Public Version

DIRECT TESTIMONY

OF

COLLIN CAIN, M.SC.

On Behalf of

THE MISSISSIPPI PUBLIC UTILITIES STAFF

BEFORE THE MISSISSIPPI PUBLIC SERVICE COMMISSION

DOCKET NO. 2018-UA-267

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Collin Cain. I am a Principal with Bates White, LLC. My business address is 2001 K Street N.W., North Building, Suite 500, Washington, DC 20006.

Q. PLEASE SUMMARIZE YOUR PROFESSIONAL AND EDUCATIONAL EXPERIENCE.

A. I have a B.A. in Economics and Political Science from the University of Toronto and an M.Sc. in Economics from the London School of Economics. I have more than 20 years of experience in power sector economic analysis, including damages estimation, power supply procurement evaluation, asset valuation and cost benefit analysis. I have conducted forensic analysis and testified on the conduct and application of forecasts, market evaluation, and risk assessment by contract counterparties. Prior to joining Bates White, I was a consultant in the energy practice of NERA economic consulting in New York and Washington, DC.

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE THIS COMMISSION?

A. I have not testified previously before the Commission. However, I have previously been part of the Bates White teams that have prepared reports for the Mississippi Public Utility Staff ("Staff") which have been filed by Staff in Commission proceedings. One such example was a report related to various Mississippi Power Company solar purchase power agreements.[1] Further, I have submitted testimony on behalf of the Commission in FERC Dockets EL18-152-000, EL09-61-004, ER13-432-002, and ER12-1384-001, *et al.*, regarding Entergy-related matters. These are summarized in my *curricula vitae* attached as Exhibit MPUS-1.

Q. PLEASE DESCRIBE BATES WHITE, LLC.

A. Bates White is an economic consulting firm with over 180 degreed professionals in economics, finance, and engineering. In addition to its Energy Practice, Bates White has practice areas in Antitrust, Finance, Intellectual Property, Healthcare, Environmental and Product Liability, and Transfer Pricing and Tax. The firm has offices in Washington, DC and San Diego, CA.

Q. **ON WHOSE BEHALF ARE YOU TESTIFYING?**

A. I am testifying on behalf of the Mississippi Public Utilities Staff.

Q. **WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

A. Bates White was retained by the Staff to provide an independent assessment of the proposed acquisition by Entergy Mississippi, LLC ("EML" or "Entergy Mississippi"

[1] The report was titled "Analysis of the CPCN Applications and Proposed Power Purchase Agreements filed Jointly by Mississippi Power Company and Hattiesburg Farm, LLC, MS Solar 2, LLC and CB Energy, LLC. The report was filed with the Commission on November 2, 2015.

or the "Company") of the Sunflower County Solar Facility ("Sunflower" or the "Facility"), based on the transaction as presented in the December 20, 2018 Joint Petition of Entergy Mississippi, LLC and Sunflower County Solar Project, LLC ("SCSP").

Q. DID BATES WHITE CONDUCT SUCH AN ASSESSMENT?

A. Yes. We conducted a review and assessment of the Joint Petition. A full report of our review and assessment is attached as Exhibit MPUS-2.

II. OVERVIEW OF THE REPORT

Q. WILL YOU PLEASE PROVIDE AN OVERVIEW OF THE REPORT?

A. Yes. Bates White reviewed the Joint Petition, accompanying testimony, and responses to data requests to evaluate the rationale, evidentiary support, costs, benefits and risks associated with the proposed transaction. Specifically, the analyses presented in the report examine:

- Market context for solar generation projects in the U.S., Southeast region, and Mississippi;
- The Entergy Mississippi solicitation process;
- The resulting Sunflower solar transaction, project design, transaction terms and warranties;
- Evaluation of the transaction rationale, economic analysis, and risks to ratepayers.

Q. BASED ON THE REVIEW PRESENTED IN THE REPORT, DO YOU HAVE SPECIFIC CONCLUSIONS AND RECOMMENDATIONS?

A. Yes. Our conclusions and recommendations, as presented in our report, are as follows:

Ratepayer cost impacts

The economic evaluation performed by EML indicates that the Sunflower solar project will likely result in a net increase in costs to ratepayers. In EML's evaluation reference case, the net cost increase is approximately $[redacted] million on a net present value ("NPV") basis, in 2018 dollars. In terms of net cost for the quantity of energy expected from the Sunflower project, this amounts to a premium of approximately $[redacted] per megawatt-hour ("MWh"), on an NPV basis in 2018 dollars. EML's analysis includes cases that produce higher and lower benefit values for the project, with the high-benefit case (high natural gas and carbon dioxide ("CO2") prices) resulting in positive net benefits of approximately $[redacted] million NPV, or $[redacted]/MWh. As discussed in the body of the report, we consider the low-benefit case (low natural gas and zero CO2 prices) to be closer to the expected future relevant for evaluating Sunflower. That case results in a net cost increase of approximately $[redacted] million NPV, or $[redacted]/MWh.

While we conclude that customer costs will likely increase with the acquisition of Sunflower, we also acknowledge that the project benefits estimated by EML exclude quantification of potential fuel diversity effects that would mitigate natural gas price volatility, and that assumed CO2 prices may be low (which would cause benefits to be underestimated). Estimated benefits also exclude local and state level economic development impacts, which would be real. We also do not dispute EML's contention that some portion of its customer base favors increased generation from renewables, even at increased cost. We also accept, with caveats, EML's stated

rationale that the Sunflower project could provide the Company with valuable information and experience regarding solar project development and operations.

EML's solicitation process

EML's solicitation that led to selection of the Sunflower project did not conform to best practices that would allow for a conclusion that the result was a least-cost outcome. In particular, [redacted] – that would have provided for a more complete review of solar options for serving Mississippi ratepayers. While we focus on deviations from what we consider best practices, we do not conclude that EML's solicitation was fatally flawed. Our observations are intended to indicate potential improvements to future solicitations that will tend to encourage robust bidder participation and enhance confidence in the value of the outcome for ratepayers.

Project design

Specific details regarding project design and materials – including the solar modules, inverters, racking, controls, and other key components – are not specified in the Sunflower offer. As a consequence, it is not possible to determine with confidence what product Mississippi ratepayers will ultimately get. Project design typically entails trade-offs in which equipment cost, efficiency/performance and quality/warranty are balanced against providing the lowest cost of electricity over the life of the contract (and ideally the life of the asset). The lack of design specification means that it is not possible to know whether the Sunflower project will be optimized for ratepayer value or, for example, vendor profitability.

Warranties

Given the early stage of development at which the Sunflower project will be at the time the Commission must decide whether to allow the proposed BOT transaction to go forward, warranties at all remaining stages of development – engineering, procurement and construction – will be essential to protect the ratepayers. Minimum warranties during each stage are specified in the terms and conditions established in the BOT Agreement, the Scope Book and associated attachments.

Because the project transfer will occur prior to definitive equipment selection and construction, it is impossible to assess fully the adequacy of warranties and their conveyance to Entergy Mississippi. However, the minimum acceptable equipment warranties for each of the main components of the Project (photovoltaic ("PV") module; DC-AC electronic inverter; PV modules racking and trackers; and other balance of plant equipment such as step-up transformer(s), power and control cables) specified in the Scope Book compare well with the warranties offered in the market for these products. One possible exception is the minimum warranty duration for inverters, which is [redacted] as long as what the market typically offers – sometimes at additional cost.

Potential for learning

EML's rationale for opting for a BOT structure for its first utility-scale solar PV project is that this type of development structure facilitates learning the solar generation business; from design/development, through construction, testing and operation. The BOT Agreement provides EML [redacted]

[redacted] However, there are no specific training programs defined for the transfer of early stage project development know-how.

It is not clear whether EML has established what it is seeking to learn and how it will know whether it has succeeded. It is important for EML to develop early-stage project development learning goals and to propose appropriate lessons learned targets/metrics for consideration by the Commission.

Performance risk

By adopting the BOT construct, Entergy Mississippi has mitigated certain risks associated with PPAs. Yet the BOT construct, in combination with the lack of design specifics in the Sunflower offer, also imposes risks on Mississippi ratepayers that they would not bear under a typical solar PPA arrangement. A significant advantage of a PPA is that the buyer pays pre-determined prices for energy actually generated. Project ownership, in contrast, entails significant cost and performance risk. The mitigation of certain risks afforded by ownership must be balanced against the reduced performance risk and potentially lower costs afforded by contracting for energy from a facility owned and operated by an experienced third party.

Should the Commission approve the Joint Petition, Bates White recommends that it condition such approval on EML obtaining minimum generation guarantees for

Sunflower output over at least 20 years following the facility commercial operation date, and that the Commission require EML to bear ultimate responsibility for such minimum performance in the event that EML is unable to enforce such guarantees. Minimum generation should be at the level at which EML evaluated Sunflower's economics, e.g., approximately a [redacted] capacity factor, and should incorporate assurance of no more than a [redacted] annual capacity degradation rate. Performance should be assessed and reported annually.

Future solicitations

Granting EML's contention that the Sunflower transaction provides value through learning, we recommend that such learning be construed to entail the entire solicitation process. We recommend that future renewable solicitations seek a broader array of offers, including PPAs, and that the solicitation incorporate more detailed information on offer requirements, offer evaluation criteria, treatment of bidder "special considerations" and other elements of good solicitation design. An enhanced solicitation process will tend to increase the bidder participation and confidence in the value of the outcome for ratepayers.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

DISTRICT OF COLUMBIA)

COUNTY OF WASHINGTON)

Collin Cain, with Bates White, LLC, being first duly sworn, deposes and says that the statements contained in the foregoing Testimony to the Mississippi Public Service Commission, in Docket No. 2018-UA-168 are true and correct to the best of his knowledge, information and belief.

Collin Cain

Subscribed and sworn to before me this the 15th day of August, 2019.

Notary Public

My Commission Expires: Feb. 14, 2024

DISTRICT OF COLUMBIA: ss
SUBSCRIBED AND SWORN TO BEFORE ME
THIS 15 DAY OF August, 2019.

NOTARY PUBLIC
My Commission Expires Feb. 14, 2024

SHERRY RAMOS
NOTARY PUBLIC
My Comm Exp Feb 14, 2024
DISTRICT OF COLUMBIA

BATES WHITE
ECONOMIC CONSULTING

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COLLIN CAIN, MSC

Principal

AREAS OF EXPERTISE

- **Economic, regulatory and market analysis**
- **Market design**
- **Asset valuation**
- **Damages estimation**
- **Forensic analysis**

SUMMARY OF EXPERIENCE

Mr. Cain specializes in economic evaluation of wholesale electricity markets. He has extensive experience developing energy and capacity market pricing and risk analysis models, and has applied these models in a variety of consulting assignments to evaluate market design, value generation assets and power supply contracts and to develop supply hedging strategies. Mr. Cain assists clients in developing regulatory strategies, and has provided expert testimony in regulatory, court and arbitration proceedings. He has provided strategic advisory work on issues such as asset divestment, stranded cost recovery, and rate unbundling. Mr. Cain also applies his expertise in forensic analysis of the conduct and application of forecasts, market evaluation, and risk assessment by contract counterparties.

Mr. Cain has provided expert testimony on market design, supply procurement, power market modeling, cost/benefit analysis, market power, cost allocation, contract damages, and energy market bidding behavior.

EDUCATION

- MSc, Economics, London School of Economics
- BA, Economics and Political Science Specialist, University of Toronto

SELECTED EXPERIENCE

- In support of a major wind farm development in Mexico, conducted a due diligence review of the project PPA price model and its application in projecting project revenues. The evaluation addressed the representation of the renewable energy banking mechanism and the priority lists for allocating project energy and capacity to load centers, and consistency with the CFE interconnection agreement.
- Evaluated competitive impacts from Tucson Electric Power's proposal for utility-owned rooftop solar and community solar. The analysis, in support of testimony before the Arizona Public Service Commission, assessed the status of the competitive market for distributed generation and the likely impacts from proposed utility offerings.
- On behalf of the Mississippi Public Service Commission (MPSC), evaluated costs and benefits of Entergy's proposal to join the Midwest Independent System Operator (MISO) regional transmission organization. The

analysis included assessment of prior cost-benefit studies as well as independent production cost modeling of the benefits to the Entergy region from joining MISO.

- Testimony on behalf of Catalyst Paper Operations, Inc., presenting an analysis of FERC's market power screens supporting Catalyst's market based rate application associated with its acquisition of power generating facilities.
- Evaluated the proposed spin-merge of Entergy's transmission assets to ITC Holdings Corp., and advised the Mississippi Public Service Commission on the costs and benefits to Mississippi, including impacts on state regulatory control.
- Quantified effects on New Jersey energy costs of the prospective merger between PSEG and Exelon Corp as part of a comprehensive cost-benefit analysis for the NJ BPU. Effects included wholesale price impacts from changes to nuclear plant availability, direct costs to the state arising from planned staff reductions, and reductions in PSE&G's regulated cost of service arising from estimated merger synergies.
- Affidavit in FERC proceeding (FERC Docket No. ER16-49-000, *et al.*) on behalf of the Electric Power Supply Association (EPSA) evaluating multiple proposals by PJM and other market participants to modify the PJM capacity market.
- Expert testimony on behalf of the Kansas Corporation Commission Staff regarding the proposed acquisition of 800 MW of wind generation by Empire District Electric Company. Analysis included an assessment of energy and capacity needs, projected value from proposed tax equity partnership, and risk allocation between investors and ratepayers.
- Expert testimony on behalf of the U.S. government regarding offsets to damages claimed by Alabama Power Company and Georgia Power Company resulting from the Government's partial breach of the spent nuclear fuel "Standard Contract."
- For the fuel audit of Nova Scotia Power for calendar years 2016 and 2017, on behalf of the Nova Scotia Utility and Review Board, evaluated the cost recovery provisions of the utility's Load Retention Tariff, and the effectiveness of provisions to shield other utility customers from incremental costs of serving load under the tariff.
- Affidavit in FERC proceeding (FERC Docket No. ER18-1314-000) on behalf of the Electric Power Supply Association (EPSA) regarding PJM's proposed Capacity Repricing mechanism to modify the PJM capacity market auctions to address state subsidies to certain generating units in PJM.
- Affidavit on behalf of the Electric Power Supply Association in FERC's *Grid Reliability and Resilience Pricing* docket (RM18-1-000). Analyzed market effects of proposed out-of-market subsidy payments to coal and nuclear generating units in ISO/RTO markets.
- Submitted testimony on behalf of Constellation Energy Commodities Group, Inc. in a complaint proceeding before FERC (Docket No. EL07-47-000) regarding the Illinois electricity supply auction. Analyzed the conduct, bidding behavior and outcome of the auction, addressing auction structure and rules, and allegations of market manipulation.
- Conducted economic assessment of KCP&L's proposed $1.2 billion environmental retrofit of La Cygne Generating Station, and testified before the Kansas Corporation Commission on behalf of Commission Staff. Developed analysis framework and key factor inputs for alternative economic assessment and evaluated supporting analyses submitted by KCP&L.

- Directed power market projections and economic benefit analyses in various applications, including: study of economic benefits for the Niagara Power Project (NYPA); cost-benefit analysis of environmental protection alternatives related to fueling of Salem Generation Station (PSE&G) and Indian Point Nuclear Power Plant (Entergy) and to the operation of Danskammer Point Generating Station (Dynegy).
- Submitted testimony at FERC on behalf of the Mississippi Public Service Commission regarding the allocation of settlement benefits among the Entergy operating companies. The testimony quantified shortfalls in benefits owed to Entergy Mississippi related to a settlement by Entergy resolving damage claims from a coal transportation disruption that restricted output at two of Entergy's generating plants.
- Conducted independent validation of Southern California Edison's (SCE) internal power supply risk assessment model, including the model's theoretical underpinnings, implementation, and interpretation of outputs. The SCE model assesses procurement cost risk based on stochastic simulation that accounts for dispatchable resources, supply contracts, power forward and gas forward positions.
- Calculated damages and submitted expert testimony on behalf of PG&E, SCE and SDG&E in separate cases before the U.S. Court of Federal Claims and Los Angeles Superior Court regarding unresolved claims stemming from energy sales by defendants into the PX and ISO markets during the California energy crisis.
- Developed RFP documents and evaluation procedures for the Ontario Ministry of Energy's 2500MW RFP. Directed the economic evaluation of generator proposals, including development of models used to estimate energy market revenues and contingent capacity support payments, and created analytical tools to evaluate aggregate costs, including transmission upgrade cost impacts, for every possible portfolio of submitted bids.
- Developed probabilistic risk management model for market price forecasting, asset valuation and power supply cost analysis. Adapted and implemented the model in applications for Oglethorpe Power Corporation (OPC), Central Maine Power Company, Vermont Yankee Nuclear Power Corporation, Commonwealth Electric Company, and Connecticut Yankee Atomic Power Company. Analyses included forecasting market clearing energy and capacity prices, and estimating hedge values for retained capacity, new unit construction, power supply bids, and financial derivatives.
- Evaluated power supply proposals for short-term and long-term RFPs by OPC, directing and assessing PROMOD scenarios for alternative supply portfolios. Created and applied an independent price forecasting model and Monte Carlo analysis to evaluate risk profiles of supply alternatives.
- Provided analytical support for RFP design and portfolio evaluation in the Ireland 500 MW capacity procurement.
- Assisted the development and implementation of BG&E's solicitation of standard offer supply service. Estimated market energy and capacity prices in a 15-year forecast applying a proprietary linear programming/optimal system expansion model.
- Served as testifying expert and produced expert report for OPC in arbitration proceedings between OPC and LG&E Power Marketing (LG&E) regarding LG&E's valuation of coal supply contracts associated with a long-term power purchase and sale agreement.
- Evaluated the Public Service Company of Oklahoma's 2008 Supply Side RFP in support of testimony for a potential bidder. Assessed bid evaluation methodology, credit and collateral requirements, and implementation of debt equivalence adjustments.
- Managed the Data and Rate Design Committees and Backup Bidding Team for the annual auctions of New Jersey Basic Generation Service (BGS). Participated in development of auction process, rules and protocols,

and regulatory filings. Directed bidder information procedures and auction Data Room Team. Conducted PJM wholesale market price assessment to determine starting prices for the descending clock auction.

- Conducted benefits analysis of proposed hydroelectric power plant development in New York State, including reliability benefits, environmental benefits and wholesale market price impacts.
- Directed economic analyses and produced white papers on the economic benefits of baseload generation from nuclear power plants on behalf of Exelon Corporation. Benefit analysis examined impacts on wholesale market prices, and peak hour power flow impacts. (Separate assignments for 5 nuclear plants: Oyster Creek, Limerick, TMI, Peach Bottom, and proposed restart of Zion).
- On behalf of Occidental Chemical Corporation, evaluated proposed changes to cost allocation methods in the Entergy production cost sharing mechanism, in support of testimony in FERC proceeding (Docket No. ER07-682-000). The evaluation estimated the impact on the individual Entergy operating companies and assessed compliance with regulatory accounting principles.
- Evaluated PJM proposals to modify OATT allocation of cost responsibility for transmission upgrades under the Regional Transmission Expansion Plan (RTEP), supporting testimony in FERC Docket EL07-57-000 (Consolidated).
- Advised the Ontario Power Authority in generator contract dispute arising from rule modifications by the Independent Electric System Operator (IESO). Provided assessment of background and intent of contract payment mechanisms and preliminary analysis of revenue impacts of rule changes on generator counterparties.
- Submitted testimony before FERC on behalf of the MPSC regarding Entergy Louisiana's proposal to allocate cancelation costs of the Little Gypsy Repower Project through the Entergy Service Agreement's rough production cost equalization mechanism.
- Developed forecast model of the CFE (Mexican electric utility) short-run cost of generation (CTCP) in support of the acquisition of a large scale wind project in Oaxaca, México. The model allowed for evaluation of potential project revenue impacts associated with increased gas-fired and renewable generation on the CFE system.
- As an advisor to a major capital finance entity, evaluated the project financial model for a proposed hydroelectric generation project in western Mexico. The model review considered representation of the renewable energy banking mechanism under Mexican energy regulation, representation of seasonal production and demand patterns, and the associated projection of profit and loss and debt service coverage of the life of the project.
- Conducted detailed valuation analysis of qualifying facility (QF) hydro plants for New York State Electric & Gas Corporation (NYSEG), supporting settlement negotiations with plant owners. The analysis considered the value to NYSEG of buying out the contracts or assuming ownership under expected default by the plant owners.
- Conducted assessment of potential effects on wholesale markets and default service procurement of the proposed merger of Exelon Corp. and Constellation Energy Group Inc., in support of testimony submitted to the Maryland Public Service Commission on behalf of Commission Staff.
- Evaluated power market modeling employed by a party in a major supply contract litigation. Evaluated the party's application of PROMOD and MIDAS models used to value the transaction, and associated risk

analyses used to assess value at risk (VaR). Identified substantive errors in inputs, contemporaneous market assumptions, risk analysis and economic inference.

- Conducted due diligence assessment of the financial modeling of off-taker PPA revenues for the 396MW Mareña wind power project in southern Mexico, including the representation of off-taker priority list weighting and energy banking under CRE renewable interconnection rules.
- Conducted valuations of all Central Maine Power (CMP) power plants, supporting negotiated sale of generation assets to FPL. Applied market price forecasts and extensive monte carlo analyses to examine multiple transaction scenarios, including the value of retaining hydroelectric facilities as a supply hedge during the transition to competition. FPL Energy agreed to pay $845 million for all of CMP's non-nuclear generating assets.
- Produced power plant valuation of the TNP One lignite-fueled unit for Texas-New Mexico Power Company to support asset sale strategy as well as litigation with respect to stranded costs.
- Directed power market price forecasts for multiple clients, applying proprietary linear programming model to evaluate optimal capacity expansion for fuel price, demand growth and technology scenarios.
- Provided consulting assistance to the U.S. Department of Justice in defending claims related to spent nuclear fuel breach of contract in *Vermont Nuclear Power Corporation, and Entergy Nuclear Vermont Yankee, LLC et al., v. The United States* in the United States Court of Federal Claims (Nos. 02898C & 03-2663C) and *Portland General Electric Company et al., v United States of America* in the United States Court of Federal Claims (No. 04-0009C).
- Assessed the benefit-cost evaluation methods and assumptions applied to the 2010-12 energy efficiency plans in Massachusetts, for the Office of the Attorney General of Massachusetts.
- Conducted extensive analyses for a California IOU in refund proceedings related to the California energy crisis. Examined impacts of the calculation and application of mitigated market clearing prices (MMCPs) in the determination of refunds owed by generators selling into the California markets.
- For Baltimore Gas & Electric (BGE) testimony before the Maryland Public Service Commission, estimated rate impacts for alternative supply scenarios. Conducted power market analysis, estimation of wholesale market impacts on retail supply auction results, and self-build generation analysis.
- Managed a multi-disciplinary team in the development of a new pricing mechanism for liquid fuels in South Africa. The work, performed for the South African Department of Minerals and Energy, established pricing methods and regulatory accounts to ensure that fuel prices appropriately reflect costs, and enhance industry investment incentives.
- Estimated benefits of competition in electric markets through four empirical analyses, and quantified the dollar benefits to Maryland consumers of wholesale competition in PJM and state retail restructuring.
- Developed economic analysis of PJM transmission cost allocation proposals for merchant transmission entity. Supported testimony filed at FERC in Docket No. ER06-880-000, *et al.*
- Directed the evaluation of the benefit-cost ratio methodology used to validate energy efficiency measures in Massachusetts.
- Evaluated PJM price formation, demand responsiveness, and DR compensation proposals for comments submitted on FERC's ANOPR on "Wholesale Competition in Regions with Organized Electric Markets" (Docket Nos. RM07-19-000 and AD07-7-000).

- Performed strategic consulting work for BGE. Prepared expert testimony submitted in Maryland electric utility restructuring proceedings and consulted on utility regulatory strategy. Addressed market impact and economic rationale of competition policy, strategic aspects of asset disposition, stranded cost recovery, and retail access.
- Consulted on asset valuation alternatives and stranded cost recovery strategy, including the application of an auction appraisal of generation assets, for Niagara Mohawk Power Corporation.
- Directed study reviewing current methods of load profiling for retail settlement and energy imbalance services in the U.S. and Canada. The work was included in a series of load profiling studies for Japan's Ministry of Economy, Trade, and Industry.
- For ISO-NE, the NYISO and PJM Interconnection, in the evaluation of the proposed centralized resource adequacy model (CRAM): assessed capacity cost recovery for varied market conditions and implications for timing and frequency of capacity auctions.
- Conducted an analysis of reserve margin impacts on energy price volatility in the development of a power supply procurement process for Acquirente Unico, the Italian electric market single buyer.
- Directed analysis of optimal market hedge ratios by customer class for Dayton Power and Light. Analysis examined risk exposure due to price-driven customer migration under proposed retail access program.
- Produced pro forma valuation for the non-nuclear portion of the Connecticut Yankee nuclear site. Study considered unique site value and costs for a new generating plant, project financing costs, and the future competitive environment including market energy and capacity prices.
- Served as testifying expert on market modeling before the Massachusetts Department of Telecommunications and Energy on behalf of Commonwealth Electric. Testimony supported analysis of Commonwealth Electric's stranded costs and buyout options for legacy power purchase agreements.
- Directed new coal generation feasibility study for proposed investment in the Four Corners region of New Mexico. The analysis included market demand, competing supply, availability and cost of electrical transmission, cost and deliverability of coal, availability of water, and environmental concerns.
- Conducted a comprehensive review of the retail access experience in New England states. Developed state-by-state profiles that outlined the regulatory regime, transition period, standard-offer and default-service provisions. Evaluated end-user and supplier exposure to variable market prices.
- Provided consulting services to Niagara Mohawk Power Corporation on the modeling of transaction value for outsourcing standard offer service.
- Evaluated the competitive market of potential suppliers for PSE&G's auction of standard offer supply.
- Advised on the theoretic foundations of economic cost concepts and regulatory applications in avoided cost cases for a group of northeast electric utilities.
- Evaluated measures of competitiveness in present and future wholesale power markets and developed several models for use in assessing forward product prices for a large U.S. public power company.
- Participated in power purchase prudence analyses for PG&E, Nevada Power Company, Texas New Mexico Power Company, and Public Service Company of Colorado.

PROFESSIONAL EXPERIENCE

Prior to joining Bates White, Mr. Cain served as a Consultant at National Economic Research Associates (NERA). In this position, he conducted a variety of power sector analyses in NERA's energy practice. Mr. Cain also served as an Economist with Jones Lang Wootton USA, where he directed economic research and market analysis for a range of corporate clients. Previously, Mr. Cain was a Consultant with Apogee Research, where he conducted economic impact analyses, and participated in a variety of transportation and environmental economics consulting assignments.

EXPERT TESTIMONY

- On behalf of the Mississippi Public Service Commission and the Arkansas Public Service Commission, *Louisiana Public Service Commission v. System Energy Resources, Inc., and Entergy Services, Inc.*, Federal Energy Regulatory Commission (Docket No. EL18-152-000). Written testimony.
- On behalf of the Electric Power Supply Association, *PJM Interconnection, L.L.C.*, FERC (Docket No. ER18-1314-000). Affidavit.
- On behalf of the Electric Power Supply Association, *Calpine Corporation v. PJM Interconnection, L.L.C.*, FERC (Docket No. ER16-49-000, *et al.*). Affidavit.
- On behalf of the United States, *Alabama Power Company and Georgia Power Company v. The United States*, in the U.S. Court of Federal Claims (No. 14-167C and No. 14-168C). Expert report.
- On behalf of the Electric Power Supply Association, *PJM Interconnection, L.L.C.*, FERC (Docket No. ER18-1314-000). Affidavit.
- On behalf of the Staff of the Kansas Corporation Commission, *IMO the Petition of The Empire District Electric Company for Approval of Its Customer Savings Plan*, before the Kansas Corporation Commission (Docket No. 18-EPDE-184-PRE). Written testimony.
- On behalf of the Electric Power Supply Association, *Grid Reliability and Resilience Pricing*, FERC (Docket No. RM18-1-000). Affidavit.
- On behalf of Calpine Corporation and NRG Energy, Inc., Application of Centerpoint Energy Houston Electric, LLC to Amend a Certificate of Convenience and Necessity for a Proposed 345-kV Transmission Line (...), Public Utility Commission of Texas (Docket No. 473-15-3595). Written testimony; live testimony at hearing.
- On behalf of Catalyst Paper Operations, Inc., *Catalyst Paper Operations Inc.*, FERC (Docket No. ER15-794-002). Written testimony.
- On behalf of the Mississippi Public Service Commission, *Entergy Services, Inc.*, FERC (Docket No. ER13-432-002). Written testimony; deposition testimony; live testimony at hearing.
- On behalf of Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company and the State of California, *Pacific Gas and Electric Company and Southern California Edison Company v. The United States; San Diego Gas & Electric Company v. The United States*, in the U.S. Court of Federal Claims (No. 07-157C and No. 07-167C, Consolidated; No. 07184C). Written testimony; deposition testimony.
- On behalf of the Mississippi Public Service Commission, *Louisiana Public Service Commission v. Entergy Services, Inc., et al.*, FERC (Docket No. EL09-61-004). Written testimony; deposition testimony; live testimony at hearing.

- On behalf of the Mississippi Public Service Commission, *Louisiana Public Service Commission v. Entergy Services Inc., et al.*, before the FERC (Docket Nos. ER12-1384, *et al.*). Written testimony; deposition testimony; live testimony at hearing.
- On behalf of Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company, *Electric Refund Cases,* in the Superior Court of the State of California (Judicial Council Coordination Proceeding No. JCCP 4512). Written testimony; deposition testimony.
- On behalf of the Staff of the Kansas Corporation Commission, IMO the Petition of Kansas City Power & Light Company for Determination of the Ratemaking Principles and Treatment that Will Apply to Recovery in Rates of the Cost to be Incurred by KCP&L for Certain Electric Generation Facilities Under K.S.A. 66-1239, before the Kansas Corporation Commission (Docket No. 11-KCPE-581-PRE). Expert report; live testimony at hearing.
- On behalf of Constellation Energy Commodities Group, Inc., *The People of the State of Illinois, ex rel. Illinois Attorney General Lisa Madigan v. Exelon Generation Co., LLC, et al.*, FERC (Docket No. EL07-47-000). Affidavit.
- On behalf of Oglethorpe Power Corporation, in contract dispute brought by LG&E Energy Corp. and LG&E Energy Marketing, Inc. (CPR Arbitration proceeding). Expert report; deposition testimony; live testimony.
- On behalf of Commonwealth Electric Company, Petition of Cambridge Electric Light Company and Commonwealth Electric Company requesting approval of their Transition Charge Reconciliation Filing, before the Massachusetts Department of Telecommunications and Energy (Docket No. DTE 99-90). Live testimony.

PUBLICATIONS AND PRESENTATIONS

- "Renewable Natural Gas Supply and Demand for Transportation" White paper (June 2019).
- "Biodiesel Distribution in the US and Implications for RFS2 Volume Mandates" (July 2016).
- "Clean Energy Certificates: The Key to Renewable Energy Financing," with Nicolás Puga. Electricity Future Forum Mexico 2014 (November 2014).
- "Evaluation of the Entergy Mississippi Proposal to Join MISO," Report to the Mississippi Public Service Commission. (August 2012, Revised)
- "Beyond Loan Guarantees: Fostering U.S. Nuclear Investment in a Post-Fukushima World," with Glenn George. Conference paper and presentation, Center for Research in Regulated Industries 30th Annual Eastern Conference. Skytop, PA (May 2011).
- "Retail Rate Comparisons and the Electric Restructuring Debate," with Jonathan Lesser. Bates White briefing paper, 2008-E-11-01. (November 2008).
- "Economic and System Reliability Benefits of the Three Mile Island Generating Station," with Spencer Yang and Jonathan Lesser. White paper (April 2008).
- "Trends in Electricity Deregulation." Conference presentation at DTN/Meteorlogix Energy Summit. Minneapolis (June 2008).
- "A Common Sense Guide to Wholesale Electric Markets," with Jonathan Lesser. White paper (April 2007).
- "Utility Mergers: The Exelon-PSEG Merger." Workshop presentation, Market Power, Mergers, and Governance, Center for Research in Regulated Industries. Newark (January 2007).

- "The Fallacy of High Prices," with Howard Axelrod and David DeRamus. Public Utilities Fortnightly 144 (November 2006).
- "Nuclear Power in Future Electric Rate Cases." Conference presentation, Managing the Modern Utility Rate Case, Law Seminars International. Las Vegas (February 2006).
- "Applications of Probabilistic Price Modeling." Workshop presentation, Marginal Cost Working Group. Washington, DC (September 2004).
- "The 2004 BGS Auctions," Presentation to American PowerNet. PJM Interconnection, Norristown, PA (December 2003).
- "RTO Formation in the Central and Southeast United States." Presentation to Iberdrola S.A. Washington, DC (July 2003).
- "Risk Analysis in U.S. Power Markets." Presentation to Companhia Energetica de Pernambuco. New York (December 2000).

BATES WHITE
ECONOMIC CONSULTING

PUBLIC VERSION

Review and Assessment of the Proposed Acquisition by Entergy Mississippi of the Sunflower Solar Facility

Report to the
Mississippi Public Utilities Staff

Prepared by Bates White, LLC

August 15, 2019

In the preparation of this report, Bates White, LLC has relied on data provided by S&P Global Market Intelligence. Under the terms of its contract, S&P Global requires that we include the following Disclaimer:

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I. Executive Summary

Bates White was retained by the Mississippi Public Utilities Staff ("Staff") to provide an independent assessment of the proposed acquisition by Entergy Mississippi, LLC ("EML" or "Entergy Mississippi" or the "Company") of the Sunflower County Solar Facility ("Sunflower" or the "Facility"), based on the transaction as presented in the December 20, 2018 Joint Petition of Entergy Mississippi, LLC and Sunflower County Solar Project, LLC ("SCSP") (In Re: Continued Modernization Of The Generating Facilities Of Entergy Mississippi, LLC With The Acquisition Of The Sunflower Solar Facility In Sunflower County, Mississippi; Docket No. 2018-UA-267).

Bates White reviewed the Joint Petition, accompanying testimony, and responses to data requests to evaluate the rationale, evidentiary support, costs, benefits and risks associated with the proposed transaction.

Specifically, the analyses presented in this report examine:

- Market context for solar generation projects in the U.S., Southeast region, and Mississippi;
- The Entergy Mississippi solicitation process;
- The resulting Sunflower Solar transaction, project design, transaction terms and warranties;
- Evaluation of the transaction rationale, economic analysis, and risks to ratepayers.

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

1. The economic evaluation performed by EML indicates that the Sunflower Solar project will likely result in a net increase in costs to ratepayers. [redacted] provides a graphical summary of the economic evaluation of the solar project performed by EML. In the reference case, the net cost increase is approximately **$[redacted] million** on a net present value ("NPV') basis, in 2018 dollars. In terms of net cost for the quantity of energy expected from the Sunflower project, this amounts to a premium of approximately $[redacted] per megawatt hour ("MWh"), on an NPV basis in 2018 dollars. EML's analysis includes cases that produce higher and lower benefit values for the project, with the high-benefit case (high natural gas and CO2 prices) resulting in positive net benefits of approximately **$[redacted] million** NPV, or **$[redacted]/MWh**. As discussed in the body of this report, we consider the low-benefit case (low natural gas and zero CO2 prices) to be closer to the expected future relevant for evaluating Sunflower. That case results in a net cost increase of approximately **$[redacted] million** NPV, or **$[redacted]/MWh**.

[redacted]

[redacted]

2. While we conclude that customer costs will likely increase with the acquisition of Sunflower, we also acknowledge that the project benefits estimated by EML exclude quantification of potential fuel diversity effects that would mitigate natural gas price volatility, and that assumed CO2 prices may be low (which would cause benefits to be underestimated). Estimated benefits also exclude local and state level economic development impacts, which would be real. We also do not dispute EML's contention that some portion of its customer base favors increased generation from renewables, even at increased cost. We also accept, with caveats, EML's stated rationale that the Sunflower project could provide the Company with valuable information and experience regarding solar project development and operations.

3. EML's solicitation that led to selection of the Sunflower project did not conform to best practices that would allow for a conclusion that the result was a least-cost outcome. In particular, the [redacted] – that would have provided for a more complete review of solar options for serving Mississippi ratepayers. While we focus on deviations from what we consider best practices, we do not conclude that EML's solicitation was fatally flawed. Our observations are intended to indicate potential improvements to future solicitations that will tend to encourage robust bidder participation and enhance confidence in the value of the outcome for ratepayers.

4. Specific details regarding project design and materials – including the solar modules, inverters, racking, controls, and other key components – are not specified in the Sunflower offer. As a consequence, it is not possible to determine with confidence what product Mississippi ratepayers will ultimately get. Project design typically entails trade-offs in which equipment cost,

efficiency/performance and quality/warranty are balanced against providing the lowest cost of electricity over the life of the contract (and ideally the life of the asset). The lack of design specification means that it is not possible to know whether the Sunflower project will be optimized for ratepayer value or, for example, vendor profitability.

5. Given the early stage of development at which the Sunflower County Solar Project will be at the time the Commission must decide whether to allow the proposed BOT transaction to go forward, warranties at all remaining stages of development – engineering, procurement and construction – will be essential to protect the ratepayers. Minimum warranties during each stage are specified in the terms and conditions established in the BOT Agreement, the Scope Book and associated attachments.

   Because the project transfer will occur prior to definitive equipment selection and construction, it is impossible to assess fully the adequacy of warranties and their conveyance to Entergy Mississippi. However, the minimum acceptable equipment warranties for each of the main components of the Project (solar photovoltaic ("PV") module; DC-AC electronic inverter; PV modules racking and trackers; and other balance of plant equipment such as step-up transformer(s), power and control cables) specified in the Scope Book compare well with the warranties offered in the market for these products. One possible exception is the minimum warranty duration for inverters, which is [redacted] as long as what the market typically offers – sometimes at additional cost.

6. EML's rationale for opting for a BOT structure for its first utility-scale solar PV project is that this type of development structure facilitates learning the solar generation business; from design/development, through construction, testing and operation. The BOT Agreement provides EML with broad access rights to the Project, Seller, and Seller's Contractors and Subcontractors, personnel, and other representatives working on the Project. These access rights explicitly allow EML and its representatives to monitor, review, and observe the performance and progress of any aspect of Seller's work on the project (such as design, engineering, equipment selection, technology procurement, construction, testing, and operations), and to prepare for owning, managing, and operating the Project. However, there are no specific training programs defined for the transfer of early stage project development know-how.

7. It is not clear whether EML has established what it is seeking to learn and how will it know whether it has succeeded. It is important for EML to develop early-stage project development learning goals and to propose appropriate lessons-learned targets/metrics for consideration by the Commission.

8. By adopting the BOT construct, Entergy Mississippi has mitigated certain risks associated with PPAs. Yet the BOT construct, in combination with the lack of design specifics in the Sunflower offer, also imposes risks on Mississippi ratepayers that they would not bear under a typical solar PPA arrangement. A significant advantage of a PPA is that the buyer pays pre-determined prices

for energy actually generated. Project ownership, in contrast, entails significant cost and performance risk. The mitigation of certain risks afforded by ownership must be balanced against the reduced performance risk and potentially lower costs afforded by contracting for energy from a facility owned and operated by an experienced third party.

9. Should the Commission approve the Joint Petition, Bates White recommends that it condition such approval on EML obtaining minimum generation guarantees for Sunflower output over at least 20 years following the facility commercial operation date, and that the Commission require EML to bear ultimate responsibility for such minimum performance in the event that EML is unable to enforce such guarantees. Minimum generation should be at the level at which EML evaluated Sunflower's economics, e.g., approximately a [redacted] capacity factor, and should incorporate assurance of no more than a [redacted] annual capacity degradation rate. Performance should be assessed and reported annually.

10. Granting EML's contention that the Sunflower transaction provides value through learning, we recommend that such learning be construed to entail the entire solicitation process. We recommend that future renewable solicitations seek a broader array of offers, including PPAs, and that the solicitation incorporate more detailed information on offer requirements, offer evaluation criteria, treatment of bidder "special considerations" and other elements of good solicitation design. An enhanced solicitation process will tend to increase the bidder participation and confidence in the value of the outcome for ratepayers.

The balance of this report is organized as follows:

Section II presents background on utility-scale solar energy development in the U.S. the Southeast region and Mississippi.

Section III presents a summary and assessment of the key provisions of the proposed Sunflower Solar transaction.

Section IV presents an assessment of the acquisition rationale, solicitation, and Sunflower offer terms.

Section V presents an assessment of EML's economic evaluation of the Sunflower project.

Section VI presents our conclusions and recommendations.

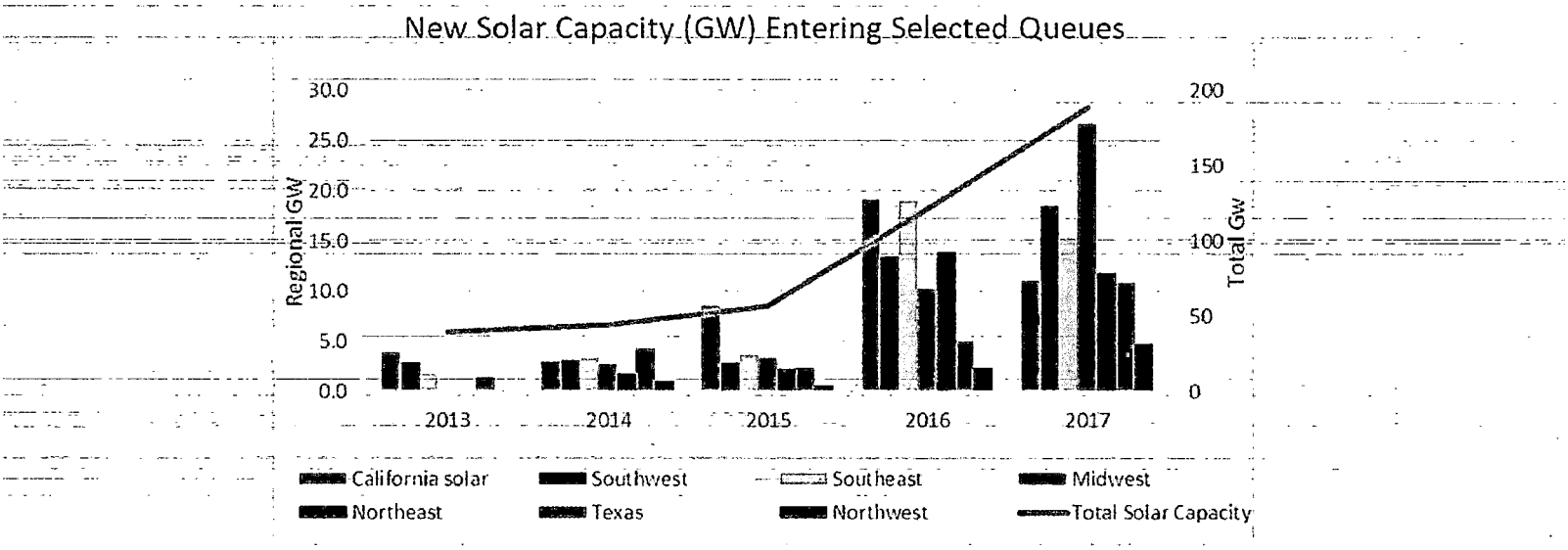
II. Background

II.1. Trends in Utility-Scale Solar

Utility-scale solar is typically defined as any ground-mounted photovoltaic ("PV"), concentrating photovoltaic ("CPV"), or concentrating solar-thermal power ("CSP") project larger than 5MW$_{AC}$ in capacity. Based on this definition, two-thirds of all states have at least one utility-scale project. Figure 2 charts the growth in utility-scale solar development by region over the period 2013 to 2017. The data presented are GWs of capacity entering 35 selected queues, summed by region, and the regional total capacity (existing plus new), by year. The growth in solar project development in recent years has been driven by a combination of factors, including the declining capital cost of utility-scale solar facilities and extension of the 30% federal Investment Tax Credit ("ITC") beyond 2016. Queue growth in 2016 and 2017, in particular, was stimulated by a change in the ITC eligibility requirement from an "in-service" standard to a "commence construction" standard. While not all projects entering a queue will be built, growth in utility-scale solar capacity is expected to remain strong.[1]

[1] We note that the Southeast region referenced in Figure 2 is defined, somewhat idiosyncratically, to encompass 16 states: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, New Jersey, North Carolina, Oklahoma, Pennsylvania, Tennessee, South Carolina, and Virginia.

Figure 2: Solar Capacity by Region[2]



The ITC provides a direct offset to federal income taxes based on the applicable credit percentage of investment in eligible solar property. The ITC was created as part of the Energy Policy Act of 2005, initially with a sunset for eligibility at December 31, 2007. The ITC has been extended multiple times, most recently in December 2015, with a 30% tax credit available for projects eligible as December 31, 2019, dropping to 26% in 2020, 22% in 2021, and a permanent rate of 10% for commercial and utility-scale projects applicable as of 2022.[3] It has been reported that solar developers are accelerating purchases of solar modules in 2019 as a strategy to lock in the 30% credit rate, and federal legislation has been proposed to further extend the higher rate.[4]

There are two ways to secure the full ITC. One is to begin physical work of a significant nature (no threshold required) by the end of 2019. The second is to meet a 5% safe harbor threshold (applicant pays or incurs 5% or more of the total cost) by the end of 2019. Until recently, a caveat was that once physical work had begun, work had to be continuous to satisfy the "commence construction" requirement. However, in

[2] Mark Bolinger, Joachim Seel, Lawrence Berkeley National Laboratory, "Utility-Scale Solar Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition", Public Data File, September 2018, Figure 29. https://emp.lbl.gov/utility-scale-solar/

[3] https://seia.org/initiatives/solar-investment-tax-credit-itc. The 10% rate will apply only to commercial and utility-scale installations, i.e. non-residential applications. The ITC rate for residential installations will be 0% from 2022.

[4] https://www.greentechmedia.com/articles/read/solar-itc-extension-bill-introduced-in-house-and-senate.

June 2018, the IRS released a milestone guidance clarifying that no expenditure quantity threshold will apply to the determination of whether significant physical work has occurred, and that the continuity requirement is deemed to have been met if a project is placed in service by the end of the fourth calendar year after the year in which construction began.[5, 6] For example, if construction begins by December 31, 2019, and the project is placed in service by December 31, 2023, it is considered to have qualified and will receive the full 30% ITC. However, even if not placed into service by December 31, 2023, the project may satisfy the continuity requirement based on a determination of "relevant facts and circumstances."[7]

Utility-scale solar has become increasingly competitive with other forms of generation. The installed price of utility-scale solar photovoltaic projects declined by more than two-thirds over the period 2007-2009 to 2017 with capacity-weighted average prices declining from $\$6.21/W_{AC}$ to $\$2.04/W_{AC}$ over that period.[8] Figure 3 below illustrates the trend in the installed price of utility-scale solar capacity over the 2010 to 2017 period.

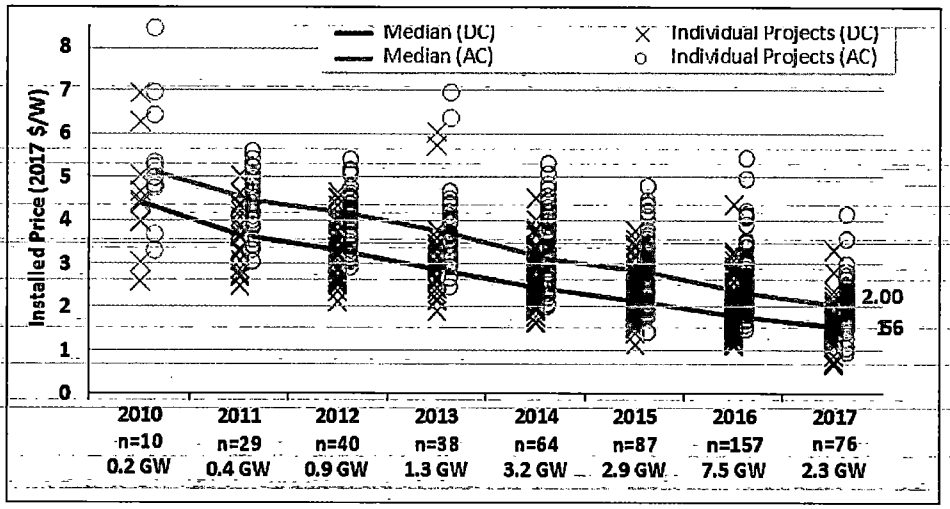
[5] IRS Notice 2018-59, Beginning of Construction for the Investment Tax Credit Under Section 48, June 22, 2018. ("IRS Notice")

[6] IRS Notice, Section 4, paragraph .02.

[7] IRS Notice, Section 4, paragraph .01.

[8] Mark Bolinger, Joachim Seel, Lawrence Berkeley National Laboratory, "Utility-Scale Solar Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition", Public Data File, September 2018, Figure 8. https://emp.lbl.gov/utility-scale-solar/

Figure 3: Installed Price of US Utility-Scale PV and CPV, 2010-2017[9]

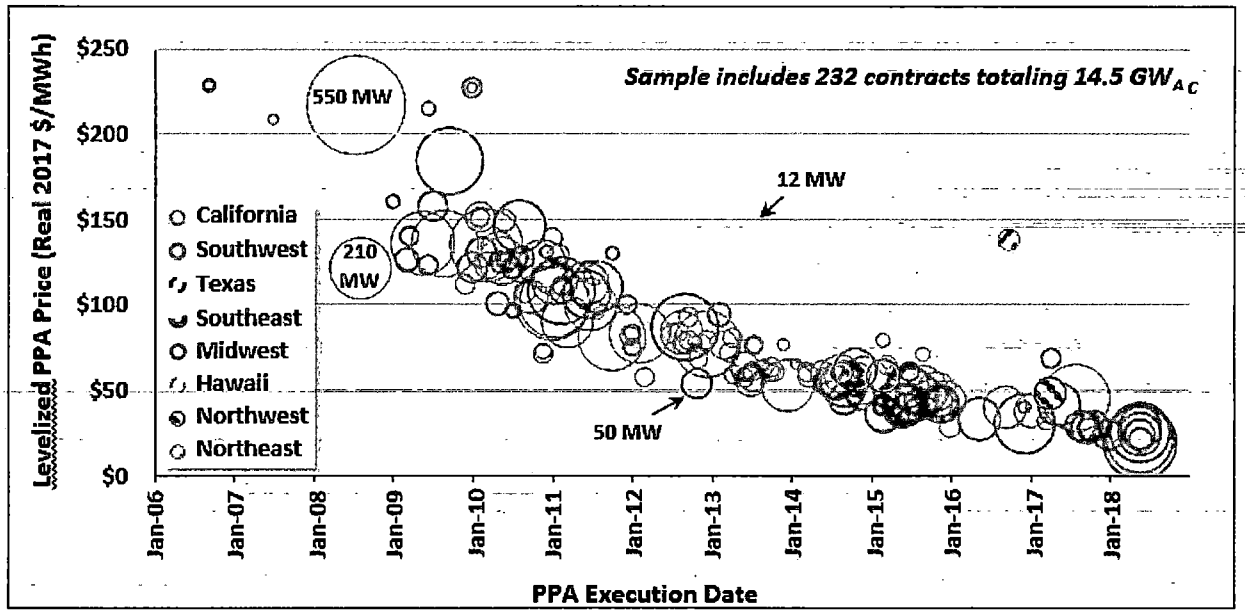


An accepted means by which to measure the overall competitiveness of different generating technologies is the levelized cost of energy ("LCOE"). The LCOE represents the total cost of building and operating a generating plant per unity of generated energy. It is typically calculated as the net present value of the plant costs or PPA payments over the plant operating life or term of the PPA, divided by the discounted quantity of generation expected to be delivered. (As we discuss in Section V of this report, there are discrepancies in methodology and assumptions that can affect the comparability of LCOE values for different projects.) For solar projects, with no fuel costs and relatively small associated operating and maintenance ("O&M") costs, the LCOE typically vary between projects in proportion to the capital costs subject to regional differences in incentives. A reduction in the ITC credit from 30% to, eventually, 10%, is expected to negatively impact (i.e., increase) the LCOE for solar projects. The impact on solar project levelized costs of the ITC's reduction to its "permanent" level of 10% may be tempered by other factors, particularly continued performance improvements and reduced manufacturing costs.[10]

[9] Source: Mark Bolinger, Joachim Seel, Lawrence Berkeley National Laboratory, "Utility-Scale Solar Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition", September 2018, Figure 8, page 15.

[10] In response to data requests, EML provided projected levelized costs for the Sunflower Solar Facility under three different scenarios.

Figure 4: Levelized PPA Prices by Region, Contract Size, and PPA Execution[11]



In "Utility-Scale Solar, Empirical Trends in Project Technology, Cost, Performance and PPA pricing in the United States – 2018 Edition", the authors note several trends in connection with the growth in utility-scale solar capacity.[12]

1. Increased use of solar tracking systems that allow inverters to operate closer to or at full capacity for a greater percentage of the day. In 2017, approximately 80% of all new capacity utilized solar tracking systems. Interestingly, the authors noted that for the "first time within our sample, projects that use single-axis trackers exhibited no upfront cost premium compared to fixed-tilt installations, but actually slightly lower prices."[13]

[11] Figure reproduced from: Mark Bolinger, Joachim Seel, Lawrence Berkeley National Laboratory, "Utility-Scale Solar Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition", September 2018, Figure 18, page 32.

[12] Under its recently approved IRP, Georgia Power will add 80MW of battery energy storage and over 2,200MW of new renewable (solar, wind or biomass) generation to its energy mix by 2024. This will increase Georgia Power's total renewable capacity to 5,390MW or 22%. https://www.southerncompany.com/newsroom/news-releases.html

[13] Bolinger *et al.*, page 3.

2. Citing limited data, the authors stated that publicly available data suggests PV O&M costs of approximately $8/MWh in 2017.[14] These costs are direct operating costs and do not include operating expenses such as property taxes, insurance, land royalties, performance bonds, etc.
3. Average capacity factors for a sample of projects increased from 21.8% (2010-vintage) to 27.1% (2013-vintage) and have remained fairly steady at that level as increased use of trackers has offset the impact of locating project on sites with lower resource value.[15]
4. The increased value of solar, driven by the decline in capital cost and increased operating efficiency, has been somewhat offset by declines in the wholesale energy market value of solar in regions with an abundance of solar. The addition of storage to a solar project, while increasing the total project LCOE, is seen as augmenting the net value of solar.[16]

II.2. Utility-Scale Solar Projects in Mississippi

For the 12 months ending May 2019, solar power accounted for less than 1% of electricity generation in Mississippi. Approximately two-thirds of Mississippi's electricity net generation was sourced from natural gas, with nuclear and coal generation accounting for approximately 19% and 11%, respectively. Table 1 summarizes the most recent annual generation data for the state.

Table 1: Mississippi Net Electricity Generation by Source[17]

	Mississippi	U.S.
Petroleum-Fired	<0.5%	1%
Natural Gas-Fired	67.5%	36.2%
Coal-Fired	11.2%	26.4%
Nuclear	18.72%	19.4%
Hydroelectric	0%	6.8%
Solar	0.5%	1.6%
Other Renewables	2.5%	8.6%

As recently as 2014, Mississippi had no large solar installations. As of June 2019, major utility-scale projects, totaling approximately 160MW, include the Sumrall 1 (52MW) and 2 (52MW) solar facilities (Mississippi Power) that commenced operations in December 2016 and 2017, respectively;[18] the 50MW

[14] Bolinger *et al.*, page 3.
[15] Bolinger, page 3.
[16] Bolinger et al., pp 3-4.
[17] https://www.eia.gov/state/?sid=MS#tabs-3 for Mississippi and for US from Electric Power Monthly, Release date July 24, 2019 data for May 2019 (trailing 12 months). https://www.eia.gov/electricity/monthly/#generation
[18] Developed by Origis Energy

Hattiesburg solar facility (Mississippi Power) that opened in September 2017; and, a 4.2MW installation, at the Naval Base Construction Battalion Center in Gulfport, MS (Mississippi Power) that opened in April 2017.

Entergy Mississippi's only solar facility is the 1.5MW (3 x 500-kW units) utility-scale pilot project, "Bright Futures", completed in 2017.[19] Elsewhere, in Arkansas, Entergy Arkansas, LLC contracts for capacity and energy from the 81MW Stuttgart Solar Energy Center and the Arkansas Public Service Commission has approved a PPA for the 100-MW Chicot Solar Project, expected to be online in 2020.[20] In Louisiana, Entergy New Orleans has had construction approved for a 5MW commercial-scale rooftop solar system on existing buildings in Orleans Parish.

Entergy Mississippi's Integrated Resource Plan[21] is "intended to provide a comprehensive look at considerations in designing and leveraging a diverse, balanced, and forward-thinking portfolio of resources to meet EMI's customers' needs."[22] The Company's current resource portfolio is shown in Table 2 below:

Table 2: Entergy Mississippi Fuel Mix, 2019[23]

Fuel Type	MW	Percentage
Coal	420	12%
Nuclear	508	15%
CCGT	911	27%
Legacy Gas	1,513	45%
Solar	2	<1%
Total	3,354	

Over the IRP planning period of 2018 to 2037, the total net reduction in EML's generating capacity from anticipated unit deactivations may be as much as 3,000MW.[24] This reduction includes deactivation of a number of existing legacy gas generating units as well as the retirement of coal units.[25] As noted in the testimony of Ms. Decuir, the Company is currently in a short capacity position and relies on the planning resource auction ("PRA") to cover a portion of its annual Midcontinent Independent System Operator

[19] Joint Petition, page 5.

[20] Entergy, "2018 Integrated Report", page 21. Accessed at: https://www.entergy.com/investor_relations/annual_publications/.

[21] Attachment B, Exhibit MMD-1 of the Joint Petition for Certificates of Public Convenience and Necessity.

[22] Attachment B, Exhibit MMD-1, page 4.

[23] Attachment B, Exhibit MMD-1, page 22

[24] Attachment B, Exhibit MMD-1, page 24.

[25] Attachment B, Exhibit MMD-1, page 28.

("MISO") Resource adequacy Requirement.[26] To meet capacity and energy requirements, dispatchable gas alternatives and/or renewable sources are being considered as shown in Table 3 below.[27]

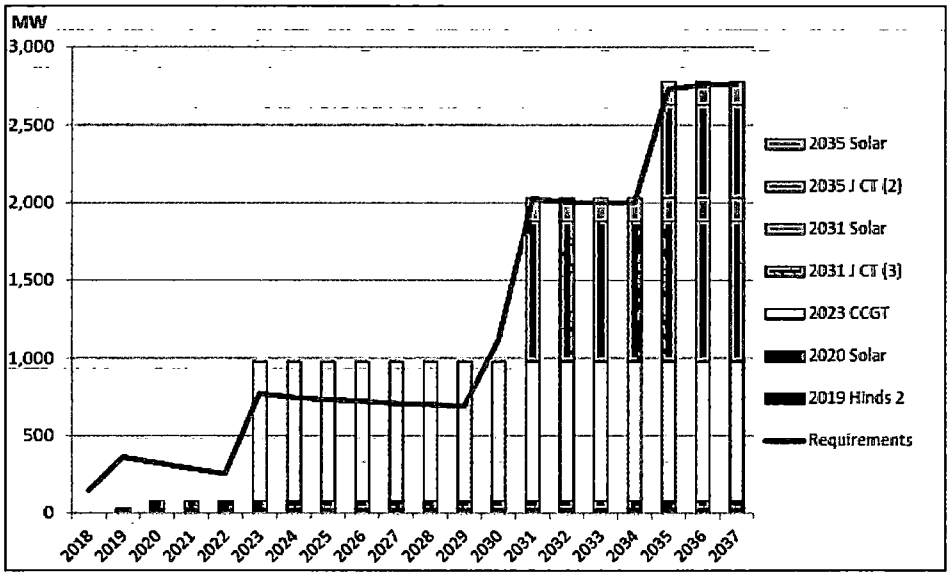
Table 3: Entergy Mississippi Planned Capacity Additions to 2037[28]

Resource Type	Nameplate Capacity (MW)
Combustion Turbines	1,500
Solar	600

Source: Entergy Mississippi IRP

The capacity additions are projected to phase in over the forecast period as shown in Figure 5 below:

Figure 5: Capacity Expansion Portfolio[29]



[26] Attachment B to the Joint Petition, Direct Testimony of Mary M. Decuir, page 17, lines 4-7. ("Decuir")

[27] Attachment B, Exhibit MMD-1, page 28.

[28] Attachment B, Exhibit MMD-1, pages 45 and 47. Data are for Future 1, which reflects Reference assumptions and a 1/3 to 2/3 split of renewables to natural gas for incremental market additions.

[29] Attachment B, Exhibit MMD-1, page 47, Figure 15.

III. The Sunflower Solar Transaction

The Joint Petition of Entergy Mississippi, LLC and Sunflower County Solar Project, LLC ("SCSP") seeks authorization for SCSP to "construct and Entergy Mississippi to acquire, own, operate, improve, and maintain" an approximately 100 MW solar photovoltaic facility ("Sunflower" or "the facility") located in Sunflower County near the City of Ruleville, Mississippi.[30] Entergy Mississippi proposes to purchase the facility pursuant to the terms of a Build-Own-Transfer Acquisition ("BOT Agreement"). The parties to the BOT Agreement are Entergy Mississippi, SCSP and Canadian Solar, Inc. ("CSI"). SCSP is a wholly-owned subsidiary of Recurrent Energy Development Holdings, LLC, which, in turn, is a wholly-owned subsidiary of Recurrent Energy. Recurrent Energy is a wholly-owned, indirect subsidiary of CSI and functions as CSI's US project development arm.[31]

Entergy Mississippi issued its solicitation for solar photovoltaic resources in December 2017 [redacted] The solicitation received [redacted] proposals from [redacted] different greenfield development resources located in Entergy Mississippi's load zone.[34] The procurement process was not subject to oversight by the Mississippi Public Service Commission,[35] consistent with Mississippi regulation and with the Company's IRP, which provide no guidelines for capacity procurement. Nevertheless, as noted in the Direct Testimony of Michael J. Goin, under the BOT structure, regulatory approvals and other necessary conditions are required before the facility can be built.[36]

The Solicitation documents provided in response to MPUS 1-2 include details on the proposal submission process outlining the information to be included and the manner in which proposals were to be submitted. The documents are less clear on the evaluation criteria to be applied in selecting the final project.[37]

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[30] The RFP specified a minimum 100MW$_{AC}$ and maximum 200MW$_{AC}$ guaranteed capacity.

[31] Recurrent Energy purchased the Sunflower project from Tradewind Energy, Inc. on July 13, 2018 as noted in response to MPUS 1-2(d).

[32] See responses to MPUS 1-1 and MPUS 1-2.

[33] See response to MPUS 1-2.

[34] Decuir, page 20, lines 4-6.

[35] See response to MPUS 1-2.

[36] Attachment C to the Joint Petition, Direct Testimony of Michael J. Goin, page 4. ("Goin")

[37] Our review of the solicitation is provided in Section 27.

[redacted]

The Sunflower facility is an approximately 100MW$_{AC}$ greenfield facility to be developed by SCSP located near the City of Ruleville, Mississippi.[43] As Entergy Mississippi noted in response to MPUS 1-12, "Consistent with the Project Schedule, Seller has indicated that final Project plans and specifications are not expected to be complete until after the date scheduled for the Commission's issuance of a final order on the merits in this proceeding." The facility is expected to occupy approximately 1,000 acres and will include PV modules mounted to a single-axis tracking system connected to DC-to-AC inverter stations and a substation with a 115 kV main power transformer.[44] [redacted] MISO has concluded its interconnection study and determined that no upgrades are required to connect the Sunflower facility to the Entergy Mississippi Ruleville 115 kV substation with network service.[46] SCSP has executed an interconnection agreement with Entergy Mississippi and MISO.

The BOT agreement is structured such that Entergy Mississippi will pay SCSP approximately [redacted] of the purchase price, plus [redacted], at the closing of the facility. The

[38] See response to MPUS 1-3 and Direct Testimony of Mary M. Decuir, page 20, lines 7-8.
[39] See response to MPUS 1-3(c).
[40] See response to MPUS 1-2, Confidential attachment "Main Body_Conf", page 5.
[41] See Response to MPUS 1-3(c).
[42] Attachment D – Conf HSPM Exhibit PDN-1, page 4.
[43] Goin, Exhibit A, Scope Book, page 3.
[44] Goin, Exhibit A, Scope Book, page 3.
[45] Goin, page 4.
[46] Goin, page 7. Agreement was executed May 20, 2018.

balance is to be paid [redacted]

Testimony in support of the petition was filed by the following witnesses:

1. Spivey J. Paup, Director of Development, Recurrent Energy: This testimony describes SCSP and its owner's experience with utility-scale solar projects in the US and its ability to satisfy its obligations under the BOT Agreement.[49] In his testimony he notes that Recurrent Energy has, to date, "developed, constructed, and/or brought to operation 2.3 gigawatts of solar projects in the United States and currently maintains a project development pipeline of five additional gigawatts across the United States."[50] These projects include several of equal or larger size than the Sunflower project. Mr. Paup notes that Recurrent Energy has executed power contracts covering 3.4 gigawatts of capacity with "a wide variety of counterparties ranging from regulated and deregulated utilities, commercial customer, universities, and financial institutions."[51] Recurrent Energy has also structured sales at various stages of the project life including prior to construction start, achievement of commercial operation and after the project has become operational.

   Mr. Paup notes that SCSP's responsibilities include the "procurement of the equipment, systems, and the other assets that will constitute the Facility, engaging contractors, including an Engineering, Procurement and Construction ("EPC") contractor, and managing the work of relevant contractors who will carry out the construction of the Facility."[52]

2. Mary M. Decuir, Manager, Resource Planning, Entergy Mississippi: Ms. Decuir's testimony provides the explanation as to why the Sunflower project is consistent with Entergy Mississippi's Integrated Resource Plan, filed as an attachment to her direct testimony.[53] It is her testimony that the acquisition of the Sunflower facility provides Entergy Mississippi with the opportunity to add significant solar generation to the portfolio which will provide the Company with an opportunity to

[47] BOT Agreement, Article XVII.
[48] See response to MPUS 1-28.
[49] Attachment A to the Joint Petition Direct Testimony of Spivey Paup, ("Paup").
[50] Paup, page 4.
[51] Paup, page 5.
[52] Paup, page 5.
[53] Decuir, page 3.

gain experience with the operation of a sizeable utility-scale solar facility. In addition, it is consistent with the objectives of the planning process "that seek to serve customers' power needs reliably, at the lowest reasonable supply cost, and to mitigate exposure to risks that may affect customer cost or reliability."[54] Finally, she notes that this project provides Entergy Mississippi with an opportunity to offer a reasonably-sized community solar program as it is also seeking approval to "implement a community solar offering for customers, sourced initially from the Bright Future solar facilities that can be expanded later when the Sunflower Solar Facility comes on-line."[55]

3. Michael J. Goin, Director, Planning Analysis for System Planning and Operations, Energy Services, LLC on behalf of Entergy Mississippi: Mr. Goin's testimony explains why the BOT structure was chosen for purposes of adding the solar facility to the Company's generation portfolio. Specifically, he states that the BOT structure was selected because it "(1) reduces EML's overall project risk, including development, construction, and permitting responsibilities, and (2) enhances EML's experience with solar project development, construction, and operation."[56] The BOT Agreement as executed in October 2018 between SCSP, CSI, and Entergy Mississippi was provided as an attachment to Mr. Goin's testimony.[57]

4. Phong D. Nguyen, Manager, Planning and Decision Support Analysis, Entergy Services, LLC on behalf of Entergy Mississippi: Mr. Nguyen's testimony describes the economic analyses performed to support the purchase of the Sunflower facility. Mr. Nguyen states, "[u]nder reference natural gas and carbon dioxide (CO_2) assumptions, the evaluation indicated that adding the Sunflower Solar Facility to EML's generation portfolio at a purchase price of $138.4M (not including transaction and other costs, resulted in a net savings of approximately $[redacted] (2018$) excluding terminal value and $[redacted] including terminal value on a net present value basis over the assumed asset life (using EML's financial WACC as of 12/31/16) as compared to the base case portfolio without the resource."[58] Included as an attachment to his testimony is an October 2018 presentation on the Sunflower project to the Entergy Mississippi Operating Committee.

5. Allen A. Heard, Manager, Regulatory Filings, Entergy Services, LLC on Behalf of Entergy Mississippi: Mr. Heard's testimony estimates the first year's rate base to be $153.2 million, equal to the sum of the purchase price, transaction and other costs.[59] The first year's non-fuel revenue

[54] Decuir, page 4.

[55] Decuir, page 4.

[56] Goin, page 5.

[57] Goin, Attachment C – Conf HSPM Exhibit MJG-1.

[58] Attachment D to the Joint Petition, Direct Testimony of Phong D. Nguyen, page 5. ("Nguyen") The total cost is $153.2 million comprised of $138.4 million plus transaction costs, construction oversight, contingency and other costs. (page 12)

[59] Attachment E to the Joint Petition, Direct Testimony of Allen A. Heard, page 4. ("Heard")

requirement, excluding property taxes, is estimated at $19.88 million.[60] [redacted] The calculations supporting these estimates are provided in an attachment to his testimony, filed as Attachment E – CONF Exhibit AAH-1.

[60] Heard, page 4.

IV. Assessment of Acquisition Rationale, Solicitation and Sunflower Offer Terms

IV.1. Acquisition Rationale

Entergy Mississippi is pursuing the acquisition of the Sunflower facility on the basis that it provides the Company with the opportunity to add significant solar generation to the portfolio and gain experience with the operation of a sizeable utility-scale solar facility. In addition, the acquisition of Sunflower is stated to be consistent with the objectives of the planning process "that seek to serve customers' power needs reliably, at the lowest reasonable supply cost, and to mitigate exposure to risks that may affect customer cost or reliability."[61] Finally, the Company notes that this project will also provide an opportunity to offer a reasonably-sized community solar program as it is also seeking approval to "implement a community solar offering for customers, sourced initially from the Bright Future solar facilities that can be expanded later when the Sunflower Solar Facility comes on-line."[62]

In response to MPUS 1-1, Entergy Mississippi states that in contrast to a PPA, ownership of the Sunflower facility through a BOT structure will give the Company more flexibility and options for responding to changes in supply conditions, shifting market rules and economics, regulatory environments, technology advancements, evolving environmental compliance standards, and other unknown future conditions. [63] Further, the Company notes that PPAs are treated as debt for purposes of evaluating Entergy Mississippi's balance sheet.[64] Entergy Mississippi cites four "key factors" that ensure ownership of the Sunflower facility provides greater benefits than a potential PPA. These factors are:

1. Ownership provides the option to consider future upgrades as advances in solar panel technology and technologies such as battery storage present economic investment opportunities that may provide additional benefits to customers.
2. Ownership provides an opportunity and flexibility to develop future solar access options similar to those proposed in the Community Solar offering.
3. The anticipated design life of the Sunflower facility is 30 years but it is expected to operate beyond 30 years.

[61] Decuir, page 3, lines 2-5.
[62] Joint Petition, page 2.
[63] As noted in Response to MPUS 1-1.
[64] Response to MPUS 1-1.

4. The Sunflower facility offers an opportunity to further diversify the Company's generation portfolio with an owned asset.

IV.1.1. Assessment of the Acquisition Rationale

Public utilities operating within the State of Mississippi are required to comply with Rule 7, Section 102 of The Public Utilities Rules of Practice and Procedure ("Rules") with respect to constructing, extending, acquiring, or operating any physical facility or plant to be used directly or indirectly, in the operation of a public utility. The Rules do not set forth criteria which would serve to guide a utility in developing an RFP, selecting a project submitted as the result of an RFP, or ensuring competitive bidding. Further, at a minimum, there is no requirement for a third-party, independent review. As a result, Entergy Mississippi was not required to determine whether or not the costs, benefits and risks of the BOT facility selected would compare favorably to the costs, benefits and risks associated with executing a long-term PPA for the same size solar generating facility.

PPAs have historically been the contractual vehicle of choice through which regulated utilities acquire solar resources from independent power producers and secure financing for these types of projects. In the current low or negative electric consumption growth environment, new investment opportunities in generation are essentially limited to replacement of generating facilities retired due to age, or to more stringent environmental regulations. Utilities are strongly motivated to invest in utility-owned generation on which to earn a return; instead of contracting with an external solar generator and simply passing the cost to the ratepayer. While there is nothing intrinsically wrong with the BOT model,[65] its formulation requires that the proper reallocation of risk and reward is proposed and tested against a realistic assessment of the increased exposure of the ratepayer to the inherent risks of solar projects. Given the expanded role for the utility, from provider of reliable least-cost electric service to that of investor agent for the ratepayers, the risk/reward allocation must be acceptable to the regulator.

[redacted], Entergy Mississippi has mitigated certain risks associated with PPAs but has not provided itself with an adequate means by which to assess the costs and risks to which the ownership of these facilities exposes ratepayers. Further, while the Company has [redacted], risks remain. Chief among these is operational performance risk. As we discuss further in Section V, one distinct advantage of procuring solar power through a PPA is that the buyer only pays for

[65] Both Bates White and Entergy Mississippi agree that a self-build option would have been unsuitable given Entergy Mississippi's inexperience with utility-scale solar facilities.

energy received. Under utility ownership, ratepayers bear full plant costs regardless of generation output, and the lower the plant output, the higher the cost per unit of energy.

Entergy Mississippi states the Sunflower transaction will provide the Company an opportunity to gain experience with the operation of a sizeable utility-scale solar facility. When asked what specific arrangements had been put in place to secure access to the technology and information, Entergy Mississippi stated that the Agreement provided [redacted][66] In Bates White's opinion, these arrangements are not sufficient to provide assurance that Entergy Mississippi will gain the hoped for experience. The Company has announced that it intends to hire an Owner's Engineer to oversee the project and provide design review and field oversight of the project construction and commissioning activities.[67] In addition, Entergy Services, LLC has added a Solar Manager to its staff and is "currently exploring ways to manage the solar O&M efforts with established companies, including the current project developer, experienced in solar facility maintenance."[68] The addition of experienced personnel is a positive development.

With respect to the statement that PPAs are treated as debt for purposes of evaluating Entergy Mississippi's balance sheet, it is true that the major rating agencies, such as Standard and Poor's ("S&P"), treat PPAs as debt when calculating certain credit metrics. However, the dollars of debt attributed to the PPA holder are adjusted for risk factors which are "inversely related to the strength and availability of regulatory or legislative vehicles for the recovery of the capacity costs associated with power supply arrangements."[69] For example, applying S&P's methodology, if a company has legislatively-mandated cost recovery, the risk associated with the contract is considered to be at or near zero and no debt is imputed to the PPA holder. A 100% risk factor indicates that all risk related to the contractual obligations rests with the Company; a 0% risk factor indicates "that the burden of the contractual payments rests solely with ratepayers."[70] Entergy Mississippi has an automatic electric fuel adjustment clause with the energy component of purchased power recovered through the fuel clause and the capacity component recovered in separate rider. The fuel adjustment clause is based on projected fuel use and costs, with a provision for the reconciliation of over- and under-recoveries, and is adjusted annually. The Commission conducts an annual audit of all fuel

[66] Response to MPUS 1-8. See also Response to MPUS 1-27.

[67] Response to MPUS 1-11.

[68] Response to MPUS 1-10.

[69] Standard and Poor's, *Methodology for Imputing Debt for U.S. Utilities Power Purchase Agreements*, 2007, available at: www.standardandpoors.com.

[70] Ibid., page 3.

purchases and submits an annual report to the Legislature. Thus, the ability of EML to pass the PPA cost through these mechanisms reduces the potential impact of a PPA on the S&P risk factor to zero or close to it.

In Section V, we present data on the levelized costs of energy associated with recent utility-scale solar PPAs. While there are some challenges in putting such PPA pricing on a direct comparable basis to the levelized cost of energy of the Sunflower project, recent PPA prices have generally been significantly below the Sunflower LCOE. The mitigation of certain risks afforded by ownership must be balanced against the reduced performance risk and potentially lower cost afforded by contracting for energy from a facility owned and operated by an experienced third party.

IV.2. Entergy Solicitation

IV.2.1. The Entergy Solicitation

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[71] Response to MPUS 1-2(a).

[redacted]

[redacted]

[redacted]

[redacted]	
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

[redacted]

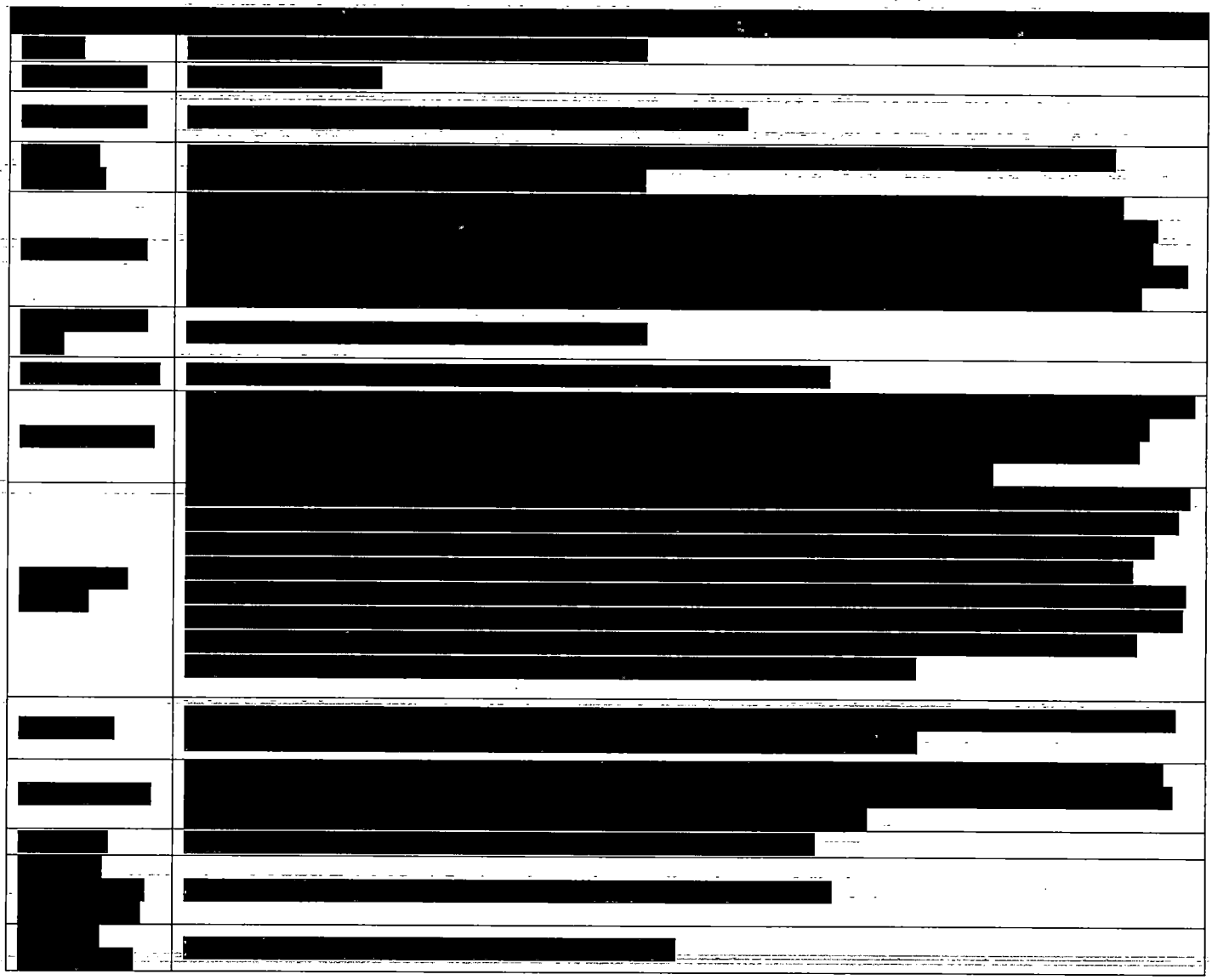
72 Confidential Attachment to the Response to MPUS 1-2, Main Body_CONF.pdf

[redacted] CSI, Recurrent Energy's ultimate parent company, is one of the world's largest solar power companies and a leading manufacturer of solar PV modules.

Table 6 summarizes the key terms of the transaction as it currently exists.

[73] Confidential Attachment to the Response to MPUS 1-2, Scope Book, Section 2.2, Integrated Master Schedule
[74] Ibid., Section 2.4.
[75] See Response to SCSP MPUS 1-1 filed August 1, 2019.
[76] See Highly Sensitive Attachment to MPUS 1-2, MPUS 1-2 Clarification #1_Question and Response_HSPM.
[77] Ibid., Questions 10 to 13.
[78] MPUS 1-2(d).

Table 6: Terms as Transacted with SCSP



IV.2.2. Observations Regarding the Solicitation Process

The following is a list of observations regarding the EML BOT solicitation based on Bates White's experience implementing and monitoring renewable energy procurements by utilities and power agencies.

[79] See Response to MPUS 1-1 filed August 1, 2019.

While we focus on deviations from what we consider best practices, we do not conclude that EML's solicitation was fatally flawed. Our observations are intended to indicate potential improvements to future solicitations that will tend to encourage robust bidder participation and enhance confidence in the value of the outcome for ratepayers.

1. [redacted]

   In response to MPUS 1-5, requesting information on CSI's experience with BOTs, SCSP states that financing terms of this transaction are similar to the terms of prior construction loans that have been arranged by Recurrent Energy for other utility-scale solar energy projects. Specifically, "BOT" refers to the transfer element of the transaction; it is the construction of the facility that is financed. Further, "Recurrent Energy, which is responsible for CSI's U.S. development work, has arranged over $9 billion in project financing to date, including approximately $3.7 billion of construction and term debt raised across a number of solar energy transactions."[86]

2. The RFP did not involve Commission, Staff or an independent third-party evaluator in its review and evaluation of the submitted projects. While this is not required by regulation, including any or all of these entities in the review would permit valuable input from parties who are charged with protecting ratepayers' interests.

[80] Response to MPUS 1-25(a). See also response to MPUS 1-28 which defines "commercial operation date".

[81] See Responses to MPUS 1-1 and MPUS 1-26. MPUS 1-2 Appendix B (Term Sheet)_CONF, page B-18.

[82] BOT Agreement filed as "Attachment C-CONF HSPM Exhibit MJG-1.pdf."

[83] See Response to MPUS 1-26 and Section 9.2 of the BOT Agreement filed as "Attachment C-CONF HSPM Exhibit MJG-1.pdf."

[84] See Response to MPUS 1-18.

[85] Response to MPUS 1-3(c). See also Response to second question in MPUS 1-5 which indicates some but limited experience with BOT financing on the part of both Entergy Mississippi and Entergy Services.

[86] Response of Sunflower County Solar Project, LLC, MPUS 1-2 which was referred to SCSP in response to MPUS 1-5.

3. The RFP's evaluation criteria are unspecified and vague.[87] The description of the proposal evaluation and selection (Section 4.0) provides no information on the specific criteria to be used in Entergy's review of the bids.[88]

The RFP should define or provide the following:

- Price and non-price criteria or weightings to be utilized;
- The appropriate economic metric (e.g., levelized price vs. NPV of benefits to ratepayers) to be utilized in assessing costs;
- Whether or not any portfolio modeling will be done, as well as what model assumptions and sensitivity/scenario analyses are to be undertaken;[89]
- An explanation of how the creditworthiness of the bidder will be evaluated (including the beneficial impact of securing a letter of credit or parental guarantee);
- An explanation of how a bidder's list of "special considerations" will be evaluated;
- A description of how the evaluation considered EML's stated "preference" for a Closing date of no later than [redacted].

Ambiguities regarding evaluation criteria reduce bidder confidence in the RFP process, can negatively impact participation, and may induce higher or additional risk premiums in bidders' cost proposals.

4. [redacted]

5. The RFP lacks a draft BOT agreement for bidders to review. Instead bidders were provided a term sheet and a "Scope Book." The ability to fully review and comment on a draft agreement is replaced by the submission of "special considerations" by the Bidder. This unnecessarily complicates the contracting process. [redacted]

[87] Confidential Attachment to the Response to MPUS 1-2, Main Body_CONF.pdf, Section 4.0.

[88] The response to MPUS 1-2(a) provided a copy of the documentation comprising the Solicitation, which did not include an explanation of how bids were reviewed.

[89] Information on the model assumptions was provided in response to MPUS 1-14 and Entergy Mississippi provided copies of the model in response to MPUS 1-13 for each of the high gas, low gas and reference cases.

[90] MPUS 1-2 Main Body_CONF.pdf, page 7.

[91] Provided in a highly sensitive attachment to MPUS 1-2, "MPUS 1-2 IssuesList_for_AppendixB_TermSheet_MSPM.pdf.

6. [redacted]

7. [redacted]

8. With respect to the timing of payment and transfer of the facility, [redacted] is reasonable and within standard industry practice, though it is not the only approach taken. The use of project milestones and liquidated damages is also an effective approach.

9. [redacted]

[92] Appendix B page B-6.
[93] Defined in response to MPUS 1-28 and MPUS 1-29.

[redacted]

10. [redacted]

11. [redacted]

IV.3. Warranties

The highest risk to the projected economic performance of a solar PV generating facility resides in degradation of its performance and potential corrective maintenance costs over the life of the facility.

Like any manufactured product, the components in a solar PV plant: solar PV modules, electronic DC-AC inverters, and PV module racking and solar trackers; are all at risk of manufacturing defects and premature failure.

[94] See Response to MPUS 1-24.

[95] See Highly Sensitive Attachment to MPUS 1-2, MPUS 1-2 att_Sunflower_County_Responses_to_EMI_Questions_2018-02-05_HSPM, responses to questions 13 and 14.

[96] See Response to MPUS 1-20.

[97] See Response to MPUS 1-21.

All these components are typically covered by manufacturing warranties that protect against defects in materials and workmanship. Additionally, to insure against the possibility of the equipment manufacturer going out of business, the manufacturers can purchase warranty insurance from an underwriter to offer extended product warranty insurance covering the long-term integrity of the equipment itself and protection against environmental issues, premature wear and tear, etc. Considering the 25-year or longer expected operating life of solar facilities, a longer-term warranty is desirable.

Due to the unique nature of the SCSP BOT transaction, [redacted] is impossible at this stage to fully assess the adequacy of warranties and their conveyance to Entergy.[98]

Nevertheless, a review of the of the Scope Book, the document which sets forth the technical and commercial terms that the project and all its components must meet to satisfy the terms and conditions of the BOT Agreement, has been conducted by Bates White. The main objective of the review was to assess the warranty requirements that the equipment, mostly selected after the CPCN is to be granted, would have to meet, and what compensatory measures are available to EML, if any, were the terms of the warranties not met by the equipment vendors.

In the following paragraphs we describe the warranty currently offered by vendors for each main component of the solar generating facility. We provide a description of the most common warranties available in the market today and, the warranty requirements established by Entergy in the Scope Book. This is followed by our observations as to the adequacy of the requirements in the Scope Book and any recommendations to strengthen EML's position in obtaining a market or better warranty.

In response to MPUS DRs about how the key plant component warranties were determined and how they compared to industry offerings, and specific questions regarding the basis for maximum PV panel degradation rates and electromechanical equipment warranties shorter than overall plant lifetime, Entergy has stated that the warranties in the Scope Book [redacted]

[98] While the Build-Operate-Transfer concept of this transaction may be functionally preserved by the terms of the BOT Agreement, the risk of regulatory approval of the transaction is hard to assess given the early stage in the project development process at which the issuance of a Certificate of Public Convenience and Necessity has been requested. In reality, this transaction could be characterized as Transfer-Build-Operate.

[redacted]

The answer to MPUS-1-22 suggests that the appropriate provisions have been made for the transfer of all manufacturer warranties to EML.

IV.3.1. Solar PV panel warranties

While a relatively rare occurrence, solar panels can fail. Such failure is generally due to one of two factors: a) a breakdown of the microwires inside a cell causing a short circuit (and a hot spot); or, b) failure of the encapsulation that keeps water out of the active part of the panel. While uncommon in most recent panel vintages from reputable manufacturers, it is hard to predict whether over time, as solar panels age, these types of failures will become more common.

Depending on the nature of the panel failure, the failed panel may be left in place or, if its failure impacts the performance of neighboring panels, it must be replaced with a new one. The product manufacturing warranty and/or warranty insurance should cover the cost of replacement panels and, in some cases, the cost of shipping and of the labor to replace it.

Leading solar PV panel manufacturers offer product warranties of varying duration associated with specific modules, but most manufacturers offer a 10-12 year product warranty from the date of installation. A few premium manufacturers offer product warranties as long as 20-25 years.

[99] Answer to MPUS 1-17

Additionally, the chemical materials used in the solar PV cells deteriorate and break down over time. This does not typically manifest itself as a sudden drop in electricity production by the cells, but as a gradual loss of capacity and energy production over time from the date of first installation. Degradation rates vary from one brand to another, so these rates are important for a comprehensive solar panel comparison and solar cost calculation. Some manufacturers experience degradation rates as high as 0.8% per year, while the best panels offer degradation rates as low as 0.3% per year. The average degradation rate across manufacturers is in the range of 0.5% per year. This means that, for a panel with a 0.5% degradation rate, at the end of 25 years, panels should still operate at about 88% of their original capacity. In summary, most solar PV manufacturers doing business in the U.S. offer warranties for above 80% performance output after 25 years, with some manufacturers guaranteeing higher performance for some of their modules. [100]

[redacted]

[100] Solar Industry Update, Q1/Q2 2018, David Feldman, Robert Margolis, NREL/PR-6A20-720, August 2018, p. 41.
[101] Attachment A-01 to Scope Book - PV Module Technical Specification
[102] Attachment A-01 seems to prescribe silicon PV modules.

IV.3.2. Inverter warranties

Other than the breakers used to disconnect the inverter from the rest of the system for repair of replacement, inverters mostly consist of solid state electronics. Over time, capacitors, integrated circuits and other electronic components, wiring and other insulating materials can fail with age and use. Most inverter manufacturers offer materials and workmanship warranties of 10 years or more that cover any failures of those components for the warranty period.

[redacted]

IV.3.3. PV module racking/tracker warranties

The solar tracker is possibly the most complex and prone to failure component in a solar PV facility, involving solid state electronics, electric motors, gears, and other mechanical linkages and programming (software).

A result of this complexity is that trackers are more likely to fail during storms and require substantial labor to repair or replace once in operation. Trackers also have some of the shortest warranties of all solar plant components. While panels and inverters are often guaranteed for 25 or 10 years respectively, trackers warranties are typically limited to 5 to 10 years, with warranties for mechanical components falling at the short end of the spectrum.

[redacted]

IV.3.4. Project warranty

Individual equipment performance warranties do not ensure the satisfactory performance of a solar PV generating facility as a whole. Facility design, proper equipment matching and integration, field installation and programming of control functions are not typically covered by equipment manufacturer warranties, but require a system wrap warranty from the EPC contractor, if one is employed in the development of the project. Other compensatory measures, either as adjustments to price or liquidated damages, can be put in place to keep the project owner whole, should the plant fail to meet performance requirements.

[redacted]

[103] The BOT Agreement is filed as Attachment C – CONF HSPM Exhibit MJG-1.pdf.

In response to MPUS 1-18 regarding whether the Seller's balance sheet provides sufficient strength to support the warranties in the BOT Agreement, and whether alternatively, is EML requiring some degree of reinsurance as backstop to cover the system warranties for the life of the project, EML answered that:

[redacted]

IV.3.5. Procurement and Transfer of Warranties from Contractors/Subcontractors

[redacted]

IV.4. Knowledge Transfer Arrangements

Part of EML's rationale for selecting a BOT structure for its first utility-scale solar PV project is their belief that this type of development structure would allow them to learn the solar generation business; from design/development, through construction, testing and operation.

If EML's learning objective is to be fulfilled, it will be essential to establish whether the specific arrangements made by EML and CSI through SCSP to secure access to information and technology will effectively convey the know-how sought by EML.

In response to MPUS-1-8 inquiry on these agreements, EML responded:

[redacted]

[redacted]

In its response to MPUS 1-8, EML missed the opportunity to clarify whether it has established what it is seeking to learn and how it will know whether it has succeeded in obtaining the sought-after knowledge.

As a minimum, the knowledge acquisition process during the design stage should:

a. Include work breakdown structure/budget details to optimally learn about equipment cost and/or labor productivity.

b. Include participation in cost reduction/value engineering discussions and contribution to design decisions that, for example, could result in greater production at a reasonable incremental expense.

Additionally, in the training in Project operation, EML should require that the lessons include how to operate the solar PV plant in compliance with IEEE-1547 (2018) to provide the most grid-friendly operation. Training should include ramp rate control, power factor adjustments and frequency regulation

requirements to demonstrate that the plant can operate safely, and in compliance with NERC and other reliability standards used in MISO, as required in the Interconnection Agreement and general requirements.

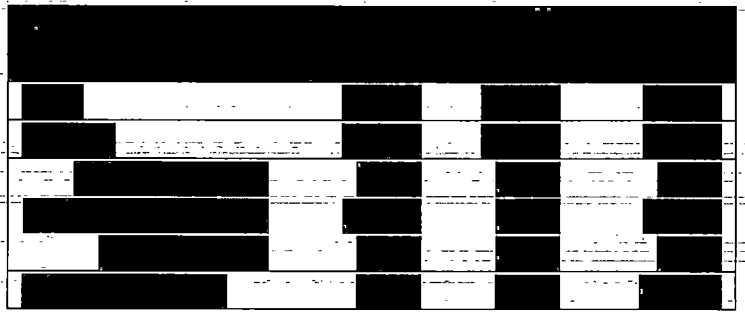
V. Economic Evaluation

V.1. EML Economic Evaluation

EML conducted an economic assessment of the Sunflower project as part of its bid evaluations. Assessments of costs and benefits for three cases were provided in response to data requests. [redacted], below, which duplicates [redacted] from the Executive Summary, provides a graphical summary of the case results. The corresponding data are presented in [redacted].

[redacted]

[redacted]



The economic evaluation performed by EML indicates that the Sunflower project will likely result in a net increase in costs to ratepayers. In the reference case, the net cost increase is approximately $[redacted] million on a net present value basis, in 2018 dollars. In terms of net cost for the quantity of energy expected from the Sunflower project, this amounts to a premium of approximately $[redacted]/MWh, on an NPV basis in 2018

dollars. EML's analysis includes cases that produce higher and lower benefit values for the project, with the low-benefit case (low natural gas and zero CO2 prices) resulting in net costs of approximately $[redacted] million NPV [redacted], and the high-benefit case (high natural gas and high CO2 prices) resulting in positive net benefits of approximately $[redacted] million [redacted].

Based on our assessment of the assumed natural gas and CO2 prices for the respective cases, we find that the low-benefit case (low natural gas and zero CO2 prices) is likely to be closer to the expected future relevant for evaluating Sunflower. [redacted] charts the natural gas prices applied in the three evaluation cases (reference, low and high) and NYMEX futures prices for natural gas at Henry Hub (data accessed on August 8, 2019). While natural gas futures are relatively illiquid in out-years, the NYMEX data nonetheless represent a market reference suggesting that EML's reference and high cases are both relatively high. These relatively high natural gas price cases in turn drive high estimated benefits for energy from the Sunflower project.

[redacted]

In contrast, we find the CO2 prices in the evaluation cases to be somewhat low. We would expect a high CO2 price case to reflect price levels likely to have significant impacts in reducing emissions, and our view is that such prices would exceed $[redacted]. [redacted] It is nonetheless true that potential future CO2 prices are highly uncertain, and our view is that natural gas prices will likely be a greater driver of benefits from the Sunflower project.

[redacted]

V.1.1. Plant generation assumptions

[redacted]

Assuming the reported P50 performance level for Sunflower is accurate, we find that this is reasonable to apply in the economic analysis of Sunflower. The plant ought to achieve this performance level about half the time, with output falling short in some years, and exceeding the P50 level in others. However, it is fair to say that using a P50 level capacity factor to assess potential ratepayer benefits is not a conservative assumption. For example, project investors and lenders often focus on P90 output for renewable projects,

as a better measure of *reliable* output levels. [redacted] Data for utility-scale solar plants in states east of Texas and at a latitude similar to Mississippi's indicate an average annual capacity factor of approximately 23%, based on a mix of data for 2017, 2018 and 2019 operating years. We identified 25 solar facilities with an installed capacity of at least 50MW and with at least twelve full months of operating data. Data for these facilities are summarized in Table 8. The table includes operating data for a mix of periods because data were not available beyond 2017 for some plants, and other plants began operation later in 2017 or 2018, and did not have full-year data for one or both of those years. Though the data are limited, because utility-scale solar projects are so recent, they represent diversity in project size, type, location and operating period that provides a useful summary of plant performance.

The three Mississippi facilities, Sumrall I, Sumrall II, and Hattiesburg, achieved capacity factors of 25.5%, 23.9%, and 20.6%, respectively for calendar year 2017. The 25 facilities had a median annual capacity factor of 23.0% – meaning half of the facilities had a higher capacity factor, and half lower – and the aggregate average capacity factor for all the plants also equaled 23.0%.

Table 8: Utility-scale Solar Projects in the Southeast U.S.[104]

State	Power Plant Name	Owner	Regulatory Status	Operating Capacity (MW)	12 mo. Net Generation (MWh)	Capacity Factor	First op. year	Data year
Mississippi	Hattiesburg Farm	Shell New Energies US, Silicon Ranch Corp.	Unreg.	50.0	90,294	20.6%	2017	2018
Mississippi	Sumrall I Solar Farm (Mississippi Solar 2)	D. E. Shaw Renewable	Unreg.	52.0	116,156	25.5%	2017	2018
Mississippi	Sumrall II Solar Farm (Mississippi Solar 3)	Origis Energy USA Inc.	Unreg.	52.0	108,749	23.9%	2017	2018
Alabama	LaFayette Solar Project	Centaurus Renewable Energy	Unreg.	79.2	160,946	23.2%	2017	2018
Alabama	River Bend Solar Plant	NextEra Energy	Unreg.	75.0	150,174	22.9%	2016	2017
Arkansas	Stuttgart Solar Energy Center	NextEra Energy	Unreg.	81.0	162,934	23.0%	2018	2018
Georgia	Butler Solar Project	Scarlet Renewables, Southern Power Co.	Unreg.	100.0	225,627	25.8%	2016	2018
Georgia	Decatur Parkway Solar Project	Scarlet Renewables, Southern Power Co.	Unreg.	80.0	185,459	26.5%	2015	2017
Georgia	Jeff Davis County Solar (Hazlehurst II)	Shell New Energies US, Silicon Ranch Corp.	Unreg.	52.5	117,864	25.6%	2016	2018
Georgia	Live Oak Solar Farm	NextEra Energy	Unreg.	51.0	98,069	22.0%	2016	2018
Georgia	Sandhills (Taylor County PV Solar Project)	Scarlet Renewables, Southern Power Co.	Unreg.	143.0	298,042	23.8%	2016	2017
Georgia	White Oak Solar Project	NextEra Energy	Unreg.	76.5	159,285	23.8%	2016	2017
Georgia	White Pine Solar Project	NextEra Energy	Unreg.	101.2	206,488	23.3%	2016	2017
North Carolina	Bladen Solar Farm	Cypress Creek Renewables	Unreg.	50.0	103,952	23.7%	2017	2018
North Carolina	Bullock Solar	Cypress Creek Renewables	Unreg.	50.0	99,666	22.8%	2017	2018
North Carolina	Conetoe II Solar Farm	Duke Energy Renewables NC	Unreg.	80.0	170,874	24.4%	2015	2017
North Carolina	Innovative Solar 37 Project	Dominion Generation Inc	Unreg.	79.0	154,021	22.3%	2017	2018
North Carolina	Innovative Solar 42 (IS 42)	Falck Renewables Is42, Recurrent Energy	Unreg.	71.0	133,352	21.4%	2017	2018
North Carolina	Innovative Solar 46 Project	Cypress Creek Renewables	Unreg.	78.5	146,612	21.3%	2016	2018
North Carolina	Monroe Solar Facility	Duke Energy Carolinas	Regulated	60.0	93,060	17.7%	2017	2018
North Carolina	Ranchland Solar (Justice Farms)	SunEnergy1	Unreg.	60.0	128,679	24.5%	2017	2018/19
North Carolina	Rutherford Farm	Scarlet Renewables, Southern Renewable En.	Unreg.	74.8	131,764	20.1%	2016	2018
North Carolina	Summit Farms Solar (Wildwood Solar)	Dominion Generation Inc	Unreg.	60.0	114,754	21.8%	2016	2018
North Carolina	Warsaw Farm	Duke Energy Progress	Regulated	65.0	115,981	20.4%	2015	2017
South Carolina	Solvay Solar Energy (Jasper County Solar)	Dominion Generation Inc	Unreg.	71.4	143,891	23.0%	2017	2018

[104] Data source: S&P Global Market Intelligence.

A substantial majority of the estimated benefit from EML owning the Sunflower project – approximately 69% in EML's reference case – comes from avoided variable costs, resulting from solar generation displacing energy from higher-cost resources or spot market purchases. Net benefits consequently depend closely on the actual amount of generation from the Sunflower facility. As noted above, a significant downside to plant ownership compared to purchasing solar power through a PPA is that total costs are essentially fixed, while the cost per unit of energy depends on how much energy is actually produced. Solar PPAs typically provide for performance penalties that protect the buyer if the quantity of energy delivered is below a specified minimum level, i.e., the seller must pay a penalty to the buyer for the seller's failure to meet a minimum energy volume for a given service year. Further, the buyer pays only for energy actually generated. In contrast, under facility ownership costs are effectively fixed, so that the lower the plant output, the higher the cost per unit of generation.

[redacted]

In light of these facts, we recommend that approval of the Joint Petition be conditioned on EML obtaining minimum generation guarantees that the Sunflower plant will achieve an annual capacity factor each year of [redacted], the level at which the evaluation of benefits was performed. Such guarantees should apply for at least 20 years, comparable to the term of a typical solar PPA, and should incorporate assurance of no more than a [redacted] annual capacity degradation rate. Further, EML should be required to bear ultimate responsibility for such minimum performance in the event that EML is unable to obtain or enforce such guarantees. Such requirements will provide important protections for ratepayers, who would otherwise be required to bear the full plant costs (including shareholder equity profit) with no assurance of what they would receive in return. We have not conducted a comprehensive survey of regulatory treatment of comparable utility investments in other jurisdictions, but have identified one case in which a state commission conditioned approval of a utility solar investment on ratepayers being "held harmless" for annual plant performance below a set capacity factor – see: Commonwealth of Virginia State Corporation Commission Case No. PUR-2018-00101 (Order dated January 24. 2019).

V.1.2. Sunflower capacity value

In its economic evaluation, EML assumes that the capacity value provided by Sunflower will be priced based on the cost of a new gas-fired combustion turbine (CT). EML's reasoning is that the capacity market is moving quickly to an equilibrium in which incremental capacity purchases – and therefore avoided capacity purchases – will be priced at the "cost of new entry" (CONE) of new generation capacity, assumed to be a new CT. While we generally accept the economic reasoning behind this assumption, at the same time, we note that such a pending capacity equilibrium is a common basis for forward-looking cost and benefit assessments in MISO and elsewhere. The actual arrival of such equilibrium capacity pricing seems to be delayed repeatedly, and there is no evidence of which we are aware of capacity transactions in the MISO South region at prices close to CONE. Conceptually, we accept the premise of EML's assumption. However, we believe that capacity equilibrium is likely to occur later than assumed by EML, which would mean that the capacity value estimated for Sunflower is somewhat overstated.

V.1.3. Additional observations regarding EML economic evaluation

Property tax

[redacted]

Terminal value

[redacted]

[105] See Highly Sensitive Attachment to MPUS 1-2, MPUS 1-2 Clarification #1_Question and Response_HSPM.
[106] See Highly Sensitive Attachment to MPUS 1-13, Assumptions worksheet, cell F59.

[redacted]

V.2. Sunflower Levelized Cost

EML estimates the real, levelized cost for the Sunflower project to be $[redacted]/MWh in 2018 dollars, evaluated over the 30-year life of the assets, and including amortization of transmission upgrade costs over 45 years. An important caveat regarding the approximately $[redacted]/MWh LCOE value is that EML applies a calculation method that differs from the approach typically used to calculate LCOEs reported for comparable projects in other jurisdictions. EML's method is one reasonable way to calculate the LCOE of Sunflower, and is appropriate for calculating the LCOE's of alternative offers in EML's solicitation to allow for comparison on an equivalent basis. Indeed, we believe EML's method produces a more appropriate reference value for the utility and for ratepayers than the method that has become common practice in the industry. In both the EML and the common industry approach, the LCOE for a project is calculated as the NPV of all project capital and O&M costs, divided by a discounted volume of energy over the applicable asset life or contract term. Discounting both costs and energy creates a meaningful levelized 'average' cost. Both methods use a WACC discount rate for cost. However, where the common industry practice is to use the same WACC rate to discount the energy volumes, EML uses the real return rate – i.e., the WACC excluding inflation. Each method can be used as a consistent basis for comparing different projects, but the levelized cost calculated using one method is not comparable to the levelized cost calculated using the other. For example, because EML uses a lower discount rate, the discounted energy volume in the denominator of the cost/volume calculation is *larger*, and the resulting LCOE in $/MWh is *smaller* than it would be using the common industry method.

If the EML calculation were instead calculated using the same WACC discount rate for both the numerator and denominator of the cost/volume calculation, the resulting LCOE would be $[redacted]/MWh rather than the $[redacted]/MWh from EML's method. Again, we find EML's method to be reasonable, and arguably more appropriate to the perspective of the Company and ratepayers than the common industry method. However, because LCOE is typically calculated with the same discount rate for both cost and energy, we find that the higher LCOE value of approximately $[redacted]/MWh is more appropriate for comparison to other available LCOE figures. At the same time, an important caveat is that it is difficult to demonstrate close

[107] See Highly Sensitive Attachment to MPUS 1-2, MPUS 1-2 att_Sunflower_County_Responses_to_EMI_Questions_2018-02-05_HSPM, responses to questions 2 and 3.

comparability of the costs and other assumptions underlying the LCOE values for other projects, because relevant project context and calculation details, such as generation and return rates, are often not known.

V.3. Solar Project Comparables

V.3.1. Installed cost

As noted immediately above, it is challenging to demonstrate close comparability of project/PPA cost measures. Nevertheless, available data from other projects provides useful context for assessing the Sunflower transaction. Lawrence Berkeley National Laboratory ("LBNL") reports an average capacity-weighted installed price for utility-scale PV of $2.04/W-AC (2017$), based on a sample of 76 projects, with a median price of $2.00/W-AC.[108] The LBNL average corresponds to an installed cost of $204 million for a 100MW AC project such as Sunflower. The total upfront cost of the Sunflower project, including acquisition price, additional capital, and transmission cost (excluding O&M and land lease costs), is approximately $153 million on an NPV basis, in 2018 dollars, which compares favorably with the average reported by LBNL. However, the LBNL data set includes only those projects for which all phases were in operation by the end of 2017. The data are consequently backward-looking, and not necessarily representative of offers in the market from the 2017-18 time period, such as those is response to EML's solicitation. In fact, given the pattern of rapidly falling costs, and continued reports of PV efficiency gains, it would be surprising if the Sunflower installed cost were not below the 2017 average for operational projects.

V.3.2. Levelized Cost of Energy

Comparing Sunflower to other solar projects and PPAs on an LCOE basis provides another useful reference, though with equal or greater challenges in comparability. A standard reference for levelized costs is the Lazard Freres Levelized Cost of Energy Analysis ("Lazard"), most recently in its twelfth version (November 2018). Lazard estimates LCOEs for a utility scale solar PV project ranging from $36/MWh to $46/MWh.[109] This is very likely not comparable value to the $[redacted]/MWh LCOE for Sunflower (as calculated using the common industry method). It is not clear, for instance that the Lazard numbers

[108] Source: Mark Bolinger, Joachim Seel, Lawrence Berkeley National Laboratory, "Utility-Scale Solar Empirical Trends in Project Technology, Cost, Performance, and PPA Pricing in the United States – 2018 Edition", Public Data File, September 2018, Figure 8. https://emp.lbl.gov/utility-scale-solar/

[109] Lazard's Levelized Cost of Energy Analysis, Version 12.0, November 2018. The Lazard analysis assumes 60% debt at 8% interest rate and 40% equity at 12%. https://www.lazard.com/media/450784/lazards-levelized-cost-of-energy-version-120-vfinal.pdf

include costs such as transmission and land leases, as the stated intent of the Lazard analysis is to compare the current state of different generation technologies, not to provide estimates of regional cost variations that are distinct from technology. Removing these costs for Sunflower results in an LCOE of approximately $[redacted]/MWh. Lazard also applies notably low capital costs in its LCOE calculations for PV, ranging from $950/kW to $1,250/kW. Technology cost assumptions applied in modeling by the U.S. Energy Information Administration have the installed cost of utility-scale PV at approximately $1,900/kW.[110] The Sunflower direct acquisition cost is approximately $1,326/kW; adding transmission and additional capital results in a total of approximately $1,532/kW.

Finally, a number of assumptions applied in the Lazard estimates are not visible, and even for those that are described – for example, the range of assumed capacity factors for solar PV – the exact calculation used to derive the LCOEs is not provided. As demonstrated above, in Section V.1.1., relatively modest variations in assumed capacity factor can have substantial effects on LCOE. As Lazard notes, the values they report are intended to be consistent for the purposes of comparing the costs of different technologies, and so are not necessarily for evaluating the cost of a particular project such as Sunflower. The comparability of the Lazard PV cost numbers to the Sunflower context is not possible to determine with confidence.

V.3.2.1. Transaction comparables

Actual transaction prices provide another basis for assessing the costs of the Sunflower project. However, again, determining direct comparability to the Sunflower context is challenging. LCOE values for projects in the southwest U.S. are strikingly low, largely because achieved capacity factors are significantly higher in desert regions. LBNL reports an average capacity factor for PV tracking facilities of 29.1% in the southwest U.S., and 30.2% for such facilities in California.[111] We have identified individual projects in the West and Southwest with annual capacity factors in excess of 32%.[112] Because of high solar irradiance in the western U.S., and resulting high generation levels from solar PV projects, levelized energy prices for recent projects in the western U.S. are notably less. Recently-announced PPAs for projects in Nevada and Arizona have been reported at levelized prices under $30/MWh. However, these LCOEs are not

[110] U.S. Energy Information Administration, "Cost and Performance Characteristics of New Generating Technologies, Annual Energy Outlook 2019", accessed at: https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

[111] Bolinger *et al.*, Figure 15, page 26.

[112] For example, the 150 MW Mesquite Solar 3 project in Arizona had a reported capacity factor of 33.9% for 2018; the 100 MW Playa Solar 2 project in Nevada had a reported capacity factor of 33.7% for 2018; and the 100 MW RE Astoria project in California had a reported capacity factor of 32.9% in 2018.

comparable to the estimated levelized cost for the Sunflower project, because the generation profiles based on regional solar irradiance are so different.

Levelized prices for projects located in the southeastern U.S., encompassing states comparable to Mississippi in solar irradiance, are generally higher than for projects in the west. We have observed pricing for recent PPAs for utility-scale solar PV projects in southeastern states that correspond to levelized pricing in a range of $60/MWh to $70/MWh.[113] These projects are reasonably comparable to Sunflower in terms of size, location and vintage, yet the associated pricing is not necessarily directly comparable to the levelized cost estimated for Sunflower. We find that EML's calculated levelized cost of energy for the Sunflower project of approximately $[redacted]/MWh is too low to be comparable to the observed PPA cost range, for the reasons discussed above in Section V.2. At the same time, the alternative calculation, based on common industry practice, that results in a value of $[redacted]/MWh for Sunflower may be somewhat high to be directly comparable. For example, the levelized prices for PPAs often do not include transmission upgrade costs. If this cost component is removed for Sunflower, the calculated levelized cost falls to approximately $[redacted]/MWh. Additionally, PPAs are typically 20-year contracts, while Sunflower is evaluated over a 30-year asset life. If the Sunflower project is evaluated on the basis of 20-years of full output and 20 years of cost from EML's evaluation (also excluding transmission cost), the resulting LCOE becomes approximately $[redacted]/MWh.

While the discussion above highlights the challenge of establishing comparability in available cost measures with which to assess Sunflower, a more important takeaway is that it demonstrates why it is so important to run a broad, rather than narrow, procurement process, particularly for new and rapidly advancing technologies. Had EML conducted a solicitation seeking PPA offers as well as BOT offers, it would be much easier to establish comparability in levelized pricing, and to assess the validity of EML's claims regarding the value of direct utility ownership. It would also be possible, for example, to require PPAs to be offered with a terminal purchase option, with would further facilitate comparative assessment. We therefore recommend that future renewable solicitations conducted by EML seek a broader array of offers, including PPAs, and that the solicitation incorporate more detailed information on offer requirements, offer evaluation criteria, treatment of bidder "special considerations" and other elements of good solicitation design. An enhanced solicitation process will tend to increase the bidder participation and confidence in the value of the outcome for ratepayers.

For reference, we note that renewable procurements for Duke Energy Carolinas and Duke Energy Progress, beginning in 2018 and continuing, seek offers of resources provided through PPAs or to be owned by the respective utilities. As approved by the North Carolina Utilities Commission ("NCUC"), the Competitive

[113] We cannot cite project-specific data because of confidentiality restrictions.

Procurement of Renewable Energy ("CPRE") program provides for an independent administrator of the procurements, and allows for participation by independent developers offering PPAs or BOT-type arrangements, as well as the regulated utilities and Duke Energy's unregulated renewables development company.[114] The first procurement tranche, completed in April 2019, resulted in the selection of 12 proposals totaling 515MW.

[114] The CPRE program is addressed in NCUC Docket No. E-2, SUB 1159 and Docket No. E-7, SUB 1156. The updated final report for the Tranche 1 procurement, filed July 23, 2019, is accessible via the NCUC web site: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=5b68acb6-db0c-4a1a-bad4-c06ad45828c8

VI. Conclusions and Recommendations

Our conclusions and recommendations are as follows:

Ratepayer cost impacts

The economic evaluation performed by EML indicates that the Sunflower Solar project will likely result in a net increase in costs to ratepayers. In EML's evaluation reference case, the net cost increase is approximately $[redacted] million on an NPV basis, in 2018 dollars. In terms of net cost for the quantity of energy expected from the Sunflower project, this amounts to a premium of approximately $[redacted]/MWh, on an NPV basis in 2018 dollars. EML's analysis includes cases that produce higher and lower benefit values for the project, with the high-benefit case (high natural gas and CO2 prices) resulting in positive net benefits of approximately $[redacted] million NPV, or $[redacted]/MWh. As discussed in the body of this report, we consider the low-benefit case (low natural gas and zero CO2 prices) to be closer to the expected future relevant for evaluating Sunflower. That case results in a net cost increase of approximately $[redacted] million NPV, or $[redacted]/MWh.

While we conclude that customer costs will likely increase with the acquisition of Sunflower, we also acknowledge that the project benefits estimated by EML exclude quantification of potential fuel diversity effects that would mitigate natural gas price volatility, and that assumed CO2 prices may be low (which would cause benefits to be underestimated). Estimated benefits also exclude local and state level economic development impacts, which would be real. We also do not dispute EML's contention that some portion of its customer base favors increased generation from renewables, even at increased cost. We also accept, with caveats, EML's stated rationale that the Sunflower project could provide the Company with valuable information and experience regarding solar project development and operations.

EML's solicitation process

EML's solicitation that led to selection of the Sunflower project did not conform to best practices that would allow for a conclusion that the result was a least-cost outcome. In particular, [redacted] – that would have provided for a more complete review of solar options for serving Mississippi ratepayers. While we focus on deviations from what we consider best practices, we do not conclude that EML's solicitation was fatally flawed. Our observations are intended to indicate potential improvements to future solicitations that will tend to encourage robust bidder participation and enhance confidence in the value of the outcome for ratepayers.

Project design

Specific details regarding project design and materials – including the solar modules, inverters, racking, controls, and other key components – are not specified in the Sunflower offer. As a consequence, it is not possible to determine with confidence what product Mississippi ratepayers will ultimately get. Project design typically entails trade-offs in which equipment cost, efficiency/performance and quality/warranty are balanced against providing the lowest cost of electricity over the life of the contract (and ideally the life of the asset). The lack of design specification means that it is not possible to know whether the Sunflower project will be optimized for ratepayer value or, for example, vendor profitability.

Warranties

Given the early stage of development at which the Sunflower project will be at the time the Commission must decide whether to allow the proposed BOT transaction to go forward, warranties at all remaining stages of development – engineering, procurement and construction – will be essential to protect the ratepayers. Minimum warranties during each stage are specified in the terms and conditions established in the BOT Agreement, the Scope Book and associated attachments.

Because the project transfer will occur prior to definitive equipment selection and construction, it is impossible to assess fully the adequacy of warranties and their conveyance to Entergy Mississippi. However, the minimum acceptable equipment warranties for each of the main components of the Project (PV module; DC-AC electronic inverter; PV modules racking and trackers; and other balance of plant equipment such as step-up transformer(s), power and control cables) specified in the Scope Book compare well with the warranties offered in the market for these products. One possible exception is the minimum warranty duration for inverters, which is [redacted] as long as what the market typically offers – sometimes at additional cost.

Potential for learning

EML's rationale for opting for a BOT structure for its first utility-scale solar PV project is that this type of development structure facilitates learning the solar generation business, from design/development, through construction, testing and operation. The BOT Agreement provides EML with [redacted]. However, there are no specific training programs defined for the transfer of early stage project development know-how.

It is not clear whether EML has established what it is seeking to learn and how will it know whether it has succeeded. It is important for EML to develop early-stage project development learning goals and to propose appropriate lessons-learned targets/metrics for consideration by the Commission.

Performance risk

By adopting the BOT construct, Entergy Mississippi has mitigated certain risks associated with PPAs. Yet the BOT construct, in combination with the lack of design specifics in the Sunflower offer, also imposes risks on Mississippi ratepayers that they would not bear under a typical solar PPA arrangement. A significant advantage of a PPA is that the buyer pays pre-determined prices for energy actually generated. Project ownership, in contrast, entails significant cost and performance risk. The mitigation of certain risks afforded by ownership must be balanced against the reduced performance risk and potentially lower costs afforded by contracting for energy from a facility owned and operated by an experienced third party.

Should the Commission approve the Joint Petition, Bates White recommends that it condition such approval on EML obtaining minimum generation guarantees for Sunflower output over at least 20 years following the facility commercial operation date, and that the Commission require EML to bear ultimate responsibility for such minimum performance in the event that EML is unable to enforce such guarantees. Minimum generation should be at the level at which EML evaluated Sunflower's economics, e.g., approximately a [redacted] capacity factor, and should incorporate assurance of no more than a [redacted] annual capacity degradation rate. Performance should be assessed and reported annually.

Future solicitations

Granting EML's contention that the Sunflower transaction provides value through learning, we recommend that such learning be construed to entail the entire solicitation process. We recommend that future renewable solicitations seek a broader array of offers, including PPAs, and that the solicitation incorporate more detailed information on offer requirements, offer evaluation criteria, treatment of bidder "special considerations" and other elements of good solicitation design. An enhanced solicitation process will tend to increase the bidder participation and confidence in the value of the outcome for ratepayers.

DIRECT TESTIMONY

OF

COLLIN CAIN, M.SC.

ON BEHALF OF THE

MISSISSIPPI PUBLIC UTILITIES STAFF

DOCKET NO. 2018-UA-267

August 15, 2019