BEFORE THE

LOUISIANA PUBLIC SERVICE COMMISSION

***IN RE*: APPLICATION OF ENTERGY LOUISIANA, LLC FOR APPROVAL OF THE ENTERGY FUTURE READY RESILIENCE PLAN (PHASE I)**	**))))**	**DOCKET NO. U- ______**

DIRECT TESTIMONY

OF

CHARLES W. LONG

ON BEHALF OF

ENTERGY LOUISIANA, LLC

DECEMBER 2022

TABLE OF CONTENTS

EXHIBITS

I. INTRODUCTION

A. Qualifications

Q1. PLEASE STATE YOUR NAME AND CURRENT BUSINESS ADDRESS.

A. My name is Charles W. Long. My business address is 6540 Watkins Drive, Jackson, Mississippi 39213.

Q2. ON WHOSE BEHALF ARE YOU FILING THIS DIRECT TESTIMONY?

A. I am testifying before the Louisiana Public Service Commission ("Commission" or "LPSC") on behalf of Entergy Louisiana, LLC ("ELL" or the "Company") in support of the proposed resilience projects that will benefit ELL's customers and communities.

Q3. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Entergy Services, LLC ("ESL")[1] as Vice President of Power Delivery Operations.

Q4. PLEASE DESCRIBE YOUR EDUCATION AND BUSINESS EXPERIENCE.

A. In 1991, I graduated from the University of Alabama in Tuscaloosa with a Bachelor of Science degree in Electrical Engineering. I began my professional career in 1992 with Louisiana Power & Light Company (now ELL) as a system protection engineer,

[1] ESL is a service company to the five Entergy Operating Companies ("EOCs"), which are Entergy Arkansas, LLC ("EAL"), ELL, Entergy Mississippi, LLC ("EML"), Entergy New Orleans, LLC ("ENO"), and Entergy Texas, Inc. ("ETI").

remaining in that capacity until 1996. In 1996, I moved into transmission operations planning within Entergy Services, Inc. (the predecessor of ESL), where I worked until 2000. In 2000, I became the substation supervisor in Baton Rouge, Louisiana, for the former Entergy Gulf States Louisiana, L.L.C. ("Legacy EGSL").[2] In 2006, I assumed the role of Manager, Transmission Planning with planning responsibility for transmission facilities for EAL and EML.

In April 2012, I was promoted to Director, Transmission Planning, where I oversaw the development of proposals for the expansion of, and improvements to, the transmission systems of the EOCs, including those of ELL. Specifically, my responsibilities included providing leadership and guidance to a staff of managers and engineers engaged in all aspects of long-term transmission planning, including the development of projects and plans designed to (1) ensure that the transmission systems of the EOCs remain in compliance with North American Electric Reliability Corporation ("NERC") reliability standards governing transmission planning, as well as local planning criteria, and (2) deliver energy to the customers of ELL and the other EOCs at the lowest reasonable cost.

In June of 2019, I was promoted to Vice President, Transmission Planning & Strategy, where I oversaw the development of the transmission capital investment plans and options for the EOCs. In August of 2021, I was promoted to Acting Vice

[2] On October 1, 2015, pursuant to Commission Order No. U-33244-A, Legacy EGSL and the former Entergy Louisiana, LLC ("Legacy ELL") combined substantially all of their respective assets and liabilities into a single operating company, Entergy Louisiana Power, LLC, which subsequently changed its name to Entergy Louisiana, LLC ("Business Combination"). Upon consummation of the Business Combination, ELL became the public utility that is subject to Commission regulation and now stands in the shoes of Legacy EGSL and Legacy ELL in pending Commission dockets.

President, Transmission, where I led the Transmission business unit which planned, designed, constructed, operated, and maintained the transmission assets of the EOCs.

In May of 2021, I assumed my current position as Vice President of Power Delivery Operations within the Power Delivery Organization, which is a new organization within ESL. I describe the Power Delivery Organization later in my testimony. The Power Delivery Operations group that I lead is responsible for the safe and reliable operation of the EOCs' respective transmission and distribution electrical systems. As the leader of that group, I further ensure that my organization's operations processes, practices, and procedures conform to NERC, Federal Energy Regulatory Commission ("FERC") and Southeastern Electric Reliability Corporation ("SERC") regulations and that future plans to improve the reliability performance and resilience of the systems include the operational experiences my teams collect. I am a registered professional engineer in the state of Louisiana and have over thirty years of experience in system planning, operations, and maintenance. My work experiences include significant involvement in the planning for and recovery from the impacts of hurricanes, ice storms and other major weather beginning with Hurricane Andrew in 1992, and most recently with Hurricane Ida. A list of my prior testimony is attached as Exhibit CWL-1.

B. <u>Purpose of Testimony</u>

Q5. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My direct testimony supports the Company's Application in this proceeding seeking approval of the Entergy Future Ready Resilience Plan ("Resilience Plan"). That plan represents the next evolution in satisfying ELL's obligation to serve and meet customers' expectations. The goal of the Resilience Plan is to enhance the resilience of ELL's transmission and distribution ("T&D") infrastructure in a defined period so that future storm restorations can occur more expeditiously and efficiently, resulting in (1) customers experiencing shorter service interruptions and (2) the reduction of storm restoration costs. In fact, Company witness Jason De Stigter notes in his direct testimony that ELL's Comprehensive Hardening Plan, which is a large component of the Resilience Plan, is reasonably projected to produce a reduction in storm restoration costs of approximately 50 percent. Moreover, the projects identified in the Comprehensive Hardening Plan are reasonably projected to produce a decrease in the projected customer minutes interrupted ("CMI") after a major storm by approximately 55 percent over the next 50 years. Those cost and customer outage reductions would be transformative.

ELL's storm experience, especially with recent, major hurricanes, indicates that the Commission should consider accelerating resilience efforts, and the Comprehensive Hardening Plan is different from what ELL previously has done to enhance the reliability and resilience of its T&D infrastructure. Maintaining and enhancing the reliability of T&D infrastructure is an ongoing process for ELL, and the Company enhances resilience by implementing new engineering design standards as it performs its reliability work. Enhancing resilience in the course of reliability work, however, will not provide resilience to as many customers in as timely a manner as proactive, continuous resilience work. That being said, and as is noted by Company witness Sean Meredith in his direct testimony, Resilience Plan projects should improve system reliability over the long run. In the past, ELL has undertaken some resilience efforts during storm restoration, but those efforts were targeted and more narrowly-focused than the plan presented here. Moreover, as I discuss below and as Mr. Meredith discusses in his direct testimony, addressing resilience during storm restoration involves significant obstacles and challenges and is not as efficient as proactive resilience work. The Resilience Plan also includes a requested increase in vegetation management spending, which should complement ELL's proposed hardening efforts. Accordingly, the Commission should approve the Resilience Plan, with an appropriate cost-recovery mechanism, so that ELL can begin the Resilience Plan's initial phase and deliver comprehensive resilience benefits to customers.

Q6. HOW IS YOUR TESTIMONY STRUCTURED?

A. In Section II, I discuss the Power Delivery Organization, which is responsible for planning, operating, and maintaining ELL's transmission and distribution systems, as well as the Capital Projects Organization, which designs and constructs ELL's transmission and distribution system. Those two organizations will work with ELL to execute the Comprehensive Hardening Plan and bring resilience benefits to ELL and its customers. In Section III, I discuss the ongoing process of the Company's reliability work on its distribution and transmission systems, which includes an overview of those systems and operations. In Section IV, I address ELL's proposed changes to vegetation management programs and spending. Finally, in Section V, I discuss the need for the Comprehensive Hardening Plan and the benefits that a comprehensive resilience effort can provide.

II. THE POWER DELIVERY ORGANIZATION

Q7. YOU PREVIOUSLY EXPLAINED THAT THE POWER DELIVERY ORGANIZATION IS A NEW GROUP WITHIN ESL. PLEASE ELABORATE.

A. The Power Delivery Organization was formed in May 2022, and it essentially resulted from the combination of what had been ESL's separate distribution and transmission organizations. Those organizations were combined for a number of reasons, including: (1) to enhance coordination between the transmission, distribution, and capital projects teams in order to deliver service to our customers; (2) to improve the resilience and reliability of our transmission and distribution systems, and to achieve our customer-centricity goals; (3) to improve our ability to manage electrification, renewables, and resilience by centralizing certain functions in project delivery; (4) to improve safety performance; and (5) to improve the overall customer experience by more effectively executing planned and unplanned work.

Q8. WHO IS THE LEADER OF THE POWER DELIVERY ORGANIZATION?

A. Elaina Ball is the Senior Vice President, Power Delivery, and I report to Ms. Ball.

Q9. PLEASE DESCRIBE THE POWER DELIVERY ORGANIZATION.

A. The Power Delivery Organization is responsible for planning, operating and maintaining ELL's transmission and distribution systems that provide power and energy to homes, businesses, and governmental entities within the Louisiana communities that ELL serves. Power Delivery also is responsible for setting and maintaining the engineering standards to be applied to the transmission and distribution systems, while also designing and constructing smaller projects, such as projects necessary to interconnect new customers and to replace failed equipment. Larger projects and programs involving more complex project management and engineering techniques are executed by the Capital Projects organization, subject to the standards set by the Power Delivery Engineering group. I discuss both the Capital Projects organization and the Power Delivery Engineering group below. A significant majority of the proposed Comprehensive Hardening Plan's resilience work will therefore be executed by the Capital Projects organization and contractors that the organization retains. Accordingly, the Capital Projects organization and the Power Delivery Organization will work with ELL to execute the Comprehensive Hardening Plan and bring resilience benefits to ELL and its customers.

Q10. HOW IS THE POWER DELIVERY ORGANIZATION ORGANIZED?

A. The Power Delivery Organization contains the following groups: (1) Power Delivery Engineering; (2) Project and Portfolio Development; (3) Power Delivery Services; (4) Storm Operations; and (5) Power Delivery Operations, which is the group that I lead.

Q11. WHAT ARE THE RESPONSIBILITIES OF THE POWER DELIVERY ENGINEERING GROUP?

A. The Power Delivery Engineering group assures that there are appropriate transmission and distribution engineering and construction standards and processes throughout the Power Delivery and Capital Projects organizations. The group sets the standard of work for all engineers in the Power Delivery and Capital Projects organizations. The standards set and maintained by the Power Delivery Engineering group meet or exceed all National Electrical Safety Code ("NESC")[3] standards and are in accordance with other recognized industry standards. In the case of the Comprehensive Hardening Plan, and as is discussed in greater detail in Mr. Meredith's direct testimony, the Company has established more stringent wind loading design standards that incorporate the recent operating experiences from major storms including Hurricanes Laura and Ida, which were particularly devastating and catastrophic storms that impacted the communities that ELL serves. These new wind loading design standards will result in more resilient facilities. The pace at which facilities designed to these new standards will replace legacy facilities designed to prior standards is the subject of the Comprehensive Hardening Plan.

Q12. WHAT ARE THE RESPONSIBILITIES OF THE PROJECT AND PORTFOLIO DEVELOPMENT GROUP?

A. The Project and Portfolio Development group develops and prioritizes the portfolio of projects necessary to serve our customers reliably, including new facilities, the renewal and replacement of aging or poorly performing assets, the construction of facilities to support or enable economic growth, and the development of projects to address a range of other needs. This group is also charged with developing the

3 The Institute of Electrical and Electronics Engineers ("IEEE") defines the NESC as follows: "Published exclusively by IEEE and updated every five years to keep the Code up-to-date with changes in the industry and technology, the National Electrical Safety Code® (NESC®) sets the ground rules and guidelines for practical safeguarding of utility workers and the public during the installation, operation, and maintenance of electric supply, communication lines and associated equipment." https://standards.ieee.org/products-programs/nesc/.

strategies around maintaining and replacing assets and the overall design of the transmission and distribution systems.

Q13. WHAT ARE THE RESPONSIBILITIES OF THE POWER DELIVERY SERVICES GROUP?

A. The Power Delivery Services group supports my group, along with the Capital Project's project delivery organization, by centralizing certain functions such as safety, vegetation management, fleet management, field metering, environmental services, and right-of-way. This group also implements best practices to provide these services across the EOCs' transmission and distribution systems during the construction of new facilities as well as the renewal of and maintenance of these facilities.

Q14. WHAT ARE THE RESPONSIBILITIES OF THE STORM OPERATIONS GROUP?

A. The Storm Operations group supports storm-related operations, such as planning for major storm events and implementing strategies to respond to them, while continuously monitoring and updating storm safety and performance metrics. This group, along with ESL and EOC employees who are involved in storm restoration, participate in the restoration strategy group, which is activated during severe weather such as widespread severe thunderstorms and hurricanes.

Q15. WHAT ARE THE RESPONSIBILITIES OF THE POWER DELIVERY OPERATIONS GROUP THAT YOU LEAD?

A. The Power Delivery Operations Group oversees the day-to-day operations of the transmission and distribution systems that deliver energy from generation resources to the customers served by each of the EOCs, including ELL. The Power Delivery Operations team is responsible for a number of activities, including: constructing facilities to interconnect new customers, responding to and restoring outages, operating and monitoring the performance of the transmission and distribution systems, repairing and maintaining transmission and distribution assets and facilities, and an array of support functions such as engineering services for small, *ad hoc* projects.

The electric grid consists of electric transmission and distribution systems that bring energy from generating facilities to ELL's customers. The Power Delivery Operations group monitors the transmission and distribution system loads and voltage levels, along with other characteristics, to ensure there is adequate capacity to meet customer needs and that the quality of the energy delivered meets customer expectations. In addition, the group handles routine and emergency switching needed to maintain a continuous supply of electricity to customers and to address customer interruptions as safely and quickly as reasonably possible.

The electric transmission and distribution systems require regular inspection and maintenance to preserve their integrity and ability to provide reliable service to customers. These maintenance activities are both preventative and reactive, as discussed later in my testimony. Preventative maintenance includes equipment inspections and introducing new maintenance practices to enhance the overall operation and reliability of the electric system, whereas reactive repairs and upkeep are required when service is interrupted due to strong winds, lightning, or other types of damage. Maintenance activities also include routine vegetation management along rights-of-way ("ROWs"). Should these inspections, monitoring by the control centers, or system events identify facilities not performing correctly, jobs are planned to upgrade or replace those facilities.

Moreover, to accommodate customer growth, ELL must continually add to or upgrade its distribution facilities. These additions, both major and minor, require constructing distribution line extensions or increasing the capacity of existing distribution facilities. Construction also includes clearing new ROWs of vegetation. The construction of new or enhanced distribution lines is part of ELL's goal to provide safe and reliable service at the lowest reasonable cost to all current and prospective customers.

The Power Delivery Operations organization utilizes over 1,200 employees across ESL and ELL, including line workers; engineers; engineering associates; substation mechanics; technicians; operators; region, line, and construction supervisors; drafters; storekeepers; administrative assistants; and various others, as well as hundreds of contract resources. These employees and contractors provide support for ELL in the areas of engineering, design, operations, accounting, customer service, and other miscellaneous areas and perform these activities for the five ELL regions identified later in my testimony. Coordination between these employees, at both a centralized and localized level, allows for synergies between the various teams in the performance of their duties.

III. THE ONGOING PROCESS OF T&D RELIABILITY AND AN OVERVIEW OF THE COMPANY'S T&D SYSTEMS AND OPERATIONS

A. The Distinction Between Reliability and Resilience

Q16. BEFORE DISCUSSING RELIABILITY, PLEASE EXPLAIN WHAT YOU MEAN BY THE TERM "RESILIENCE" SO THAT A DISTINCTION BETWEEN THE TWO CONCEPTS CAN BE UNDERSTOOD.

A. As discussed by Company witness Phillip R. May, resilience is the ability to prepare for, adapt to, and recover from non-normal weather events, such as hurricanes, floods, winter storms, wildfires, tornadoes, and other major disruptions. By comparison, system reliability focuses on the availability of power to customers under normal operating conditions, which include day-to-day operational challenges such as thunderstorms. Although resilience and reliability are complementary from the customers' perspective, the projects being proposed as part of the Resilience Plan were selected specifically to help improve resilience as compared to a focus on system reliability.

For electric utility systems, resilience relative to severe weather events has at least three critical dimensions: (1) hardening, which involves building or improving a system in ways that will make it better able to withstand the impacts caused by severe weather events; (2) modernization, which includes adapting the system to reflect or incorporate newer technologies that can improve the system's ability to withstand non-normal weather events, including self-healing networks, smart sensors, fault-detection technology, and microgrids; and (3) recovery, which includes incorporating customer-sited generation and back-up options and designing resources to assist with recovery after a major weather event. While such efforts should be expected to have positive impacts on the day-to-day operations of the utility system under normal conditions (*i.e.*, reliability), projects designed to improve resilience are focused particularly on preparing the electric system to withstand and recover from severe, non-normal weather events.

Q17. PLEASE ELABORATE ON THE RELATIONSHIP BETWEEN RESILIENCE AND RELIABILITY.

A. As discussed by Mr. May, and although, as I just indicated, resilience efforts may avoid interruptions that are measured by traditional reliability indices, defining a precise relationship between resilience and reliability is challenging. That said, while reliability focuses on the availability of power to customers, resilience takes a broader view of the grid and looks for ways to avoid, mitigate, survive, and/or recover from the effects of disruptive events.

Q18. IS THE APPROACH TO RELIABILITY THE SAME FOR DISTRIBUTION AS FOR TRANSMISSION?

A. In many respects, the approach is the same. For both functions, ensuring reliability entails planning for the expected needs of the system, now and in the future, as well as identifying the causes of outages and targeting activities to prevent their recurrence, or reduce their impact. The primary differences in the approach to reliability for each function are based on the different general designs of each system. The transmission system is generally a looped system, meaning that every point where energy is delivered from the transmission system has at least two sources. Thus, the reliability experienced by customers from the transmission system is good if one of the sources is highly reliable even if the other source is less reliable. In contrast, the majority of the distribution system is radially fed, meaning that in most cases, each customer is dependent on a single source, and thus the reliability that customers experience is based on the reliability of that single source.

From an overall system perspective, the transmission system interconnects generators and other systems together, and thus the reliability of the entire electric system can be impacted by transmission reliability issues. The reliability of the transmission system is not only important to ensure the quality of the service provided to an individual customer, but also to ensure the reliability of the entire Eastern Interconnection.[4] Transmission system reliability challenges are less frequent than those affecting the distribution system, but they can be enormously impactful, as seen from the widespread blackouts that have been experienced in the Northeast in 2003,[5] in the West in 2011,[6] and in Texas in 2021 during Winter Storm Uri.[7] In

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4 The Eastern Interconnection reaches from Central Canada eastward to the Atlantic coast (excluding Québec), south to Florida and west to the foot of the Rockies (excluding most of Texas). All of the electric utilities in the Eastern Interconnection are electrically tied together during normal system conditions and operate at a synchronized frequency operating at an average of 60Hz.

5 States in the Midwest and Northeast United States, along with Ontario, Canada, faced a blackout on August 14, 2003. The states affected alongside the Canadian province of Ontario were Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, and New Jersey. The blackout started shortly after 4:00p EST, with some areas not being restored for four days.

contrast, distribution system reliability challenges are more frequent, but also tend to be very localized as compared to transmission. Thus, the solutions identified for addressing transmission reliability challenges may differ from the solutions best suited for distribution. Nonetheless, the fundamentals of identifying the existing or potential future causes of outages and improving the systems so that they are less likely to be impacted by those causes through improved component designs, system designs, or operational practices are the same.

In any event, and as will be discussed below, ELL has maintained its distribution and transmission assets to support reliable operations while keeping rates affordable. ELL's asset management programs that support reliability, however, will not transform ELL's transmission assets like the proposed Resilience Plan would. An overview of the Company's distribution and transmission systems and operations will put the Company's proposed Resilience Plan's resilience projects into further context.

U.S.-Canada Power System Outage Task Force, *Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations,* United States Department of Energy (April 2004), *available at* https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.

[6] On September 8, 2011, a blackout occurred, affecting states in the Pacific Southwest, along with parts of Mexico. The states affected alongside areas in Mexico contained parts of Arizona, Southern California, and Baja, California. The blackouts began during the afternoon, with some areas not being restored for up to 12 hours, due to an 11-minute system disturbance.

Staff, *Arizona-Southern California Outages on September 8, 2011,* The Federal Agency Regulatory Commission and the North American Electric Reliability Corporation (April 2012), *available at* https://www.nerc.com/pa/rrm/ea/September%202011%20Southwest%20Blackout%20Event%20Document%20L/AZOutage_Report_01MAY12.pdf.

[7] On February 15, 2021, over 4 million customers throughout the State of Texas lost power, with many of the outages occurring through the following day.

The Earth Observatory, *Extreme Winter Weather Causes U.S. Blackouts,* National Aeronautics and Space Administration (February 16, 2021), *available at* https://earthobservatory.nasa.gov/images/147941/extreme-winter-weather-causes-us-blackouts.

B. ELL's Distribution System and Operations

1. Evolution and Status of ELL's Distribution System

Q19. PLEASE DESCRIBE ELL'S DISTRIBUTION SYSTEM AND THE GENERAL FUNCTION IT SERVES.

A. The distribution system is the infrastructure that ultimately delivers electric power to most of ELL's customers. ELL's distribution system begins at the substations, where power is transformed from transmission-level voltage into distribution-level voltage, a voltage level suitable for delivering power directly to residential, and certain commercial, governmental, and industrial customers.[8] ELL's electric distribution system is the portion of the electric grid operating at voltage levels below 69,000 kilovolts (69 "kV"). The predominant operating voltages of the Company's distribution circuits are 13.2 kV, 13.8 kV, and 34.5 kV (nominal, phase-to-phase). ELL's distribution system serves nearly 1.1 million customers. There are approximately 500 ELL substations that supply power to over 32,000 distribution circuit miles, of which approximately 28,000 are overhead circuit miles, and approximately 4,000 are underground circuit miles.

The Power Delivery Organization operates local Service Centers throughout the areas served by ELL. These local service centers and the distribution facilities supported by them are divided among five larger geographic operating regions consisting of 28 networks. Their respective geographical boundaries are depicted in the map in Figure 1.

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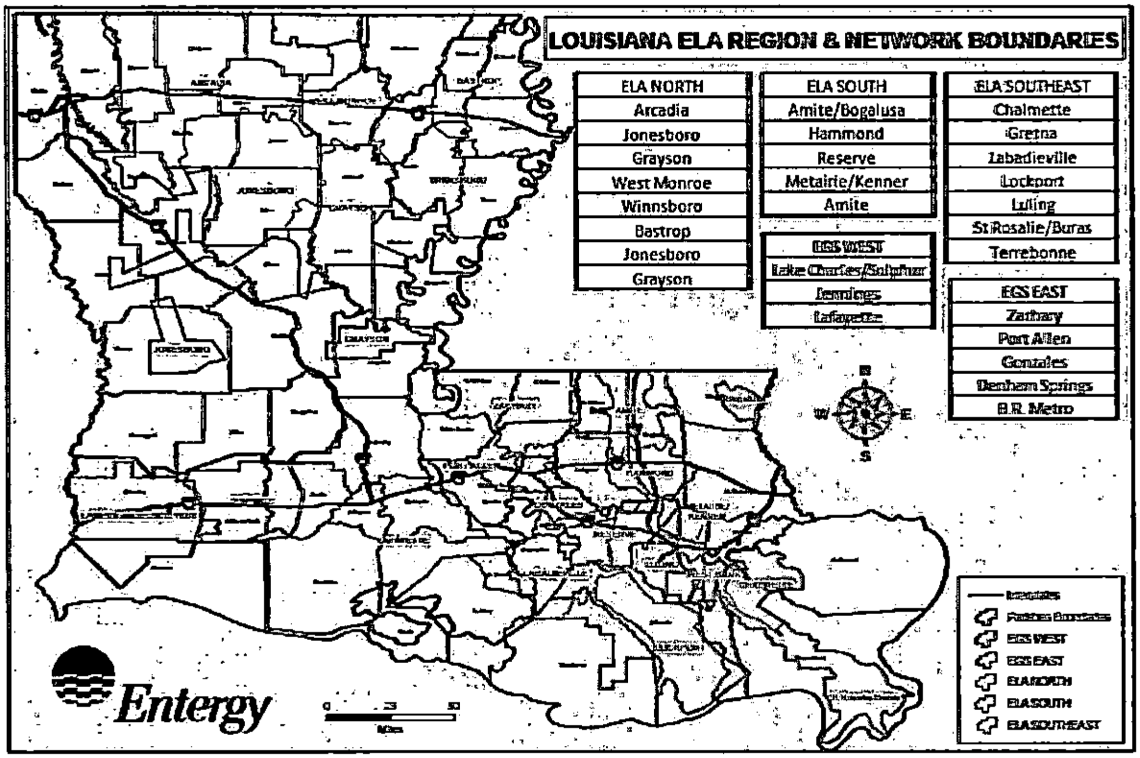
[8] Some of ELL's largest commercial, governmental, and industrial customers are connected directly to the Company's transmission system.

Figure 1

Map of ELL's Geographical Regions



Q20. WHAT IS THE STATUS OF ELL'S DISTRIBUTION SYSTEM?

A. ELL has ramped up the pace and level of its distribution investment in recent years and plans to continue making significant investments to modernize and improve the reliability and resilience of the distribution grid. On average, the Company invested approximately $267 million annually in capital spending for its distribution system for the five-year period of 2017 through 2021, with distribution line plant closing increasing from $177 million in 2017 to $377 million in 2021.[9]

Like many of its utility peers, ELL has an aging distribution system that is now in a period of significant modernization as it evolves to address changes in customer expectations and grid technologies, opportunities to maximize the benefits of the Company's investment in AMS,[10] and the increasing frequency and severity of named storms and other extreme weather events, as evidenced in the past two Atlantic hurricane seasons and in the recent tornadoes that have impacted Louisiana as described by Mr. May.

As I discuss further below, ELL's distribution plan combines system hardening and grid modernization efforts with traditional reliability and infrastructure programs with an objective to improve the overall service quality provided to customers. This distribution plan involves a coordinated effort to undertake replacement and hardening of aging distribution infrastructure and deploy devices that enable functionalities associated with a modernized grid.

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[9] Distribution capital additions for 2017-2021 exclude amounts related to storm damage and Advanced Metering System ("AMS") investments.

[10] The Commission approved ELL's AMS in LPSC Order No. U-34320. *See,* Order No. U-34320 (August 25, 2017), *In re: Application of Entergy Louisiana, LLC for Approval to Implement a Permanent Advanced Metering System and Request for Cost Recovery and Related Relief, Docket No. U-34320.*

Q21. CONCERNING SERVICE QUALITY, HAS ELL TRADITIONALLY PROVIDED RELIABLE SERVICE TO ITS CUSTOMERS?

A. Yes. ELL has a long track record of providing reliable service to its customers. In its General Order of April 30, 1998, issued in Docket No. U-22389, the Commission set minimum distribution reliability performance standards that were phased-in over a period of seven years to reach the current metrics: an annual System Average Interruption Frequency Index ("SAIFI")[11] score of 2.28 and an annual System Average Interruption Duration Index ("SAIDI")[12] score of 2.87 hours, or 172.2 minutes. In the two decades since that order was issued, ELL has consistently exceeded the LPSC's minimum performance levels. ELL's SAIFI score was significantly lower (and therefore better) than the LPSC's minimum performance level in each year. Although there were exceptions in 2018 and 2019, years when ELL's SAIDI score was not within the Commission's performance target have been very rare, and the Company's SAIDI scores for 2020 and 2021 were within the Commission's performance target.[13] Furthermore, the 2018 and 2019 SAIDI scores

[11] SAIFI is used to measure the number of outages or interruptions per customer per year. Most electric utilities use this measurement as a tool to assess the reliability of their electrical system, excluding major outage events that cause interruptions to a significant portion of their customer base. SAIFI is calculated by adding up the number of customers experiencing a sustained outage longer than 5 minutes during the reporting period and then dividing it by the average annual number of electric customers.

[12] SAIDI measures the number of outage minutes per customer per year. Most utilities also use this measurement when reviewing the reliability of their electrical system, excluding outage events that cause interruptions to a significant portion of their customer base due to extreme weather or unusual events. SAIDI is calculated by adding up the outage minutes of all the customers that have been without power during a sustained outage longer than 5 minutes and then dividing by the average annual number of electric customers.

[13] The highest contributing outage categories to both frequency and duration of customer interruptions in 2018 and 2019 were consistent with historical interruption patterns, including primary conductor equipment failure, the presence of vegetation from outside of ELL's rights-of-way ("OROW") falling onto the Company's distribution lines, lightning, and vehicle incidents.

reflected the implementation of updated safety practices for lineman and distribution workers, which required more planned outages to be taken, and there were fewer events in those years that met the Major Event exclusion of the Commission's General Order.[14] That absence of events qualifying for the Major Event exclusion certainly illustrates that 2018 and 2019 did not have the sort of Atlantic hurricane season that we experienced in 2020 and again in 2021, but ongoing efforts to modernize the grid also minimize the impact of outages by decreasing the number of affected customers. So, although ELL continues to provide reliable service as measured by the Commission's established requirements, SAIFI and SAIDI scores should not be viewed in isolation from the challenges that ELL faces in providing reliable service or the industry transformation that is underway to modernize the distribution grid.

Q22. WHAT DO YOU MEAN BY THE TERM GRID MODERNIZATION?

A. Grid modernization refers to upgrading and redesigning distribution infrastructure while also adding new technologies and intelligent devices (*i.e.*, devices equipped with communicative capabilities) that can facilitate safe multidirectional energy flows, automate operations, enable remote control operation, increase operational efficiency, reduce outage frequency and duration, improve quality of service, increase reliability and resilience, expand options for and enhance communications with

[14] *See*, General Order (April 30, 1998), *In re: Ensuring Reliable Electric Service* §2 ("Major Event: A catastrophic event that exceeds the design limits of the electric power system, such as an extreme storm. These events shall include situations where there is a loss of service to 10% or more of the customers in a region, and where full restoration of all affected customers requires more than 24 hours from the beginning of the event.").

customers, and improve storm and outage response restoration times. Grid modernization is a fundamental change to the way electric utilities evaluate, invest in, operate, and maintain the distribution system, while monitoring and responding to the rapid pace of technological innovations and evolution of customer needs and expectations. This change involves adopting a more customer-centric strategy for designing and maintaining the distribution grid – one which seeks to minimize interruptions experienced by customers regardless of fluctuating conditions on the distribution system.

The technology and infrastructure components that comprise a modernized grid can be thought of in three broad categories: Smart Grid Infrastructure, Smart Grid Technology, and Advanced Distribution Planning.

The first category, Smart Grid Infrastructure, includes assets capable of supporting increased bidirectional power flow and which facilitate optimization of distributed energy resources ("DERs") like solar power photovoltaic and battery storage systems. Examples of Smart Grid Infrastructure assets include conductors with increased load-carrying capacity, electronic reclosers to sense and isolate issues, and smart tie switches allowing alternate energy paths.

The second category, Smart Grid Technology, represents the specialized sensors, collectors, and associated software systems that collect, analyze, and deliver information for real-time decision-making and automation. Examples of technologies in this category include: (i) Smart Grid Sensors: small communication nodes that serve as detection stations in a sensor network, which enable the remote monitoring of equipment such as transformers and power lines; (ii) Distribution Automation ("DA") Enabled Devices: distribution grid devices, such as reclosers, regulators, and capacitors, that are equipped with smart controls that enable the devices to communicate with utility software solutions and perform real-time sensing and reconfiguration of the distribution system; and (iii) Data Analytics Software: computer programs that use data from smart devices to identify portions of the distribution system reporting abnormal conditions and enable proactive engineering analyses to prevent outages in these areas by replacing equipment before it fails.

The third category, Advanced Distribution Planning, represents a transition from peak-based analysis of the system in order to leverage additional data captured from AMS and DA to perform more robust analysis during multiple time periods and under differing load conditions to ensure infrastructure upgrade projects meet future load scenarios.

Q23. PLEASE ELABORATE ON HOW THIS MORE CUSTOMER-CENTRIC STRATEGY MARKS A FUNDAMENTAL CHANGE FROM THE INDUSTRY'S TRADITIONAL APPROACH TO DISTRIBUTION ASSET MANAGEMENT.

A. Although there have certainly been exceptions over time, the electric utility industry traditionally has not replaced or reconfigured distribution assets until they reached end of life. This approach has been considered cost-effective for customers and reflects the balance that utilities must strike between reliability and cost. As I indicated above, however, the industry is evolving and modifying that approach by deploying new technology and preventative elements. In fact, ELL, like the electric utility industry in general, is in a cycle of increased capital expenditures to replace or upgrade aging distribution infrastructure to improve reliability and keep pace with, among other things, evolving technology and expanding regulatory and safety requirements. This new approach is being enabled by new technology and developed in response to increasing customer expectations for reliability enhancements aimed at preventing outages altogether (as opposed to reactive measures designed to minimize customers impacted by, and shorten the recovery time associated with, an outage). This approach requires a more modern, responsive, and resilient grid.

Q24. CAN YOU PROVIDE ANY EXAMPLES OF THE TYPES OF PROJECTS THAT ELL HAS RECENTLY UNDERTAKEN TO IMPROVE ITS DISTRIBUTION SYSTEM?

A. Yes. ELL recently constructed new substations and distribution circuits in Calcasieu, Ouachita, and Lafourche Parishes that increase the resilience of its system. In Calcasieu Parish, the Company recently invested approximately $23.8 million to construct the new Goos Ferry substation and install more than 3 miles of new distribution circuits that provide electricity from the substation to area homes and businesses in the Gillis, Moss Bluff, and North and East Lake Charles areas.

In Ouachita Parish, the Company recently constructed a new Cotton substation and installed nearly 10 miles of new distribution circuits to serve customers south of West Monroe. In addition to the Cotton substation's two transformers, several reclosers were installed to incorporate automation and create Self-Healing Networks, the details and benefits of which I describe later in my testimony. In total, the Company invested approximately $18.8 million on the Cotton substation project.

In Lafourche Parish, the Company recently invested approximately $23.6 million to construct the new Chackbay substation, including additional transformer capacity through installation of new distribution circuits. These new circuits create electrical tie points with the adjacent substations to form a mutually-supported substation group, creating operational flexibility along with provisions for an alternate source of electricity for area customers previously served in a radial configuration.

The Cotton, Goos Ferry, and Chackbay substations are designed for expandability to accommodate additional transformation and circuits as the electrical system continues to grow.

Q25. PLEASE ELABORATE ON THE COMPANY'S EFFORTS TO MAINTAIN AND IMPROVE ITS DISTRIBUTION SYSTEM.

A. ELL currently implements several programs to improve reliability and maintain infrastructure. As I noted above, many of these efforts are reactive, meaning that the actions taken are in response to devices that have failed and/or outages that have occurred, while others are preventative, meaning that the actions taken are an attempt to prevent devices from failing and/or outages from occurring. Together, these programs helped to mitigate the effects of Hurricane Ida on the Company's infrastructure, and I describe them briefly below. In fact, grid investments implemented by the EOCs avoided an estimated 24,321 customer interruptions during Hurricane Ida as a result of new reclosers and Self-Healing Networks.

<u>FOCUS Program</u>[15] – Targeted inspection based on repeated, prioritized outages. The program identifies devices (*e.g.*, breakers, reclosers, line fuses, and sectionalizers) where reliability has been adversely affected. A list of FOCUS devices is then created, prioritized by customer interruptions, and areas behind the devices are then selected to have work performed during the calendar year. The intent of the FOCUS Program is to improve the reliability performance of the selected FOCUS-identified devices; it is not a full feeder inspection. Remediation plans include replacing damaged equipment; installing animal guards and/or protective covers to mitigate outages caused by animals; shielding, installing, or relocating lightning arrestors; and addressing target vegetation issues. The FOCUS Program also addresses ELL's worst-performing distribution circuits and devices, as identified annually in accordance with Commission orders in Docket Nos. U-22389 and U-33244. The Company's FOCUS Program has led to reliability improvements. For example, using a three-year, rolling average of customer interruptions on circuits and devices that have undergone FOCUS improvements, customer interruptions have decreased. Specifically, for all FOCUS projects undertaken by ELL from 2011 through 2018, if one takes the rolling average of customer interruptions during the three-year period preceding each FOCUS project, and if one compares that to the rolling average of customer interruptions during the three-year period following each

[15] "FOCUS" stands for "Find the device, Observe the condition, Collect the damages, Understand the value, Succeed with the results."

FOCUS project, customer interruptions on those devices and circuits have been reduced, in the aggregate, by 44 percent. Moreover, our more recent FOCUS work is showing similar trends for "customer interruption" reductions, but more time is needed to determine whether those trends will continue or reach a point of diminishing returns.

Strategic Reliability Plan – Multi-part program using device reliability performance to prioritize general reliability improvement projects that focus on decreasing customer interruptions and outage durations. Programs that are part of the Strategic Reliability Plan (implemented in 2021) include:

- Repeat Devices – Projects driven by repeated historical outages that may not qualify for other reliability programs. Designed to be a quick-reacting trigger for reliability improvement work for customers that see an above-average number of outages.
- Outage Follow Up – Reliability projects driven by large Customer Interruption ("CI")[16]/Customer Minutes ("CM")[17] outages (>500 CI and >50,000 CM).
- Network Identified – General reliability work that is not triggered by device performance but is based on addressing point-specific reliability concerns before they turn into customer interruptions.
- 5 Percent Worst Performing – Reliability projects driven by an annual look-back at ELL's 5 percent poorest-performing feeders. The poorest-performing devices

[16] Customer Interruption is defined as the number of customers experiencing the outage.

[17] Customer Minutes is defined as the duration of the outage in minutes multiplied by the number of customers experiencing the outage.

on those feeders are slated for work unless previously identified as part of another program.

Distribution Automation Program – Includes identification and implementation of Self-Healing Networks (also known as automatic load transfer systems). Self-Healing Networks include a compilation of devices such as reclosers, switchgear, switches, and a network of communication devices used to automatically reconfigure the source of power after isolating an outage so that all other unaffected customers in the surrounding area are restored to improve customers' quality of service. Since 2019, ELL has installed 265 reclosers as part of the Distribution Automation Program. These reclosers have produced 63,467 avoided customer interruptions for the twelve months ending September 30, 2022. While we will need to monitor customer interruptions to determine whether these reductions will be sustained over time, these figures are an early indication that the Distribution Automation Program is producing benefits.

Sectionalization Program – Involves the placement of sectionalizing devices (pole top switches, reclosers, etc.) to improve restoration times for customers. This program is designed to fast-track installation of a DA communications system to reap the benefits of increased sectionalization in advance of full grid modernization in an area.

Feeder Level Investment Plan ("FLIP") – Identifies and addresses all reliability concerns on a complete feeder route based on historical performance and other factors.[18] It should be noted that, to date, 18 FLIP projects have been completed for ELL, with most projects having in-service dates on or after December 2021. If one compares the rolling average of customer interruptions during the two-years preceding the completion of each FLIP project to the monthly average of customer interruptions after each completion date, there is a reduction of 15,945 customer interruptions annually across the portfolio of 18 feeders, which is an approximate 51 percent reduction in customer interruptions. While we will need to monitor customer interruptions to determine whether these reductions will be sustained over time, these figures are an early indication that the FLIP work is producing benefits.

Pole Program – Consists of a visual inspection of the pole and, where appropriate, excavation or reinforcement. ELL maintains a cyclical pole inspection program that uses an outside vendor to inspect a portion of ELL's poles each year. The recommended program actions depend on the findings of the inspection and the age of the pole. Poles judged to be sound receive no further action. Those identified as needing additional attention are either treated in the field or reinforced, depending on the condition of the pole. Those that are deemed beyond treatment or reinforcement are prioritized for replacement. The Pole Program inspects approximately 10 percent of the distribution pole assets on a yearly basis. The 2022 program year is year 4 of the first ten-year cycle, which will end in 2028, at which time the program will begin the second ten-year cycle and will repeat thereafter. After the first ten-year cycle is

[18] The FLIP replaced the Company's Backbone Program in 2021. The Backbone Program was a proactive infrastructure program designed to inspect and address the portion of selected circuits from the substation breaker up to and including the first protective device that has the responsibility of isolating the remainder of the circuit.

completed in 2028, and as the second ten-year cycle proceeds, the Company expects that pole rejection rates will decrease by approximately 60 percent, as compared to the rejection rates found during the first ten-year cycle.

Equipment Maintenance Program – Includes annual inspections on reclosers, switch cabinets, capacitor banks, and voltage regulators to ensure operational performance. Inspections can result in either replacement or repair of the equipment.

Underground Residential Distribution ("URD")/Cable Program – Involves the splicing or replacement of failed primary URD cable. Replacement of failed URD cable is performed in lieu of splicing when possible to prevent future outages.

Vegetation Management Program – Consists primarily of a cycle-based proactive element, but the program also includes reactive, customer-driven, and selective herbicide components. The proactive trim cycles are examined annually and are determined by several factors, including growth rates, type and density of side and floor vegetation, vegetation-related outage information, and time since last maintenance. Identified circuits or areas are maintained using a combination of both conventional side trimming and herbicides depending on the specific application. The reactive component of the program consists of investigating potential problem areas that are identified by Company personnel and/or stakeholders and determining a remedial course of action when the potential problem involves the Company's facilities. For example, ELL seeks to address through this reactive component reports of damaged, dying, diseased, decayed, leaning, or otherwise compromised trees located outside its ROWs[19] that might endanger the Company's conductors and structures, particularly during storm events. Because those efforts seek to remove trees from private property, they require negotiations with OROW property owners. The remedial work itself involved with removing such danger trees can be considered preventative because it may avoid future damage to the distribution system (and the associated cost of repair). Table 1 below shows the number of ELL customer interruptions caused by vegetation over the past five years:

Table 1

Year	Number of ELL Customer Interruptions Caused by Vegetation
2017	265,372
2018	307,050
2019	274,486
2020	209,127
2021	173,316

As the table indicates, ELL has seen a reduction in vegetation-caused customer interruptions in 2020 and 2021. Those interruptions, however, can be caused by a number of factors, including vegetation-management funding levels, major storms that blow down trees, and weather patterns.

[19] Vegetation located outside of ELL's ROWs is referred to herein as "OROW" vegetation.

Q26. PLEASE ELABORATE ON THE STANDARDS AND PRACTICES THAT APPLY TO ELL'S VEGETATION MANAGEMENT PROGRAM.

A. There are several standards and practices that ELL observes and follows in its vegetation management program.[20] The Company and its vegetation contractors follow applicable guidelines established by the Occupational Safety and Health Administration and industry-accepted standards, including (1) American National Standards Institute ("ANSI") A300 – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning); and (2) ANSI Z133 – Pruning, Repairing, Maintaining, Removing Trees, and Cutting Brush – Safety Requirements. All utilities in Louisiana must also perform their vegetation work in accordance with the Louisiana Department of Agriculture and Forestry's Horticulture Commission Law (La. Rev. Stat. §§ 3:3801-3816) and the Horticulture Commission's Rules and Regulations. In addition, all work plans must comply with the Entergy Transmission and Utility Operations Safe Work Rules Manual.

The target distribution pruning cycle is determined for each individual circuit based on its own unique characteristics (*i.e.*, last cycle pruning, actual clearances achieved from conductor, tree growth rates, percentage of fast-growing tree species, side/floor vegetation, etc.) and historical reliability information. Target pruning cycles can range from two (2) to eight (8) years. Urban circuits, where trimming rights are often more restrictive, are on a more frequent schedule due to the more

[20] The Company filed its current vegetation management plan ("Entergy's Line Clearing Program Overview for 2021") with the Commission on September 30, 2022, pursuant to the Commission's General Order.

limited clearance that the Company is able to achieve. Unless a previous trim point allowed for greater clearance (which ELL would maintain), the Company generally trims to provide minimum below and side clearance of six (6) to fifteen (15) feet between a tree and a primary conductor and twenty (20) feet between an overhanging limb and a primary conductor. The minimum general clearance depends on the rate of tree growth (slow or fast) and location (*i.e.*, smaller ROW widths in predominantly urban areas and larger ROW widths in rural areas).

From time to time, as required, the Company will initiate a focused effort to address areas where the cycle-maintenance vegetation program may not adequately address reliability needs. For example, in early 2021, the Company inspected and identified work on several circuits that had a high number of vegetation-related outages in 2020 (including circuits located in areas that ultimately would be impacted by Hurricane Ida later in 2021). Vegetation-related work (beyond routine tree trimming) was identified and completed prior to the 2021 hurricane season on these circuits in order to improve overall reliability. As a result of this work, we saw a 75 percent reduction in customer interruptions and a 43 percent reduction in outages on those circuits from 2020 to 2021. We also performed additional danger tree removals and skyline trimming on certain targeted devices beginning in May 2021 and continued that work until Hurricane Ida made impact.

In its May 2020 filing in Commission Docket No. U-35565, noting that the increased investment that ELL was making in its distribution system would provide additional opportunities to identify and address danger trees as more work is done to modernize the grid, the Company set forth a proposal to coordinate with grid