BEFORE THE MISSISSIPPI PUBLIC SERVICE COMMISSION

2017-UA-79	IN RE:	SUPPLEMENTAL PETITION OF SOUTHERN SPIRIT TRANSMISSION LLC FOR CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE PROPOSED SOUTHERN SPIRIT TRANSMISSION PROJECT

DIRECT TESTIMONY

OF

JEFF DICHARRY

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ENTERGY SERVICES, LLC

ON BEHALF OF

ENTERGY MISSISSIPPI, LLC

OCTOBER 2023

Q1. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, EMPLOYER AND JOB TITLE.

A. My name is Jeff Dicharry. I am employed by Entergy Services, LLC[1] ("ESL" or "Entergy"), an affiliate of Entergy Mississippi, LLC ("Entergy Mississippi," "EML," or the "Company"), as Senior Manager of Transmission and Distribution Planning. My office is located at 9425 Pinecroft Drive, The Woodlands, Texas 77380.

Q2. ON WHOSE BEHALF ARE YOU TESTIFYING?

A. I am testifying on behalf of Entergy Mississippi.

Q3. PLEASE STATE YOUR EDUCATION AND YOUR PROFESSIONAL AND WORK EXPERIENCE.

A. I graduated from Louisiana State University in 2000, with a Bachelor of Science degree in Electrical Engineering. In 2005, I attained a Master of Electrical Engineering degree from the University of New Orleans.

I began my professional career in 2001 with ESL as a substation design engineer in New Orleans, LA, remaining in that capacity until 2004. In 2004, I moved into transmission operations planning within ESL, where I worked in Jackson, MS until 2008. Beginning in 2008, I worked as a distribution asset planning engineer with ESL in the

[1] ESL is the service company that provides engineering, planning, accounting, legal, technical, regulatory, and other administrative support services to Entergy Mississippi, LLC, Entergy Texas, Inc., Entergy Louisiana, LLC, Entergy Arkansas, LLC, and Entergy New Orleans, LLC (collectively, the "Entergy Operating Companies").

Woodlands, TX until 2012. I became an employee of Entergy Texas, Inc. ("ETI") as the distribution line supervisor of The Woodlands, Texas distribution network in 2012 and was promoted to Manager of Transmission Planning for ETI in July 2014. In 2019, I attained the role of Manager of Distribution Asset Planning (as an ESL employee) for Entergy Louisiana, LLC, Entergy New Orleans, LLC, and ETI. In 2022, I began my current role as Senior Manager of Transmission and Distribution Planning supporting Entergy Mississippi and Entergy Arkansas, LLC.

I have over 22 years of experience in the electric utility industry, and I am currently a registered professional engineer in the state of Texas.

Q4. WHAT ARE THE DUTIES AND RESPONSIBILITIES OF YOUR PRESENT POSITION?

A. As Senior Manager of Transmission and Distribution Planning, I am responsible for management and oversight of 17 engineers and three managers accountable for ensuring adequate compliance, long-term capacity, and risk mitigation of the Entergy transmission and distribution systems affecting customers within the states of Mississippi and Arkansas. My team is primarily responsible for initiating capital projects that are developed from detailed modeling and analysis of the electric transmission and distribution systems under various system conditions. My team evaluates the adequacy of the transmission and distribution systems by identifying potential constraints, assessing available capacity, and identifying the operating limits of the electrical system including transmission lines, substations, and distribution infrastructure. The engineers on my team are responsible for

updating and maintaining system power flow models used to assess long-term transmission and distribution adequacy. These transmission models are coordinated regionally and throughout the Eastern Interconnection to adequately model the interconnected transmission system.

In addition to these duties, the transmission planning engineers and managers that I oversee are involved in coordinating Entergy Mississippi's transmission expansion plan with Midcontinent Independent System Operator, Inc. ("MISO") in their MISO Transmission Expansion Plan ("MTEP") process. Projects identified in the Entergy Mississippi transmission expansion plan and MISO MTEP are both based on the North American Electric Reliability Corporation ("NERC") Reliability Standards and Entergy's local transmission planning criteria.

Q5. BASED ON YOUR EXPERIENCE AND PROFESSIONAL EXPERTISE, PLEASE SUMMARIZE YOUR ULTIMATE CONCLUSIONS REGARDING THE SOUTHERN SPIRIT TRANSMISSION PROJECT ("SST PROJECT" OR THE "PROJECT"), AS DESCRIBED IN FURTHER DETAIL IN YOUR TESTIMONY.

A. As a representative of EML, I submit that EML has no objection to the SST project as long as the project proceeds in a manner that does not adversely impact or harm EML's customers or customers of other public utilities in the State,[2] from both a cost and reliability perspective. Unfortunately, SST has not provided any evidence demonstrating that EML's

[2] Throughout my testimony, I sometimes refer to the potential harm to EML customers. Implicit in that reference is the potential harm to the customers of other public utilities in Mississippi.

customers would not be harmed by this project; in fact, absent such evidence, the current facts suggest a high likelihood that EML's customers would be disadvantaged by this project. Consequently, I conclude that the evidence submitted in this matter does not support a finding that the public convenience and necessity requires this project, absent conditions that protect EML's customers from future economic and reliability-related harm. As currently submitted, I believe the project will very likely harm EML customers. As demonstrated by the evidence from SST and MISO, that harm is almost certain in some cases, absent mitigation.

Q6. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I describe uncertainties related to the SST project and potential adverse impacts on EML's customers.

As I understand from SST's Direct Testimony, the project involves a 3,000 MW DC link between the ERCOT market and EML's system in MISO South, which SST describes as being "without risk"[3] to EML's customers. Yet, there are many risks to EML's customers, including key risks that have not been evaluated at this time. For example, SST has not identified how much of its 3,000 MW capacity will be injected into or withdrawn from MISO South and how much capacity will be injected into or withdrawn from other transmission systems; SST is apparently still evaluating this fundamental and impactful design issue. Neither SST nor MISO have studied or identified the likely numerous AC

[3] SST Supplemental Petition for Certificate of Public Convenience and Necessity, ¶ 43 (Feb. 14, 2023) ("Petition").

upgrades in Mississippi, which EML and other transmission owners (not SST) would be required to build and own). These upgrades will be required to accommodate injections and withdrawals from the project without degrading transmission reliability, including the AC upgrades that will be required to reliably accommodate injections and withdrawals from the project in MISO South, the new 500 kV-ac line interconnecting the proposed AC-DC converter station in Choctaw County with another transmission system, and the AC upgrades that will be required to reliably accommodate injections and withdrawals on a neighboring transmission system. SST has not specified the type of MISO interconnection or transmission services that will be used, which both have important implications for EML and its customers (including the operation and dispatch of EML's generating units), nor has SST committed to obtaining these services. It appears that MISO similarly has no current plans to study these impacts.[4]

While many of these decisions may or cannot be made by SST prior to MISO completing necessary transmission studies, MISO has provided no indication as to when the various studies it is conducting related to the impact of this project on EML and MISO South will be completed. Further, SST has not performed a production cost analysis with respect to the MISO system to permit evaluation of important issues, like the extent of congestion caused by the project or the cost to address a contingency on the SST line. Nor has SST committed to pay for the costs caused by its project, which is troubling because of its attempts in Texas to avoid paying for such costs.

[4] See MISO's Data Request Responses to EML (First and Second Sets, combined), attached as Exhibit 1.

In order to ensure protection of EML customers and customers of other public utilities in the State from undue harm associated with this project, I propose that the Commission does not currently have the relevant and necessary facts to make a determination at this time that the public convenience and necessity requires approval of SST's project or that the project is currently in the public interest. Therefore, the Commission should wait on determining the public convenience and necessity of this project until SST updates its petition with the relevant and necessary studies, information and commitments in order for the Commission to adequately review this project. The supplemental petition should incorporate a demonstration of need and tangible, public interest, the identification of the AC upgrades necessary to reliably accommodate injections and withdrawals from the project, and commitments from SST that it, or its subscribers, will obtain NRIS or long-term firm transmission service for injections, obtain long-term firm transmission service for withdrawals, and pay for associated AC upgrades, and that SST will address coordination and entanglement issues. Any supplemental petition should incorporate a production cost analysis to permit an evaluation of the project's impacts on power flows, the energy market, and Mississippi customers.

Alternatively, if the Commission decides to approve the petition in its current form, I recommend that approval be conditioned on commitments by SST to obtain NRIS or long-term firm transmission service for injections, obtain long-term firm transmission service for withdrawals, pay for associated AC upgrades, and address coordination and entanglement issues.

It would be reasonable for the Commission to establish such conditions. For

example, the Public Utility Commission of Texas ("PUCT"), when evaluating a request for a CCN for the Texas portion (the "Garland" portion) of the SST project, established numerous conditions in its order approving the CCN, including many directing ERCOT to update its rules to ensure reliability of the ERCOT system and an appropriate allocation of costs. Here is an excerpt from that order:

> The unique characteristics of this docket justify the conditions imposed by the Commission in this Order. The size of the DC tie to which the Garland line in this docket will be connected is unprecedented. If the Southern Cross DC tie becomes operational, it will become the newest, most-severe contingency in ERCOT… the Southern Cross DC tie poses serious reliability questions, and it is uncertain the degree to which the Commission's current rules and ERCOT's protocols, bylaws, operating guides, standards, and systems may need to be revised to address these concerns – although there is little doubt some revision is required. Some of the conditions imposed in this Order are required to address this reliability issue. These serious reliability concerns lead to questions of cost: How much will it cost, and who should be responsible for the costs, to minimize the effects of, or to be prepared to deal with, this new contingency?... This is especially true because no party met the burden of proof in proving what benefits, if any, ERCOT ratepayers will gain from the Southern Cross DC tie. Some of the conditions in this Order are required to address this cost-responsibility issue.[5]

Notably, the PUCT was obligated to approve SST's application because the Texas legislature passed a law directing it to approve SST's application, specifically. Fortunately for the PUCT, it has jurisdiction over ERCOT and was able to direct ERCOT to modify its rules to protect the public interest. Unlike the PUCT and its jurisdiction over ERCOT, the Commission does not have jurisdiction over MISO, and SST has taken the position that the Commission lacks jurisdiction over SST as well (other than with respect to siting this

[5] Public Utility Commission of Texas Order at pp. 5-6, Docket No. 45624, (May 23, 2017) ("PUCT Order).

project). Thus, it is particularly important for the Commission to thoroughly evaluate the project and to establish appropriate conditions, where necessary, to protect the public interest. As discussed throughout my testimony, SST's petition lacks the information necessary for the Commission to conduct such an evaluation. For this and other reasons, this project should not be approved until such information is provided to the Commission.

I. DESCRIPTION OF THE PROJECT

Q7. PLEASE DESCRIBE SST'S REQUEST.

A. SST is requesting authorization to site and construct the Mississippi portions of a new high voltage direct current ("HVDC") transmission project linking the Electric Reliability Council of Texas ("ERCOT") with the Southeast Reliability Corporation ("SERC"), including the southern portion of the Midcontinent Independent System Operator ("MISO"). On the western end, the project would interconnect to the ERCOT transmission system through two 345 kV switching yards and a 345 kV-ac transmission line. That line would run to an AC-DC converter station on the border of Texas and Louisiana. From there, a ~320 mile ±500-600 kV-dc transmission line would run ~200 miles across Louisiana to a Mississippi River crossing and a further 122 miles in Mississippi to another AC-DC converter station in Choctaw County. On the eastern end, the project would interconnect to the MISO transmission system through a 500 kV-ac switching station adjacent to the converter station and a short 500 kV-ac line connecting the switching station with the existing 500 kV-ac Wolf Creek substation owned by EML and used to deliver energy from EML's Choctaw generating facility to EML's customers. The Mississippi

portion of the project for which SST is seeking authorization to site and construct includes the 122 mile ±500-600 kV-dc line, the AC-DC converter station in Choctaw County, the 500 kV-ac switching station, and the short 500 kV-ac line.

In addition to the proposed interconnection to MISO through EML's Wolf Creek substation, SST is evaluating additional interconnections with other transmission systems in the Southeast, including Southern Company and TVA. These interconnections would involve additional unspecified AC transmission facilities – likely including at least one 500 kV-ac line, according to SST – linking the converter station in Choctaw County with the other transmission systems. SST notes that any such facilities would be the subject of an additional or supplemental filing with the Commission for siting approval.

In addition to the Mississippi portion of the project for which SST is requesting authorization now and the unspecified AC transmission facilities linking the converter station to one or more neighboring transmission systems that SST may seek authorization for later, additional unspecified AC upgrades will be necessary to reliably accommodate injections and withdrawals from the project. These AC upgrades, which will likely be extensive as discussed below, will be identified in studies by MISO and other transmission providers conducted in response to requests for interconnection service and transmission service. Notably, and as required by the MISO tariff, these AC upgrades will be built and owned by EML and other transmission owners, not by SST. The absence of any discussion by SST of these AC upgrades is a major omission because it fails to provide the Commission with a complete picture of the project and its potential impact. Similarly, the failure by SST to specify the form of interconnection service or transmission service that

it will obtain for the project is a major omission, as is the absence of any commitment to obtain those forms of service, because these decisions affect the AC upgrades that will be necessary, the way that the project may be operated, any benefits that may arise from construction of the project, and the impacts on EML customers.

Q8. PLEASE COMMENT ON THE SIZE OF THE PROJECT AND ITS IMPACT ON THE POWER SYSTEM.

A. This is a very large project both in terms of its physical footprint and in terms of its impact on the power system planned and operated by EML on behalf of its customers. The project is currently planned to be capable of transmitting 3,000 MW of power in either direction.[6] To put this in perspective, 3,000 MW is approximately equal to EML's current peak load or the maximum output of EML's generation fleet, which is spread across the EML transmission system and not interconnected at a single point. Thus, when power is flowing east on the line, the injection at a single location on EML's system could be as big as the maximum output of its entire generation fleet; and when power is flowing west on the line,

[6] Two notes are warranted to address uncertainties in the size of the project and the amount that will be delivered to MISO South. First, SST's Petition describes the project as currently planned as having a bi-directional capacity of 3,000 MW (Petition at page 2), but the accompanying testimony of Deral Danis notes that SST will be studying two sizes – 2,000 MW and 3,000 MW – to address apparent voltage issues in ERCOT (Danis at page 6). Because the petition describes SST as a 3,000 MW project and because Mr. Danis expresses confidence in the 3,000 MW size, I also describe it as a 3,000 MW project in my testimony.

Second, the petition says that "although the Project as currently proposed will terminate in Choctaw County with an interconnection in MISO South, the Project's design includes the ability to accommodate additional interconnections beyond MISO South." (Petition at paragraph 38.) Because the currently proposed project terminates in MISO South, my testimony addresses a scenario in which 3,000 MW is injected or withdrawn from MISO South. However, I note that SST anticipates interconnecting the project to the Southern Company and delivering a portion of its capacity there (Petition at paragraph 20) and that SST has only requested 1,500 MW of MISO interconnection service (Danis at page 10).

the withdrawal from a single location on EML's system could be as big as its existing peak load. Similar to the concerns expressed by the PUCT noted above, upon its completion, SST would immediately become the single largest contingency event in MISO South. Neither SST nor MISO has given any information to suggest they have considered the impact this project is likely to have on MISO's day-to-day operations. To reliably accommodate such large injections and withdrawals (and fluctuations between injections and withdrawals) will very likely require substantial additional transmission facilities beyond those identified in SST's petition. In addition, injections and withdrawals of this magnitude will have major impacts on the way that generation facilities in Mississippi are operated – causing them to ramp down when power is flowing east, to ramp up when power is flowing west, and to constantly be positioned to ramp up or down to accommodate changes in flows on the line.

Q9. HAS SST PROVIDED SUFFICIENT EVIDENCE TO DEMONSTRATE A NEED FOR THE PROJECT?

A. No, SST has not provided evidence to show that the project is needed for reliability. SST's witnesses speculate that there is potential for reliability benefits – without any Mississippi specific analysis to support such speculation. Nor has SST put forward the type of economic analysis demonstrating net benefits that typically accompanies a CCN application premised on economic benefits rather than reliability, instead relying on an analysis of employment and GDP impacts and a qualitative description of asserted beneficial impacts on power systems in the Southeast. Nor has SST identified any

subscribers of its capacity, nor even demonstrated tangible interest in the project among potential subscribers.

II. AC UPGRADES NECESSARY TO RELIABLY ACCOMMODATE INJECTIONS

Q10. PLEASE DESCRIBE THE LOCATION THAT SST HAS PROPOSED TO INTERCONNECT TO EML'S TRANSMISSION SYSTEM.

A. The project will interconnect to EML's existing Wolf Creek Substation in Choctaw County, MS via a short 500 kV-ac transmission line. This will likely require an expansion of the existing Wolf Creek 500kV substation. Figure 1 depicts the location of the proposed interconnection at Wolf Creek relative to the existing transmission topology.

FIGURE 1

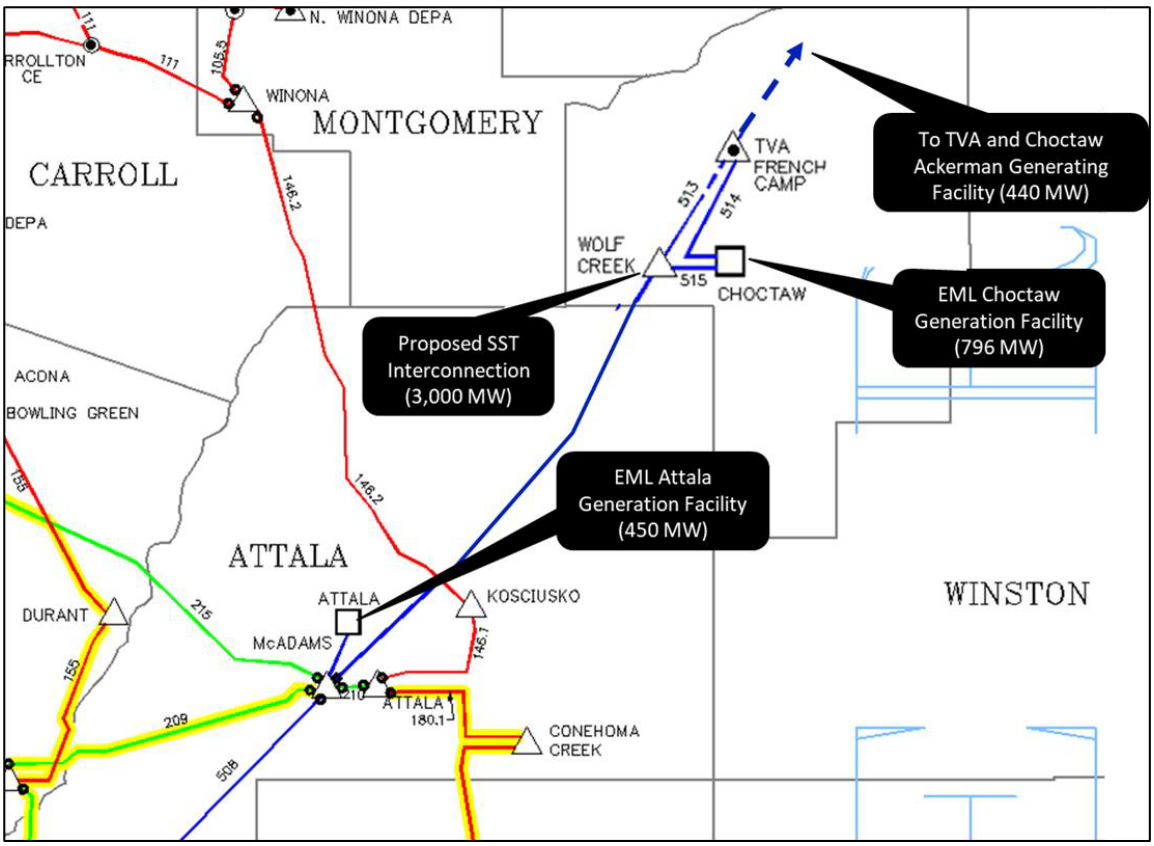

Figure 1 shows that the location of the proposed interconnection is near the border between EML's transmission system, which is part of MISO, and TVA's transmission system. Figure 1 also shows that the location of the proposed interconnection is electrically similar to the location of EML's Choctaw and Attala generating facilities and the Ackerman generating facility interconnected to the TVA system, by which I mean that SST will interconnect to the same 500 kV line as these resources (1,686 MW). The capacity of this line is insufficient (because it was not designed or intended) to accommodate simultaneous injections from SST and these generating facilities – even if injections from

SST are limited to 1,500 MW instead of 3,000 MW and without consideration of flows from any other generators.

The inability of this 500 kV line to accommodate the output of these specific resources demonstrates the obvious need for AC upgrades to address overloading of the 500 kV line to which SST is proposing to interconnect. In addition to addressing overloading on this 500 kV line, additional AC upgrades will likely be necessary to ensure that power can be distributed further "downstream" of the interconnection point because the existing system was not designed to accommodate an incremental 3,000 MW injection (approximately doubling EML's current generating capacity) – or even a 1,500 MW injection – at this location. AC upgrades – potentially including several large ones – will very likely be required to reliably accommodate injections from the project. However, MISO has not yet identified the upgrades that will be necessary to reliably accommodate injections from SST and SST has provided nothing to indicate it has attempted to identify those upgrades, either.

Q11. PLEASE DESCRIBE THE PROCESS TYPICALLY USED TO EVALUATE REQUESTS FOR INTERCONNECTION SERVICE IN MISO.

A. Generators may elect to obtain either Energy Resource Interconnection Service ("ERIS"), which conveys the right to inject energy but not to provide capacity, or Network Resource Interconnection Service ("NRIS"), which involves a more in-depth study and conveys the

right to inject energy and to provide capacity.[7] I note that the right to provide both energy and capacity is what ensures the resource is available to MISO during periods of high demand, which availability is a purported benefit of this project.

Q12. PLEASE DESCRIBE THE PROCESS TO OBTAIN "INJECTION RIGHTS" IN MISO.

A. My understanding is that SST may request "injection rights" through a special process for HVDC projects that originate outside MISO (the Attachment GGG process), in which case the resources that interconnect to the ERCOT side of SST could be designated as NRIS resources eligible to inject energy and provide capacity to MISO through the SST, subject to conditions including confirmation that the resources in ERCOT have long-term firm transmission service from the resource to the point of interconnection. My understanding is that the power flow studies that would be used to identify the upgrades necessary to grant "injection rights" are the same studies used by MISO to identify the upgrades necessary to grant NRIS.[8]

Q13. PLEASE DESCRIBE THE POWER FLOW STUDIES USED IN THE INTERCONNECTION PROCESS.

A. There are two power flow studies. The first identifies the upgrades required to grant ERIS and the second identifies the additional upgrades required to grant NRIS. In the ERIS study, the projects in MISO South that are requesting either form of service – ERIS or

[7] *See* MISO's Data Request Responses to EML (First and Second Sets, combined), attached as Exhibit 1 (describing the processes for studying requests for interconnection service in MISO).
[8] *See* MISO's Data Request Responses to EML (First and Second Sets, combined), attached as Exhibit 1.

NRIS – are added to a power flow model with a base case dispatch. Those projects are then ramped up and other generation elsewhere in MISO South is ramped down. Contingencies are evaluated to identify violations, upgrades are identified to resolve those violations, the costs of the upgrades are estimated, and the estimated costs are allocated among projects based on their impact.

Following the ERIS study, MISO conducts the NRIS study for projects that requested NRIS. As in the ERIS study, there is a base case dispatch that is modified by ramping up the MISO South projects requesting NRIS and ramping down generation proportionally elsewhere in MISO South. Following this transfer, for each constraint that is identified as potentially binding, a "severe yet credible" dispatch is created by ramping up the 30 NRIS resources with the highest contributing shift factors on the constraint. Where violations are identified, upgrades are identified to resolve those violations, costs are estimated and then allocated among projects based on their impact.[9]

Q14. IF SST WERE TO OBTAIN ERIS RATHER THAN NRIS, WOULD THAT PRESENT ANY CONCERNS?

A. Yes. If SST were to procure ERIS, rather than NRIS, as a means to inject energy, then the upgrades necessary to reliably accommodate injections may not be identified, particularly given the location of SST. I address the possibility of ERIS being used to facilitate injections because the MISO rules related to the HVDC lines are new and untested and

[9] See MISO's Data Request Responses to EML (First and Second Sets, combined), attached as Exhibit 1 (MISO Response to EML 2 describes how power flow studies are undertaken as part of the request for service).

there is therefore some uncertainty surrounding them. In addition, at least one HVDC developer has argued that MISO should develop an option to inject energy into MISO through HVDC lines using ERIS.

Recall that the ERIS study involves ramping up the batch of new generation requesting service and ramping down a corresponding amount of existing generation with service. This means that SST, as a new "resource" requesting service, would be ramped up and Choctaw and Attala, as existing resources with service, could be ramped down. MISO would then perform contingencies on this power flow case to identify violations and upgrades to resolve those violations. The problem is that the power flow may not include the output of SST together with the full output of Choctaw and Attala and therefore wouldn't identify the upgrades that would be necessary to accommodate the combined output of these resources. The predictable result would be an inability to operate Choctaw and Attala during periods with east-bound flow on SST due to congestion on the transmission system. This would be problematic. Further aggravating matters is the potential that MISO would address the congestion in the transmission planning process through the identification of "Market Efficiency Projects," which are a category of projects whose costs are allocated to Load Serving Entities ("LSEs"). If this were to occur, it would have the effect of shifting the responsibility for the cost of the upgrades necessary to reliably accommodate injections from SST to EML and other LSEs in the area. Notably, if SST were to obtain ERIS rather than NRIS, it would not be capable of providing accredited capacity in the MISO Planning Resource Auction.

SST has asserted that the project will improve reliability in the Southeast by providing an additional source of power during scarcity events in the Southeast. Assuming for the moment that there would be surplus generating capacity available in ERCOT, which may not be the case if ERCOT was simultaneously experiencing scarcity as it was during Winter Storm Uri, and further assuming that flows on the line were not curtailed by ERCOT to address reliability, SST could provide an additional source of energy and that could improve reliability. But if the additional source of energy effectively displaces the output of Choctaw and Attala, as would be the case if SST were to obtain ERIS rather than NRIS, then any reliability benefits for the Southeast would be diminished because the additional energy provided by SST would be offset by reduced energy from Choctaw, Attala, and potentially other resources whose output could be limited due to transmission constraints caused by injections from east-bound flow. Similarly, SST's assertions regarding economic benefits associated with the displacement of higher cost energy in the Southeast are undermined if the resources displaced by east-bound flow are two highly efficient combined cycle power plants – Choctaw and Attala – as would be the case if SST were to obtain ERIS rather than NRIS.

My concerns in this regard would be alleviated if SST were to commit to obtain NRIS (or "injection rights" conveying NRIS), but it has not done so. SST has initially requested NRIS (or "injection rights") for half of the capacity of the project (or 1,500 MW), but many projects withdraw their requests for NRIS during the queue process and pursue ERIS instead because the ERIS power flow study is less stringent than the NRIS power flow study and, consequently, it is generally less expensive to obtain ERIS than NRIS.

Transmission service could be attained in addition to ERIS to allow for a resource to appropriately participate in MISO as a capacity resource, but as discussed later in the testimony, there is little detail or commitment provided by SST around this. The lower cost of ERIS provides SST with an incentive to procure ERIS instead of NRIS, and this would be problematic, as discussed above.

Q15. COULD MISO TRANSMISSION SERVICE BE USED AS AN ALTERNATIVE TO INTERCONNECTION SERVICE FOR THE PURPOSE OF INJECTING ENERGY INTO MISO THROUGH AN HVDC LINE?

A. Yes, my understanding is that MISO transmission service could be used as an alternative to interconnection service for the purpose of injecting energy into MISO through an HVDC line. As discussed in the following section, requests for long-term transmission service are evaluated through "off-line" studies to identify the upgrades necessary to reliably accommodate injections. Alternatively, requests for short-term transmission service are evaluated through an accelerated and automated process that does not include the identification of upgrades. For the reasons discussed below regarding the need for long-term transmission service to reliably accommodate withdrawals, if SST or its subscribers choose to use transmission service instead of interconnection service for the purpose of injecting energy into MISO, they should be required to obtain long-term firm transmission service for that purpose.

III. AC UPGRADES NECESSARY TO RELIABLY ACCOMMODATE WITHDRAWALS

Q16. PLEASE DESCRIBE THE NEED FOR SST OR ITS SUBSCRIBERS TO OBTAIN MISO TRANSMISSION SERVICE.

A. SST notes that it expects power to flow in both directions. Whereas MISO interconnection service or transmission service will be necessary for eastbound flows that are injected into MISO, MISO transmission service will be necessary for westbound flows that are withdrawn from MISO.

Q17. HOW ARE REQUESTS FOR TRANSMISSION SERVICE STUDIED BY MISO?

A. A transmission customer can choose to reserve transmission service on a long-term or a short-term basis. Long-term requests are evaluated through a study process that involves power flow analyses to evaluate whether the transmission system is capable of reliably accommodating the request, which in this case would involve withdrawals at the Wolf Creek substation, or if transmission upgrades would be required to ensure reliability. If the transmission customer chooses to reserve the service, it pays for the cost of any upgrades that are necessary. My expectation is that extensive upgrades would be necessary to reliably accommodate 3,000 MW of withdrawals from the Wolf Creek substation because the system has understandably not been planned to address this magnitude of power flows.

In contrast, short-term requests involve an automated and accelerated process to evaluate whether withdrawals are expected to be feasible based on a generic representation of conditions. This process does not include an "offline" study to identify the upgrades that may be necessary to reliably accommodate withdrawals and effectively relies on

generating facilities to redispatch to address transmission congestion when actual conditions deviate from the generic conditions used to evaluate the request.

Q18. SHOULD SST OR OTHERS SEEKING TO WITHDRAW POWER FROM THE WOLF CREEK SUBSTATION TO EXPORT TO ERCOT BE REQUIRED TO RESERVE LONG-TERM TRANSMISSION SERVICE?

A. Yes, otherwise the upgrades necessary to reliably accommodate withdrawals from the Wolf Creek substation will not be identified, constructed, or paid for by the exporters. Rather, the exporters could request short-term service from MISO and, if it is deemed available based on generic conditions, use that transmission service to support exports to ERCOT.

Of course, EML's transmission system has not been planned to accommodate up to 3,000 MW of withdrawals at the Wolf Creek substation (the equivalent of trying to serve EML's peak load from a single substation). Yet, if short-term service is granted based on a representation of generic conditions and actual operating conditions deviate from that, then EML and other Mississippi-owned generating facilities on the MISO system may be re-dispatched to facilitate the withdrawals. The LMP-based pricing system is intended to capture the marginal cost of redispatch necessary to facilitate withdrawals and thereby assign the marginal cost of redispatch to exporters, but in practice some of the costs of congestion are not reflected in LMPs and are thus borne by others. This is of particular concern due to the unique pricing system in ERCOT, which involves extreme pricing

during scarcity conditions.[10] The extreme pricing system in ERCOT means that, when scarcity exists in ERCOT, there will be incentives to "pull" as much energy as possible through the EML transmission system and ultimately the Wolf Creek substation for export to ERCOT. If upgrades are not planned to accommodate such withdrawals, then congestion should be expected and, absent the protections for EML's customers I previously discussed, EML and its customers would be forced to bear a portion of the cost of redispatch necessary to address it.

Q19. PLEASE DESCRIBE THE APPLICABLE MISO TRANSMISSION RATES AND THE ALLOCATION OF TRANSMISSION REVENUE.

A. My understanding is that the applicable transmission rate would reflect the cost-of-service of transmission facilities in the EML Transmission Pricing Zone ("TPZ"). MISO would collect the transmission rate paid by the transmission customer and distribute the revenues among Transmission Owners in MISO.

If the transmission customer reserves Network Integration Transmission Service or "NITS," then the MISO would distribute the revenues to EML. In turn, EML would share a portion of the revenues with Cooperative Energy because it is also a transmission owner in the EML TPZ, and the remainder of the revenues would be credited to EML's retail rates pursuant to established retail ratemaking procedures.

[10] *See, for e.g.*, https://www.reuters.com/business/energy/texas-power-consumers-pay-price-winter-storm-2021-02-18/ ("Texas is the only state in the continental United States that runs a stand-alone electricity grid. Unlike other U.S. grid operators, regulators in Texas use scarcity pricing to ensure reliability, but that can cause real-time prices to soar due to shortages.")

Alternatively, if the transmission customer reserves Point-to-Point Transmission Service or "PTP," then a portion – more than half – of the revenues collected by MISO could be distributed to Transmission Owners outside Mississippi. The amount of PTP revenue distributed to EML would be further distributed in the same way as NITS revenue – a portion would be shared with Cooperative Energy and the remainder would be credited to EML's retail rates.

In addition to these rates for transmission service in MISO, SST indicates that it will maintain a separate tariff providing for transmission service on its project. SST has not published a copy of the tariff, including its rates and terms of service. The absence of information about the rates and terms of service on SST is an additional source of uncertainty, because the rates and terms of service may affect the way that the facility is operated, including provisions related to curtailment, ramping, and the scheduling of power.

Q20. PLEASE DESCRIBE THE BILLING DETERMINANTS FOR MISO TRANSMISSION SERVICE.

A. For NITS service, which is long-term, a transmission customer's billing determinant for a month is its MW of load during the monthly coincident peak hour of the transmission pricing zone in which it is located. For PTP service, the billing determinant is the MW size of the reservation, and this applies for the duration of the reservation. Notably for PTP service, reservations may be as short as one hour.

Q21. HAS SST INDICATED WHICH TYPE OF TRANSMISSION SERVICE WILL BE USED IN MISO TO SUPPORT EXPORTS TO ERCOT?

A. No. Its petition is completely silent on that issue. SST does not say whether long-term or short-term service will be used. This is an important omission because it determines whether an offline study will be conducted to identify the upgrades necessary to reliably accommodate withdrawals. Nor does SST say NITS or PTP will be used. This is another important omission because it affects whether the amount of transmission revenue collected, whether that transmission revenue is distributed to transmission owners in Mississippi or among transmission owners throughout MISO, and therefore in turn affects the transmission revenue credited to retail customers.

I note that the amount of transmission revenue at issue is potentially substantial. For example, the current transmission rate for the EML TPZ is $65,989/MW-year. If applied to a 3,000 MW reservation for long-term PTP service, that translates to approximately $198 million per year. On the other hand, if applied to a 3,000 MW reservation for long-term NITS service that is only scheduled outside of the 12 monthly coincident peak hours, that translates to $0 per year. Similarly, for a series of 100 hourly reservations for 3,000 MW of on-peak PTP service (the hourly on-peak rate is approximately $16/MWh), that translates to less than $5 million per year. The wide range of potential transmission revenue at stake – between $0 and $198 million per year –

illustrates the importance of decisions regarding the type and duration of transmission service reserved in MISO to support exports.[11]

IV. COST OF AC UPGRADES

Q22. SHOULD SST OR ITS SUBSCRIBERS BE REQUIRED TO PAY FOR THE COST OF AC UPGRADES NECESSARY TO OBTAIN INTERCONNECTION AND TRANSMISSION SERVICE?

A. Yes, because they would not be built "but for" the need to reliably accommodate injections and withdrawals from SST. SST and its subscribers are clearly the cost causers.

Q23. HOW DOES THE MISO TARIFF ASSIGN RESPONSIBILITY FOR THE COST OF UPGRADES NECESSARY TO OBTAIN INTERCONNECTION AND TRANSMISSION SERVICE?

A. The cost of upgrades necessary to obtain interconnection service and transmission service are allocated to the interconnection and transmission customers whose requests necessitated the construction of the upgrades, as discussed above, with the exception of 10% of the cost of certain upgrades at 345 kV or above, which are socialized throughout MISO. For SST or its subscribers to acquire the appropriate forms of service may require the construction of upgrades at 345 kV or above, and thus there may be some amount of costs that are socialized throughout MISO, including to EML.

[11] MISO transmission rates are public. They are available here: https://www.misoenergy.org/markets-and-operations/settlements/ts-pricing/.

Q24. WHY HAVE YOU PROPOSED A CONDITION THAT WOULD REQUIRE SST TO COMMIT TO PAY FOR THE COST OF AC UPGRADES ASSOCIATED WITH THE PROJECT?

A. I believe that it would be appropriate to condition any approval of the project – now or preferably later – on a requirement for SST to commit to pay for the AC upgrades for two reasons.

The first is that the MISO cost allocation protocols may change. This could happen, for example, if FERC were to change its policies regarding cost allocation. I will note that in national discussions surrounding interconnection reform, many have suggested and FERC has actively considered the socialization of interconnection costs.

The second is that SST has contested being responsible for costs associated with its project in a proceeding in Texas in which it sought certification for the 345 kV facilities interconnecting its converter station on the border of Louisiana and Texas with the AC transmission system in ERCOT. In that proceeding, the PUCT deemed it appropriate to attach numerous conditions to its order certifying the tie line, including conditions requiring SST to pay for the cost of the project and related upgrades. As documented in the PUCT's Order, SST opposed these conditions:

> This docket has revealed that the Southern Cross DC tie will result in additional costs to ERCOT, which include extraordinary costs that arise specifically from the Southern Cross DC tie, the Garland line, and the Garland and Oncor substations. Because the customers of exported power are not ERCOT customers, under the current market design and rules, they will not bear any responsibility for the extraordinary costs specific to the Southern Cross DC tie, Garland line, and Garland and ERCOT substations that they impose on the ERCOT system. Southern Cross believes that those customers – and therefore Southern Cross – should get a

> free ride as to these extraordinary costs. The Commission disagrees and determines that the public interest demands that ERCOT ratepayers should not bear any of the costs associated with the Garland line, the Oncor substation, the Garland substation, or the Southern Cross DC tie that are properly borne by others.[12]

Q25. HAS SST ALREADY COMMITTED TO PAY FOR THE COST OF AC UPGRADES ASSOCIATED WITH THE PROJECT?

A. No. While SST has stated that it will pay for the cost of the project, the project is defined in a way that does not include the AC upgrades necessary to reliably accommodate injections and withdrawals. In light of its advocacy positions in Texas, in which it contested being responsible for these costs, I believe it would be appropriate for the Commission to condition approval of this project upon SST making an MPSC-enforceable commitment to pay for these costs.

V. POWER FLOWS AND ENERGY MARKET IMPACTS

Q26. HOW DOES SST DESCRIBE ITS EXPECTATIONS FOR OPERATION OF THE PROJECT?

A. SST Witness Danis expects power to flow primarily in the west-to-east direction to bring renewable energy from ERCOT to the Southeast, but for power to flow in the east-to-west direction when prices are higher in ERCOT or when there are emergency conditions in

[12] *See* PUCT Order, pp. 7-8.

ERCOT.[13] SST Witness Kottler states that "power will flow from ERCOT to SERC or vice versa based on the relative costs and needs in each region…"[14]

I don't object to either of these descriptions, but I think it's important to note the economic incentive to schedule power from the lower cost market to the higher cost market. At first glance, it may seem that if LSEs in MISO South were to enter contracts to purchase the output of wind energy in ERCOT, reserve transmission service on SST, and schedule the wind energy to flow on SST from west to east, that the physical flow of power would be from west to east. But if prices are higher in ERCOT, that will encourage scheduling behavior that may lead to physical flows in the opposite direction. For example, assume that contracted wind output is 1,000 MW and this output is scheduled from west to east. If prices are higher in MISO, then market participants could schedule up to 2,000 additional MW from west to east and this would result in 3,000 MW of physical flow from west to east. But if prices are higher in ERCOT, then market participants could schedule up to 4,000 MW from east to west, resulting in 3,000 MW of physical flow from east to west. The purpose of these examples is to illustrate how energy prices in each market and the spread between them may ultimately determine the direction of physical flow. Thus, I would caution against thinking about SST as a line that just carries wind from west to east. I would expect flows to be much more dynamic and responsive to price spreads.

[13] Danis testimony at 10-11.
[14] Kottler testimony at 10.

Q27. DOES ESTABLISHING A LINK BETWEEN THE ERCOT MARKET AND MISSISSIPPI PORTION OF MISO SOUTH PRESENT ANY RISKS FOR MISSISSIPPI CUSTOMERS?

A. Yes. SST describes the potential for generators in the Southeast to sell power into ERCOT during periods when energy prices are high in ERCOT as an opportunity to generate additional revenues that can be credited to customers.[15] To a certain degree, this does represent an opportunity. In particular, if the ERCOT market was experiencing scarcity and high prices, then there would be an incentive for market participants to schedule power to ERCOT and this would effectively increase demand and market prices in the Mississippi portion of MISO South where EML buys the energy it needs to serve its load and sells the output of its generation. If EML's generation exceeded its load such that it was "net long" during such a period, then it would generate additional revenue from net sales and that additional revenue would be credited to EML's customers. However, if EML were "net short" during such a period, then its net purchase would be at a higher price and this would **increase** costs recovered from customers.

The upshot is that by establishing a large new "link" between the ERCOT market and the Mississippi portion of MISO South, SST will tie these two markets together. This may represent a revenue **opportunity** for EML (on behalf of its customers) during periods when EML is net long and high prices in ERCOT have the effect of raising prices in the Mississippi portion of MISO South, but it also represents a **risk** if EML is net short during

[15] *See* Petition, ¶ 36.

such periods. Thus, it is simply incorrect for SST to state that the project presents no risk for Mississippi customers.[16] **There is absolutely risk for Mississippi customers in establishing a link to ERCOT**, particularly due to the system of extreme energy pricing used there.

For example, during the months of February 2021, July 2022, and August 2023, the average day-ahead prices in MISO were $68, $78, and $34/MWh, while the average day-ahead prices in ERCOT were $1,723 (25 times higher), $137 (nearly 2 times higher), and $306/MWh (9 times higher). During months like these, there would be very strong incentives for market participants to schedule large amounts of power from east to west, and this could cause prices in Mississippi to be much higher than they otherwise would be. The Commission should be aware of this risk as it considers whether the project is in the public interest.

Q28. COULD INJECTIONS AND WITHDRAWALS FROM THE PROJECT CAUSE CONGESTION?

A. Yes, and the congestion could be severe. As discussed above, at 3,000 MW, the project is very large in relation to the size of the existing system – withdrawals approximately equal to EML's current peak load and injections approximately equal to the maximum output of EML's entire generation fleet, and thus a near-doubling of peak power flows on the existing system (the same concepts are valid even with a 1,500 MW interconnection at the Wolf

[16] *See* Petition, ¶ 44.

Creek Substation). Simply put, the system was not designed to accommodate these flows. As discussed above, extensive AC upgrades will likely be necessary to reliably accommodate the additional flows from SST, yet these AC upgrades will only be built and paid for by SST and its subscribers if the appropriate forms of service are procured to reliably accommodate injections and withdrawals, and SST has not made any commitments in that regard. Even if these upgrades are planned, injections and withdrawals from the project could still cause congestion.

Unfortunately, I am not currently in a position to assess the extent of congestion caused by SST or the impacts on EML and its customers due to a lack of information provided by SST and MISO in this proceeding. These impacts can be evaluated through production cost analyses and an estimate of adjusted production cost savings derived from the difference in production costs with and without a project, which analyses and estimates are often submitted by applicants in CCN proceedings to permit interveners and the public utility commission to consider impacts of the project and to make determinations regarding the public interest. For example, EML's recent applications for certification of solar projects have incorporated production cost analyses and estimates of adjusted production cost savings. Similar analyses would be helpful here. Thus, it is necessary for the Commission to require that SST provide the Commission with a production cost analysis that permits an evaluation of congestion **before** the Commission approves this project. Notably, the analysis should incorporate AC upgrades related to the project once those upgrades have been identified. It is unclear how the Commission can find that the public convenience and necessity requires the SST project absent such evidence.

Q29. ARE THERE OTHER WAYS THAT SST COULD INCREASE COSTS FOR EML CUSTOMERS?

A. Yes. The bulk power system is operated in such a way that it will remain reliable following a long list of potential contingencies. In particular, (a) generators are dispatched such that, in the event of a contingency, the immediate redirection of power flows will not "overload" elements of the transmission system and (b) generators are committed and dispatched such that there is "unloaded" capacity, or "operating reserves", that can be ramped up or turned on quickly to maintain the balance between generation and load, and thus system frequency.

In general, the cost associated with committing and dispatching the system to ensure reliability in the event of a contingency is higher for larger contingencies. This is because the bigger the contingency, the more conservative pre-contingent operations must be. Specifically, this means pre-contingent operations generally involve lighter flows on the transmission system and more operating reserves.

To address the possibility that flows on the project could immediately stop due to a weather event, malfunctioning equipment, or another reason on project – whether on the 345 kV line and 345 kV switching yards in Texas, or along the ~322 mile DC line through Louisiana, across the Mississippi River, and through Mississippi, or at either of the two AC-DC converter stations, or at the 500 kV switching station in Choctaw County, or on the 500 kV tie line in Choctaw County, or at the interconnection to the Wolf Creek substation – MISO may determine that it is appropriate to prepare for such a contingency. Otherwise, if flows were to stop immediately, the immediate redirection of power flows

could overload transmission elements and/or lead to unacceptably high deviations in system frequency. However, MISO has not indicated how it would address operations of SST should it be constructed.

At up to 3,000 MW, SST represents a very large contingency. To address it would require very conservative pre-contingent operations, and this could entail substantial costs. I am not currently in a position to evaluate the extent of these costs, but I will note that the PUCT found that they were significant. Notably, SST was pursuing a 2,000 MW project at the time the PUCT made this finding. It is now pursuing a 3,000 MW project, which represents a larger potential contingency.

> If the Southern Cross DC tie becomes operational, it will become the newest, most-severe single contingency in ERCOT. This is one of the reasons that the facility is unique. The fact that the DC tie may appear to be a "load" when exporting electricity does not preclude that characterization. The loss of this "load" could cause a critical imbalance on the ERCOT system.[17]
>
> Southern Cross argues that the DC tie will not cause a substantial increase in ancillary services needed in ERCOT, and that no change in the current manner that ancillary costs are assigned is necessary. Southern Cross argues that the DC tie should get a free ride on these extraordinary costs also. The Commission agrees that this is a highly technical question and has requested ERCOT to evaluate this matter. The Commission also agrees, however, with ERCOT and other parties that additional ancillary services will likely be required to support the operation of the DC tie, and at certain levels, that requirement may be significant.[18]

The extent of the costs and the responsibility for them under the MISO Tariff have not been evaluated by SST, but they could and should be evaluated through production cost

[17] *See* PUCT Order, p. 5.
[18] *See* PUCT Order, pp. 8 – 9.

analysis. Thus, it is necessary for the Commission to require that SST supplement provide the Commission with a production cost analysis that permits an evaluation of the cost to address a contingency on SST and the responsibility for those costs under the MISO Tariff **before** the Commission approves this project. It is unclear how the Commission can find that the public convenience and necessity requires the SST project absent such evidence.

VI. COORDINATION

Q30. DOES THE INTRODUCTION OF A NEW TRANSMISSION OWNER IN MISSISSIPPI REQUIRE COORDINATION PROTOCOLS TO ENSURE SYSTEM RELIABILITY?

A. Yes. In addition to safety protocols and adherence to design minimum clearances, the main concern with utility crossings is rapid response time for conductor entanglement scenarios. For various reasons such as extreme wind events, rapid coordination is required between a transmission and distribution owner to restore service in the event of entanglement. In the case of a vertically integrated utility such as EML, the coordination plans have inherently been built into existing operational and safety protocols. Introducing SST as a transmission owner without direct load serving responsibility creates some exposure to degraded electrical service reliability if not addressed prior to construction. SST has acknowledged this need[19] but also does not clearly lay out a plan for coordination with any utility crossed by the new HVDC line.

[19] In response to EML's First Set of Data Requests to SST, issued July 10, 2023, SST provided the following, public response to Request 2-19: REQUEST: "Identify all entities that will perform maintenance of the HVDC line on behalf of SST." RESPONSE: "SST has not reached the stage of project development at which maintenance

Q31. PLEASE EXPLAIN THE POTENTIAL RELIABILITY OR PHYSICAL IMPACT TO MISSISSIPPI CUSTOMERS ASSOCIATED WITH THE INITIAL INTERCONNECTION.

A. EML, as a vertically integrated utility, has the responsibility to respond to outages or other system operational risks, such as extreme weather events, immediately. As previously mentioned, introducing SST as a transmission owner without direct load serving responsibility creates some exposure to degraded electrical service reliability. Specifically, if the broader grid was impacted in a way where the new transmission line was critical to outage restoration or grid stability due to an impacting event, operational protocols would need to be in place to ensure all parties are aligned and respond rapidly. Any delayed response to a critical restoration event could result in significant duration outages or grid stability issues locally as well as regionally, due to the proposed 3,000 MW capacity of the new transmission line.

Q32. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, at this time.

contractors will be identified and contracts executed. As discussed in response to EML 2-16, SST will determine its maintenance contractors about the same time construction begins. It is generally expected that maintenance personnel will be contractors from local service providers who are familiar with local first responders and terrain and can be at project facilities with limited delay."

STATE OF TEXAS

COUNTY OF MONTGOMERY

Personally appeared before me, the undersigned authority in and for the jurisdiction aforesaid, JEFF DICHARRY, who after being by me first duly sworn stated that he is Senior Manager of Transmission and Distribution Planning for Entergy Services, LLC, and that as such is fully authorized to make this affidavit; and further stated that the matters and things contained in the foregoing Direct Testimony are true, accurate, and correct as therein set forth to the best of his knowledge, information, and belief.

Jeff Dicharry

JEFF DICHARRY,
SENIOR MANAGER OF TRANSMISSION AND DISTRIBUTION PLANNING
ENTERGY SERVICES, LLC

SWORN TO AND SUBSCRIBED before me, this the 16th day of October 2023.

Estephany Villarreal

NOTARY PUBLIC

ESTEPHANY VILLARREAL
Notary Public, State of Texas
Comm. Expires 08-22-2025
Notary ID 131256200

My Commission Expires:

08/22/2025

RP 6.111 CERTIFICATE OF SERVICE

I, Alicia S. Hall, counsel for Entergy Mississippi, LLC, hereby certify that on this day I have caused to be filed the above and foregoing Direct Testimony of Jeff Dicharry with the Mississippi Public Service Commission, and I have delivered a copy of the same via electronic mail to:

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I have further delivered a copy of the above and foregoing document to the following parties by U.S. Mail:

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and that, in the filing of this document, I have complied with Rule 6 of the Commission's Public Utilities Rules of Practice and Procedure.

This the 16th day of October 2023.

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