STATE OF LOUISIANA

BEFORE THE

LOUISIANA PUBLIC SERVICE COMMISSION

	)	
APPLICATION OF ENTERGY	)	
LOUISIANA, LLC FOR APPROVAL OF	)	
GENERATION AND TRANSMISSION	)	
RESOURCES PROPOSED IN	)	**DOCKET NO. U-37425**
CONNECTION WITH SERVICE TO A	)	
SIGNIFICANT CUSTOMER PROJECT	)	
IN NORTH LOUISIANA, INCLUDING	)	
PROPOSED RIDER, AND REQUEST	)	
FOR TIMELY TREATMENT	)	

Direct Testimony and Exhibits of

Nicholas W. Miller

On Behalf of the

Alliance for Affordable Energy and

Union of Concerned Scientists

Public Redacted Version

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I. INTRODUCTION

Q. Please state your name, business address, and position.

A. My name is Nicholas W. Miller. I am a principal with HickoryLedge LLC, a consultancy providing technical services. My business address is 124 Clipp Rd, Delmar NY 12054.

Q. On whose behalf are you testifying in this proceeding?

A. I am submitting testimony on behalf of the Alliance for Affordable Energy and Union of Concerned Scientists (collectively, the "NPOs").

Q. Please summarize your work experience and educational background.

A. I am an internationally known power system engineer, with specialization in integration of wind and solar power to bulk power systems. I hold Bachelor and Master of Engineering Degrees in Electric Power Engineering from Rensselaer Polytechnic Institute, Troy, New York.

I presently provide technical advice to regulatory bodies (including the Public Utility Commission of Hawai'i), renewable project developers, grid operators in the US, the US Department of Energy, and I perform research with a variety of research entities. I recently conducted research on bulk grid stability for the Midwest ISO ("MISO"). I lead the Stability Task Force of Energy Systems Integration Group, with a focus on oscillatory behavior of inverter dominant power systems.

I spent 3/8 of a century with GE, serving my final decade in the role of Senior Technical Director for GE Energy Consulting. In the last 16 years at GE, I led analytical developments for integration of GE Wind Turbine-Generators into power systems, spearheading efforts to develop new applications, controls and systems for large-scale coordination of wind and solar generation with other system resources. I have lectured and provided consultation on wind and solar power integration to governments and institutions in more than three dozen countries. My work on new techniques for the analysis and control of transient and voltage stability of very large power systems is cited in my Institute of Electrical and Electronics Engineers ("IEEE") Fellowship.

I am an elected member of the National Academy of Engineering, an IEEE Life Fellow, a Licensed Professional Engineer in NY, and a Distinguished Member of CIGRE.

My resume is attached as Exhibit NWM-1.

Q. Have you previously testified before the Louisiana Public Service Commission ("LPSC" or "Commission")?

A. No, I have not.

Q. What is the purpose of your testimony?

A. My testimony evaluates the transmission-related aspects of the Application submitted by Entergy Louisiana, LLC ("ELL" or "Company"). ELL is seeking Commission approval to build three combined cycle gas plants (the "Planned Generators") and various transmission facilities to serve the load from a data center that would be developed by Laidley LLC ("Laidley" or "Customer"), a subsidiary of Meta Platforms, Inc.[1] The Application and direct testimony is based on a data center load of [[redacted]] MW, but in supplemental testimony ELL announced that the Customer is now seeking to increase the data center load [[redacted]] MW.[2]

In my testimony I focus on three transmission-related issues. *First*, I discuss several technical risks associated with the Application that may impose capital or operational costs, or which may adversely impact system reliability. In particular, I address the risk of transmission constraints and dynamic load behavior problems, the mitigations for which could be costly. I also address the transmission-related implications of the proposal, announced in mid-February, to increase the data center load [[redacted]] MW. *Second*, I discuss the Smalling Facility, and its relevance to ELL's Application. *Finally*, I

[1] Throughout its Application and testimony, ELL refers to the Laidley as "the Customer," and the proposed data center as "the Project."
[2] *See* Supplemental Direct Testimony of Laura L. Beauchamp at 4 ("Beauchamp Supplemental Testimony").

briefly discuss ELL's proposal to construct the third Planned Generator – another 1x1 combined cycle combustion turbine ("CCCT") with a nameplate capacity of 754 MW – in southern Louisiana.[3]

Q. What information did you review in preparing your testimony?

A. I reviewed ELL's testimony, exhibits, workpapers, and discovery responses (including the attachments produced with those responses). I also reviewed NERC, ERCOT, Dominion and other industry materials and presentations regarding the load characteristics and impacts of large data centers.

Q. Please summarize your findings.

A. Based on my review and analysis, I conclude the following:

- ELL's Application may have underestimated the transmission improvements necessary to adequately serve the Customer's data center load. More specifically, ELL has not adequately evaluated certain thermal, voltage, and transient stability risks that may have significant cost impacts. If further analysis or subsequent developments reveal such constraints, the mitigations necessary to address them could be costly.
- The dynamic electrical behavior of the Customer's data center loads may impose new and significant risks to the reliability, performance, and equipment on the power grid, particularly on nearby generating stations. ELL has not adequately evaluated these risks, and the Company's failure to thoroughly evaluate these issues poses significant risk to grid stability and ELL's existing ratepayers.
- The Electric Service Agreement ("ESA") between ELL and Customer will not become effective until the "later of December 1, 2026, Commission approval of the 'System Generation Capacity Upgrades' (as that term is defined in the CIAC Agreement), or completion of the first phase (and partial energization of) the Smalling Facility."[4] For the reasons discussed in Section III below, the ESA might not become effective until sometime after December 1, 2026.

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[3] In supplemental testimony, ELL specified that the third Planned Generator would be built at the Waterford site. Beauchamp Supplemental Testimony at 2-3.
[4] Direct Testimony of Laura K. Beauchamp at 13 ("Beauchamp Direct Testimony").

- The transmission-related rationale for the third generator, to be located in southern Louisiana, is questionable.

II. THE COMPANY'S TRANSMISSION-RELATED PROPOSALS POSE RISKS THAT COULD INCREASE COSTS TO RATEPAYERS.

Q. Please briefly describe the transmission-related components of the Company's Application.

A. As noted above, the Customer is proposing to build a large data center in North Louisiana. ELL's Application describes the data center load as [[[redacted]]] MW,[5] but in supplemental testimony ELL stated that the Customer has requested increasing the load [[[redacted]]] MW.[6]

To accommodate the Customer Project at [[[redacted]]] MW, ELL has proposed building an array of generation resources, transmission facilities, and substation projects. In addition to three Planned Generators, ELL describes the following facilities as "required to meet the Customer's power requirements and reliably serve the Project":[7]

- Substation Projects[8]
  - Smalling Substation
  - Car Gas Road 500 kV Substation
  - Customer Substations 1-6.
- Point-of-Delivery Projects[9]
  - Car Gas Road to Smalling Substation 500 kV Lines 2 and 3
  - Smalling Substation to Customer Substations 1-6 and 230 kV Transmission Lines
- System Improvement Projects[10]
  - Mount Olive to Sarepta 500 kV Transmission Lines and Facilities
  - Substation Equipment Upgrades

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[5] Beauchamp Direct Testimony at 4.
[6] Beauchamp Supplemental Testimony at 4.
[7] Direct Testimony of Daniel Kline at 13 ("Kline Direct Testimony").
[8] Kline Direct Testimony at 13-14.
[9] Kline Direct Testimony at 14.
[10] Kline Direct Testimony at 14.

The estimated cost of these facilities is substantial: ELL estimates that construction and commissioning of the Substation and Point-of-Delivery projects will cost $[[[redacted]]], and the System Improvement projects will cost $546.75 million.[11]

Under ELL's proposal, the Customer would pay for the Substation and Point-of-Delivery projects, but all ratepayers would be financially responsible for the System Improvement projects.[12]

Notably, although ELL is proposing that all ratepayers cover costs of the Mt. Olive to Sarepta line (whose estimated cost is $546 million), ELL has acknowledged that "but for the Customer Project, there is no immediate need for Mt. Olive to Sarepta 500 kV line."[13]

Q. Do you have concerns about the adequacy and design of ELL's proposed transmission plan?

A. Yes. I have two core concerns. First, I believe that ELL's Application may understate the full scope of transmission facilities necessary to meet this large new data center load. As I discuss in Section II.A below, the transmission system designed by ELL may be subject to three types of constraints that could limit the delivery of power to the Customer data center: thermal constraints, voltage constraints, and transient stability constraints. Based on the evidence presented by ELL, I believe the Company has not adequately evaluated the risk of these potential constraints. If thermal, voltage, or transient stability problems are identified after further analysis (or after the data center's commencement of operations), ELL will need to apply mitigations. The potential cost of such mitigations could be significant.

Second, ELL has failed to adequately evaluate the risks associated with the dynamic behavior of the Customer's data center load. Large data centers, like the one that ELL is

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[11] Kline Direct Testimony at 15.

[12] Kline Direct Testimony at 15. ELL witness Ryan D. Jones collectively refers to the substation and point-of-delivery projects as the "Customer-Specific Transmission Projects." Direct Testimony of Ryan D. Jones at 34. All ratepayers would cover the O&M costs for these facilities, which witness Jones estimated would be $[[[redacted]]] annually in 2027 and 2028, and $[[[redacted]]] annually starting in 2029. *Id.* at 15.

[13] ELL response to NPO 13-8(c)(ii) (public version) (attached as Exhibit NWM-2).

seeking to accommodate, can have rapidly fluctuating loads. For example, the load can drop suddenly due to a disconnection in power, or the data center's energy demand can oscillate or ramp rapidly. As recent events in Texas and PJM have demonstrated, the rapidly fluctuating loads of large data centers pose serious challenges to the stability of the grid. Given that the Customer's proposed data center would be [[[redacted]]] than existing data centers, these grid stability concerns are particularly acute here.

If these load fluctuation problems are not adequately addressed, businesses and residents in North Louisiana could face major disruptions to their electric service. These load fluctuations could also damage equipment at the new Franklin Farms CCCT facility, as well as at nearby generation facilities, such as the Grand Gulf Nuclear Station. The ISO may have to adopt defensive operations strategies with significant cost and efficiency penalties. Addressing these load fluctuation problems could be costly, potentially requiring additional capital expenditures for transmission and substation equipment such as dynamic compensation equipment, EMS upgrades, and other infrastructure. Further, there is a risk of increased operating costs for ancillary services (such as REG and spinning reserve) because more expensive generation may need to run just to provide the additional support to the grid that was not anticipated in the planning process.

I address these concerns in greater detail below.

A. Risks Associated with the Transmission System

Q. You have noted that ELL's Application does not adequately address the risks of transmission constraints associated with the addition of the Customer's data center load. Can you describe these risks?

A. Yes. The risks associated with transmission constraints fall into three general categories: thermal risks, voltage risks, and transient stability risks. I discuss these risks in greater detail below.

1. Thermal Risks

Q. Please explain your concern regarding thermal risks.

A. The thermal limits of the transmission system, including the new 500 kV facilities proposed by ELL, may be insufficient to serve the data center load while maintaining the system's overall reliability. Based on my review of ELL's filing and discovery responses, I believe that ELL has not sufficiently investigated this risk. And if thermal violations arise, they could cause transmission overloads, reducing reliability for ELL's customers. Operating subject to such constraints could be costly, and capital investment in possible mitigations could run into the tens of millions of dollars or more.

Q. Please elaborate.

A. Thermal limits are a key factor constraining the amount of power that can be delivered over a transmission line. They reflect the fact that power lines and other equipment get hotter as loading increases (e.g., overhead lines that expand and sag as they get hot). When the loading exceeds the thermal limits of a transmission line or other equipment, this can create safety, fire, and reliability problems. For example, when overloaded power lines sag excessively, they can "flash over" to ground (i.e., arcing).[14] Exceeding thermal limits can also create capital cost risk, because power lines, transformers, and other equipment can experience irreversible damage if they get too hot.

Given the serious consequences that can result from thermal violations, transmission operators generally impose operating constraints to stay within thermal limits. Here, such constraints may become necessary with the addition of the Customer's data center load. A primary concern is that the transmission system's thermal limits will restrict the

[14] These concerns are most acute following loss of one or more system elements, such as a line trip. Note, too, that the thermal constraints are not limited to power lines; other equipment through which the power must flow can also be limiting. This includes transformers, but can also include substation equipment such as line reactors, line traps, and switches.

amount of power that can be delivered to the Customer from the bulk power system (e.g., from the Car Gas Road substation and points beyond).[15]

Based on the evidence presented by ELL, it is unclear whether the Company has performed the analysis necessary to determine the thermal limits for power delivered to the data center site. ELL's filing shows that the Company is assuming that the transmission system can deliver up to [[[redacted]]][16] This limit may be important, because the two Planned Generators adjacent to the data center cannot run 100% of the time; they will require planned maintenance outages, and will also be subject to forced outages.[17]

ELL should conduct studies to determine the maximum import limit, i.e. the most power that can be supplied to the Customer load from the ELL system. To perform those studies, the Company should examine scenarios in which (i) the Planned Generators operate at reduced levels of dispatch, and (ii) one or both of the Generators are completely off-line. Until ELL has performed these analyses and presented the results, the Commission should be concerned about thermal constraints limiting delivery of power to the data center, and ELL's ratepayers should be shielded from the risk of costly must-run constraints necessary to address this problem.

Q. What mitigations could address potential thermal violations?

A. If additional analysis demonstrates that the transmission system's thermal limits need to be increased, there are a variety of mitigations that could address these issues. The

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[15] For reference, please see the transmission diagram provided in Exhibit DK-2.

[16] HSPM Exhibit LKB-2 at 145 [redacted]]].

[17] ELL's filing does not identify the assumed forced outage rate for the Planned Generators, [[[redacted]] ELL's response to Sierra 1-15(i), "Sierra 1-15 ELL_Sierra_H1-15_Responses_Sendout_HSPM," tab i. **Note**: many of the HSPM documents discussed in my testimony have also been designated Attorney's Eyes Only.

MISO has found that the 2019-2023 class average forced outage rate for combined cycle units ranged from 5.16 - 6.95% depending on the season. MISO, *Planning Year 2025-2026 Loss of Load Expectation Study Report* at 22-23, https://cdn.misoenergy.org/PY%202025-2026%20LOLE%20Study%20Report685316.pdf.

applicability of these measures would depend on the scope of the problems, the type of equipment, and other factors. But some or all of the following could potentially raise thermal limits:

- Advanced conductors. Using new conductor technologies, such as those with carbon and/or composite cores, instead of the steel wire cores used for conventional conductors, would enable the transmission lines to have higher power carrying capability and less sag.
- Advanced line (HSIL) design. The standard line (tower) design has a natural constraint on power transfer: the surge impedance loading. New line designs, so-called high surge impedance lines (HSIL), (such as the BOLD$_{tm}$ design) can raise this limit by as much as 30%, while having minimal impact on capital costs.
- Grid Enhancing Technologies (GETS). Transfer limits are often set by the ability of lower voltage transmission (e.g. 230 and 115kV lines) to handle power when it is diverted from the 500kV system by disturbances (think automobile traffic detours). A suite of these technologies introduces new options for economically addressing these types of constraints. A recent ELL discovery response,[18] [[[redacted]]], exhibits the type of limiting behavior for which GETS could be an effective mitigation.
- Special Protection Schemes (SPS). There is a class of grid protection variously called SPS (special protection schemes) and RAS (remedial action schemes) that could relax transmission constraints. Broadly described, they add switching actions as part of the response grid events, particularly line trips. Here, they might take the form of "instantly" commanding a non-essential portion of the Customer load to temporarily cease following loss of one of the lines feeding the Smalling substation. This could facilitate substantially higher levels of power import to the Customer.
- Substation and other non-line equipment upgrades.

Q. What is the potential cost of these mitigation measures?

A. The cost of these mitigations can vary significantly, ranging from less than a $1 million (SPS), to millions or tens of millions of dollars (substation upgrades and GETS), to a 5-10% premium on the cost of a new-build transmission line (advanced conductors and

[18] ELL response to NPO 15-1(a)(i), HSPM.

HSIL). For example, if advanced conducting were necessary for the sixty-mile Mt. Olive to Sarepta 500 kV line, that could increase the cost of the line by approximately $25-50 million (5-10% above ELL's $546 million estimate).

I cannot provide a specific cost estimate because we do not yet know the specific mitigations that would be necessary to address inadequate thermal limits. It is also important to understand that solving these thermal problems may require several different mitigation measures, or the deployment of a measure at more than one location (e.g., upgrading multiple substations).

2. Voltage Risks

Q. Please explain your concern regarding voltage risks.

A. For a transmission system to remain stable and reliable, it is critical that voltage be maintained within a narrow range. Because voltage levels are strongly affected by the amount of power being transferred, the Customer's data center carries an elevated risk of voltage problems.[19]

ELL has proposed addressing voltage issues through the construction of three Planned Generators, which it claims "will help maintain electric system voltage at desired levels."[20] ELL witness Kline discusses these claimed benefits in his testimony.[21]

Based on my review of the Company's plans, I believe that the Planned Generators are an imperfect – and potentially inadequate – solution to potential voltage issues. Although these CCCTs can provide voltage support *while operating*, they will not provide such

[19] Keeping the voltage to acceptable levels, especially following system disturbances, is important not only for the system's overall stability, but will also be the limiting factor in establishing transfer limits (i.e., the amount of power that can be delivered to different point, such as the data center). Voltage support is generally required to maintain voltage levels within an acceptable range. It is also worth noting that utility and customer/end-user equipment are at risk if voltage levels are too high, so holding voltage down to acceptable levels is also important.
[20] Beauchamp Direct Testimony at 36.
[21] *See* Kline Direct Testimony at 23-24.

support while offline.[22] And as noted above, the Planned Generators cannot run continuously in perpetuity; they will need periodic planned outages for maintenance, and will also be subject to potential forced outages. If the system cannot provide adequate voltage support when one or more of the CCCTs are offline, that could impact the stability of the transmission system– while also limiting the amount of power deliverable to the data center. These concerns are especially acute here given the data center's large size [redacted]]], high energy needs [redacted]]], and high load factor [[[redacted]]].[23]

Q. Has ELL adequately evaluated the system's voltage performance during periods when the Planned Generators are offline?

A. No. Based on the information provided in discovery, it appears that ELL has not sufficiently analyzed this issue. ELL's direct testimony does not address the issue. In discovery, ELL was asked if it "performed any analyses of either power flows or market impacts during outages of the Planned Generators, particularly during peak demand hours," and to produce any reports or summaries of the analysis results, as well as any supporting modeling files. ELL responded "no."[24] Although ELL claimed that "[o]utages were taken into account during the analysis to ensure the solutions for redundancy needs of the new Customer would operate as planned," ELL failed to produce any summary of results, and conceded that "[n]o models are available."[25] This conclusory response indicates that ELL has not adequately explored this risk.

Q. What are the implications of the Planned Generators' inability to provide voltage support while offline?

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[22] Operation of synchronous generation, such as the proposed new generation, provides high quality (fast, smooth, agile) voltage support, and can mitigate a range of voltage problems. But such voltage support is only provided when the units are online and operating.
[23] *See* Owens Direct Testimony at 4; HSPM Exhibit LKB-2 at 193.
[24] ELL response to NPO 13-5(b) (attached as Exhibit NWM-3).
[25] ELL response to NPO 13-5(b), (b)(i) (attached as Exhibit NWM-3).

A. There are at least two. First, ELL may be compelled to run these CCCTs when it is uneconomic to do so. Although voltage support from synchronous generators, like the proposed gas-fired CCCT units, is largely independent of the active power (MW) being generated, it is necessary for the generator to be running and connected (synchronized) to the grid. And those units will have a minimum power level, below which operation is not possible. Consequently, if voltage support is <u>required</u> from the Planned Generators, the grid must accept at least the minimum power generation, even if it is not the most economic source. This means that rather than committing the CCCT units as "economic" resources in the MISO energy markets, ELL may need to commit the units as "must run" resources – forcing the units to run regardless of the economics. The result would be that these generation assets are operated sub-optimally, i.e. out-of-merit to achieve a reliability objective. Although the problem of fossil units running uneconomically when committed as "must run" is a greater issue with respect to coal-fired generation, the proposed CCCTs could face this issue too if they are committed as "must run" resources in the energy market.[26]

Second, even if uneconomic dispatch were not an issue, the fact remains that the CCCTs cannot run 100% of the time indefinitely. So, if voltage support is required from the Planned Generators, the transmission system will be impacted during unit outages. Such outages would also potentially impact the amount of power that can be delivered to the Customer's data center.

Q. What mitigations could address this voltage risk?

A. If additional analysis demonstrates that the Planned Generators are necessary for voltage support, ELL would need to develop additional transmission facilities that can provide such support during unit outages. Although the appropriate mitigation can only be

[26] This could also be a growing problem in future years as more renewables come online, given that CCCTs incur fuel and other variable costs when operating, while the variable cost of wind and solar is close to zero.

identified after further analyses, addressing this problem might require one or more of the following:

- Specifying the CCCTs so they can be operated as synchronous condensers even when they are not producing power. This would require the units to be custom designed with a clutch that allows the generator to be synchronized without the turbines attached. This would enable voltage support without the generation of power – i.e. operation as a synchronous condenser.
- Installing static reactive compensation equipment, such as mechanically switched shunt devices (i.e. shunt capacitors and reactors). This equipment could potentially be sited at one or more nearby substations.
- Installing dynamic reactive compensation equipment, such as static VAR compensators (SVCs) or static compensator (STATCOMs).[27]

Q. What is the potential cost of these mitigations?

A. The cost of these mitigations can vary significantly, ranging from less than a $1 million for certain static reactive compensation devices, to tens of millions of dollars for solutions like SVCs, STATCOM, and plant retrofits. Addressing these voltage risks could require a combination of mitigation measures, each of which could increase ELL's costs. Similar to the thermal risk issue discussed above, I cannot provide a cost estimate because ELL has not adequately investigated the scope of this potential voltage problem.

3. Transient Stability Risks

Q. Please explain your concern regarding transient stability risks.

A. Transient stability reflects a transmission system's ability to return to an acceptable equilibrium following a major disturbance. Such disturbances could include events such as a lightning strike, as well as a rapid change in load.

[27] ELL has noted that it looked at [[[redacted]]]. ELL response to NPO 13-1(c)(i), HSPM (attached as HSPM Exhibit NWM-4). ELL's apparent familiarity with these technologies is encouraging, because if further analysis reveals the need for more voltage support, the Company should be capable of implementing those mitigations.

In this case, I am concerned that ELL has not adequately investigated whether the transmission system, including the transmission facilities proposed in the Application, can handle unstable generator swing behavior during disturbances, particularly under conditions of higher power import from the rest of the system and for all reasonable conditions that may be encountered. Transient stability limits can be lower than the thermal and voltage limits discussed above, and it is unclear whether ELL has thoroughly analyzed this issue.

Q. Please elaborate.

A. A transmission system with new and existing transmission, especially 500kV improvements, often exhibits unstable generator swing behavior when disturbed. This is a concern because the system is sometimes subjected to large disturbances. These disturbances cause the system to swing. If the system cannot successfully return to a satisfactory equilibrium following such disturbances, that would violate transient stability requirements. The amount of power being transferred – such as the power that would be delivered to the data center – is often a key factor, and this aspect of system stability will often translate into power transfer limits.

Here, it is unclear whether ELL has fully evaluated this issue. In direct testimony included with the initial filing, ELL witness Kline stated that his "team on behalf of ELL performed steady-state, stability, and short circuit analysis to identify the transmission and generation upgrades that are needed to accommodate the [data center] Project."[28] But when asked in discovery to provide reports and models associated with those analyses, ELL's mid-February discovery responses did not provide a stability analysis report, and only included modeling files for the steady state analysis.[29] In another discovery response provided in mid-February, ELL stated that the stability analysis modeling "is currently ongoing."[30] But when subsequently asked for a status update on the stability analysis, in a

[28] Kline Direct Testimony at 21. ELL's references to "stability analysis" are referring to transient stability analysis.
[29] *See* ELL responses to NPO 5-2(b), 5-3(a) (attached as Exhibit NWM-5).
[30] ELL response to NPO 5-8(b), (c) (attached as Exhibit NWM-6).

March 21 discovery response ELL stated that the analysis was complete, and provided [redacted]]].[31]

What *is* clear is that ELL has not yet completed the stability analysis for the [[[redacted]]] MW data center that the Customer is now planning to construct; that analysis is ongoing.[32]

Taken together, I have concerns about the adequacy of ELL's stability analysis. Typically, when a stability analysis is performed, the resulting reports are lengthy (sometimes to running a 100 pages or more), with numerous technical details about the issues encountered and potential mitigations. ELL's documentation of its study [redacted]]] is minimal, and does not address [redacted]]. And because ELL does not intend to complete its updated analysis until after the deadline for direct testimony, Staff and intervenors will not have an adequate opportunity to review and submit testimony on it.

Q. Could these transient stability risks be affected by the Planned Generators' operation?

A. Yes. The proposed CCCTs have the potential to address these transient stability constraints. But, similar to the issue described above with respect to the voltage support, the CCCTs can provide those services only when operating. Thus, the concern I raised above the CCCTs' inability to run 100% of the time applies equally to this transient stability issue. And here again, ELL may be compelled to must-run the CCCTs even when it is uneconomic to do so.

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[31] ELL response to NPO 12-2(c), "NPO 12-2c Project Titanium Stability Study Scope & Results_AEO" (attached as CEII-HSPM Exhibit NWM-7). **Note**: Because ELL has identified this document as containing Critical Energy Infrastructure Information ("CEII"), it will only be provided to those who have signed an appropriate NDA for CEII.
[32] ELL response to NPO 12-5(a), HSPM (attached as HSPM Exhibit NWM-8) (confirming, in public portion of response, that the stability analysis is ongoing).
[33] "NPO 12-2c Project Titanium Stability Study Scope & Results_AEO" (attached as CEII-HSPM Exhibit NWM-7).

Q. If stability problems are identified after additional analysis, or if the data center's import stability limits are lower than the thermal limits identified by load flow analysis, what mitigations would be required?

A. Given the lack of information in ELL's Application, testimony, and discovery responses, I cannot provide a definitive answer. But there is a spectrum of potential equipment that may be necessary to deal with this issue, such as:

- Control modifications to the proposed CCCTs
- Installing dynamic reactive compensation equipment, such as SVCs or STATCOMs.
- Installing large lower impedance substation (500/230kV) transformers and other components
- Alternative transmission line designs, such as HSIL lines (discussed above)

Q. What is the potential cost of these mitigations?

A. Here again, the cost of these mitigations can vary widely, ranging from less than a $1 million to tens of millions of dollars or more. And addressing the transient stability constraints could require a combination of mitigation measures, each of which could carry significant cost. The full cost of such mitigation will only become clear after much more analysis.

Q. Do you have additional concerns about the Company's transmission-related proposals?

A. Yes. Although ELL repeatedly cites its intention to procure up 1,500 MW of new solar and/or hybrid resources for the Customer,[34] ELL has not identified the transmission improvements necessary to integrate these resources into the grid. In discovery, ELL was asked to "identify transmission resources that will be required for the wind and the 1500MW solar projects under the Corporate Sustainability Rider ('CSR') agreement,

[34] *See, e.g.*, Beauchamp Direct Testimony at 6, 36, 62. ELL goes so far as to claim that approval of the three gas plants will "aid in the integration of the 1,500 MW of new solar resources." *Id.* at 52.

providing a table of new transmission lines and substation upgrades and estimated costs." ELL did not provide the information. Instead, the Company objected that this information was "not relevant to the relief requested in this docket," and asserted that the necessary transmission resources "will be identified and known when such resources are identified and evaluated."[35] Similarly, when ELL was asked if Exhibit DK-4, which lists transmission and distribution project schedule milestones, included the "infrastructure required for wind and solar projects covered by the CSR," ELL provided no information.[36]

The concerns I have raised above about whether and how much power can be delivered from the bulk power system to the Customer are highly relevant. Specifically, ELL should determine if it will be possible, within the context of the proposed transmission for the Customer, to deliver this power to the Customer facility. This concern is a subset of my broader concern that thermal, voltage and stability risks may constrain the system to required operation of the new CCCTs, even when they are uneconomic.

B. Risks associated with dynamic behavior of the Customer load

Q. Please explain what is meant by the term "dynamic behavior" as it applies to data center loads like the one the Customer intends to build.

A. The industry is finding that data center loads can be highly disruptive. Data centers are often discussed and even planned for as if their loads are static, which is part of what makes them "high load factor" customers. But the reality is that their demand can be highly variable on timescales that introduce significant challenges for the bulk electric power system. In general, these loads, which utilize complex power electronics (switched-mode power supplies), have the possibility of imposing rapid pulsations, steep ramps up and down, and unexpected/uncontrolled starts and stops. These variations are likely to induce both reliability and cost-related concerns.

[35] ELL response to NPO 12-9 (attached as Exhibit NWM-9).
[36] ELL response to NPO 12-10 (attached as Exhibit NWM-9).

An example of this variability is given in Figure 1 below.

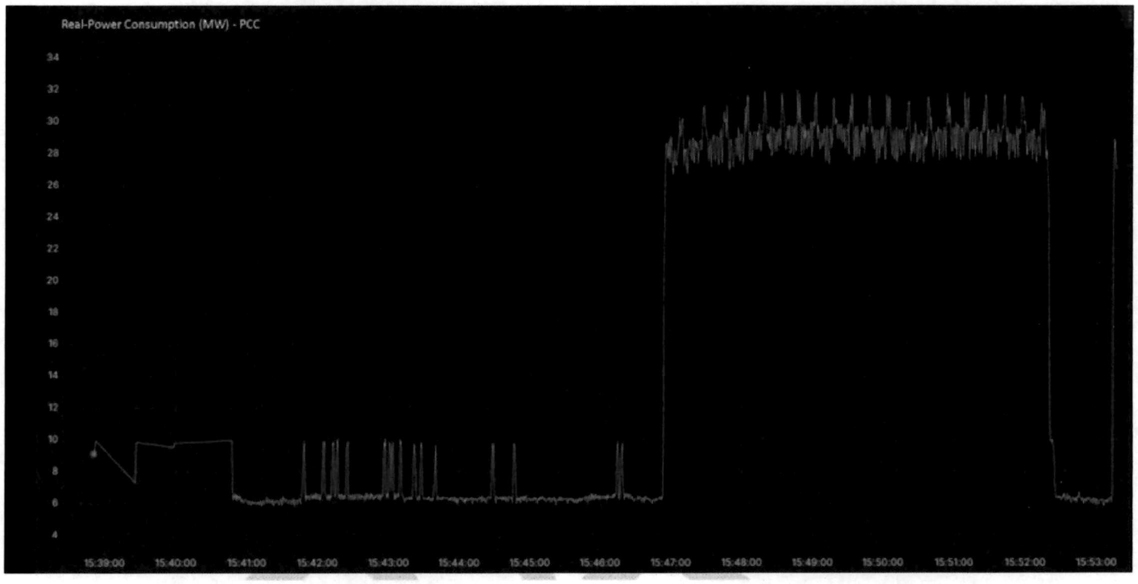

Figure 1: example of a data center's dynamic behavior load

As described in the draft working paper, "Practical Guidance and Considerations for Large Load Interconnections,"[37] this Figure shows:

> . . . how non-conventional [data center loads] are compared with historical end-use loads, where AI training runs result in extremely intermittent power consumption. Figure [1] shows an example of a 50 MW data center block (the entire facility has four points of connection totaling 200 MW). Active power consumption captured with a microprocessor-based relay high speed data recorder shows power consumption jump from 6 MW to 30 MW in a matter of 290 ms (about one-quarter of a second). Power consumption is then highly variable, with 5 MW spikes, for about 5 mins before returning to low power consumption levels and shortly after

[37] Elevate Energy Consulting, *Practical Guidance and Considerations for Large Load Interconnections* at 16 (Mar. 2025), https://gridlab.org/portfolio-item/practical-guidance-and-considerations-for-large-load-interconnections/.

> returning to high power consumption. Note that this facility is not interfaced with the grid through [an uninterruptible power system], so the power consumption is observed directly on the grid side of the customer interface.[38]

Although the data center represented in Figure 1 is [[[redacted]]] than the one the Customer wishes to build, this Figure provides a general sense of how data center loads can vary significantly over very short periods of time.

Q. Would the Customer's load exhibit similar behavior as that shown in Figure 1?

A. The answer is we, ELL, and perhaps even the Customer do not know. Apparently, the only load shape provided by the Customer to ELL was "a monthly load ramp and expected load factor."[39] No hourly data was provided. It similarly appears that the Customer did not provide sub-hourly nor sub-second data, since [[[redacted]]]. Further, the load fluctuations in Figure 1 is just one example of disruptive behavior. Data center loads are subject to many other types of dynamic behavior.

Unless the Customer is required to operate with flat power demand, we should assume that the risks posed by the dynamic behavior of data centers apply here as well. To assume otherwise would expose ELL's existing customers to very significant grid reliability and cost risks.

[redacted] **Q.** **[[redacted]**

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[38] *Id.* at 15-16.
[39] ELL response to NPO 8-1 (attached as Exhibit NWM-10).
[40] "NPO 12-2c Project Titanium Stability Study Scope & Results_AEO" (attached as CEII-HSPM Exhibit NWM-7).

[redacted]]]

Q. You have noted that ELL's Application does not adequately address the risks associated with rapid fluctuations in the data center load. What are these risks?

A. As discussed previously, data centers, like the one the Customer is planning to build, are extremely dynamic – i.e., the load fluctuates significantly over extremely short periods of time (within milliseconds, seconds or tens of seconds). If a very large customer's load fluctuates rapidly, that can threaten the stability of the grid. NERC planning criteria specify "design basis events" for loss of generation. These types of disturbances typically involve the loss of very large central station generation. In the Eastern Interconnection, the worst mandatory planning event is for 4500 MW loss (a large nuclear plant plus sympathetic trip of other fossil units). At [[[redacted]]], disturbances involving [[[redacted]]] the proposed Customer load are [[[redacted]]] all but the most extreme events ever encountered in the Eastern Interconnection. That the behavior could involve multiple rapid disconnection and reconnection or other pathologies at these power levels presents unprecedented and poorly understood risks to system reliability.

Q. What types of impacts might result from this dynamic load behavior?

A. The impacts may include poor voltage and frequency performance, control instability, torsional stress on thermal generators, and increased demand on ancillary services. I describe these impacts in more detail below.

Q. Please describe the potential impacts of poor voltage and frequency performance.

A. The ability of the data center loads to continue operating through system disturbances that are "visible" to the loads through voltage and frequency is a major concern. Such "ride-through" capability has been a major reliability concern for inverter-based resources such as solar PV, wind and battery systems. Now the industry, including

NERC, is deeply concerned about these loads.[41] The behavior of the Customer loads is not known at this time, and models to allow for quantitative analysis are mostly not available. In the event that the data center loads exhibit large, rapid load variations, grid resources that normally counter the effects of such variations may be too slow or too limited to produce acceptable grid performance.

The possible consequences of failing to address these concerns include violation of performance criteria; excessive power variation resulting in violation of system power balance criteria (e.g. BAL-001-02, the NERC standard for balancing real power within a balancing authority); voltage flicker, which is a reduction in power quality and may adversely affect end-users (rate-payers) with annoyance (light flicker) and excessive stress on end-user equipment; failure of the data center load to "ride-through" inevitable grid disturbances could result in the abrupt disconnection of huge amounts of power consumption, with potentially serious adverse impact on the balance and stability of the host grid.

One such example of this was described in an incident report that NERC issued in January 2025. A normally cleared fault on a 230-kv line in the Eastern Interconnection led to the simultaneous loss of 1500 MW of data center load.[42] The recovery of the 1500 MW took about three hours and is still not fully understood. While the event did not lead to cascading effects on the rest of the grid, a noticeable over-frequency occurred and the grid operator had to take measures to reduce voltage to within normal operating levels. NERC said this event highlights potential reliability risks for the bulk power system "with respect to the voltage ride-through characteristics of large data center loads." It also made several recommendations, including that transmission planners should:

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[41] Recent experience in ERCOT showed behavior "very sensitive to voltage disturbances," with large fractions of large electronic loads (like data centers) failing to ride-through events. *See* Yunzhi Cheng, *Large Load Impact on Stability Limits*, ESIG (March 19, 2025), https://www.esig.energy/download/session-4a-large-load-impact-on-stability-limits-yunzhi-cheng/?wpdmdl=12933&refresh=67e16eb14b66e1742827185.

[42] NERC, *Incident Review: Considering Simultaneous Voltage-Sensitive Load Reductions* (Jan. 8, 2025), https://www nerc.com/pa/rrm/ea/Documents/Incident_Review_Large_Load_Loss.pdf.

1. Require validated dynamic response models of large loads in their facility interconnection requirements;
2. Study the impact of these large load disconnections on the system; and
3. "Ensure that operating agreements with large loads include ramp rates when connecting/reconnecting large loads to the system."[43]

Q. Have you seen any evidence that ELL has evaluated the risks of the Customer's dynamic load behavior?

A. No. Based on my review of the Application, testimony, and discovery, it appears that ELL has failed to analyze these risks, identify requirements on the performance of the large load to mitigate them, or evaluate the severity of such risks. This poses a major concern for ELL's ratepayers.

In order to study these risks, a variety of phasor (fundamental frequency) dynamic time simulations and phasor frequency domain analysis can be used, if the behavior of the load is known.

I should note that the transmission materials included with ELL's Application [[[redacted]]] at some future point in the process.[44] This type of study could be viewed as a proxy for considering dynamic load behavior. But this line item does not address my concerns. First, it appears ELL will not complete that study until some undefined future date, by which point this Commission may have already approved ELL's proposal. Second, a [[[redacted]]] cannot substitute for the analysis needed to address the more complex behavioral risks discussed above. While [[[redacted]]] are a necessary step, they alone are not sufficient.

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[43] *Id.* at 8-9.
[44] HSPM Exhibit LKB-2 at 176 [redacted]].

Q. If dynamic load problems are identified after additional analysis, what mitigations would be required?

A. Given the lack of information in ELL's Application, testimony, and discovery responses, I cannot definitively say. Potential mitigations might include the installation of grid equipment such as static VAR compensators (SVCs) or even dynamic energy storage (battery, flywheel, e-STATCOM or other agile storage technologies). These potential mitigations would likely be expensive; given the size of the data center, the cost could run to hundreds of millions of dollars.

Mitigating the problem may also require steps to design (or redesign) the characteristics of the Customer load. It is essential that the Customer be financially responsible for whatever mitigation measures are found to be necessary – at any stage of the project execution.

Q. What are the potential impacts of and solutions to control instability risks?

A. Mechanisms that control the massive power electronics of the customer load may exhibit unacceptable interaction, such as rapid sustained power and voltage swings. This concern is related to, but distinct from, the previous risk. Much of the AC power delivered to the customer site will pass through power electronics that convert the electricity to DC before it is used by various processes. The power electronics are sophisticated and have extremely fast acting controllers. Generally, these controllers are designed with the expectation that grid supplying their power is "big," i.e. that their behavior will have little effect on the supply. In this case, with [[[redacted]]] of load being connected to the grid, that assumption may not be correct. This gives rise to a risk of control instability, in which the customer's load "fights" with the host grid. It is possible for violent, rapid and sustained electrical vibration to occur. These vibrations are usually slower than 60Hz, and fall under a group of phenomena called "sub-synchronous oscillations." Such instability is often highly dependent on the exact condition on the host grid, and consequently acceptable load behavior can, without warning, devolve into poor, unacceptable behavior for seemingly minor changes in the grid condition.

An example of this type of problem occurred in ERCOT in October 2024. ERCOT observed a period during which there was an approximately 23 Hz oscillation with about a 25 MW peak to peak magnitude.[45] ERCOT initiated a roughly 50 MW drop of demand from the data center, which removed the instability. Since then, modifications at the data center appear to have removed the root cause. Though it did not occur in this example, these types of instability create safety and equipment life risks that are potentially very expensive to fix. And given that the Customer's proposed data center would be [[[redacted]]] than the data centers in the ERCOT example, these grid stability concerns are particularly acute here.

If these load fluctuation problems are not adequately addressed, businesses and residents in North Louisiana could face major disruptions to their electric service.

The type of analysis needed to evaluate these risks includes detailed time and frequency domain analysis using specialized tools. ELL should pursue these analyses as soon as possible.

Mitigating this risk may involve redesign of controls for the Customer loads, performed in collaboration with ELL. After the data center is operating, ELL and the Customer would also need to conduct dedicated monitoring specifically to look for these behaviors on the system. But monitoring after the data center is online is not a substitute for the pre-in-service work that should be conducted as soon as possible.

Q. What are the potential impacts of and solutions to torsional stress risks?

A. This item is related to but separate from the previous two risks and reflects a very specific risk. It is possible for the voltage and frequency variations or control instabilities to interact with the rotating turbine-generator of nearby thermal power plants. This risk

[45] Yunzhi Cheng, *Large Load Impact on Stability Limits* at 5, https://www.esig.energy/download/session-4a-large-load-impact-on-stability-limits-yunzhi-cheng/?wpdmdl=12933&refresh=67e16eb14b66e1742827185.

involves torsional stress, i.e. "twisting," of the long steel shaft of either the new combined cycle power plants or other existing turbine-generators in the vicinity of the Customer.[46] Stresses can occur as a result of control interaction (one specific variety of sub-synchronous oscillation), or as individual shocks (transient torques). Both of the Planned Generators that would be co-located with the Customer may be at risk.

The Grand Gulf nuclear plant may also be at risk of torsional stress. While Grand Gulf is located about 60 miles southeast of the load, it is in close electrical proximity to the Customer load. This risk would be particularly serious if there were line-outages that increase the electrical coupling of the data center load to the Grand Gulf plant.

Undue torsional stress due to interaction with the Customer load could result in loss-of-life of the generating assets. In an extreme case, this stress could cause mechanical failure of the shaft or other components.

To evaluate this risk, an analysis includes torsional interaction screening; frequency domain analysis; and possibly control hardware-in-the-loop (CHIL) simulations. This is specialized engineering and modeling options to assess these risks are generally not available/adequate as of today.

To address this problem, the Customer's load may need to be modified. In addition, there may be a need for transmission/grid modifications that reduce the coupling between the load and the affected turbine-generators. Capital equipment in the form of specialized protective relays at the at-risk generators may be necessary as well. It is important to note that options for mitigation at any nuclear power plant may need separate treatment and have timing, regulatory, technical constraints because it would fall under the Nuclear Regulatory Commission's purview.

Q. What are the potential impacts of and solutions to increased demand on ancillary services?

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[46] By "vicinity," I mean the electrical vicinity.

A. The Balancing Authority (BA), i.e., MISO, has the operating obligation to keep their portion of the interconnection in balance. This means that it is their responsibility to match load and generation so as to maintain scheduled power exchange with neighbors and to do their part to maintain the interconnection frequency at 60Hz. These concerns cover a range of time frames, from a few seconds to hours. The BA procures several different types of reserve services and obtaining these services has costs, most of which are socialized to all ratepayers. Specific services include regulation service, which is intended to counter rapid variations (seconds to minutes). It is a paid service, procured through market mechanisms. Other reserve products address the risk of large discrete disturbances, such as the trip of a power plant. These services are mostly focused on adding power to make up for a sudden deficit. Rapid or step increase in the Customer Load will lean on these services. But a related concern is regulation "down," in which the Customer load drops or disconnects entirely.

If the variation of the load is sufficiently excessive, the BA may need to procure additional regulating services. This may involve direct costs for the purchased service or operating constraints (e.g. changes in dispatch) that have power market clearing price impacts. Generally, these incremental costs are socialized. The concern for increased services has been raised in connection with data centers elsewhere. For example, in a recent filing before FERC (Docket Nos. EL25-49-000) PJM argued that "participants involved in co-location arrangements should pay the costs of any grid services they consume, and the arrangements must be reliable and operationally manageable."[47]

Q. How would this risk be analyzed and mitigated?

A. ELL would need to perform comparative statistical analysis that is designed to test if significant incremental services are needed to accommodate the Customer load.

[47] FERC Docket No. EL25-49-000, Answer of PJM Interconnection LLC at 4 (Mar. 24, 2025), , https://www.pjm.com/-/media/DotCom/documents/ferc/filings/2025/20250324-el25-49-000.pdf.

Mitigating this problem could involve operational change or capital expenditures. For example, design of the customer load with the intent of moderating variations that could drive a need for additional balancing services could mitigate this challenge. More capital-intensive options such as agile energy storage from devices such as e-STATCOM or battery systems that are designed to provide balancing within the Customer's facility would likely be effective, but are also costly and should not be borne by ratepayers.[48] Mitigation on the grid could take the form of procuring more services, and in more extreme cases, adding agile energy storage outside of the facility.

This is new ground for grid planners. These services are normally the responsibility of the balancing authority and are not specifically assigned to individual customers. However, in this case, with such a large load, the Commission should consider requiring the Customer to bear a greater proportion of the increased ancillary services costs, which could be significant.

C. Risks of the load increase announced in mid-February

Q. In the discussion above, you address identified transmission-related risks associated with ELL's Application. How does the proposed load increase announced in mid-February affect those risks?

A. The proposed load increase exacerbates the risks I previously discussed. As mentioned above, ELL's Application was based on the Customer building a data center whose load would be [[redacted]] MW.[49] This means that the transmission studies discussed by ELL witness Kline,[50] and his conclusion that ELL's proposed transmission facilities will "maintain[] reliability for existing customers,"[51] were based on that load. But in mid-February, three and a half months after ELL filed its Application, the Company submitted supplemental testimony announcing that the Customer approached ELL about increasing

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[48] Note that some of these capital investments may be needed to mitigate the other risks I discuss above.
[49] Beauchamp Direct Testimony at 4.
[50] Kline Direct Testimony at 21.
[51] Kline Direct Testimony at 37.

the data center load to [[[redacted]]] MW.[52] This means that ELL would need to accommodate a peak load that is [[[redacted]]] than the [[[redacted]]] MW studied to date. This increase will require rework of the studies referenced in the testimony. The concerns I have raised would equally apply to this larger load, with many of those risks increasing as the load gets bigger.

Q. ELL states that it has analyzed the Customer's proposed load increase.[53] Do ELL's analyses address the risks you have identified?

A. No. Although ELL has performed some studies on the proposed [[[redacted]]] MW load, and identified additional transmission facilities that would need to be built,[54] those studies are neither complete nor sufficient. For one thing, I have not seen evidence that ELL's supplemental analyses are addressing the specific concerns I've identified above. For another, some of these analyses are incomplete, such as the stability analysis for the increased load.[55] Likewise, ELL has not completed the routing study, and the Class 5 cost estimate, for the additional new 500 kV line that would be required for the increased load.[56] All of the concerns raised above will still apply with the increased load, and the potential mitigations I outlined above will still apply.

[52] Beauchamp Supplemental Testimony at 4.
[53] Beauchamp Supplemental Testimony at 4.
[54] Beauchamp Supplemental Testimony at 4 ("However, the increased load requested by the Customer will require the construction of additional transmission facilities (the 'Additional Facilities') that are currently estimated to cost approximately [redacted]]]").
[55] ELL response to NPO 12-5(a), HSPM (attached as HSPM Exhibit NWM-8) ("Consequently, the stability study for the [[[redacted]]] MW facility is ongoing and will be completed by end of April 2025.").
[56] ELL response to LEUG 7-8(c) (attached as Exhibit NWM-11).

III. SMALLING FACILITY

Q. Please describe the Smalling Facility's relevance to this case.

A. As discussed in the public version of witness Beauchamp's direct testimony, the Smalling Facility plays a critical role in the effective date of the Electric Service Agreement ("ESA") between ELL and the Customer:

> Rider 1 to the ESA includes certain additional, specific terms relating to, among other things, the Minimum Charge paid by the Customer. Section 2 of Rider 1 updates the effective date of the ESA and provides that the effective date will be the later of December 1, 2026, Commission approval of the "System Generation Capacity Upgrades" (as that term is defined in the CIAC Agreement), or completion of the first phase (and partial energization of) the Smalling Facility.[57]

Thus, until the Smalling Facility's first phase has been completed, and the facility is partially energized, the ESA will not take effect.

As for what the "Smalling Facility" is, that is defined [[[redacted]]].

Q. Is there reason to think that the ESA's effective date will be later than December 1, 2026?

A. Yes. [[[redacted]

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[57] Beauchamp Direct Testimony at 13.
[58] HSPM Exhibit LKB-2 at 145.
[59] *Id.* at 186.

[redacted]]]

IV. THE THIRD GENERATOR'S CONNECTION TO THE CUSTOMER PROJECT IS TENUOUS.

Q. From a transmission perspective, how has ELL characterized the rationale for its proposal to build a third CCCT in southern Louisiana?

A. First, ELL witness Kline has characterized all three generators as "needed to serve the Project."[63] And witness Kline argued that the third generator should go in the southern part of the state – away from the data center – to replace the north-to-south system flows that are expected to diminish with siting of the data center and "ensure the southern portion of ELL's transmission system remains reliable."[64]

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[60] *Id.* at 145.
[61] Direct Testimony of Matthew Bulpitt at 44; Beauchamp Direct Testimony at 14.
[62] ELL response to NPO 13-3, HSPM (attached as HSPM Exhibit NWM-12).
[63] Kline Direct Testimony at 4; *see also id.* at 23-24 (describing claimed benefits of CCCTs).
[64] Kline Direct Testimony at 23.

Q. Do you have any comments about the transmission need for the third generator?

A. I think there are some questions about whether the third CCCT, which would be sited at the Waterford site in southern Louisiana, makes sense from a transmission perspective.

First, ELL never independently evaluated the third generator in its transmission analyses. In all of the transmission scenarios that ELL thoroughly evaluated, the Company assumed that it would build three combined cycle units; the Company did not consider scenarios in which only the two 1x1 CCCTs near the data center would be built.[65] The construction of three plants, with one located in southern Louisiana, was simply a base assumption for each scenario.

Second, when asked in discovery to "explain, including any studies and analyses, why additional generation is necessary in the south when generating stations are being constructed in the north which are proposed and designed to serve the Customer's load," ELL did not provide any studies or analysis. Instead, the Company simply referred back to witness Kline's testimony.[66] With regard to witness Kline's testimony on diminished north-to-south flows, ELL was asked to identify "the specific conditions under which north-to-south system flow would be diminished." ELL provided a conclusory response that simply cited back to the testimony.[67]

For illustrative purposes, a simple sensitivity analysis was performed under my direction using the load flow models that ELL produced in discovery. For this sensitivity, we removed the third CCCT (i.e., the one in southern Louisiana) from the load flow case. The goal was to see if removal of the third CCCT unit caused a significant increase in thermal violations. We ran two cases, a winter peak and summer peak, under two scenarios: (a) a scenario that included a third CCCT (as in the Company's modeling), and (b) a scenario that removed a third CCCT, but was otherwise identical. We then ran contingencies on both scenarios. We discovered that, with the absence of the third CCCT,

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[65] Kline Direct Testimony at 25-36 (describing scenarios studied).
[66] ELL response to NPO 2-4 (public redacted version) (attached as Exhibit NWM-13).
[67] ELL response to NPO 5-6 (attached as Exhibit NWM-13).

the transmission is mostly unchanged. The results of this sensitivity analysis are further described in CEII-HSPM Exhibit NWM-14.[68]

Again, this sensitivity analysis is purely illustrative, but it does raise questions about the trannptesion benefits of the third CCCT that ELL is seeking to build, particularly in regard to serving the Customer load.

V. CONCLUSION AND RECOMMENDATIONS

Q. What do you recommend to the Commission?

A. First, I should note that NPO witness Catherine Kunkel is presenting a recommendation based on the transmission risks discussed in my testimony. Setting that aside, my recommendations are set forth below:

1) If the Commission is inclined to approve ELL's Application, it should condition its approval of the Application as follows:

a) ELL is directed to perform additional studies to determine the upper limits on power delivery from the bulk power system (exclusive of the two co-located Planned Generators) to the Customer load. Such studies will evaluate a broad range of scenarios concerning the commitment and dispatch of the Planned Generators. These studies will be completed by 9/1/25. At the completion of the studies, ELL will make a filing in this docket that clearly identifies the equipment and phenomena that cause those limits. Should the studies show that the upper limit on power delivery from the bulk power system to the Customer load is less than [[redacted]], ELL will complete additional study to (1) estimate the annual operating cost penalty of operating constrained by this limit, and (2) identify transmission equipment options to raise the limit to [redacted] Estimate of

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[68] **Note**: Because this Exhibit contains information that has been identified as Critical Energy Infrastructure Information ("CEII"), it will only be provided to those who have signed an appropriate NDA for CEII.

capital costs for the identified options should be included. These studies will be completed by 12/31/25, and the study results will be filed in this docket.

b) ELL is directed to specify a set of detailed studies, in collaboration with the Customer, to evaluate risks as well as incremental capital and operating costs that may result from variations in the Customer's power consumption, and other dynamic behavior by the Customer load. Risks to reliability, power quality, and generation and transmission equipment should be considered. The detailed study specification will include plans for an initial evaluation study of these risks. The specification will document details of the ELL-Customer collaboration plan for ongoing evaluation, and as necessary mitigation, of risk, that covers the entirety of the project schedule. The study specification will be completed by 8/1/25. The initial evaluation study will be completed by 12/31/25. At the completion of the initial evaluation study, ELL will make a filing in this docket that clearly identifies any problems associated with the Customer's dynamic load, and how ELL will collaborate with the Customer to address any problems that are identified during project execution. The full set of detailed studies will be completed by 12/31/27. At the completion of the detailed studies, ELL will make a filing in this docket that clearly identifies any problems associated with the Customer's dynamic load, how they have been addressed and any costs associated with mitigation.

c) Each of ELL's quarterly monitoring reports[69] will include a transmission update, with a discussion of new study results, construction or operational challenges, and newly identified mitigations.

2) The Commission should consider separating approval of the third Planned Generator, the Mt. Olive-Sarepta 500kV line, the Webre-Babel 500kV line, and possible Car Gas - Mt. Olive 500kV, from the improvements in the immediate vicinity of the Customer

[69] *See* Exhibit LKB-5; Beauchamp Direct Testimony at 67.

facility. Further analysis, including reconsideration of transmission as an alternative to the third Planned Generator, should be directed.

Q. Does this conclude your testimony?

A. Yes.

BEFORE THE LOUISIANA PUBLIC SERVICE COMMISSION

<table>
<tr><td colspan="2">ENTERGY LOUISIANA LLC, ex parte</td></tr>
<tr><td>IN RE: APPLICATION FOR APPROVAL OF GENERATION AND TRANSMISSION RESOURCES IN CONNECTION WITH SERVICE TO A SINGLE CUSTOMER FOR A PROJECT IN NORTH LOUISIANA</td><td>DOCKET NO. U-37425</td></tr>
</table>

AFFIDAVIT

I, Nicholas Miller, being first duly sworn, deposes and says that he is the same Nicholas Miller whose Direct Testimony accompanies this affidavit; that such testimony was prepared by him; that he is familiar with the contents thereof; that the facts set forth therein are true and correct to the best of his knowledge, information and belief; and that he adopts the same as his sworn testimony in this proceeding.

____
Nicholas Miller

Sworn to and subscribed before me on this 3rd day of April, 2025, in ALBANY, NY
__________.

____
NOTARY PUBLIC

DANIELLE BALZAN
NOTARY PUBLIC, STATE OF NEW YORK
Registration No. 01BA6363644
Qualified in Albany County
Commission Expires August 21,2025

My commission expires: 8/21/2025