% for the gasification block yielding an overall contingency of 7.5% on the project. BREI considers this level of contingency to be low when compared to other projects of this magnitude and complexity, and when considering the current stage of the project development and execution due to the overall physical size of the project in land area, which spreads out the workforce and effects labor productivity. Further, the peak months of field labor may be a strain on finding sufficient workers that are productive. At peak, labor on site is projected to exceed 2000 workers for a number of months. In our opinion, labor productivity may be reduced when nearing the peak labor force and also because of the constant 50 hour work week. This may add to MPC's labor cost estimate. BREI suggests that MPC develop a total project cost sensitivity that includes a higher contingency on the total project cost in lieu of the MPC considering technology risk and engineering and construction status. When compared to other projects of this magnitude and complexity, the ultimate capital cost cap of \$2.88 billion would appear to include a more customary and reasonable level of project contingency. It should be further noted that progressing construction with only partial engineering completion can lead to a high level of field changes and the need for higher levels of contingency to account for field change orders as engineering is completed. At the November Progress Meeting, MPC stated that as of September construction and engineering were 9% and 51% complete respectively. Close monitoring of both field and engineering change orders will be required to track the cost and schedule impact of these changes, contingency run-down, and the ultimate cost of the project. More discussion with MPC is needed to develop a full understanding of their engineering and field change order process and tracking methods.
9. BREI reviewed MPC's Financial Model ("Proforma") and discussed with MPC both the status of the Project DOE Loan Guarantee and the underlying Proforma assumptions. MPC advised that they do not expect to receive a conditional loan commitment from DOE until late 2011 or possibly early 2012. While MPC is confident that the DOE will approve the loan, there is concern over the current level of government funding available and uncertainty in the approval process including the required Office of Management and

Budget (OMB) consent. MPC has developed a sensitivity Proforma case to evaluate a non-DOE funded project. MPC advised that they believe non-DOE funded debt will carry a premium of approximately 75 basis points over the DOE loan. Based on BREI's current experience as DOE's Independent Engineer on several Loan Guarantee applications, the average DOE guaranteed debt interest rate is approximately 5%. BREI's interpretation of the Proforma provided for review indicates Gross Construction Expenditures of \$2.789 billion and Total Uses of Funds of \$2.882 billion not including mine working capital, and an assumed debt interest rate of 5.82% which is inconsistent with the \$2.4 billion capital cost cap imposed by the Commission Order. Based on the assumed interest rate, it is possible that the Proforma provided for BREI review is based on a non-DOE debt financed project. Further, the Proforma provided by MPC is based on 100% MPC ownership of the project. A Proforma sensitivity reflecting a 17.5% SMEPA purchase has not yet been provided for BREI review. BREI recommends that a Proforma sensitivity case reflecting the SMEPA purchase be developed and/or provided for independent review. Further discussions with MPC are recommended reconcile these differences and to confirm their estimates for the non-DOE debt interest rates.

10. Accurate tracking of the project status schedule is a critical component in assuring that the project achieves the May 2014 Commercial Operation Date, which is a condition precedent for the project to receive the \$133 million 48A Phase I Investment Tax Credit. As noted above, MPC's integrated project schedule has not been resource loaded, and shows a critical path with certain activities with a duration less than that required to complete that particular task (referred to as "negative float"). In addition, the MPC schedule is judged to be aggressive and may be further constrained by the status of engineering completion. BREI recommends that MPC should develop a fully resource loaded schedule and make the re-evaluation of the project critical path a top priority. BREI and MPC have agreed to conduct schedule review meetings at the onset of Phase 2 to obtain a better understanding of MPC's scheduling philosophy and to address the schedule issues and concerns identified in this report. If the resource loaded schedule indicates problems in achieving the May, 2014 commercial operation date, MPC may need to develop recovery plans to restore a reasonable critical path leading to the scheduled Project Commercial Operation Date. Any corrective actions will need to be implemented as soon as practical in order to recover any schedule slip. If it is found that engineering completion is or becomes the critical path, SCS will have to increase engineering staff or obtain outside engineering support.
11. BREI visited the project site in March 16-17, 2011 and on July 20-21, 2011, and began monthly visits to the site to assess the status of construction progress at that time. BREI has been submitting monthly Site Inspection Reports to MPUS under separate cover since July 2011. In our meetings thus far, BREI judged construction progress to be on schedule and that the construction staff and site superintendent were very knowledgeable and experienced with projects of this magnitude. However, with construction activities continuing to ramp-up, it is necessary for the MPUS to continually receive monthly updates on construction status. To accomplish this, BREI recommends the following monitoring program be instituted at the onset of Phase II monitoring:

- During the site visit, perform random inspections and observations of the work activities being performed to determine they are in accordance with the integrated project schedule. Verify the quality of the installation is in accordance with Local, State, and Federal codes and standards and industry requirements.
- Monitor the work activities to be on schedule, or there are adequate work-around contingencies in place to assure no additional schedule slippages.
- Monitor the completion of the engineering drawings and procedures to be developed in a sufficient timeframe to support the procurement and construction phases of the project.
- Review and monitor the procurement and delivery of the components and materials to support construction installations.
- Perform a monthly analysis of the Scheduled Critical Path activities relative to the baseline schedule for accuracy.
- Perform a quarterly analysis of the current construction schedule relative to the baseline schedule.
- Review and monitor the earned value system for tracking progress.
- Review and monitor the turnover process from Construction to the Startup group.
- Monitor periodic testing of the various systems during the startup process.
- Monitor scope and cost changes to the project.
- Monitor the effectiveness of the project Safety program to be in accordance with OSHA and State of Mississippi requirements.
- Make necessary recommendations to the project team to enhance and support the project for a successful completion.
- Periodic visits (i.e. quarterly) by BREI Engineering personnel to review the status of the detailed design efforts at the SCS and KBR facilities. Reviews should include designs ability to support the construction field installations and to monitor the engineering products to be in accordance with the schedule.
- When unexpected and out-of-the-ordinary conditions or events arise on the project or are potentially expected, BREI will submit to the Staff a document outlining our concerns and the actions required to review and possibility mitigate these detrimental conditions. The document will include the reason for our concern and the associated costs/man hours to perform the additional reviews. These reviews will be over and above the forecasted hours shown below.

12. The current requirement to capture 65% CO₂ is achievable based on MPC's design and the selection of UOP's "Selexol" process for CO₂ separation. Capture and sequestration of 65% of the CO₂ produced is a condition precedent for the project to receive the \$279 million 48A Phase II Investment Tax Credit. MPC has executed a CO₂ off-take agreement with Denbury Resources Inc. and with Tellus Operating Group, LLC for up to 70% and 30%, respectively of the required CO₂ off take. Each of the contracts contains provisions for off-take of 100% of the CO₂ produced, however, under the Tellus contract, MPC can only provide 100% of the total CO₂ output for a total of 35 cumulative operating days in any given calendar year.. Tellus and Denbury agreements have 20 and 16 year terms respectively which will necessitate developing alternative CO₂ sequestration plans for the 40 year project life. In addition, it is well known that CO₂ injection into individual oil fields has a finite life. However, it is also known that Texas

and Oklahoma and other states may have a great number of wells that may be suitable for CO₂ injection, but this would require additional piping, infrastructure and associated costs. Therefore, any associated off-take conditions and the ability to negotiate longer term agreements with Tellus and Denbury or others need to be framed in this context. BREI discussed the issue of long term CO₂ off take assurance and alternate plans with MPC. MPC advised that they are approaching this on several fronts including internal SCS planning work in conjunction with the balance of their coal fired generation fleet, at the university level, and at the PSDF research center in Wilsonville, Alabama, which is now focusing on carbon separation and sequestration technology development. However, MPC has not clearly defined what these alternate plans may include or what the cost impact for CO₂ sequestration will be during the later years of the project life. Such plans need to be developed by MPC. Both off-take Agreements are based on transfer of CO₂ title at the point of delivery, and both have reasonable indemnification provisions to protect Mississippi Power from subsequent liability from CO₂ escape, leakage or migration after transfer of title. However, with recent legislation defining CO₂ as a pollutant, it is possible that the ability to transfer title could be challenged. BREI recommends that this issue be reviewed with MPC's legal counsel and that it be recommended that they further research this issue and develop contingency plans, should the ability to transfer title be challenged.

13. There are certain permitting issues regarding "dependency" of the lignite mine and IGCC plant. While the IGCC plant has received all critical permits, the Sierra Club has argued that the sole purpose of the lignite mine is to supply the gasifier plant with fuel and the IGCC plant relies solely on the lignite mine for fuel. Consequently, Sierra Club is of the opinion that both facilities should have been permitted as a single emissions source. This issue was raised by the Sierra Club during their review of the draft PSD (Air) permit. Specifically, the Sierra Club noted that, "The power plant and the mine must be considered together as a single source". MPC has developed a detailed legal opinion defending their permitting approach in response to the Sierra Club's challenge. With the MDEQ approval of the Lignite Mine Surface Coal Mining and Reclamation Permit on December 15, 2011, issues related to the Sierra Club challenge are significantly reduced.
14. The predicted electric production and power consumption in the process units were determined to be reasonable. Some margin for guaranteed performance and for degradation should be applied to confirm long term revenue projections. BREI recommends that MPC should perform a degradation analysis to determine the degradation of the combined cycle output and heat rate to confirm MPC's long term revenue projections.

**ATTACHMENT D: 2012 COST & SCHEDULE ANALYSIS REPORT (REDACTED
PUBLIC VERSION FILED 11/26/2012)**

PUBLIC UTILITIES STAFF

CHAD J. REYNOLDS
GENERAL COUNSEL

MICHAEL MCCOOL, DIRECTOR
WATER & SEWER DIVISION

CHRISTOPHER GARBACZ, DIRECTOR
ECONOMICS & PLANNING DIVISION



VIRDEN C. JONES
EXECUTIVE DIRECTOR

RANDY TEW, DIRECTOR
ADMINISTRATIVE SERVICES DIVISION

WENDY COLLINS, DIRECTOR
ELECTRIC, GAS & COMMUNICATIONS

DONNA CHANDLER, DIRECTOR
COMMUNICATIONS SECTION

November 26, 2012

FILED

NOV 26 2012

VIA ELECTRONIC MAIL ONLY

**MISS. PUBLIC SERVICE
COMMISSION**

Mississippi Public Service Commission
Attn: Hon. Brian U. Ray, Executive Secretary
Post Office Box 1174
Jackson, Mississippi 39215

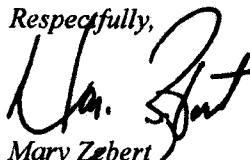
Re: PETITION OF MISSISSIPPI POWER COMPANY FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AUTHORIZING THE ACQUISITION, CONSTRUCTION, AND OPERATION OF AN ELECTRIC GENERATING PLANT, ASSOCIATED TRANSMISSION FACILITIES, ASSOCIATED GAS PIPELINE FACILITIES, ASSOCIATED RIGHTS-OF-WAY, AND RELATED FACILITIES IN KEMPER, LAUDERDALE, CLARKE, AND JASPER COUNTIES, MISSISSIPPI
MPSC Docket No. 2009-UA-14

Dear Mr. Ray:

Attached please find Staff's Independent Monitor's Project Schedule and Cost Evaluation Report regarding the above referenced docket. The Staff requests Mississippi Power Company to file any reply comments within ten (10) business days of the date of this Evaluation Report filing.

If you have any questions regarding the Staff's request or of the filing of this Evaluation Report, please contact Chad Reynolds at (601) 961-5471.

Respectfully,


Mary Zebert
Paralegal Specialist

/mz

Attachment

Cc: Mississippi Power Company via E-mail only
Central Filing via E-mail only

FILED

NOV 26 2012

**MISS. PUBLIC SERVICE
COMMISSION**

**INDEPENDENT MONITOR'S
PROJECT SCHEDULE AND COST EVALUATION**

for the

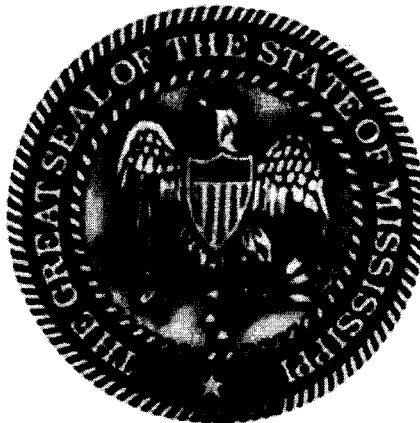
KEMPER COUNTY IGCC PROJECT

in the

STATE OF MISSISSIPPI

prepared for

MISSISSIPPI PUBLIC UTILITIES STAFF



Prepared by

**BURNS AND ROE ENTERPRISES, INC.
800 KINDERKAMACK ROAD
ORADELL, NEW JERSEY 07649**

November 15, 2012

Redacted Public Version

DISCLAIMER

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**KEMPER COUNTY IGCC PROJECT
INDEPENDENT MONITOR'S PROJECT SCHEDULE AND COST EVALUATION**

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1 EXECUTIVE SUMMARY

1.1 Introduction

At the March 2012 independent monitor's monthly progress meeting held on March 8, 2012, Mississippi Power Company (MPCo) advised both Burns and Roe Enterprises (BREI), the Mississippi Public Service Commission's (MPSC) Independent Monitor (IM), that the Kemper Integrated Gasification Combined-Cycle (IGCC) Project (Kemper Project) was going to overrun the \$2,400,000,000 construction cost cap (or "soft cap") as stipulated in the MPSC's Certificate of Public Convenience and Necessity. MPCo further advised that they were in the process of re-forecasting the estimated completion costs at that time, and that they would complete a revised project construction cost estimate and be prepared to present a full explanation of the basis and reasons for the increase in cost to the independent monitors in early May 2012.

During meetings on May 11, 2012, in Birmingham, Alabama, MPCo and Southern Company Services (SCS) presented a "cost outlook" of \$2,760,000,000 for the project to BREI, and further advised that the Project was still on schedule for the May 1, 2014, commercial operation date¹. The SCS cost outlook was based on actual project status as of March 31, 2012, or the cost outlook "Date Stamp." While a significant amount of data was presented at the meeting, some critical information required to complete BREI's independent evaluation of the project's cost and schedule was not provided. The information did not include a re-baselined project schedule along with responses to previous BREI questions regarding the schedule, and SCS's project management and tracking procedures, which would have allowed BREI to assess the actual status of engineering, procurement, and construction, as well as the accuracy of the \$2,760,000,000 cost outlook. Furthermore, the \$2,760,000,000 cost outlook appeared to contain no contingency budget, and SCS at that time had not updated the project critical path schedule analysis to reflect the reported growth in engineering, commodity quantities, construction labor man hours, late deliveries, and construction "work-arounds" required to meet the May 1, 2014, commercial operation date. BREI determined that an accurate reconciliation of the project cost or schedule to the level of accuracy requested by the Mississippi Public Utilities Staff (MPUS) could not be determined based on the information provided and, thus, it could not verify whether the Kemper Project could be completed on schedule and within either the \$2,760,000,000 cost outlook or the \$2,880,000,000 maximum recoverable construction cost allowed under the MPSC certificate order.

As a result, on May 30, 2012, BREI recommended to the MPUS that it commission a cost and schedule evaluation to provide a more accurate and independent estimate of the current status, percent complete, scope, schedule risk, and cost of the remaining work, as well as the estimated

¹ In this Report, May 1, 2014, is referred to as either the project completion date or commercial operation date.

total cost and completion date for the Kemper Project. BREI's evaluation represents our best estimate of the final construction cost and completion date based on the methodology discussed herein, and it also identifies areas of continued concern and uncertainty.

BREI provides a list of recommended actions that MPCo and SCS (collectively "the company") should consider implementing. Other project risk factors, which could further impact the completion of the project, are also addressed along with our recommendations to assist MPCo and SCS in improving the project's cost and/or schedule outlook.

During the course of the evaluation, MPCo notified BREI (on August 7, 2012) that SCS had reassigned responsibilities of a major construction subcontractor, KBR-Yates, from the project in an effort to reduce cost by lowering overhead and utilizing less equipment at the site. KBR-Yates had been responsible for construction of the gasifier island, the most critical and complex part of the project, which was behind schedule due to delays in the delivery of gasifier components. Performance Contractors, a construction firm already working on the Kemper Project, assumed an expanded construction scope by taking over KBR-Yates' responsibilities and a significant portion of the KBR-Yates' construction craft labor. BREI has been monitoring the status of this transition and has seen minimal negative impact on the schedule due to the transition of, or loss of, construction craft labor. BREI recommends that a schedule re-assessment be performed six months from the date of the reassignment (February 2013) to determine whether any long term impacts to the project may have been caused by this change.

1.2 Evaluation Methodology and Scope

BREI's evaluation plan and methodology consisted of several phases beginning with the determination of select areas or "slices" of the project to be examined, specifically in the gasifier and gas treatment areas to get a representative cross-section of construction activities, schedule status and costs. These areas were selected as they represent the highest level of construction criticality, the most complex parts of the project, and the areas with technology risk. A field evaluation was then conducted by a team of senior professionals experienced in evaluating project engineering and construction status, cost estimating, project scheduling, and procurement to assess the accuracy of the construction percent complete values that MPCo and SCS reported in their May 12, 2012, cost forecast. The team then moved to Birmingham and went through the same process with the SCS engineering staff to assess the accuracy of the engineering percent complete values reported. BREI also evaluated SCS's procurement procedures and procurement status focusing on bulk materials (piping, electrical cable, instruments, steel, and concrete) where significant growth in the quantities required to complete the project had been reported by the company, and where the most procurement cost uncertainty still remains.

BREI completed a preliminary project cost and schedule evaluation and presented its findings to MPUS and MPCo at a joint meeting on August 22, 2012. During and immediately following the

meeting, a list of additional data required to complete our evaluation was requested by BREI. This included a request for an updated and re-baselined project schedule, which was provided.

Using the information provided in May 2012 and as updated by the company on July 31, 2012, BREI developed an independent "baseline cost estimate" of the Kemper Project with a Date Stamp of July 31, 2012. The baseline cost estimate considers BREI's estimates of percent complete, remaining work to complete, project schedule, and completion date; and assumes that the project will be completed on May 1, 2014, on schedule. The baseline cost estimate BREI arrived at includes an evaluation of labor rates and commodity prices, labor productivity and probable labor costs that we believe will be experienced for the remaining duration of the project. The unit and labor rates utilized by SCS were evaluated based on trends reported by SCS from the period May through August 2012, BREI's internal database information, knowledge of other similarly sized projects being planned or under construction in the Southeast, and the experience of the evaluation team. Confidence levels were developed and a contingency budget analysis was conducted. Appropriate levels of contingency budget were included in the baseline cost estimate, in the areas where we believe the potential for additional growth in cost exists, taking into account engineering and construction status, previous project experience and professional judgment. This data was then used to conduct a statistical analysis to determine the most probable project cost using Monte Carlo methods.

BREI's evaluation also included an evaluation of the project's most current project schedule which was updated and re-baselined on August 31, 2012. This evaluation focused on the Critical Path elements of the schedule using Primavera P6 scheduling software. The evaluation considered the progress achieved to date compared to the current target completion dates. Outstanding engineering releases, major procurement delivery dates, and major commodities installation plans were compared to the original project baseline plan to determine how much installation progress is being achieved, and to determine the rate of progress achieved to date against the rate of progress reported by SCS. BREI used this high level rate of progress indicator to forecast completion in other areas.

BREI executed two independent critical path and schedule risk analyses to determine a most probable completion date and to validate our findings. First, the August 31, 2012, re-baselined schedule critical path was analyzed and adjusted to reflect BREI's opinion of both duration and logic for selected critical path tasks. BREI identified fourteen specific schedule activities for this evaluation. Logic, duration estimates, as well as early and late completion date estimates were developed for each, based on BREI's estimates of quantity increases, procurement delivery delays and required work-arounds including gasifier structural steel, late engineering release of pipe fabrication drawings, additional pipe fabrication, pipe and electrical installation quantities above baseline, and other factors. Activities judged to have high levels of uncertainty such as the impact of offsite utility relocations, turnover package reviews, start-up and commissioning (considering the first-of-a-kind start-up of the TRIG gasifiers), and construction completion were

also considered. BREI then utilized the Primavera P6 Monte Carlo risk analysis module to determine a probabilistic estimate of the revised critical path. Estimated completion dates with confidence levels at 20%, 50%, and 80% were then identified. A higher schedule confidence level, as expressed in this evaluation, represents a higher probability that the project will be completed at, or before, the estimated completion date. BREI then performed a separate Monte Carlo analysis of the SCS August 31, 2012, re-baselined critical path schedule without modifying logic or activity durations by applying confidence levels directly to the critical path activities using the Primavera P6 Monte Carlo risk analysis module to determine a probabilistic estimate of the baseline schedule completion date. The results of this evaluation were compared to BREI's re-created schedule to validate the results of our evaluation and assess its reasonableness.

In parallel with the schedule risk analysis, BREI developed an estimate, based on data provided by the company, of the indirect project carrying costs that would result from a delay in the project completion date. Separate estimates were developed for delays incurred during construction and start-up, since the project carrying costs are reduced significantly when the project transitions from construction to start-up.

1.3 Evaluation Conclusions

Completion Status

During the monthly independent monitor's meeting held on September 13, 2012 (reflecting data through July 31, 2012), SCS reported that the project had achieved an engineering/design completion of 87% and a construction completion of 30%. Based upon the opinions of the independent monitors who attended the meeting and the subsequent tour of the facility, by those who have a great deal of familiarity with the Kemper Project, it was concluded that these percentages appeared to be accurate.

Baseline Cost Estimate

Based on the methodology outlined above, BREI developed a baseline cost estimate using MPCo's May 11, 2012, cost outlook data, which was presented in September's monthly monitor's meeting (reflecting status through July 31, 2012). This data included additional procurements, materials quantities, installation unit rates, labor rates, engineering, indirect cost, and other costs. Appropriate contingencies were developed based on project status and applied in areas where risk remains. Cost category confidence levels were developed and a statistical analysis was conducted to estimate the most probable completion cost using Monte Carlo methods. BREI's estimated baseline cost range for the Kemper Project is \$3,000,000,000 – \$3,150,000,000, or a variance of approximately 7% - 8% above MPCo's current estimate of \$2,880,000,000 which is also the MPSC's hard cost cap. The baseline cost range is based on a

90% level of confidence. A 90% level of confidence, as expressed in this report, represents that there is a 90% probability that the completion cost will fall within the defined range of costs. This estimate does not include the possibility of any force majeure or schedule delay events; however, it does consider the costs associated with accelerating the schedule to meet the May 1, 2014, commercial operation date.

Estimated Completion Date

Based on the re-created critical path schedule as defined above, BREI utilized the Primavera P6 Monte Carlo risk analysis module to determine a probabilistic estimate of the project completion date. Completion dates with confidence levels at 20%, 50%, and 80% are identified in the table below. Based on the completion date evaluation, it is BREI's opinion that the most probable completion date lies between November 6, 2014, and November 29, 2014. For comparative purposes, BREI's independent Monte Carlo analysis of the SCS baseline schedule indicates a completion date range of September 5, 2014, to November 28, 2014, based on the same confidence levels.

Confidence Level	Estimated Completion Date
20%	11/06/2014
50%	11/29/2014
80%	12/20/2014

Estimated Project Delay Costs

If a delay during construction occurs, it will likely happen as the construction efforts are ramping down such that the project indirect costs would then be below those incurred during the peak of construction. Based on the indirect cost data provided by the company, BREI estimates that a project schedule overrun allowance of \$8,000,000 to \$12,000,000 per month will cover the cost of additional construction management, construction equipment and operators and other associated indirect cost items, depending on when during the construction ramp down the delay occurs. It is estimated that an allowance of \$3,000,000 to \$5,000,000 will cover additional costs resulting from an extension during the start-up phase that goes beyond the anticipated project completion date to cover the cost of additional staff, stand-by construction labor and materials.

Importance of Completion Date in Controlling Project Cost

As evidenced in the Baseline Cost Estimate, Completion Status, and the Estimated Project Delay Cost sections above, a delay in the completion of the project will add significantly to the final project cost. Therefore, it is recommended that the company continually re-evaluate the project

schedule and completion status, and develop remedial actions to both minimize further delays in schedule and, where prudent, develop schedule acceleration plans to improve upon the project completion date. BREI's recommendations and remedial actions summarized below are intended to assist the company in achieving these goals.

1.4 Recommendations and Remedial Actions

The Kemper Project has been planned and conceived to provide a potential long term benefit to both the Mississippi consumers and to MPCo by providing needed fuel diversity while being one of the cleanest coal fueled generating facilities in the country as a result of the utilization of TRIG gasification technology. This, along with large scale carbon capture and sequestration for beneficial enhanced oil recovery will provide a significant reduction in carbon dioxide emissions. The recommendations contained below are intended to aid both MPCo and SCS in addressing some of the challenges they are experiencing in managing the schedule and controlling the cost of executing this very challenging first-of-a-kind project.

The company has experienced challenges in its implementation of the Kemper Project. As the Independent Monitor to the MPUS, BREI has seen the project grow in both scope and cost while MPCo's schedule and projected commercial operation date of May 1, 2014, has been maintained. MPCo has re-emphasized its commitment to complete construction, commissioning and start-up by that date.

MPCo's cost estimate for the facility has grown to \$2,880,000,000 with a reported contingency budget of \$72,000,000 currently allocated. While the project has achieved a high degree of completion in engineering and design, there are still 17 more months of major construction activities to be conducted. Significant project uncertainties remain with construction at approximately 30% complete, and with many challenging activities including offsite pipe spool fabrication and its installation, electrical cabling installation, commissioning, testing, and start-up of all the facilities. Based on our analyses and evaluations, we have concluded that the contingency of \$72,000,000 allocated by MPCo may not cover the remaining uncertainties, and, as a result, we believe the project costs could exceed \$3,000,000,000, especially if the project scheduled completion date of May 1, 2014, is not met.

If the project is delayed either due to construction or start-up difficulties, these delays will increase the project cost. While MPCo is committed to completing the project on schedule, there are still some risks in the updated and re-baselined August 31, 2012, schedule. This leads us to conclude that there is a low probability that the May 1, 2014, projected commercial operation date can be achieved unless all of the specific construction work-arounds are implemented, and future unforeseen delays or difficulties are effectively addressed. There is still a technology risk due to scale-up and the extrapolation of the TRIG technology from the Wilsonville PSDF pilot

facility size to the commercial Kemper project which could delay start-up and result in additional project costs.

Through the course of BREI's monitoring of the Kemper project and attendance at the monthly independent monitor's site meetings, as first reported to MPUS following the August 2011 site meeting, and as verified through this evaluation, BREI has determined that SCS, in the execution of the Kemper project, is not utilizing some basic project management and project controls tools and techniques that are available and customarily used in the industry for a project of this magnitude. Although SCS has such tools available within its corporate tool kit of Project Management Procedures, SCS has advised that it has opted not to utilize several of its standard corporate procedures for the Kemper Project. In addition, these early project decisions appear to have made it difficult at the present stage of the project for SCS to effectively monitor, track and manage the logistics of complex tasks such as pipe spool fabrication, and installation. BREI's specific recommendations to MPCo and the MPUS include:

- Conduct a detailed review of the August 31, 2012, re-baselined schedule to verify and, if necessary, modify the logic, predecessors and successors to each activity.
- Consider the benefits of labor loading and commodity loading the P6 project schedule for the remaining critical path activities, rather than using a separate Excel spreadsheet for planning and projecting construction labor needs. The value of this kind of approach has been recently demonstrated by the successful work-around plan that SCS utilized taking advantage of a fully resource loaded schedule that SCS implemented for the gasifier delivery recovery plan. This action alone has significantly improved the gasifier component delivery dates and in BREI's opinion has contributed to a two to three month improvement in the overall project schedule.
- SCS developed a pipe fabrication plan, which is part of the overall piping installation plan. SCS needs to continue to monitor and update the plan based upon conditions in the field, and continue to use the plan as a tool for success.
- SCS developed and is implementing an effective pipe installation plan, which coincides with the activities on the baseline schedule. Continue to use the plan and to maintain the elements of the plan for success.
- SCS developed and is implementing an effective electrical installation plan, which coincides with the activities on the baseline schedule. Continue to use the plan and to maintain the elements of the plan for success.
- Use SCS Procedure PR07, Receipt, Storage and Handling, for a material control program at the site.
- Re-evaluate the balance between the cost of accelerating the schedule and the cost of delaying commercial operation. It may be more cost-effective to minimize acceleration

costs at the expense of a later commercial operation date. This evaluation would need to consider potential loss of the 48A Phase I Investment Tax Credit.

- Give further thought to the parallel gasifier start-up plan. At a minimum, stagger the start-up of each train by two to four weeks to take advantage of lessons learned and to minimize the possibly of damaging both trains should a start-up problem occur. Accelerate operator hiring and training including additional staff to support parallel start-up.
- Provide additional labor and labor training with direct SCS oversight as the construction staff is ramped up to meet peak requirements. A third shift could be contemplated but it should be analyzed thoroughly before it is implemented since it could add inefficiencies which may increase the total project cost with minimal schedule benefit.
- Consider accelerating the commissioning and start-up of the combined-cycle plant for operation on natural gas. This could result in early incremental revenue to MPCo under favorable market conditions which could offset some of the loss of the 48A Phase I investment tax credit if it were lost due to a delay in commercial operation.
- Assure development of a commissioning, start-up, and testing plan commensurate with the first-of-a-kind status of the technology being used. Detailed procedures should be developed to anticipate any challenges which the gasifier and cleanup systems may face during commission, start-up and testing.

2 DETAILED EVALUATION SUMMARY AND FINDINGS:

2.1 Methodology/Adjustment of Commodities and Unit Rates:

BREI completed an evaluation of the Kemper project in order to obtain sufficient data to forecast the remaining cost of the project. The data collected at both the site as well as the SCS office in Birmingham was a “slice” through the gasifier building, the gas cleanup area, and the pipe racks. These areas were selected as they represent the areas with the highest level of construction completion, the most complex parts of the plant, and the highest level of technology risk. The evaluation was focused on the following commodities:

- Structural Steel
- Piping
- Cable Tray
- Cable

BREI estimated the remaining or “to-go” quantities based upon our understanding and verification of the SCS methods of calculating quantities coupled with our own in-house methods, databases and the experience of our evaluation team. All remaining quantity calculations were performed using July 31, 2012, as the baseline for commodity installations. This date was established as the baseline date that was agreed upon by BREI, MPCo and the MPUS. Table 1 compares the original MPCo certified cost estimate quantities to those reported as of July 31, 2012, cost outlook, and to BREI’s estimated quantities “to-go.” In addition to the remaining quantities, BREI also evaluated and adjusted the unit rates² and craft labor rates³ being used by SCS in the current cost outlook. The unit and labor rates utilized by BREI in this evaluation were developed based upon the current experience rates achieved to date at the Kemper site and the trends in these rates, our internal database information, knowledge of other similarly sized projects being planned or under construction in the Southeast, and the experience of the evaluation team. Table 1 provides a comparison of quantities and unit rates. A complete list of BREI’s labor rates compared to those applied by SCS is included in Table 3. The logic applied by BREI in developing its quantities, unit rates and labor rates estimates are summarized below.

² “Unit Rate” as referred to in this report is the number of construction man hours required to install a unit of material, i.e. linear foot of pipe, ton of structural steel, etc.

³ “Craft Labor Rate” refers to the rate expressed as dollars/man hour paid for specialty craft labor.

Table 1
Evaluated Quantity Comparison for Selected Areas

Component	Unit	Certification		July 31st Forecast		To-Go			BREI Forecast	
		Quantities	Unit Rate	Quantities	Unit Rate	Installed Quantities	To-Go Quantities	Current Unit Rate	TO-GO Quantities	Unit Rate
Steel	Ton	28,168		37,552		14,465	23,087		23,087	32.39
Piping (Above Ground)	LF	605,946		731,493		41,902	689,591		703,383	4.44
Cable Tray	LF	66,238		148,280		35,383	112,897		112,897	1.566
Cable (Power/Control)	LF	3,218,675		12,756,782		208,605	12,548,177		12,548,177	0.1
Conduit	LF	N/A		618,092		6,846	611,226		611,226	0.80
Terminations	EA	N/A		197,320		4,284	193,536		193,536	1.12
Concrete	CY	50,181		97,191		81,506	15,685		15,685	
Instruments	EA	N/A		10,625		0	10,625		10,625	11.00

2.2 Craft Labor Rate Evaluation

The company indicated that the current labor rates used by the project are negotiated with each contractor and include various craft rates. For the current forecast, they used an average rate of [REDACTED] per hour for the gasifier and the gas clean-up areas and a [REDACTED] per hour rate for the combined-cycle and balance of plant (BOP) areas. The rates were determined by utilizing a craft mix ratio and the actual contractual billable rate for each craft. For the cost forecast presented in May 2012, the timing differential in craft rates was considered when developing the average rate. The billable contractual rate for an ironworker is the same as a pipefitter. The differential with electrician rates are driven by the Davis-Bacon Act of 1931 which established the requirement for paying prevailing wages on public works projects.

The company cost outlook assumes a [REDACTED] per man hour average rate. This rate considered the higher contractual billable rate for electricians. Also included was a per diem and a 55 hour work week. There are no day or night shift differential costs included, however, the electrical craft will utilize apprentices where appropriate to bring down the overall rate. The project indicated increases were considered for welders and specialty craft.

In the evaluation, BREI used the current project rates. However BREI feels that in order to attract a higher quality specialized worker such as welders for high alloy pipe, the project may have to reconsider a higher rate to attract such a qualified work force for these specialize skills.

2.3 Logic Applied for Additional Commodities

The following provides an overview of the methodology utilized by BREI in determining additional quantities, and unit rates for quantities that were used in the development of a baseline cost estimate for the Kemper Project as described in Section 2.3.2 of this Evaluation Report.

Structural Steel:

- Based on BREI's evaluation and judgment as of July 31, 2012, it is our opinion that the structural steel quantities as presented are accurate based upon the following factors: The steel design is 99% issued for construction (IFC).
- The design model is 99% complete.

BREI adjusted the current project steel overall unit rate (32.29 MH per ton) for the "to-go" quantities. Approximately 40% of the steel in place and the minor steel (grating, splice plates, and stair stringer) are being installed as the steel is erected from elevation to elevation.

Concrete:

For concrete quantities, BREI used the same quantity as reported in the MPCo September 13, 2012, report (based on July 31, 2012, data) since 92% of the design drawings are IFC. Further, a majority of the equipment has been purchased, and foundation information has been received, allowing for an accurate estimate of the remaining concrete and foundation requirements.

Since approximately 84% of the concrete is installed, BREI did not adjust the unit rate used by the project.

Pipe:

BREI views piping as having the highest risk for potential additional cost and schedule overruns due to potential fabrication issues, late delivery of materials, and securing a sufficient amount of skilled workers to support the project schedule at the low labor rates included in the company cost outlook.

Since the May 2012 independent monitor's cost outlook meeting, the piping quantities have grown by approximately 32,863 LF, which covers a 5 month period. (The May data presented by the company was based upon a March 1, 2012, Data Date or time stamp). With the piping design at 91% complete and design drawings IFC, BREI feels that an estimated increase of 2% of the

remaining quantities to go would be prudent to account for potential scope and quantity growth for the piping commodities of the project.

Piping in the amount of 41,902 LF has been installed (7% of the total LF required). The piping installation unit rate of 3.82 (man hours per foot) currently reported by the company is higher than the July 31, 2012, reported unit rate of 3.02, indicating an upward trend. A majority of the installed quantities to date is located in pipe racks, which represents some of the simpler installations. Therefore, BREI believes that it is prudent and appropriate to adjust the to-go unit rate to approximately 4.44 for the remaining piping quantities.

Pipe Insulation:

This is a material and labor item reported as a subcontracted item of work by SCS. BREI did not adjust this commodity as it equates to approximately 45% of the total linear feet of piping, which is typical for a project of this size.

Duct Banks:

BREI did not make any adjustments to the duct bank installation rate or cost as they are 95% installed (IFC) for the project.

Power and Control Cable:

Based on experience, it is BREI's opinion that electrical power and control cable installation, including electrical terminations, represents the second highest risk for a cost and schedule overrun for a project at this stage of completion due to the status of engineering completion which is the least complete compared to the other engineering disciplines at only 22% IFC and just less than 65% modeled for the remainder of the design.

Considering the above, and based on the fact that the design has shown minimal scope growth since the March 1, 2012, Data Date presented at the May cost meeting, BREI has not increased the electrical cable quantities.

Power cable represents only 8% of the overall linear feet of cable for the project leaving the remaining 92% as control cable. The control cable is easier to pull or install in bulk; however, tagging each line and installing to the end devices afterwards is much more time consuming than that for power cable. Therefore, BREI has adjusted the current project unit rate of 0.05 to 0.10 for the remaining quantities to be installed. Another factor in making this determination is that the current installation rate is trending [REDACTED] and as the project activities increase, and additional craft are mobilized, this rate may well be jeopardized due to the congestion and complexity of running the control cable to the end devices.

Circuits and Terminations:

SCS estimates the total number of circuits and terminations together at 25,440 and 197,820 respectively. Terminations equate to approximately 8 terminations per circuit. This ratio appears reasonable. With the circuits at 85% design complete and the terminations at 99% design complete, BREI did not adjust the quantities; however, we have increased the unit rate slightly above the SCS estimate to account for expected inefficiencies due to congestion as the project activities increase and additional craft are mobilized and complexity of making terminations increases due to the increased rate of cable pulling.

Instrumentation:

The project instruments quantity as of the May 2012 meeting (March 1, 2012, Data Date) reflected a total of 10,625 instruments. As the current number remains the same with no scope growth for this commodity and 71% IFC, BREI has not increased the commodity quantities in this case, however, we have adjusted the unit rate to 11.00 for the same reasons noted above.

Conduit:

SCS does not design conduit as it is a component that is "field run," or installed as determined by the field craft foreman. SCS estimated 618,072 LF of conduit for the project. This number appears reasonable as the cable quantities have not increased.

Based on the current trend of conduit installations running higher than the project unit rate (0.48 vs. 0.35), BREI is of the opinion that this rate will escalate further and has increased the conduit unit rate in this evaluation to 0.80. This is based on the minimal amount currently installed to date, the fact that the actual rate is already running above the project unit rate, and the consideration that conduit typically runs high on most projects because it is a "field run" commodity. With no prior design, this lessens the control that construction management has to determine actual quantities, but allows the craft to determine the locations, which typically results in cost overruns.

Cable Tray:

Cable tray requirements are driven by the amount of electrical and control cable required. BREI has not increased the cable quantities for the project, so an increase of the cable tray is not required. This decision is supported by the fact that the cable tray design is now 97% IFC.

The current installation rate of cable tray is trending at 0.87 with 24% installed. BREI believes that the unit rate from this point on will increase for the remainder of the installation due to the difficulty of the locations of the remaining cable trays. BREI believes that a unit rate of 1.56 for the remaining installation is realistic.

Logic Applied to Non-Commodity Adjustments

Non-commodity related items were also reviewed and are summarized in Table 2 below. The table reflects the SCS forecasted dollars for each item and also shows the BREI forecast. An analysis of the basis for BREI's adjustments is provided below.

Table 2
Non-Commodity Forecast

	SCS Dollars To-Go	BREI Estimated Dollars To-Go
	July	July
SCS Controlled Labor (Total of categories defined below)	\$100,390,190	\$110,110,261
Design Labor ⁴ (SCS and KBR)	\$25,972,884	25,972,884
Project Support	\$4,756,995	\$5,232,695
Project Management	\$3,364,675	\$3,701,143
Construction Management	\$45,566,802	\$52,401,822
Start Up Labor	\$20,728,834	\$22,801,717

2.3.1 Logic for SCS Controlled Labor**Design Labor:**

SCS Design Labor, a component of SCS Controlled Labor, has increased by 53% from the certified man hours to the current forecasted man hours. From the May 2012 forecast, the man hours have increased by 5,000 hours, and the design is currently 86% complete. Based on these factors and the remaining man hours (forecast minus the expended hours), SCS should have sufficient hours to complete the remaining 14% of the design without increasing the forecast.

The SCS Controlled Labor category covers various other items, which are listed below, along with BREI's estimated adjustments for each of the categories.

⁴ In this Report, Engineering and Design services are referred to as "Design Labor" in accordance with SCS convention.

Project Support:

Project Support, as a component of SCS Controlled Labor, has increased 103% from the certified man hours to the current forecasted man hours. With the project at 38% complete overall, and only 56,062 man hours remaining for Project Support, BREI feels this may be low and has added 10% (5,606) to the remaining man hours to go.

KBR Labor:

KBR Labor, also a component of SCS Controlled Labor, has essentially completed its portion of the design and is only supporting the project at this point.

Project Management:

Project Management, a component of SCS Controlled Labor, has increased 33% from the certified to the current forecasted man hours. With the project at 38% complete overall, and only 23,575 man hours remaining for Project Management, BREI feels this is low and has added 10% (2,358) to the remaining man hours to go.

Construction Management:

Construction Management, also a component of SCS Controlled Labor, has increased 56% from the certified to the current forecasted man hours. With the construction percent complete at 30% and the construction craft man hours essentially doubling in number from the certification man hours, SCS forecasted in May 2012 a total of 657,417 man hours for construction management. They have expended 201,341 (32%) as of July 31, 2012, leaving a total of 456,076 man hours to go. With additional construction management needed as craft labor numbers increase, BREI believes it is prudent to increase the forecasted construction management man hours by 15% (68,414) of the remaining hours to go.

Start-Up Labor:

Start-Up Labor, also a component of SCS Controlled Labor, has increased 86% from certified to the current forecasted man hours. Of the 202,456 man hours forecasted for start-up, 53,993 (23%) have been expended as of July 31, 2012, however the project is reporting that only 19% of the start-up activities have been completed. Based on these numbers, BREI's project experience, and the first-of-a-kind nature of this project, BREI has increased the man hours to go for start-up by 10% (5,400).

2.3.2 Baseline Cost Estimate

Based on the commodity and non-commodity analysis and adjustments summarized above, BREI adjusted the values presented in the company's July 31 cost outlook data to arrive at an independent baseline cost estimate of the Kemper Project. The baseline cost estimate BREI arrived at also includes a re-evaluation of labor, unit labor and commodity prices utilized by SCS based on trends reported by the company from the period May through August 2012, BREI's internal database information, knowledge of other similarly sized projects being planned or under construction in the Southeast, and the experience of the evaluation team. The baseline estimate is based on a project completion date of May 1, 2014, therefore, the incremental indirect cost resulting from a schedule delay is not included in the baseline cost estimate.

Both the company and BREI agree that the cost estimate for a project as large and complex as the Kemper Project, with first-of-a-kind technology risk, at this stage of execution, must carry a contingency budget to cover remaining uncertainties BREI evaluated each of the line items covered in the evaluation and assigned a level of contingency based on growth trends identified to date, construction completion status, engineering status of each of the disciplines, technology risk, and level of uncertainty based on our experience and judgment. A contingency was not added to the balance of plant costs because a majority of these costs have already been incurred, and because BREI believes there is a low probability for growth in the balance of these cost areas.

The resultant contingency applied to the project in BREI's baseline estimate is on the order of 4% to 5%, which we believe to be appropriate based on project status, project cost and schedule trends to date, level of uncertainty, and technology risk. BREI recommends a reassessment of the contingency levels carried in this evaluation over the next 6 to 12 months, with appropriate adjustments made (either up or down) to both applied contingency and the estimated project cost, based on the trends in project completion and costs that are evidenced over the period.

The results of the baseline cost evaluation are summarized as follows:

MPCo Cost Outlook to BREI Baseline Cost Estimate Comparison		
MPCo July 2011 Project Cost Forecast (\$)	BREI Independent Baseline Cost Estimate (\$)	Variance (\$ / Percent)
\$2,880,000,000	\$3,166,146,000	\$286,146,000 / 9.9%

A detailed breakdown of BREI's baseline cost estimate is included in Table 3. The basis for the development of Table 3 is summarized as follows:

- A detailed breakdown of the quantities included in the company's July 31, 2012, cost outlook was developed including commodity quantities along with their assumed unit rates. The total company's commodity costs including installation were summed along with their estimated non-commodity costs (engineering, indirect costs, and the cost to procure additional commodities), representing the areas evaluated in the company's July 31, 2012, cost outlook which totaled \$1,259,608,153.
- The \$1,259,608,153 evaluated cost was then subtracted from the total July 31, 2012, \$2,880,000,000 cost outlook. The difference, \$1,548,391,847, represents the balance of the Kemper Project cost.
- The unit rates expressed in BREI's Table 3 baseline cost outlook represent the average of the unit rate achieved to date for the quantities installed and BREI's estimated unit rates for the to-go quantities.
- A majority of the balance of the project costs includes equipment already procured, bulk materials and field labor for the categories not evaluated above, offsite interconnection facilities including transmission and fuel facilities, start-up fuel and energy, and other areas. These costs were carried as a constant in BREI's baseline cost estimate because we believe there to be a low probability of growth in these areas. Any growth should be covered by contingency.
- Labor productivity, additional overtime and additional per diem were included in BREI's evaluated cost estimate but are not apparent in the company's cost estimate. These three line items account for \$62,200,000 that BREI has included. BREI believes that, in order to meet schedule an additional 700,000 field labor hours will be expended due to labor productivity losses. Additionally, these additional field labor hours and other issues will account for increases in cost for more hours worked on an overtime basis and more per diem costs to attract workers from outside the area that would be needed in order to make up the difference.
- No adjustments were made for schedule extension overhead costs.

2.3.3 Probabilistic Baseline Cost Analysis

Following a thorough review and validation of the estimated baseline costs, BREI assigned a confidence band to each of the cost line items again based on growth trends identified to date, completion status of construction, engineering status of each of the disciplines, technology risk, and level of uncertainty based on our experience and judgment. These confidence bands are expressed as (+/-) percentages in Table 3 and were used as (+/-) dollar ranges in the final cost probabilistic cost analysis.

A statistical analysis to determine the most probable final project cost for each of the completion dates, using “@RISK” Monte Carlo Probabilistic software, was used to develop a probable cost range for the baseline cost estimate.

The results of this analysis, based on a 90% confidence level, as generated by @RISK and as illustrated in Figure 1, predict a final baseline cost range of \$3,091,753,319 to \$3,136,388,921 with a mean of \$3,113,844,752 or a variance of \$233,844,752 (8.1%) above the company’s current estimate of \$2,880,000,000.

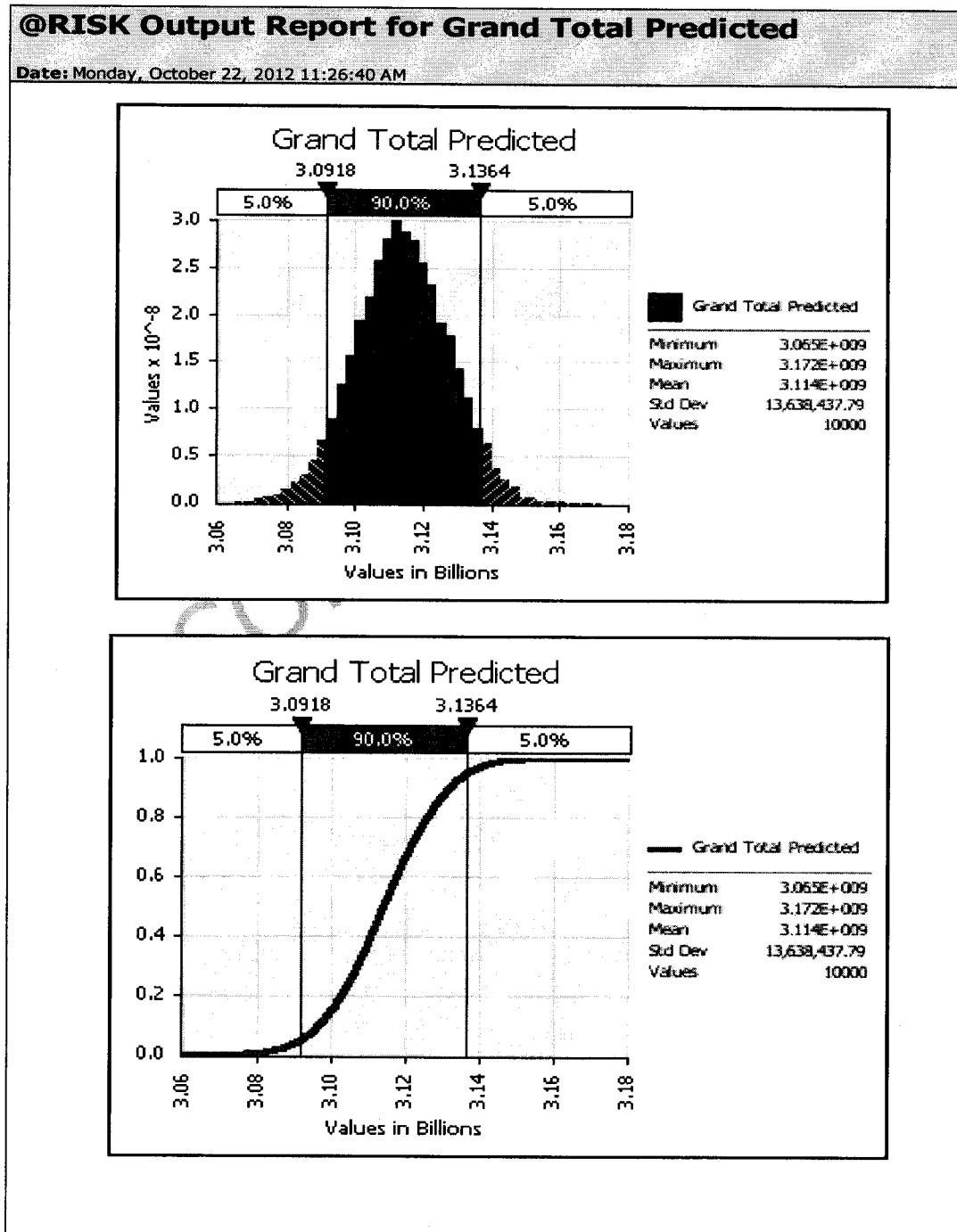
Table 3
BREI Baseline Cost Estimate

MPCo JULY 31, 2012 COST OUTLOOK										BREI BASELINE OUTLOOK							
Description	Quantity	Unit	Unit Rate (Note 1)	Labor Hrs.	Labor \$	Rate \$	Total	Quantity	Unit	Unit Rate	Labor Hrs.	Labor \$	Rate \$	Total	Variance	BREI Contingency	Risk Analysis Confidence Level
Concrete (Material and Labor)	97,191	cyds					76,193,646	97,191	cyds	764				76,193,646	-	3,809,677	(-) +2
Steel	37,662	tons			51,602,661		51,602,661	37,662	tons	30	1,128,660	51,821,760	46	51,821,760	269,109	2,691,088	(-) +2
Piping	731,493	lf			97,421,701		97,421,701	745,303	lf	4.4	3,279,333	150,849,327	46	150,849,327	63,427,626	18,101,919	(-) +3
Insulation (Material and Labor)	1	ls					31,977,024	1	ls					38,692,770	6,616,746	4,831,132	(-) +3
Cable Tray	148,280	lf			8,407,476		8,407,476	148,280	lf	1.42	210,658	9,685,660	46	9,685,660	1,278,174	1,162,278	(-) +3
Conduit	618,072	lf			9,658,920		9,658,920	618,072	lf	0.79	488,277	22,480,736	46	22,480,736	12,801,816	2,696,288	(-) +3
Elect. Power/Control Cable	12,766,782	lf			28,866,841		28,866,841	12,766,782	lf	0.067	864,704	39,316,402	46	39,316,402	10,460,561	4,717,968	(-) +3
Electrical Terminations	197,820	ea			8,316,720		8,316,720	197,820	ea	1.12	221,868	10,191,686	46	10,191,686	1,876,967	1,223,002	(-) +3
Instrumentation	10,626	ea			4,026,960		4,026,960	10,626	ea	11	116,876	6,376,260	46	6,376,260	1,349,290	646,160	(-) +3
Engineering/CIM/Start-Up	1	ls			332,080,433		332,080,433	1	ls			332,080,433			-	16,604,022	(-) +2
Indirect Costs	1	ls			236,621,463		236,621,463	1	ls			236,621,463			-	28,274,676	(-) +3
Procure Additional Material	1	ls			430,426,370		375,486,418	1	ls			439,900,000			64,413,682	62,788,000	(-) +3
Schedule Extension Overhead	0	mo						0	mo								
Productivity - Hours Lost Due to Extensive Overtime to Accelerate Schedule	0	hrs						700,000	hrs		700,000	32,200,000	46	32,200,000	32,200,000	3,220,000	(-) +2.5
Additional Overtime to Accelerate Schedule	0	ls						1,600,000	hrs		1,600,000	18,000,000	12	18,000,000	18,000,000	1,800,000	(-) +0
1,600,000 Hours @ \$12.00																	
Additional Per Diem Due to Accelerate Schedule	0	ls						1,600,000	hrs		1,600,000	12,000,000	8	12,000,000	12,000,000	1,200,000	(-) +0
1,600,000 Hours @ \$8.00																	
Subtotal							1,269,608,163										
Balance of Project Cost	1	ls					1,648,391,847	1	ls					1,474,290,024	214,681,871		
Total Contingency (Note 2)	1	ls					72,000,000	0	ls					1,648,391,847			
														143,464,101	71,464,101	143,464,101	
TOTAL							2,880,000,000							3,166,145,972	286,145,972		
NOTE 1: "Unit Rate" Expressed as Labor Hours per Unit of Material Installed Unless Described as "Material and Labor"																	
NOTE 2: MPCo Contingency as reported by MPCo. BREI Contingency Estimate based on project completion and risk assessment																	

NOTE 1: "Unit Rate" Expressed as Labor Hours per Unit of Material Installed Unless Described as "Material and Labor"

NOTE 2: MPCo Contingency as reported by MPCo. BREI Contingency Estimate based on project completion and risk assessment

Figure 1
@RISK Probabilistic Baseline Completion Cost Analysis Output



3 SCHEDULE EVALUATION

3.1 Schedule Logic Evaluation

BREI's evaluation of the project's most current (August 31, 2012) re-baselined schedule focused on the critical path elements of the schedule using Primavera P6 scheduling software. The evaluation considered the progress achieved to date compared to the current target completion dates. Outstanding engineering releases, major procurement delivery dates, and major commodities installation plans were compared to the original project baseline plan to determine how much installation progress is being achieved and to determine the rate of progress achieved to date against the rate of progress reported by SCS. BREI used this high level rate of progress indicator to forecast completion in other areas.

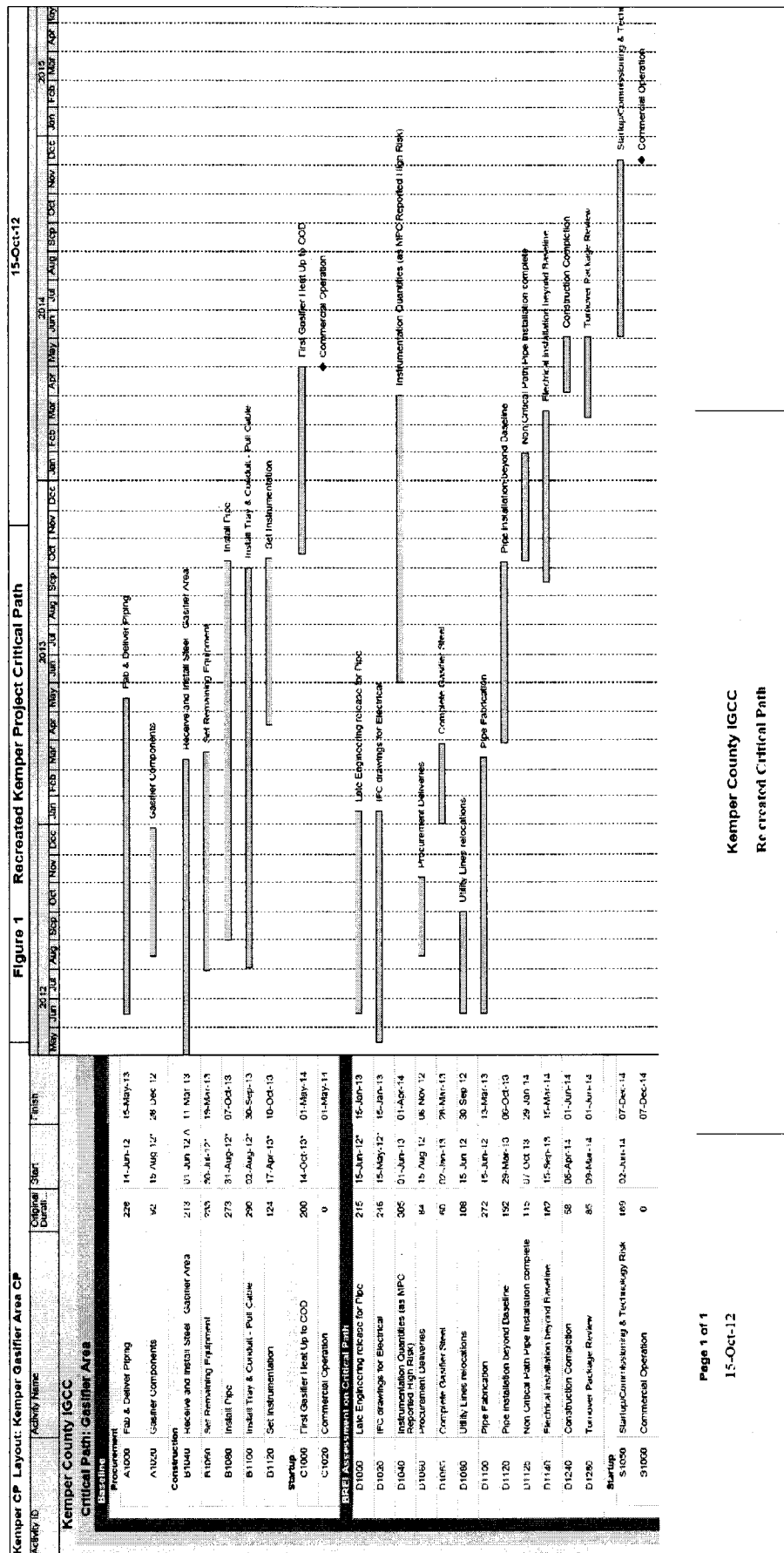
BREI executed two independent critical path and schedule risk analyses, one to determine a most probable completion date, and the second to compare and validate the results of the first evaluation. First, the August 31, 2012, re-baselined schedule critical path was analyzed and adjusted to reflect BREI's opinion of both duration and logic for the selected critical path tasks. BREI identified fourteen specific schedule activities for this evaluation. Re-created logic, duration estimates, as well as early and late completion date estimates were developed for each based on BREI's estimates of quantity increases, procurement delivery delays and required work-arounds, including gasifier structural steel, late engineering release of pipe fabrication drawings, additional pipe fabrication, pipe and electrical installation quantities above baseline, and other factors. Activities judged to have high levels of uncertainty such as the impact of offsite utility relocations, turnover package reviews, start-up and commissioning (considering the first-of-a-kind start-up of the TRIG gasifiers), and construction completion were also considered. BREI then utilized the Primavera P6 Monte Carlo risk analysis module to determine a probabilistic estimate of the revised critical path. Estimated completion dates with Confidence levels at 20%, 50%, and 80% were then identified. A higher schedule confidence level, as expressed in this evaluation, represents a higher probability that the project will be completed at, or before, the estimated completion date.

BREI then performed a Monte Carlo analysis of the SCS August 31, 2012, re-baselined critical path schedule without modifying logic or activity durations, directly applying confidence levels and assigning subjective estimates of the durations for most likely, minimum, and maximum durations to the SCS critical path activities, using the Primavera P6 Monte Carlo risk analysis module. This probabilistic estimate of the baseline schedule completion date was compared to BREI's re-created schedule to determine the reasonableness of our evaluation and to validate its results.

While the company is committed to completing the project on schedule, there are still some risks in the updated and re-baselined August 31, 2012, schedule. Based upon our evaluations, coupled

with our earlier schedule review meetings in Birmingham, our field audit findings, and the significant growth in commodity quantities and labor man hours (which have more than doubled compared to the certification budget), BREI is of the opinion that there is a low probability that the May 1, 2014, projected commercial operation date can be achieved unless all of the specific construction work-arounds are implemented, and future unforeseen delays or difficulties are effectively addressed. Based on BREI's analysis and re-created critical path, the completion date was determined to be approximately December 19, 2014. Figure 2 provides a summary of the re-created critical path schedule. BREI also developed a probabilistic estimate of the project completion date based on the revised critical path using the Primavera P6 Monte Carlo risk analysis module. Completion dates with confidence levels at 20%, 50%, and 80% were developed as summarized in Section 3.3 below. The estimated completion date with a 50% confidence level is November 29, 2014. A higher schedule confidence level, as expressed in this audit, represents a higher probability that the project will be completed at, or before the estimated completion date.

Figure 2
Re-Created Kemper Project Critical Path Schedule



3.2 Basis for Re-created Project Critical Path

BREI's re-created project critical path schedule, Figure 2, contains two major sections. The upper section of the schedule represents the baseline activities. The lower half of the schedule represents the resulting, or re-created, critical path based on the "most likely" duration assigned to each activity. The "most likely" durations are based on BREI's assessment of the durations required to complete each of the tasks based on the level of effort required to complete each task. The "most likely" completion dates include a schedule contingency based on BREI's judgment considering uncertainty and the probability for additional growth in quantities or erection/completion delays. These activities were logically tied into the baseline section of the schedule which was re-run using Primavera P6 scheduling software resulting in the predicted "most likely" completion date of December 20, 2014.

In addition, a summary level explanation of the basis for the schedule extension is as follows:

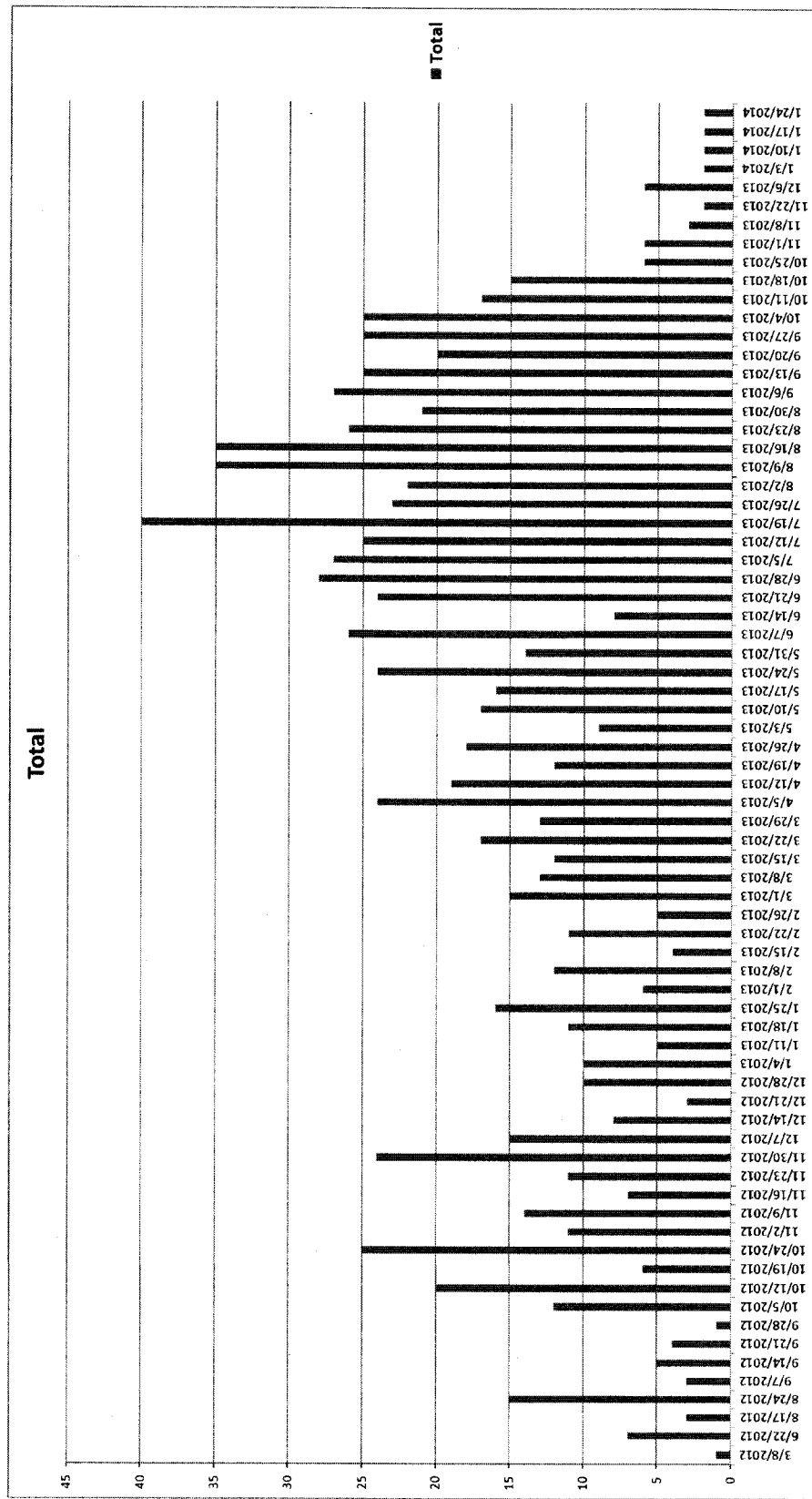
- BREI estimates that, on average, the project is about three months behind schedule to date, or 11 weeks of project slippages attributed to the work performed so far.
- The company has consistently shown a completion date later than the current baseline date of May 1, 2014, in their summary analysis during the monitor's monthly meetings. A July 17, 2014, commercial operation date (77 days or 2 ½ months late) was reported at the July 23, 2012, monthly monitor's meeting, which also supports and validates the above assumptions, however, SCS has since pulled that date back to May 1, 2014, as reported in the August 31, 2012, re-baselined schedule which identified 48 specific work-arounds.
- The company has submitted for our review a recovery plan on the most critical of the deliveries which provides for a two and a half to three month improvement in the schedule (most notably the successful fabrication work-around plan which has significantly improved upon the late deliveries of the gasifier components as further noted below), thereby minimizing the delivery impacts on the schedule by about the same time. These improvements have been considered in the final analysis of both the schedule and the performance of the Monte Carlo analysis.
- The project commodity charts indicate that several commodities are behind the original baselined schedule as presented in the company's monthly production report. Even though the SCS maintains none of this impacts the critical path, BREI does not necessary agree that these delays will have no adverse impact on the critical path. The following is presented as a trending indicator of progress to come that may result in impacts on critical path.

-
- Underground piping is shown to be behind the original plan by six months.
 - Concrete foundations are shown as three months behind the original plan.
 - Structural steel is behind the original schedule by about three months and continues to slip, however the improvement in gasifier component delivery dates has minimized this impact.
 - Process piping shows at least one month delay even though the activity is in its early stages.
- Critical path deliveries that are behind the original SCS baseline plan include:
 - Gasifier refractory lined components are up to three months late, which also impacts gasifier structure steel erection and equipment installations above a 605 foot elevation. These deliveries were originally running about six months behind schedule. The latest recovery plan by the project team accelerates delivery, and they are now only about three months behind the original baseline.
 - Remaining gasifier structural steel installation and gasifier components, which needed to be delayed to accommodate the late gasifier delivery dates, may result in up to a 5 month delay in completing the gasifier structure and systems. SCS has recently developed a work-around for the heavy lift crane which has been re-sequenced to allow its use and to mitigate delays to its demobilization which would have affected the start of construction of the number 2 conveyor transfer tower foundations for the Lignite Delivery Facilities (LDF).
 - The SCS baseline schedule did not include any schedule activities or time to complete work-arounds resulting from late equipment deliveries. SCS has now incorporated 48 work-arounds in the August 31, 2012, re-baselined schedule. While the company is acknowledging a \$20M cost impact to account for overtime and extended shifts, no finite value has been provided for the cost of work-arounds.
 - A significant amount of schedule logic is missing, including the breaking of ties between sequential activities in the construction schedule. This results in very high artificial "float" values. Float in a project schedule task is defined as an activity where more time is allotted to the activity duration than is required to complete the task. Some of the float in the current schedule is allotted to tasks related to, or on, the schedule's critical path (gasifier) activities. Some of these activities currently have negative float indicating that they are behind schedule. SCS, to its credit, has since corrected or eliminated negative float in the schedule.
 - Construction completion schedules are incomplete and are missing the critical time needed to either tie in or test mechanical and/or electrical connections to equipment.

- BREI currently estimates that pipe spool fabrication and pipe installation is projected to impact the schedule by 8 to 12 weeks. The company is mitigating this risk by having McAbee Construction, Inc. hire additional subs to increase pipe fabrication production. The impact, even-though reduced, is still there. Factors that may further drive pipe fabrication and installation delays include:
 - Availability of sufficient resources (additional piping fabrication shop capacity and craft labor) for piping fabrication and installation considering the significant growth in piping quantities required.
 - Coordination issues and possible delays between multiple pipe fabrication shops (now being planned by SCS).
 - Pipe quantity increases.
 - Electrical commodities and piping completion are now shown on the SCS schedule as occurring at the same time. While there is not a binary finish piping to start electrical relationship, there should be some lag time between the two. BREI estimates that this may add some more time to the schedule which will in turn impact system turnover to start-up and testing.
- BREI estimates that delays during commissioning and start-up may result in an 8 to 10 week schedule delay:
 - Start-up/turnover timeline for the approximately 1,100 discrete turnover packages is aggressive and challenging to meet, as shown in Figure 3. During several months, more than 100 turnover packages will need to be received, processed and accepted per month. BREI is of the opinion that this rate of turnover package acceptance may not be achieved on a consistent basis.
 - The current first gasifier heat-up baseline date is currently scheduled for December 16, 2013. Previous SCS projections showed that the first gasifier heat-up was to occur in early October 2013, which indicates that the first gasifier heat-up is approximately 2 to 3 months behind schedule. SCS expects to recover some time during commissioning, but BREI considers this unlikely due to the first-of-a-kind nature of the TRIG gasifier commissioning and start-up. SCS plans to further mitigate these delays by starting both gasifier trains in parallel rather than in series as in the original baseline. SCS believes this may compress the start-up schedule by as much as 3 months. However, BREI recommends that, at a minimum, SCS stagger the start-up of each train by 2 to 4 weeks to take advantage of lessons learned and to minimize the possibility of damaging both trains should a start-up problem occur. Accelerated operator hiring and training including additional staff to support parallel start-up is needed.

-
- BREI is of the opinion that commissioning and start-up may be further delayed due to problems encountered (possibly requiring re-engineering or systems clean-up) following process upsets during start-up of the TRIG gasifiers and gas clean-up areas. This risk has been addressed in BREI's probabilistic schedule analysis of the start-up activity duration.

Figure 3
Project Commissioning "Turn Over" Package Schedule



3.3 Schedule Probabilistic Analysis:

Following a thorough review and validation of the basis for the Schedule Extension, BREI utilized the Primavera P6 Monte Carlo risk analysis module to develop a probabilistic estimate of the revised critical path and completion schedule. Estimated completion dates with Confidence levels at 20%, 50%, and 80% were developed.

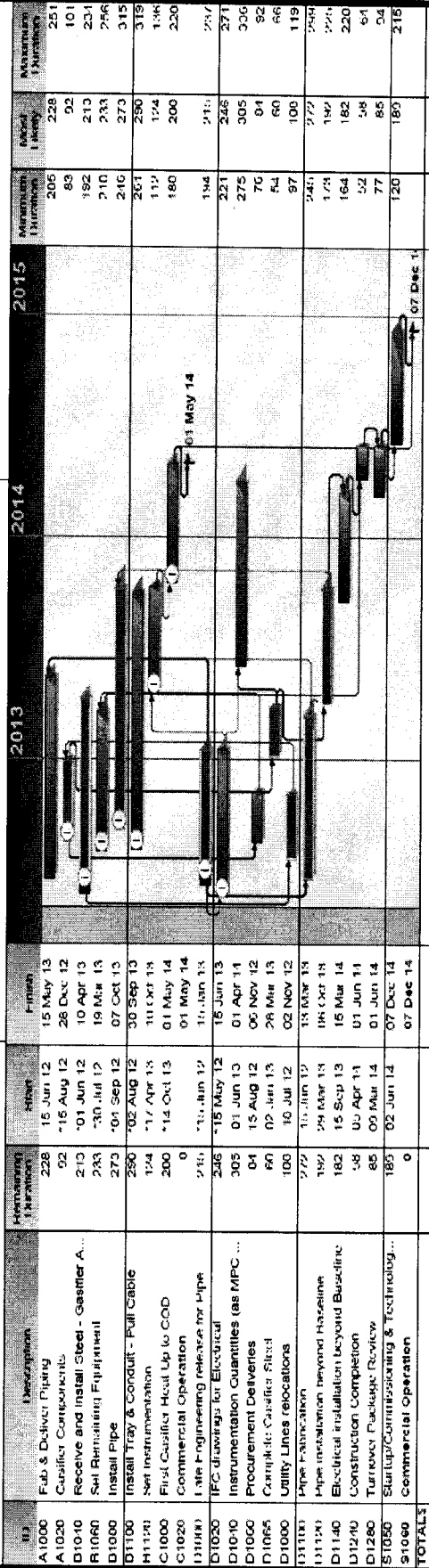
To accomplish this, BREI assigned a minimum, maximum, and most likely duration to each task; a low, medium, and high risk range was assigned to each of the schedule activities in the re-created critical path. A low risk range was defined as one where schedule slippage of that particular task has little or no impact on another schedule task. A medium risk range was defined as one where a schedule slip of that particular task would delay completion of a major component or system, but not necessarily the critical path. A high risk factor was defined as one where a schedule slip of that particular task would delay completion of a major component or system on the critical path. Each was then translated to a minimum duration, most likely duration, and a maximum duration. The resulting re-created critical path before the probabilistic Monte Carlo analysis was run is illustrated in Figure 4.

Figure 4
Probabilistic Critical Path Schedule Analysis

Kemper County IGCC

Kemper C/P

Primavera Gantt



Normal Task Vary Critical Start

ORACLE

PRIMAVERA RISK ANALYSIS

Normal, Critical

Normal, Very Critical

Finish Milestone Task

Finish Milestone, Critical

Page 1 of 1

Sort: Task ID

Plan Finish: 07 Dec 14

Filter: None

Company: Burns & Roe

Manager:

Planner: roynoldy

The results of the probabilistic analysis with completion dates at confidence levels of 20%, 50%, and 80% are illustrated in Table 4 and Figure 5 below. It is BREI's opinion that the most probable completion date lies between November 6, 2014, and November 29, 2014. The analysis further indicates that there is a 90% probability of achieving project completion between October 18, 2014, and January 6, 2015, representing confidence levels of 5% and 95% respectively.

Table 4
Estimated Completion Date Confidence Levels

Confidence Level	Estimated Completion Date BREI Re-created Schedule
20%	11/06/2014
50%	11/29/2014
80%	12/20/2014

Figure 5
Completion Date Confidence Level Distribution BREI Re-created Schedule

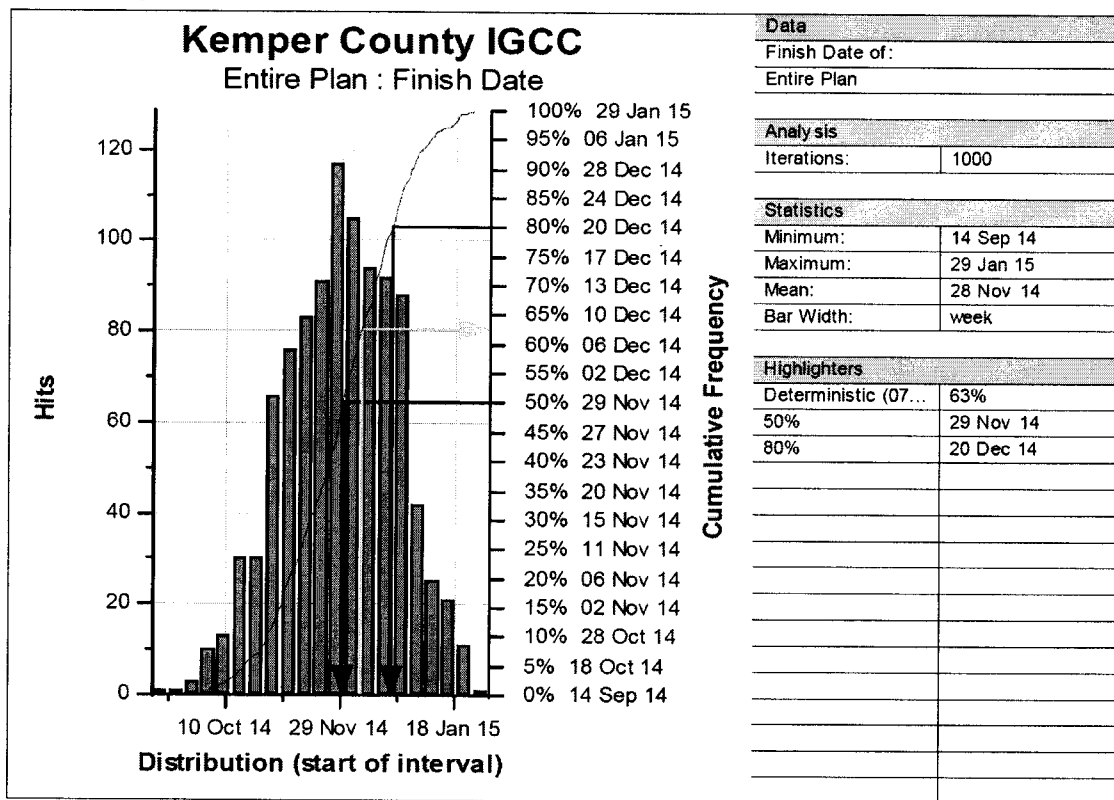
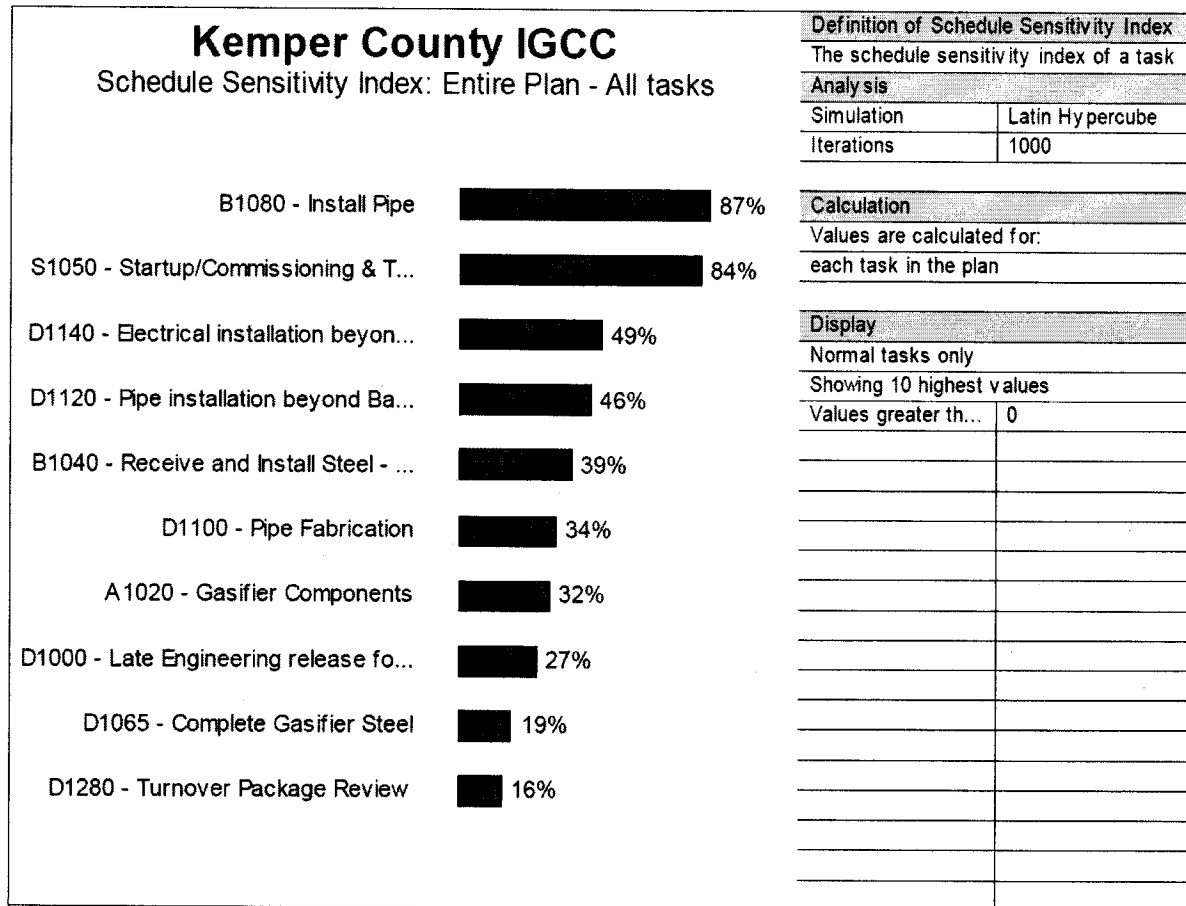


Figure 6 illustrates the sensitivity that a particular activity has on the project's critical path or the "sensitivity index." The schedule sensitivity index shows that the pipe installation (driven by fabrication) as well as commissioning and technology risk are the most sensitive schedule activities.

Figure 6
Schedule Sensitivity Index BREI Re-created Schedule



As noted earlier in this section, BREI performed a direct Monte Carlo analysis of the SCS August 31, 2012, re-baselined critical path schedule without modifying logic or activity durations, directly applying confidence levels and assigning subjective estimates of the durations for most likely, minimum, and maximum durations to the SCS critical path activities using the Primavera P6 Monte Carlo risk analysis module. The results of the probabilistic analysis with completion dates at confidence levels of 20%, 50%, and 80% are illustrated in Table 5 below.

For comparative purposes, there is a difference of approximately 2 months at a 50% confidence level, and approximately 3 weeks at an 80% confidence level when comparing the probabilistic analysis performed on the BREI re-created schedule to the direct analysis of the August 31, 2014, re-baselined schedule. Based on this comparison, BREI is of the opinion that the re-created critical path analysis is reasonable and should be considered as both a conservative and valid evaluation of the project completion date.

Table 5
Estimated Completion Date Confidence Levels SCS Schedule

Confidence Level	Estimated Completion Date SCS Baseline
20%	09/05/2014
50%	09/26/2014
80%	11/28/2014

4 ESTIMATED COST DUE TO A DELAY IN PROJECT COMPLETION DATE

Additional indirect project costs, above the baseline cost estimate will be incurred should the project completion date slip past May 1, 2014. The company has provided BREI with an estimate of their indirect costs including:

- Non-manual supervision and management personnel
- Administrative and support personnel
- Crane equipment rentals and fees
- Infrastructure trailers, port-a-johns, computers, printers, etc. (all temporary items at the site supporting the construction and/or start-up efforts)
- Crane operators, support labor, carpenters, etc. (all non-direct craft), and temporary/contract operators, engineering and supervision should the delay occur during start-up

If a delay during construction occurs, it will likely happen as the construction efforts are ramping down such that the project's indirect costs would then be below those incurred during the peak of construction. Based on the indirect cost data provided by SCS, BREI estimates that a project schedule overrun allowance of \$8,000,000 to \$12,000,000 per month will cover the cost of additional construction management, construction equipment and operators and other associated indirect cost items depending on when during the construction ramp down the delay occurs. It is estimated that an allowance of \$3,000,000 to \$5,000,000 per month of delay will cover additional costs resulting from an extension during the start-up phase that goes beyond the anticipated project completion date to cover the cost of additional staff, stand-by construction labor and materials.

5 BURNS AND ROE CONCLUSIONS AND RECOMMENDATIONS

The Kemper project has been planned and conceived to provide a potential long term benefit to both the Mississippi consumers and to the company by providing needed additional generation capacity and fuel diversity while being one of the cleanest coal fueled generating facilities in the country, as a result of the utilization of TRIG gasification technology. This, along with large scale carbon capture and sequestration for beneficial enhanced oil recovery will provide a significant reduction in carbon dioxide emissions. The recommendations contained below are intended to aid the company in better understanding and addressing some of the challenges they are experiencing in managing the schedule and controlling the cost of executing the project.

The Kemper Project has had some key challenges in its implementation. As the independent monitor to the MPUS, BREI has seen the project grow in both scope and cost while the company's schedule and its projected commercial operation date of May 1, 2014, has been maintained. The company has re-emphasized its commitment to complete construction, commissioning and start-up by that date.

As the Kemper project has evolved over the past 17 months since BREI began attending monthly monitor's meetings, BREI has provided monthly status reports to the MPUS which have summarized concerns, especially relating to cost expenditures for the design engineering area being higher than expected, and the lack of quality in the fabrication of major components, which caused late delivery of these components to the company. Although this is a first-of-a-kind design, BREI continues to believe the cost expenditures for engineering are high. The BREI forecasts included in this evaluation for engineering and design are a result of the trends and patterns established by SCS thus far for the project.

In parallel with the higher than expected engineering/design cost, BREI continues to believe that the design is solid and acceptable.

The procurement portion of the project has progressed well. SCS is currently experiencing challenges that many projects face, including late deliveries and in some cases inferior workmanship in the equipment being fabricated for the project. BREI is of the opinion that the company has made appropriate decisions in mitigating the majority of these issues as the project has progressed. However, BREI still anticipates that additional late deliveries may occur and that the company's ability to mitigate these possible late deliveries could impact the success of the project.

BREI has continued to monitor the construction field installation activities, as we feel this is the critical area that could potentially cause major cost impacts to the project. Thus far in the project, the construction efforts are acceptable and progressing well. As the project moves from

the civil engineering area to the mechanical and electrical installation areas, BREI has concerns relative to the implementation of the detailed piping/mechanical fabrication and installation plan. The process of fabricating the piping offsite adds advantages to the site logistics and utilization of proper space at the site, however, McAbee Construction, Inc., the lead Pipe Fabricator for the project does not appear to be capable of pre-fabricating the quantities we have forecasted for the project. During a recent visit to the site, SCS indicated that they have contracted with two additional fabrication facilities to support this effort. The piping plan includes the details for how they are to install the alloy pipe as this is typically the most difficult aspect of any power plant construction effort.

Another major concern is the effective implementation of the electrical installation plan. Using the SCS forecast, the company plans to install nearly 13 million linear feet of cable and still complete the project by May 1, 2014, - only 13 months from the time of this report to the end of December 2013, which is the Mechanical Completion date for the project. This schedule will require pulling over 139 miles of cable every month, including the installation of end devices and the appropriate terminations (based on a July 31, 2012, Date Stamp). The electrical execution plan and schedule must be strictly followed precisely to accomplish this goal. BREI believes this will be very difficult to accomplish.

The company's cost estimate for the facility has grown to \$2,880,000,000, with a reported contingency of \$72,000,000 currently available. While the project has achieved a high degree of completion in engineering and design, there are still 17 more months of major construction activities to be conducted. Significant project uncertainties remain with construction at approximately 30% complete, and with many challenging activities to go, including offsite pipe spool fabrication and its installation, electrical cabling installation, commissioning, testing, and start-up of all the facilities.

Based on our analyses and evaluations, we have concluded that the contingency of \$72,000,000 may not cover the remaining uncertainties and, as a result, we believe the project costs could exceed \$3,000,000,000, especially if the project scheduled completion date of May 1, 2014, is not met.

If the project is delayed either due to construction or start-up difficulties, those delays will increase the project cost. While the company is committed to completing the project on schedule, there are still some risks in the updated and re-baselined schedule (August 31, 2012), which leads us to conclude that there is a low probability that the, projected commercial operation date of May 1, 2014, can be achieved unless all of the necessary construction work-arounds are implemented, and future unforeseen delays or difficulties are effectively addressed. Also, there is still a technology risk due to TRIG technology scale-up and implementation unknowns which could delay start-up and result in additional costs.

Through the course of BREI's monitoring and attendance at the monthly independent monitor's site meetings, and as verified through this evaluation, BREI has determined that SCS, in the execution of the Kemper Project, is not utilizing some basic project management and project controls tools and techniques that are available and customarily used in the industry for a project of this magnitude. Although SCS has such tools available within its corporate tool kit of Project Management Procedures, SCS has advised that it has opted not to utilize several of its standard corporate procedures for the Kemper Project. In addition, these earlier project decisions appear to have made it difficult at this stage of the project for SCS to effectively monitor, track and manage the logistics of complex tasks, such as pipe spool fabrication and installation. BREI's specific recommendations to the company and the MPUS include:

- Conduct a detailed review of the August 31, 2012, re-baselined schedule to verify and, if necessary, modify the logic, predecessors and successors to each activity.
- Consider the benefits of labor loading and commodity loading the P6 project schedule for the remaining critical path activities, rather than using a separate Excel spreadsheet for planning and projecting construction labor needs. The value of this kind of approach has been recently demonstrated by the successful work-around plan that SCS utilized - taking advantage of a fully resource loaded schedule that SCS implemented for the gasifier delivery recovery plan. This action alone has significantly improved the gasifier component delivery dates and, in BREI's opinion, has contributed to a two to three month improvement in the overall project schedule.
- SCS developed a pipe fabrication plan, which is part of the overall piping installation plan. SCS needs to continue to monitor and update the plan based upon conditions in the field. Continue to use the plan as a tool for success.
- SCS developed and is implementing an effective pipe installation plan, which coincides with the activities on the baseline schedule. Continue to use the plan and to maintain the elements of the plan for success.
- SCS developed and is implementing an effective electrical installation plan, which coincides with the activities on the baseline schedule. Continue to use the plan and to maintain the elements of the plan for success.
- Use SCS Procedure PR07, Receipt, Storage and Handling, for a material control program at the site.
- Re-evaluate the balance between the cost of accelerating the schedule and the cost of delaying commercial operation. It may be more cost-effective to minimize acceleration costs at the expense of a later commercial operation date. This evaluation would need to consider the potential loss of the 48A Phase I investment tax credit.
- Give further thought to the parallel gasifier start-up plan. At a minimum, stagger the start-up of each train by two to four weeks to take advantage of lessons learned and to

minimize the possibility of damaging both trains should a start-up problem occur. Accelerate operator hiring and training including additional staff to support parallel start-up.

- Provide additional labor and labor training with direct SCS oversight as the construction staff is ramped up to meet peak requirements. A third shift could be contemplated but it should be analyzed thoroughly before it is implemented, since it could add inefficiencies which may increase the total project cost with minimal schedule benefit.
- Consider accelerating the commissioning and start-up of the combined-cycle plant for operation on natural gas. This could result in early incremental revenue to the company under favorable market conditions which could offset some of the loss of the 48A Phase I investment tax credit if it were lost due to a delay in commercial operation.
- Assure development of a commissioning, start-up, and testing plan commensurate with the first-of-a-kind status of the technology. Detailed procedures should be developed to anticipate any challenges which the gasifier and cleanup systems may face during commission, start-up and testing.

ATTACHMENT E: MPCo Record of Decision (ROD-10-002)

Subject:

Acceptance of a Kemper County IGCC cost cap of \$2.88 billion (net of \$296M of incentives).

Description:

During the certification process, the MPSC proposed a cost cap for the Kemper IGCC project, an amount above which costs may not be recoverable. Throughout the hearings and in subsequent actions, the Commission expressed concern about capital cost increases, largely driven by the Commission's consultants, the Commission's perceived risk of project size compared to MPC, First-Of-A-Kind risks associated with the TRIG™ technology, and cost increases at Duke's Edwardsport IGCC project. Because the TRIG™ technology was developed by Southern and there is no Original Equipment Manufacturer to look to for performance, the Company believes the Commission's request for some level of a cost cap to be reasonable. While reasonable, by law, the Commission has no authority to impose a Kemper cost cap on MPC. The only way to institute such a cap is for MPC to accept the cap via a limited waiver of its rights.

Alternatives Considered

In the Company's original March 12, 2010 proposed order, a cost cap of \$3.2 billion was proposed. The basis of the \$3.2 billion cap was the nominal "Kemper is 30% better than the next-best natural gas alternative".

The Commission countered in its April 29, 2010 Order that the Company's \$2.4 billion estimate should be the cap based on the confidence MPC witnesses expressed in testimony and at hearing. The Company determined this was an unacceptable proposal, the reasons which were outlined in the Company's subsequent 5/10/10 Motion for Reconsideration.

The Company's May 10, 2010 motion proposed a cost cap of \$2.88 billion. The \$2.88 billion cap represents a 20% increase to the Company's filed \$2.4 billion total Project estimate. The 20% was a number used by the Commission's consultant in their analysis and at hearing. In addition, the 20% increase is representative of the capital cost sensitivity analysis described in Thomas O. Anderson's Phase Two Rebuttal Testimony (reference Figure 1) of January 5, 2010, shown below.

	\$ 0 CO ₂	\$10 CO ₂	\$20 CO ₂	\$30 CO ₂
High	\$ 920 38%	\$ 550 23%	\$660 28%	\$820 34%
Vol	\$ 490 20%	\$ 330 14%	\$370 15%	\$450 19%
Mod	\$ 320 13%	\$ 180 8%	\$ 90 4%	\$210 9%
Low	\$ 20 (1%)	(\$ 140) (6%)	(\$170) (7%)	(\$110) (5%)

This table showed how much over-budget Kemper would have to be to be equal to the next best alternative, a Combined Cycle at Plant Sweatt. The average % increase across the 4 high fuel cases is 31%, the average % increase across the 8 high and vol (moderate with volatility) fuel cases is 24%, and the average % increase across the 12 high, vol, and mod cases is 19%. Since these 12 cases represent Kemper's dominant solution, the 19% average across these 12 scenarios served to substantiate the 20% number proposed by the Commission's consultant and the Company.

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Record of Decision 10-002
Kemper County IGCC Project

The Company also considered a regulatory-compact argument, a legal argument that recognized Mississippi law does not allow the Commission to impose a cost cap on the Company. The Company assessed this approach and the potential it could have on the timing and/or approval of a final Certificate. After careful consideration the Company elected not to pursue this option.

Decision Made

Accept the \$2.88 billion cost cap, with the exceptions and provisions included in the Company's May 10, 2010 Motion (and subsequently the Commission's May 26, 2010 Order). Note: Provisions were discussed and reviewed in May 19, 2010 and May 27, 2010 MRB meetings.

Rationale for Decision

- \$2.88 billion (\$2.4 billion x 120%) cost cap includes the following provisions (reference the Company's 5/10/10 Motion and the Commission's 5/26/10 Order):
 - Exclusions for Force Majeure events which are unavoidable through prudent utility practice
 - Exclusions for Change of Law or regulation effective after 5/26/10
 - Capital cost for the Lignite Mine, CO2 pipeline and ash storage (beyond the 65 acres already included in the \$2.4 billion) are excluded
 - AFUDC is excluded
 - If the CCPI2 funds are lost, as long as the Company can demonstrate best and reasonable efforts were made to obtain the funds, then they are excluded from the cap.
 - Beneficial capital is allowed if it can be demonstrated the long term benefits are equal or greater than the up-front costs.
 - Costs greater than \$2.4 billion have to be deemed reasonable and in public interest by the Commission (the same standard we already have to meet, and per Baseload Act legislation).
- MPC's acceptance of the \$2.88 billion cap is conditioned on:
 - Commission acceptance/issuance of an Order on or before May 28, 2010 due to the need to meet the May 11, 2014 COD date required for the Phase One Section 48A Investment Tax Credits.
 - Language in the Order that specified the exclusions listed above and that the acceptance of the cost cap was only due to the unique nature of the Company's developing the TRIGTM technology, and not a precedent for future Company business.
- Known (or committed, or confirmed) cost to date (May 26, 2010) is ~20%. The Project is currently under budget, and we have not used any of the \$162 million in Project contingency.
- Known cost is expected to be at 50+% at the end of 2010 and 70+% at the end of 2011.
- Engineering conducted a "what if everything goes wrong" assessment of EPC costs, a scenario that would add \$380 million of cost. The \$2.4 billion + \$0.38 billion can be characterized as a 90% confidence level.
- The additional \$100 million of cost necessary to get to \$2.88 billion (\$2.4 billion + \$0.38 billion + \$0.1 billion) is characterized as a 98% confidence level.

References

1. May 6, 2010 TOA to file email



2010.05.06 Kemper
Cost Cap TOA basis

2. May 19, 2010 MRB presentation

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Record of Decision 10-002
Kemper County IGCC Project



MRB 5-19-10

3. May 26, 2010 MPSC Order:



2010.05.26 MPSC
Revised Order

4. May 27, 2010 MRB/ERB meeting minutes:



Kemper County IGCC
MRB 5-27-10 Meeting

5. Engineering Assessment of EPC costs in "what if everything goes wrong" scenarios:



Revised Quantity
Estimate Kemper IGC

Example, for Clarity

Filed Cost (ref Exhibit (TOA-1) Appendix B)

Capital cost, net of incentives	\$2.400 billion
Incentives affecting Project Cost	<u>\$0.296 billion</u>
Total	\$2.696 billion

Final Cost Tabulation

Certified cost of Project	\$2.400 billion
Incentives lost (CCPI2) ¹	\$0.245 billion
Price of steel increase	\$0.200 billion
Mine Cost	\$0.189 billion
CO2 pipeline cost ²	\$0.080 billion
Additional ash storage requirements ³	\$0.040 billion
EPC overtime due to strike in Germany ⁴	<u>\$0.030 billion</u>
Total	\$3.184 billion

Final Cost With Exclusions Tabulation

Total of all unadjusted costs:	\$3.184 billion
CCPI2 best and reasonable exception ⁵ :	(\$0.245) billion
Mine exception:	(\$0.189) billion
CO2 pipeline exception:	(\$0.080) billion
Ash storage change in regulation exception:	(\$0.040) billion
Force Majeure exception:	<u>(\$0.030) billion</u>
Final Total	\$2.600 billion

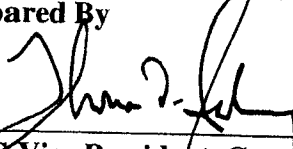
The Cost Cap is not exceeded.

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Record of Decision 10-002
Kemper County IGCC Project

Notes:

1. Assume ROD not issued by DOE due to Administration policy change.
2. Assume Company elects, and Commission agrees, that CO2 pipeline ownership in Customer's best interest.
3. Assume additional storage costs due to MDEQ disallowance of beneficial use determination for using lignite ash for reclamation.
4. Assume strike in Germany delays delivery of Syngas Coolers, EPC work-around and overtime increase cost by \$30 million.
5. Based on depth of FEIS, \$4+ million expended by both MPC and NAC to obtain favorable ROD, best and reasonable determination easily met.


Prepared By

MPC Vice President, Generation Development

8-13-10
Date
8/13/10
Date

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To: Topazi, Anthony J.; Atherton, Johnny W.; Flowers, Kimberly D.; Horsley, Donald R.;
Turnage, Frances V.
Cc: Stone, Ben H. (Balch); Cox, Ricky (Balch)
Subject: Kemper Cost Cap

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I have been in conversation with Engineering, Transmission and select members of the Core Team, and recommend we accept the \$2.88 billion capital cost cap for Kemper. This recommendation is conditioned on:

- 1.) We must receive a Certificate that allows us to proceed with engineering and construction efforts by 5/30/10. [Note that this is Sunday, which is the date in our Siemens contract, a date after which Siemens or we can terminate. As a practical matter, 5/28 or 5/31 is an acceptable proxy for the 5/30 condition.]
- 2.) Order provisions that exclude ash storage, CO2 pipeline and lignite mine costs, provide for recovery if we don't get CCPI2 funds but make best and reasonable efforts, and contain protections against Change Of Law and Force Majeure.
3. An accompanying statement within the Motion or Order that explains the only reason we are offering a cost cap is because the technology was developed by MPC's parent SO, and that this practice is outside the regulatory compact and will not apply to future generation projects, environmental retrofits, transmission and distribution projects, or any other aspect of MPC's business.

If you have any questions, or would like to discuss further, I am available to discuss.

Tommy

Supporting Data

- FEED allowed a level of conceptual engineering beyond what is typical. It is not typical to have detailed design done before certification.
- Typical cost of first time engineering applications range from: CC [REDACTED] (-2%, [REDACTED]), CC [REDACTED], (+10%, [REDACTED]), Scrubber (+15%)
- The \$2.4 billion is a 50% number, the \$2.78 billion is a 90% number, and the \$2.88 is a 99% number
- Engineering has conducted a "what if everything went wrong" assessment, which would add \$380 million to the \$2.4 billion (resulting in the \$2.78 bn 90% number)
- Failure to get CCPI2 funds would not count towards the cap as long as we made best efforts to obtain them and the resulting cost increase is in the public interest.
- Additional protection of some measure of Force Majeure and Change of Law in our proposed amended order.
- Exclusion of future ash storage, CO2 pipeline and lignite mine from the cap in our proposed amended order.
- We now know ~20% of the Project are real costs, meaning they have 1.) been expended, 2.) have a contract, 3.) have a LOI or MOU, or 4.) we have bids in hand from a competitive procurement solicitation.
- Other than the expended costs, almost all of the other cost is Major Equipment. This cost is comprised of six pieces of engineered equipment. The small number, competitive bidding process, and bids in hand provide a high degree of confidence in these numbers.
- We are currently about \$50 million under budget. (The everything goes wrong estimate has Major Equipment being \$65 million over budget.)
- Not being able to start on 5/3/10 has increased the risk of the Project, as design, procurement, land acquisition, and contract execution have been delayed. Engineering has done a screening level study and found only minimal discrete cost increases. The combined impact of these cost increases, the other subjective procurement and construction cost impacts, land and transmission impacts, and overall Project Development is estimated to be \$15 - \$20 million.
- We are on a fairly short construction schedule of four years; very short for a baseload application.
- We will have ~50% real costs known by the end of 2010, and ~70% by the end of 2011.

- Costs can go up quickly, and based on one event. The delta on one piece of equipment (HRSG) was \$30 million. An unfavorable NEPA ROD could cost \$270 million.
- The desire/mandate to meet the Commission, Staff, DOE, IRS, SMEPA, MPC, SO, Mississippi businesses, and Kemper constituents' needs will result in MPC not being able to construct the plant in the most efficient and expedient manner, causing costs to increase, schedule delays, and potentially the loss of Phase 1 ITCs (we would have to pay them back since they would have already been utilized).
- Transmission already increased its estimate from \$100 million to \$120 million. They feel it is a solid $\pm 10\%$ estimate, and recent history on transmission projects suggests the actual cost will be at or slightly under budget. With the \$100 million (\$2.88-\$2.4-\$0.38) in non-EPC cap money, the transmission cost increases are covered.
- Lignite Handling Facilities. Very similar to Transmission, already increased from \$75 million to \$87 million. Covered by \$100 million.
- Land for the 1650 acre site is sunk, and therefore "at" budget. Some portion of the remaining \$7 million for site expansion will be held for the foreseeable future as additional contingency.

Cost Cap Basis - Pro

- FEED
 - Stanton Engineering Lessons Learned
 - Higher degree of design behind estimates
 - 1st “F” based CC: -2%, 1st “G” based CC: +10%, 1st Scrubber: +15%
- Exclusion from Cap:
 - CCPI2 funds (best and reasonable efforts)
 - Change Of Law
 - Force Majeure
 - Ash storage, CO2 pipeline, Mine
- E&CS “What if everything goes wrong assessment”
 - \$380 million
- 20% of Costs to date “known/real/highly confident”
 - 50% Costs by end of 2010
 - 70% Costs by end of 2011
- Current Assessment: ~\$50 million under budget

Cost Cap Basis - Con

- Not being able to start 5/3/10
 - Compressed schedule
 - Increased risk (less design time)
- Detailed design is not done
- One event can have a significant impact
- Many Masters
 - Meeting MPSC, Staff, DOE, IRS, SMEPA, MPC, SO, Mississippi businesses, and Kemper constituent's needs will result in not being able to manage and construct the plant in the most efficient and expedient manner, causing costs to increase, schedule delays, and potential loss of Phase 1 ITCs.

Cost Cap Basis - Recommendation

- Accept the \$2.88 billion Cap
 - Would be a 20% increase
 - Protection from Cap Exclusions
- Predicated on:
 - Certificate allowing construction on or before May 31, 2010
 - Motion language that outlines Cap Exclusions and clarifies acceptance of Cap does not set a precedent

Kemper County IGCC Project
May 27, 2010
Managing Review Board
Executive Review Board
Mississippi Power, General Office
Meeting Minutes

Attendees:

Anthony Topazi (MRB, ERB)
Tommy Anderson (MRB)
Johnny Atherton (MRB)
Kim Flowers (MRB)
Don Horsley (MRB)
Frances Turnage (MRB)
Ben Stone (MRB)
Mark Lantrip (MRB, ERB)

Ed Day (MRB)
Chris Hobson (MRB)
Cindy Shaw
Rufus Smith
Todd Terrell
Brian Useforge
Cindy Webb
Lesley Lewis

Ricky Cox
Leo Manuel

1. **Call to Order** Topazi called the meeting to order, and explained this was a combined Kemper Managing Review Board and Kemper Executive Review Board. Lantrip was representing Executive Review Board members Bowers and Fanning, who were attending Mr. Farley's funeral.

2. **MPSC 5/26/10 Kemper Order**

- ⤴ Topazi reviewed the history of the Kemper Certification from the Company's March 12, 2010 proposal, to the MPSC's April 29, 2010 Order, and through the Company's May 10, 2010 Motion.
 - ⤴ Cox reviewed the MPSC May 26, 2010 Order, specifically with regard to:
 - Operations performance
 - Prudence reviews
 - Cost Cap
 - CWIP
- A two page summary handout was also provided.
- ⤴ Topazi lead a discussion to discuss risks, questions and the language in the MPSC 5/26/10 Order.
 - ⤴ Topazi put forth the motion to the MRB that the Company accept the MPSC 5/26/10 Order without modification.
 - All MRB members voted "aye"
 - No MRB member voted "nay"
 - ⤴ Topazi put forth the motion to the ERB that the Company accept the MPSC 5/26/10 Order without modification.
 - All ERB members voted "aye"
 - No ERB member voted "nay"

3. **Adjourn** Topazi adjourned the meeting.

The next MRB meeting is scheduled for June 16, 2010 in Gulfport.

The next ERB meeting is scheduled for July 15, 2010 in Atlanta.

ATTACHMENT F: Kemper Project Organizational Charts

[illegible]

****MPSC Electronic Copy ** 2013-UA-189 Filed on 04/15/2014 ****



[illegible]

****MPSC Electronic Copy ** 2013-UA-189 Filed on 04/15/2014 ****

ATTACHMENT G: BURNS AND ROE TEAM EXPERIENCE

Burns and Roe's Independent Monitoring team is comprised of senior level management and technical experts with extensive experience in the development and execution of complex conventional, FOAK and emerging technology projects including gasification and IGCC projects. Bio's for the IM team's lead personnel are included below:

Albert M. Ferrer, Vice President: As Vice President, Mr. Ferrer is responsible for all the management, business and technical services covering fossil (coal, oil and gas), biomass, solar, geothermal, wind, and other power plant technologies and including services such as, but not limited to, owner's engineering, EPC oversight, due diligence and independent engineering, commercial development analysis of merchant power plant contracts, benchmarking, performance improvement, EPC contract evaluation, development and management, construction management and oversight, asset acquisition and divestiture support, project development and financing, power purchase/sale agreements, operational risk management and prudence, environmental consulting, greenhouse gases, renewable energy implementation, distributed generation strategy development and implementation, generation assets and fleet management and optimization, power plant operational planning and associated capital cost and operating cost prioritization, divestitures and acquisitions, distressed asset management, air emissions optimization programs, operating strategies, business planning and budgeting for generation business units. He has been involved in the FEED of major petrochemical plants and refineries and the development of IGCC projects using Texaco/GE technology. He has managed and/or supervised over 100,000 Mw of owner's engineering and project due diligence consulting assignments associated with project financing, construction term financing, sale/leaseback transactions, generation asset purchase/sale transactions, and plant operation & maintenance audits. These assignments involved green-field projects and existing facilities involving various technologies including coal power plants, gas fired power plants, nuclear facilities, and renewable power plants. These due diligence assignments included site permitting reviews, cost and schedule reviews for reasonability to market conditions, technical reviews for adequacy of designs for the purpose intended, construction reviews, project management reviews to determine the efficacy of the project management tools, organization and processes being used, witnessing of testing and commissioning, contract reviews, contract change reviews, etc.

Gregory F. Zoll, PE, Project Manager: As Director of Burns and Roe's Consulting Services Division and Project Manager for Burns and Roe's assignment as MPUS's Independent Monitor for the Kemper IGCC Project, Mr. Zoll has over 30 years experience in the development, design, engineering, environmental permitting, and construction oversight of independent power projects, combined cycle cogeneration plants, gasification, refinery, utility, and bulk materials handling facilities. Mr. Zoll has overall responsibility for project development support at Burns and Roe for both fossil and renewable energy projects including conceptual planning and design, environmental permitting, contract development, and project execution oversight following financial closing. Mr. Zoll is also responsible for the oversight of Burns and Roe's Owners Engineering and Independent Engineering Due Diligence support groups. He has extensive experience in the evaluation, development and negotiation of EPC Contracts, Fuel Supply Contracts, Power Purchase and Energy Services agreements for both IPP and Industrial projects; and project management and the oversight of construction and commissioning of IPP and Cogeneration facilities designed to fire both natural gas, low BTU synthetic gas, coal, petroleum coke and biomass. His prior IGCC experience includes assignments as Burns and Roe's Project

Manager for the conceptual planning and development phases of the 400 MW Australian "Zero Gen" IGCC project which utilized Shell gasification technology and geologic CO2 sequestration; and as a technology advisor supporting Burns and Roe's assignment as the Independent Engineer for the US DOE's Loan Guarantee application review for the Christian County, Illinois IGCC project which utilized GE (Texaco) gasification technology and included CO2 separation for enhanced oil recovery. Prior to Burns and Roe, Mr. Zoll worked for GPU International as Director of IPP Project Engineering and Permitting; and for the Exxon Research and Engineering Company in the design of refinery utility systems.

Ben Hill, Executive Construction Management Consultant: Mr. Hill has 38 years of experience in the construction management industry with 20 years as a senior level construction management executive consultant with superior organizational and communication skills. Since joining Burns and Roe in 2003, Mr. Hill has served as the Construction Manager on several large scale commercial biomass energy facilities, including the H-Power Resource Recovery Project in Hawaii. Mr. Hill was involved with this project from the feasibility study level, where he analyzed and managed the team who examined the constructability and environmental issues with the potential addition of this 900 TPD MSW facility. Following the feasibility level review, Burns and Roe was contracted to provide detailed engineering and design of the facility, and Mr. Hill remained on the project throughout to evaluate the engineering, procurement plans, and interface plans with the existing facility. Following the design completion Mr. Hill remained on the project to oversee the construction and identify issues in the subcontracted construction contractors planning, scheduling, cost management and quality assurance execution capabilities. In addition to providing construction management, Mr. Hill has been essential in the Independent Engineering Reviews, Feasibility Studies, Owners Engineering, and Conceptual Designs of Burns and Roe's MSW and gasification projects. These projects include the Frederick County WTE Project, Interstate Waste Technologies, Exelon WTE Plasma Gasification, Waste Management Plasma Gasification, and ZeroPoint Downdraft gasifier Owner's Engineer Projects. As a part of his analysis in these projects, Mr. Hill has reviewed facility construction plans and schedules, assessed EPC contractor's ability to execute their responsibilities and control costs, reviewed vendor documents and supply chain management, as well as identifying constructability and siting issues. Mr. Hill also reviewed the balance of plant completion, start up, as well as operating and maintenance plans. Mr. Hill was the Construction Manager for Burns and Roe's Independent Engineering Review of the Christian County IGCC Project's Loan Guarantee Application for the DOE.

Constantinos Nicolaou, Executive Project Controls Consultant: Mr. Nicolaou has over 35 years of experience in project controls, construction planning, and scheduling for engineering, construction, start up, and outage projects. Such tasks have been completed both in home and field offices for major projects in energy and transportation. Mr. Nicolaou is an expert in the understanding of and application of the Primavera scheduling software on large complex projects. His power background encompasses, fossil, renewable and nuclear generating stations. He has served as an executive consultant to Burns and Roe's consulting division. He served for a decade on the review team tasked by DOE to assess all of their major projects both in the capacity as a cost and schedule lead reviewer, for projects worth in excess of one billion dollars including the Yucca Mountain spent nuclear waste fuel storage project in Nevada. He has been

part of award winning projects like the Texas City combined cycle project. Additionally he was the field project controls manager for PSEG Bergen combined cycle Generating station in New Jersey, the Foothills Riverside II-Simple cycle project in Kentucky, and the Chocolate Bayou Combined Cycle in Texas.

Walter Krzastek, Executive Cost Estimating Consultant: Mr. Krzastek has over 30 years of cost estimating experience including conceptual estimating for FOAK and emerging technology projects, preparing lump sum bids for engineer, procurement and construction and design and build projects in the power engineering and construction industry. Mr. Krzastek created and managed highly successful divisions for three major US general contractors to perform engineer, procurement and construction and design and build projects in the power generation market. Mr. Krzastek has extensive experience in managing and directing cost estimating and project services staffs for projects on an international basis that range in cost to values in excess of \$3 billion. Mr. Krzastek is a specialist in developing and evaluating costs and schedules for conceptual projects including many First-of-a-Kind technologies for the US Department of Energy including the Christian County IGCC project in Illinois. Mr. Krzastek is an expert in engineering and construction claims preparation, negotiation, claims defense and claims resolution. Mr. Krzastek has been retained by Owners to evaluate construction projects in progress that are being erected by an EPC, Design/Build or General Contractor which are suffering from schedule slippage and cost overruns.

Yan Kishinevsky, Director of Advanced Technologies: Mr. Kishinevsky has over 30 years of experience in project and construction management, engineering and design, research and development, financial, and economic and risk analyses. As Director of Advanced Energy Technologies for Burns and Roe's Power Generation and Delivery Division, Mr. Kishinevsky's responsibilities include the development and implementation of advanced fossil and renewable generation technologies, including coal and biomass gasification, syngas utilization for power production and co-production of chemicals and liquid and gaseous fuels, beneficial and geological CO₂ sequestration, renewables, and other clean generation technologies, independent engineering, and due diligence. Mr. Kishinevsky leads Burns and Roe's efforts aimed at broad utilization of opportunity fuels, such biomass-derived synthesis gas, landfill and anaerobic digester gases, biodiesel, and others for power generation and air emission reduction purposes. Mr. Kishinevsky has significant senior level executive industry experience in managing large complex baseload power and energy production facility construction projects, including managing and overseeing EPC contracts; technology management, integration and installation; startup and initial operations of similar complexity and directing mid-to-large sized organizations with a diverse mix of engineering, technical, construction management, and administrative functions.

Bill Louer, Senior Project Engineer: Mr. Louer has over 15 years of experience working with conventional and advanced energy projects. He has completed numerous coal and biomass combustion and gasification technical and economic feasibility studies. Bill coordinated the development of a First of a Kind CO₂ capture, CO₂ compression and CO₂ pipeline Front End Engineering and Design development project to support a new coal fired power project. He has

conducted competitive processes for the selection of leading coal and biomass gasification technologies. Mr. Louer conducted a formal competitive selection process for a gasification project which included an air separation unit evaluation and gas turbine supplier selection to support project development for this IGCC project. In support of this project, he has conducted site visits of operating coal IGCC plants in the USA and Europe to understand the operating history and challenges which should be experienced with this and other IGCC projects. Mr. Louer conducted a detailed site selection process that balanced technical, economic and environmental considerations for the IGCC project. Mr. Louer has managed biomass fuel resource assessment studies and a competitive gasification technology selection process to support biomass gasification project development which required review of operating gasification projects and all major gasification technologies. He has also supported the development of natural gas combustion turbine based projects including project heat balance development, project scope development, cost estimate development and overall site and permit support.