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GOVERNMENT OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN	**CASE NO.:** NEPR-AP-2023-0004 **SUBJECT**: Motion Submitting Testimony Adoption

MOTION SUBMITTING TESTIMONY ADOPTION

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy, LLC ("ManagementCo"), and **LUMA Energy ServCo, LLC** ("ServCo"), (jointly referred to as "LUMA"), and respectfully state and request the following:

1. On October 17, 2025, LUMA filed a *Motion Submitting 2025 IRP and Request for Confidential Treatment*. Therein, LUMA submitted the 2025 IRP recommending that the Energy Bureau approve Resource Plan Hybrid A as LUMA's Preferred Resource Plan. In compliance with the May 13th Order, LUMA filed the 2025 IRP as *Exhibit 1* and the workpapers and models relied on in developing the 2025 IRP as *Exhibit 2.* In addition, LUMA submitted the direct testimonies of seven (7) LUMA witnesses in support of portions, chapters, appendices, and workpapers of the 2025 IRP as *Exhibit 3*.

2. Among the pre-filed testimonies submitted by LUMA was the pre-filed testimony of Mr. Daniel Haughton, former Planning and Renewables Integration Director for LUMA. His testimony supported the Transmission and Distribution Plan of the 2025 IRP, as well as the transmission and distribution implications of the preferred resource plan. However, Mr. Haughton is no longer a LUMA employee.

3. LUMA has designated Mr. Pedro Meléndez Meléndez, Chief Capital Programs and Grid Transformation Officer, to adopt the pre-filed testimony of Mr. Haughton. Accordingly, LUMA is submitting the corresponding adoption of the referenced pre-filed testimony. Mr. Meléndez's testimony, including his personal circumstances and attestation, is attached herein as *Exhibit 1*. To facilitate review, a redline version of the testimony is also attached as *Exhibit 2*. As shown in the markup, the substance of the testimony remains unchanged. Therefore, Mr. Meléndez's adoption of the testimony does not affect the parties or potential intervenors participating in the captioned case.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned and **determine** that the pre-filed testimony of Mr. Daniel Haughton has been substituted with the testimony of Mr. Pedro Meléndez.

WE HEREBY CERTIFY that this Motion was filed using the electronic filing system of this Energy Bureau and that electronic copies of this Motion will be notified to the Puerto Rico Electric Power Authority: Alexis Rivera, alexis.rivera@prepa.pr.gov, and through its counsel of record, Natalia Zayas Godoy, nzayas@gmlex.net, Richard Cruz Franqui, rcruzfranqui@gmlex.net, and Mirelis Valle Cancel, mvalle@gmlex.net, and Genera PR, LLC, through its attorney of record Luis R. Román Negrón, lrn@roman-negrom.com.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, on May 5, 2026.

DLA Piper (Puerto Rico) LLC
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Exhibit 1

GOVERNMENT OF PUERTO RICO
PUERTO RICO PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN	**CASE NO.:** NEPR-AP-2023-0004

Direct Testimony of

Pedro A. Meléndez-Meléndez

Chief Capital Programs & Grid Transformation Officer, LUMA Energy ServCo LLC

April 30, 2026

Summary of Prepared Direct Testimony of
PEDRO A. MELÉNDEZ-MELÉNDEZ
ON BEHALF OF
LUMA ENERGY LLC AND LUMA ENERGY SERVCO, LLC

Mr. Pedro A. Meléndez-Meléndez ("Mr. Meléndez") is Chief Capital Programs & Grid Transformation Officer at LUMA Energy ServCo, LLC. In his prepared Direct Testimony, Mr. Meléndez supports the Transmission and Distribution Plan (Appendix 1) portion of the Integrated Resource Plan, along with the Transmission and Distribution Implications of the Preferred Resource Plan.

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I. INTRODUCTION

A. Witness Identification

Q.1 Please state your name, business address, title, and employer.

A. My name is Pedro A. Meléndez Meléndez. My business address is LUMA Energy, PO Box 363508, San Juan, Puerto Rico 00936-3508. I am the Chief Capital Programs & Grid Transformation Officer for LUMA Energy LLC and LUMA Energy ServCo, LLC (together "LUMA" or "LUMA Energy").

Q.2 On whose behalf are you testifying before the Puerto Rico Energy Bureau ("Energy Bureau" or "PREB")?

A. My testimony is on behalf of LUMA as part of the Commonwealth of Puerto Rico Energy Bureau's Case No. NEPR-AP-2023-0004, *In re: Review of the Puerto Rico Electric Power Authority [("PREPA")] Integrated Resource Plan ("IRP")*.

B. Qualifications and Professional Background

Q.3 What is your educational background?

A. I completed my Bachelor of Science degree in electrical engineering, majoring in power systems, at the University of Puerto Rico-Mayagüez. I received my Master of Science degree in electrical engineering, with a major in power systems and control systems, from Wayne State University.

Q.4 What is your professional experience?

A. I have more than 20 years of experience in the electric power industry, working across the United States. Prior to joining LUMA, I served as the vice president of planning, engineering, and construction at Jacksonville Electric Authority, the municipal electric, water, and sewer utility for Jacksonville, Florida, where I had executive responsibility for the planning, engineering, and construction of billions of dollars of capital investments to maintain and improve electric, water, and wastewater services. Prior to that, I was the director of transmission and substation operations at NextEra Energy Resources, LLC, the world's leading generator of solar and wind energy. There, I provided leadership for the field and system operations for transmission and substation assets across North America, including 46 states and Canada. Before that, I served in multiple roles of increasing responsibility at ITC Holding Company, which owns and operates high-voltage transmission facilities across the Midwestern United States, including as a director of asset protection and performance. I have also served as an engineer in the system planning and engineering team at DTE Energy, the investor-owned electric utility that serves Detroit and other communities in Michigan.

Q.5 Have you previously testified in adjudicated proceedings before the Energy Bureau?

A. Yes. I have provided testimony under oath in the following adjudicated proceedings: Case No. NEPR-AP-2023-0003, *In re: Puerto Rico Electric Power Authority Rate Review*.

II. SUMMARY OF DIRECT TESTIMONY

Q.6 What is the purpose of your Direct Testimony?

A. The purpose of my testimony is to sponsor: (1) the Transmission and Distribution ("T&D") Plan, Appendix 1 ("Appendix 1"); and (2) a portion of the T&D implications of the 2025 IRP Preferred Resource Plan.

Q.7 Are you sponsoring any statements, schedules, or exhibits in conjunction with your testimony?

A. No.

Q.8 Are there any documents you relied on for your testimony that have not already been produced in this proceeding?

A. Yes, I have relied on the following documents:

1. Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy Study ("PR100 Study"), March 2024;
2. Resolution and Order on the System Stabilization Plan, March 28, 2025, filed in Docket No. NEPR-MI-2024-0005;
3. LUMA's System Remediation Plan, May 8, 2021, filed in Docket No. NEPR-MI-2020-0019; and
4. Expert Report of Synapse Energy Associates, November 23, 2016, filed in Docket No. CEPR-AP-2015-0001.

Q.9 Are any of the materials you are sponsoring confidential?

A. Yes. The map of the Puerto Rico Transmission system may contain Critical Energy Infrastructure Information ("CEII"). A public version of this map is provided. In Section 8 of the report, there are also data and results on critical contingencies and critical elements that must be kept confidential to protect the integrity of the fragile Transmission and Distribution networks.

III. TRANSMISSION AND DISTRIBUTION PLANNING

Q.10 Are there any legal requirements for LUMA to submit its IRP?

A. Yes. LUMA is required to develop its IRP in accordance with the requirements set forth in the *Regulation on Integrated Resource Plan for the Puerto Rico Electric*

Power Authority, Regulation No. 9021 of the Energy Bureau, dated April 20, 2018 ("Regulation 9021").

Q.11 What is your understanding of what Regulation 9021 mandates, as it pertains to your testimony?

A. As it pertains to T&D System Planning, Regulation 9021 mandates that LUMA describe the existing and planned electric transmission, distribution systems, and advanced grid technologies, and analyze the T&D system's stability, reliability, and compliance with applicable standards.

Q.12 What analyses must the IRP include regarding the T&D system?

A. Table 1 below sets forth a detailed breakdown of the requirements.

Table 1: Regulation 9021 – Transmission and Distribution Planning

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(a)	**Existing Transmission Facilities Descriptions - The** IRP shall include a brief narrative description of the existing electric transmission system and identify any transmission constraints and critical contingencies. The information shall include at a minimum:
Regulation 9021	2.03(J)(1)(a)(i)	A summary of the characteristics of all existing transmission and sub-transmission facilities of thirty-eight kilovolts (38 kV) or higher;
Regulation 9021	2.03(J)(1)(a)(ii)	A discussion of whether the transmission system constrains the transfer of electricity from existing projects, potential new projects, or projects under development or consideration, including a description of its ability to interconnect intermittent renewable generation projects and microgrids, as applicable, and with as much specificity as practical;
Regulation 9021	2.03(J)(1)(a)(iii)	A schematic map of the transmission and sub-transmission network showing transfer limits, which shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time; and
Regulation 9021	2.03(J)(1)(a)(iv)	A map showing the actual, physical routing of the transmission and sub-transmission, geographic landmarks, major metropolitan areas, and the location of substations and generating plants, and interconnections with distribution substations. The IRP shall include two copies of this map on a 1:250,000 scale. Such map shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(b)	**Existing Distribution Facilities Description -** The IRP shall include a brief narrative description of the distribution system, including description of its ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and its ability to receive new loads overtime, such as, for example, increasing penetrations of electric vehicles. In addition, the IRP shall provide PREPA's current distribution system design criteria. Information of PREPA's current distribution system shall include:
Regulation 9021	2.03(J)(1)(b)(i)	Load flow or other system analysis by voltage class of the electric utility's distribution system performance that identifies and considers each of the following:

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(b)(i)(A)	Any thermal overloading of distribution circuits and equipment.
Regulation 9021	2.03(J)(1)(b)(i)(B)	Any voltage variations on distribution circuits that do not comply with the current version of the American National Standard Institute ("ANSI") Standard C 84.1, Electric Power Systems and Equipment Voltage Ratings or Standard as later amended.
Regulation 9021	2.03(J)(1)(b)(i)(C)	[The utility] shall identify any portion of this analysis that it deems Confidential Energy Infrastructure Information. The Commission will handle it in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(b)(ii)	Adequacy of the electric utility distribution system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(c)	**Existing Advanced Grid Technologies Description** - The IRP shall identify the areas within the service territory where advanced meters and other advanced grid technologies have been installed, along with any plans to expand the integration of any such technologies into its system. The IRP shall include a brief description of the installed advanced grid technologies.
Regulation 9021	2.03(J)(1)(d)	**Planned Transmission Facilities Description** - The IRP shall provide a detailed narrative description of any planned electric transmission and sub-transmission, and a description of the plans for development of facilities during the next ten years of the Planning Period. The description shall include, at a minimum, all information regarding:
Regulation 9021	2.03(J)(1)(d)(i)	New lines, including any requirements of new rights-of-way;
Regulation 9021	2.03(J)(1)(d)(ii)	Lines in which changes in capacity, either in terms of current, voltage or both, are scheduled to take place; and
Regulation 9021	2.03(J)(1)(d)(iii)	Other changes in transmission lines or rights-of-way, which would be considered as substantial additions.
Regulation 9021	2.03(J)(1)(d)(iv)	A listing of all proposed substations including size and location;
Regulation 9021	2.03(J)(1)(d)(v)	The transmission forecast shall include maps of the planned transmission system as follows: A. A map showing the planned transmission lines, substation, and generating plants as they will tie into the existing system to provide as complete a picture of the system as is possible.
Regulation 9021	2.03(J)(1)(d)(vi)	[The utility] shall submit a justification of its transmission development plans, including: A. Description and transcription diagrams of the base case load flow studies, one for the current year and one as projected five and ten years into the future, and provide base case load flow studies in a standard industry format (such as PSS/E or PSLF) along with transcription diagrams for the base cases. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(d)(vii)	A tabulation of and transcription diagrams for a representative number of contingency cases studied along with brief statements concerning the results.
Regulation 9021	2.03(J)(1)(d)(viii)	Adequacy of [the utility's] transmission system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(d)(ix)	A high-level analysis of [the utility's] transmission system's ability to permit power interchange with microgrids and other independent power producers. [The utility] should provide examples of interconnection studies from recent renewable integration projects.
Regulation 9021	2.03(J)(1)(d)(x)	A diagram showing [the utility's] import and export transfer capabilities and identifying the limiting element(s) during each season of the next ten years. In addition, [the utility] will provide a listing of transmission loading relief (TLR) procedures called during the last two seasons for which actual data are available. For each TLR event, the listing shall include the maximum level, and the duration at the maximum level, and the magnitude (in MW) of the power curtailments.;
Regulation 9021	2.03(J)(1)(d)(xi)	A description of any studies regarding transmission system improvement, including, but not limited to, any studies of the potential for reducing line losses, thermal loading, and low voltage, and for improving access to alternative energy resources.

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(d)(xii)	A one-line diagram of the transmission network. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(e)	**Planned Distribution Facilities Description -** The IRP shall provide a detailed narrative description of any planned changes in approach, standard practice, or broadly applicable substation, circuit, or feeder design for [the utility's] distribution system for the next ten years. This description shall address any changes in distribution facilities that impact the ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and the ability to receive new loads over time. [The utility] shall submit a substantiation of distribution development plans, including, if available:
Regulation 9021	2.03(J)(1)(e)(i)	Load flow or other system analysis by voltage class of the electric utility's distribution system performance that identifies and considers each of the following: A. Any thermal overloading of distribution circuits and equipment. B. Any voltage variations on distribution circuits that do not comply with the current version of the American National Standard Institute ("ANSI") Standard C 84.1, Electric Power Systems and Equipment Voltage Ratings or Standard as later amended.
Regulation 9021	2.03(J)(1)(e)(ii)	Adequacy of the electric utility distribution system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(e)(iii)	Analysis and consideration of any studies regarding distribution system improvement, including, but not limited to, any studies of the potential for reducing line losses, thermal loading and low voltage or any other problems, and for improving access to alternative resources.
Regulation 9021	2.03(J)(2)(a)	**Transmission and Distribution System Analysis -** The IRP shall identify [the utility's] transmission standards and shall confirm that the [the utility's] transmission standards are in compliance with the standards of the North American Electric Reliability Corporation. If any of [the utility's] transmission standards are inconsistent with standards from the North American Electric Reliability Corporation, then [the utility] shall identify each such inconsistent standard and provide the explanation and rationale for the inconsistency.
Regulation 9021	2.03(J)(2)(b)	The IRP shall include a System Stability Analysis, which shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI- 2016-0009 as currently amended and may be amended from time to time. The analysis shall provide operational criteria, define Ancillary Services requirements, and demonstrate least-cost mitigation solutions to maintain system stability;
Regulation 9021	2.03(J)(2)(c)	The IRP shall identify thermal and voltage reliability issues in [the utility's] transmission system and distribution systems. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time;
Regulation 9021	2.03(J)(2)(d)	The IRP shall identify transmission, distribution, and substation potential improvements to increase reliability and meet minimum transmission standards;
Regulation 9021	2.03(J)(2)(e)	The IRP shall document the transmission and distribution implications of the Preferred Resource Plan, including assessing if the plan requires incremental transmission or distribution mitigation or changes.

Q.13 Please briefly explain the difference between LUMA's transmission and distribution systems.

A. The transmission system is the critical backbone of higher voltage towers, lines, and substations that connect major generation resources to denser urban load centers. The distribution system, by contrast, is an expansive network of over 340 distribution substation transformers and over 1,100 distribution circuits that directly serve customer loads, feed new load requests, and integrate distributed generation that connects to customer rooftops.

Q.14 Please summarize LUMA's methodology for planning the transmission and distribution systems.

A. The strategic objectives driving LUMA include: system stabilization, updating end-of-life assets, reliability improvement, generation and renewable integration, and resilience hardening. Investment priorities are defined after completing thorough assessments that include asset and field condition verification; operational experiences; transmission planning analysis and studies; studies in support of customer load requests; and studies supporting generation and renewable projects.

LUMA's methodology for planning the transmission system includes first stabilizing the system by restoring critical out-of-service facilities, then addressing critical performance deficiencies through reconfiguration and redesign, and finally optimizing the grid's performance by rebuilding and hardening critical assets. These factors must all be accounted for when integrating new customer loads, and new generation projects, which are growing rapidly across the system. The system must be planned to achieve essential reliability performance based on NERC Transmission Planning criteria (TPL-001-5) and related reliability standards; for example, loss of a single transmission line, substation breaker, transformer or busbar (known as N minus 1 or "N-1") should not result in consequential load loss.

The distribution system planning methodology, in order of emphasis for distribution circuits, includes: (i) focus on restoration of critical out-of-configuration circuits, circuit breakers at substations, and substation transformers; (ii) focus on worst-performing reliability circuits and distribution automation device deployments to improve customer experience and reliability; and (iii) rebuilding and hardening of circuit backbones and selected branches to address reliability deficiencies.

Substations that supply distribution circuits are also a major focus including rebuilding of existing substations that are in poor physical condition and those with a history of operational deficiencies, and mitigating flood risk with barriers, elevation or relocation of substation assets as practicable. Also, at individual substations, LUMA focuses on reinforcing and upgrading existing system infrastructure to improve reliability, including replacing aging transformers, oil circuit breakers, distribution circuit breakers, other high-voltage equipment, and other systems as necessary to improve asset performance, system reliability, and safety.

IV. <u>THE EXISTING TRANSMISSION AND DISTRIBUTION SYSTEM</u>

Q.15 Please describe the state of the T&D system when LUMA assumed operational responsibility.

A. The T&D System was operated and maintained exclusively by PREPA prior to LUMA's commencement of operations on June 1, 2021. By all accounts, LUMA inherited a T&D System that was significantly deteriorated, in bankruptcy, and being operated in a manner inconsistent with Prudent Utility Practices, i.e., operational indicators, such as reliability metrics, price, wait times, and billing accuracy, indicated that PREPA was not performing at the same level as its comparable utilities. The T&D System was fragile, having suffered decades of neglect.

The Puerto Rico Legislature included findings on the dire state of the T&D System when it enacted both Act 120-2018, which allowed the process to select a private operator for the T&D System and laid the groundwork for the transformation of Puerto Rico's electric power system, and Act 17-2019. For example, in enacting Act 120-2018, the legislature stated that "[p]ractically no infrastructure maintenance was performed during the past decade." The Puerto Rico legislature also stated that Puerto Rico's electric power generation and distribution systems were deficient and obsolete. The 2017 Rate Order[1] and the 2020 Fiscal Plan also acknowledged PREPA's chronic underinvestment in the system. Specifically, the 2017 Rate Order notes that PREPA's infrastructure spending was not based on actual system needs.[2] The 2020 Fiscal Plan stated that, "in recent years, capital investments in the T&D System were limited to the most urgent projects to avoid imminent system failure rather than to proactively improve the grid for the future."[3]

Though these conditions were known, and therefore, not entirely unanticipated, the severity of the deterioration and consequent challenges that LUMA still faces cannot be overstated. A 2016 Study commissioned by the Energy Bureau in PREPA's last rate case, which was conducted by Synapse Energy Economics, Inc. ("Synapse T&D Study") found that the T&D System was "falling apart quite literally"[4] due, in part, to capital constraints and an inability to replace and construct lines. Lack of funds forced

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[1] Resolution and Order dated January 10, 2017, as amended in reconsideration in Case No. CEPR-AP-2015-0001 ("2017 Rate Order").

[2] *See* 2017 Rate Order, at p. 3.

[3] *See* 2020 Fiscal Plan for the Puerto Rico Electric Power Authority as Certified by the FOMB on June 29, 2020 ("2020 Fiscal Plan"), at p. 14, available at https://docs.pr.gov/files/AAFAF/Financial_Documents/Fiscal%20Plans/CERTIFIED%20FISCAL%20PLANS/2020-PREPA-Fiscal-Plan-as-Certified-by-FOMB-on-June-29-2020.pdf.

[4] Synapse Report at 18, *see also* at 12, 26, *available at* https://energia.pr.gov/wp-content/uploads/sites/7/2016/11/Expert-Report-Revenue-Requirements-Fisher-and-Horowitz-Revised-20161123.pdf.

PREPA to play "a catch-up game on maintenance – following outages, instead of improving the fundamental system."[5]

During the Front-End Transition Period ("FET"),[6] LUMA conducted a system-wide gap assessment and identified over 1,000 gaps.[7] To address these conditions, LUMA developed the System Remediation Plan (SRP) that provides and appropriately transitions toward Prudent Utility Practice and compliance with T&D OMA provisions. The gap assessment spanned the entire T&D System, including physical infrastructure, operational procedures and protocols, supporting infrastructure and information systems, and administrative practices (including employee training and certifications).

These legislative findings, the findings of the Energy Bureau, LUMA's FET evaluation and independent studies, reflect a consistent theme: the decades-long degradation of Puerto Rico's energy system is predominantly driven by a well-documented historical lack of investment in the grid, resulting from both poor planning and insufficient funding.

Q.16 What has LUMA done since assuming operational responsibility to improve the T&D system?

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[5] *Id.* at 33.

[6] The FET was the period of time from and including the Effective Date (that is, June 22, 2020) and until Commencement Date (this period, the "Front-End Transition Period") as defined by the Puerto Rico Transmission and Distribution System Operations and Maintenance Agreement and the Supplemental Agreement ("T&D OMA") executed among PREPA, the Puerto Rico Public Private Partnership Authority, and LUMA dated June 22, 2020. During the FET, LUMA was required to provide "Front-End Transition Services" to ensure an orderly transition of the responsibility for the management, operation, maintenance, repairs, restoration and replacement of the T&D System, without disrupting customer service and business continuity. The Front-End Transition Services were included in the T&D OMA to complete the transition and handover to LUMA of the operation, management and other rights and responsibilities with respect to the T&D System.

[7] *See* System Remediation Plan at p. 1, *available at* https://energia.pr.gov/wp-content/uploads/sites/7/2021/05/Motion-in-Compliance-with-Order-Submitting-Revised-Redacted-Version-of-SRP-and-Redacted-Attachments-to-Responses-to-RIs-NEPR-MI-2020-0019.pdf.

A. In compliance with Section 4.1(d)(ii) of the T&D OMA, LUMA developed a System Remediation Plan ("SRP"). At the highest level, the SRP provides a roadmap for the transition from a state in which utility assets and activities are not in compliance with Contract Standards and Prudent Utility Practices, to one where the minimum conditions are met to achieve the vision of providing safe and reliable electric service to customers. The SRP was approved by the Energy Bureau in Case No. NEPR-MI-2020-2019.[8]

Since the approval of the SRP, LUMA has implemented multiple programs to improve the T&D System, resulting in tremendous progress across all facets of Puerto Rico's electric grid. Examples include:

- **Strengthened the energy system against storms and hurricanes**: by replacing more than 32,400 utility poles with new stronger poles able to withstand winds of +160 mph.
- **Reduced the size and the impact of outages:** by installing over 10,500 grid automation devices, which have served to avoid over 460 million service interruption minutes for our customers;
- **Addressed the largest cause of outages:** by clearing vegetation from over 6,491 miles of powerlines and electric infrastructure;
- **Improved community safety and energy efficiency:** by replacing over 84,000 streetlights as part of LUMA's Community Streetlight Initiative;

[8] Case No.: NEPR-MI-2020-0019, Determination on LUMA's Proposed System Remediation Plan, Resolution & Order of June 23, 2021.

- **Enabled the adoption of Distributed Solar Photovoltaics ("DPV"):** by connecting over 175,000 customers to rooftop solar, representing 1,282 MW of clean, renewable energy for Puerto Rico, along with a recorded 153,000 Battery Energy Storage Systems representing 850 MW and 2,600 MWh of energy storage capacity, and;
- **Improved reliability during generation shortfalls:** by launching the Customer Battery Energy Sharing ("CBES") initiative to aggregate customer home batteries to provide system support during known generation shortfall events. By October 2025, CBES had over 80,000 participants reliably providing up to 65 MW of response over 4-hour events during the summer of 2025.

V. Existing Transmission System

Q.17 Please describe the existing transmission system.

A. Puerto Rico's electric transmission system includes approximately 424 miles of 230kV, 711 miles of 115kV and 1,563 miles of 38kV transmission lines and 299 substation sites spread across eight transmission planning zones spanning the Island.

Q.18 Please summarize the transmission constraints and critical contingencies on the existing system.

A. The detailed technical analysis used to evaluate the performance of the transmission network identified 26 critical contingencies that lead to significant thermal overloads for loss of a single element, and another 17 critical contingencies that lead to significant voltage violations across areas of the Puerto Rico grid. These thermal and voltage issues are so significant that they can lead to area-wide disturbances or have historically caused cascading failures that can impact large regions of the island.

Examples include a single 115/38kV transformer tripping, multiple elements overloaded by up to 190% of rated capacity, potentially triggering cascading failures in other lines and transformers.

Q.19 Has LUMA conducted a system analysis to assess the adequacy of the existing transmission system to withstand natural disasters and overload conditions?

A. LUMA has conducted physical assessments of field assets to identify those at risk of not withstanding high winds during natural disasters. Note that a detailed engineering 'Pole Loading Analysis' would be required to calculate a structure's probability to withstand specified wind speeds; however, visual inspections only identified the at-risk assets that would be highly likely to fail in high winds. LUMA has also conducted an assessment that included extensive load-flow simulations, including 982 N-1 and 77,006 N-1-1 contingencies. These simulations evaluated the transmission system's performance under various operational scenarios and identified potential vulnerabilities. The contingencies consider a broad listing of equipment types, including transmission line segments, substation transformers, generators, buses, breakers, and other equipment. The guidance in LUMA's Transmission Planning Criteria document is derived directly from the North American Reliability Corporation ("NERC") Transmission Planning (TPL 001-05) active standard for transmission planning entities.

VI. Existing Distribution System

Q.20 Please describe the existing distribution facilities.

A. Puerto Rico's electric distribution system includes 342 distribution substations that supply loads to 1,127 distribution circuits (also referred to as feeders). The source of the substation is fed from either 115 or 38 kV transmission, and the load side of substations and feeders are energized at one of five primary voltage levels: 13.2 kV, 8.32 kV, 7.2 kV, 4.8 kV or 4.16 kV. LUMA manages six operational regions across Puerto Rico: Arecibo, Bayamón, Caguas, Mayaguez, Ponce and San Juan. Section 5.1 of Appendix 1 describes of the existing distribution system.

Q.21 Please summarize the existing distribution system's ability to accommodate incremental penetration of distributed generation and its ability to receive new loads over time.

A. LUMA has worked to incorporate and mitigate the impact of distributed energy resources ("DERs") on Puerto Rico's system through both corrective action and forward-looking strategies. On one hand, LUMA continues to identify required upgrades, such as service transformers, voltage regulators and thermal capacity improvements. On the other hand, a proactive approach is being implemented through the adoption of Smart Inverter Settings, aligned with Institute of Electrical and Electronics Engineers (IEEE) -1547 standard. These settings were developed through robust stakeholder engagement, informed by operational data and system simulations and are designed to improve grid stability and reliability.

However, LUMA is quickly approaching the physical and technical limits of the distribution system to accommodate incremental distributed generation. Without significant intervention, the distribution grid will collapse under the current pace of interconnections. This means that LUMA will be unable to manage system voltage, control thermal loads, and ensure the safety and reliability of the distribution circuit infrastructure.

The safety aspect of this condition is significant. The presence of customer-owned generation throughout the distribution system means de-energized conditions can no longer be assumed during outages or maintenance activities, as DERs could potentially continue to provide power to isolated portions of the system. This situation places service personnel— and even customers at an increased level of risk due to unexpected energization and limits LUMA's ability to verify that these areas are free from all energy sources prior to performing repairs. As penetration rises, so does the operational complexity of managing these conditions safely.

Q.22 Has LUMA conducted a system analysis to assess the adequacy of the existing distribution system to withstand natural disasters and overload conditions?

A. Yes. The analysis reveals that portions of the network are well equipped to withstand natural disasters (e.g., those with underground or covered conductors and rebuilt infrastructure). However, it also reveals that a large portion of the network is very exposed to natural disasters. The analysis also reveals that a significant number of circuits and circuit sections are experiencing thermal overloads and require rebuilding to accommodate existing and planned future growth.

VII. Advanced Grid Technologies

Q.23 Please describe the current state of advanced grid technologies employed on the existing T&D system.

A. LUMA is in the process of advancing its grid modernization efforts by deploying automated switchgear, fault sensors, and advanced monitoring technologies across its distribution and transmission systems to enhance reliability and resilience. The program includes the installation of three-phase and single-phase smart reclosers with microprocessor-based controllers, enabling remote monitoring and control via Supervisory Control and Data Acquisition ("SCADA"), as well as the deployment of communicating Fault Circuit Indicators ("FCIs") to improve fault location accuracy and expedite service restoration. The initiative also involves upgrading outdated protection devices and implementing feeder automation schemes that allow for automatic isolation and restoration of feeder segments, thereby minimizing outages. Additionally, LUMA is integrating advanced sensor technologies such as Phasor Measurement Units ("PMUs") to provide high-speed, synchronized data for real-time system monitoring, event analysis, and support for renewable energy integration. These technologies are being deployed in substations, on feeders, and as part of microgrid projects in Vieques and Culebra, where they will enhance situational awareness, power quality monitoring, and operational flexibility. Collectively, these efforts are designed to create a more reliable, efficient, and future-ready electric grid for Puerto Rico.

Q.24 Does LUMA have plans to expand the integration of advanced grid technologies?

A. Yes. As of September 2025, LUMA has installed a total of 308 three-phase reclosers and 674 single-phase reclosers under its distribution automation initiative, impacting 156 distribution feeders. LUMA has plans to deploy over 13,000 single-phase reclosers and over 3,000three-phase reclosers by FY2035. Additionally, LUMA has already installed thousands of FCIs and plans to continue expanding this deployment through 2029, with optimal device placement determined by reliability studies.

Q.25 Are there any other conclusions you would like to draw from the existing T&D System?

A. Yes. Puerto Rico is at a critical juncture where the policies, laws and regulations that impact the integration of distributed renewable energy systems must be updated to reflect the pace and volume of existing conditions, and to allow for the hardening of the grid to accommodate these installations before future installations are deployed. LUMA stands ready to support accelerated deployment of customer owned resources, but the balanced approach must include: (a.) enabling customer technologies and leveraging their capabilities like smart inverter settings, (b.) protecting the grid from physical damage so safety and reliability are available to all customers, and (c.) ensuring costs are equitably assigned to protect the affordability of both technology adopters and non-participants alike.

VIII. PLANNED TRANSMISSION AND DISTRIBUTION FACILITIES

Q.26 Please describe the electric transmission and sub-transmission facilities planned to be installed during the 2025 IRP planning period.

The electric transmission and sub-transmission facilities in LUMA infrastructure plans during the 2025 IRP planning period can be divided into two categories: (1) those that were developed prior to commencement of the 2025 IRP; and (2) those that arise from the selection of the Preferred Resource Plan. With respect to the first category, Appendix 1 outlines LUMA's comprehensive five-year strategy to enhance Puerto Rico's transmission and sub-transmission infrastructure, driven by: (a.)

System Stabilization efforts to restore out-of-service transmission and substation infrastructure, and (b.) findings from the 2025 Transmission Planning Assessment. The assessment identified a range of projects to address reliability, resilience, and the integration of renewable energy, including the construction of new transmission lines, reconductoring to increase the capacity of existing lines, restoring additional facilities to service, rebuilding and reconfiguring substations, and adding and restoring out-of-service transformers.

Extensive load flow simulations and contingency analyses (N-1 and N-1-1) were conducted to identify system vulnerabilities and thermal or voltage violations across various operational scenarios, including natural disasters and peak loading conditions. Key planned transmission line rebuild projects are listed in Section 4.3.4. which are anticipated to utilize FEMA funding. Additionally, \$89.6-\$129M have been requested in an ongoing Rate Case Filing for the next three fiscal years to address the thermal overloads and voltage violations needing immediate mitigation. No new substations were proposed as a result of the 2025 Transmission Planning assessment.

With respect to the second category of planned transmission projects to support the Preferred Resource Plan, these will be identified concurrent with LUMA's PSS®E analysis, which was filed with the Energy Bureau on November 21, 2025.

Q.27 Please describe the planned changes in approach, practice, and design of the distribution system over the 2025 IRP planning period.

A. As with LUMA's proposed changes to the transmission system, the changes to the distribution system fall into two categories: (1) those planned before release of the 2025 IRP; and (2) those needed as a result of the Preferred Resource Plan selected in the 2025 IRP. With respect to the first category, the planned changes span substation and feeder rebuilds, automation, reliability upgrades, and targeted infrastructure improvements, as detailed below:

- <u>Substation Rebuilds and Upgrades:</u> The Substation Rebuild program focuses on the rebuilding of existing substations that are in poor physical condition, the rebuilding of substations with a history of operational deficiencies, the mitigation of flood risk where applicable, and the relocation of substations with a high risk of flooding when flood mitigation alone is not an option.
- <u>Substation Reliability:</u> This program will reinforce and upgrade existing system infrastructure to improve reliability, including replacing aging transformers, oil circuit breakers, distribution circuit breakers, other high-voltage equipment, alternating current/direct current (AC/DC) systems, standby generators, relays, remote terminal units, and auxiliary systems. It will also include protection and control upgrades and procurement of emergency spares.
- <u>Distribution Line Rebuilds:</u> The Distribution Line Rebuild program focuses on rebuilding distribution feeders with poor reliability performance and those that serve critical power facilities, targeting the worst-performing feeders first. This program will result in significant short-term improvements and incremental improvements over the remainder of the program.
- <u>Distribution Pole and Conductor Repair:</u> This program focuses on minimizing safety hazards caused by distribution poles, equipment, and conductors that require repair or replacement. Major repairs and replacements will be based on the results of assessments of the distribution system and on an analysis by engineers to schedule repair or replacements based on the structure's criticality.

Following this process, safety hazards and priority poles will be replaced, along with damaged equipment, conductors, and hardware.

- Distribution Automation: This program involves deploying automated switchgear and fault sensors on distribution feeders to improve grid reliability. It will take place as part of LUMA's efforts to enhance system performance through remote operations, fault detection, and faster service restoration, utilizing advanced communication tools and system analysis.

- Distribution Grid Reliability: This program focuses on reducing outages, improving response times, and ensuring the delivery of safe and reliable electricity to customers. Assessing the worst performing feeders, targeting localized reliability concerns, and performing reliability system upgrades, such as integrating FCIs and fuse coordination are the three main drivers of this program.

LUMA did not conduct a distribution-system analysis for the PRP because DPV and EV charging installations are driven entirely by customer choice and therefore cannot be forecast with the location- specific detail required for a meaningful assessment. The distribution system is already nearing technical limits due to increasing distributed generation. Given the absence of necessary data and the impracticality of performing a detailed analysis without knowing resource locations, LUMA has requested a waiver of the requirement to complete the distribution analysis.

IX. TRANSMISSION AND DISTRIBUTION SYSTEM ANALYSIS

Q.28 Please describe the transmission system standards LUMA adheres to.

A. LUMA's transmission system standards are covered in two documents – (i.) Transmission Planning Criteria and (ii.) LUMA Transmission Design Criteria and Manual. The Transmission Planning Criteria document is derived from the NERC reliability standards and incorporates best practices from other Regional Reliability Organizations. The Transmission Design Criteria document provides the physical and structural requirements for designs to meet or exceed current American Society of Civil Engineers ("ASCE") and Institute of Electrical and Electronics Engineers ("IEEE") codes and standards, including wind loading and other parameters such as ground and structural clearances. These two together ensure that transmission network performance meets essential reliability and applicable codes and standards.

Q.29 Is the transmission system that LUMA inherited in compliance with those standards?

A. No. As discussed previously, transmission planning criteria is not met, as 26 critical contingencies produce thermal violations and 17 critical contingencies produce widespread voltage violations. Also, present transmission design criteria were not the standard in place when most transmission facilities were constructed, so poles, structures, and associated infrastructure do not meet current codes and standards. For example, Act 17 - 2019 requires wind loading of 155 mph, but very few transmission structures are designed or built to this existing requirement.

Q.30 Did LUMA conduct a system stability analysis of the T&D system?

A. Yes. The discussion and results of the System Stability Analysis are located in Section 7.0 of Appendix 1.

Q.31 What thermal and voltage reliability issues were identified in the T&D systems?

A. For the "as operated" transmission system, 26 critical contingencies cause major overloads on neighboring transmission facilities, with overloads greater than 190% of a line rating in some cases. These cause cascading overloads on other facilities resulting in regional or island-wide instability and outages. Additionally, another 17 critical contingencies cause major voltage disturbances that can impact regions or lead to island-wide instability and outages. Due to the sensitive nature of these facilities, LUMA requests that these critical contingencies be treated as CEII. Transmission analysis concludes that the Puerto Rico grid is not in compliance with NERC Transmission Planning standards for system performance.

Distribution substation analysis discussed in Section 5.3.1 identified 25 distribution substations at a loading of 90% of the transformer's maximum thermal loading or higher. When including already requested new business customers, an additional 22 transformers would exceed 90% or more of the transformer's maximum thermal loading or higher. This means that significant increases in transformer capacity or new distribution substations will be required over the 3-year and 10-year investment planning horizons.

Distribution circuit analysis discussed in Section 5.3.1 identified approximately 304 of 1,127 circuits with notable voltage violations, especially due to night-time and evening peaks in hot summer months, and 164 circuits with thermal overloads.

Q.32 Are there specific issues on the distribution system with respect to DER integration? .

A. Yes, it was also found that DER and the bi-directional flows during daytime, and during lightly loaded shoulder months contribute to violations in 660 feeders, split into 285 voltage issues, and 638 thermal issues including service transformer overloads and primary circuit conductors in neighborhoods across the island. Note, the timeframe of study for DER and PV injection impacts (light load, often in February – April) and mid-day load and generation levels means that these violations are mostly unique from the evening peak thermal and voltage violations that occur when PV is not producing, and demand is high, especially in the summer months (June – October). Beyond their impact on system performance metrics, sustained thermal overload and persistent voltage excursions of this nature carry direct safety consequences that go beyond ordinary grid reliability concerns. Most critical is the risk of unintentional islanding. This is a condition where portions of the distribution system remain energized by customer-owned DERs even after being electrically isolated from the main system. Although current interconnection regulations include anti-islanding requirements, the sheer volume and geographic density of DERs across the system has significantly increased the complexity of verifying de-energized conditions in the field. The decentralized and uncontrolled nature of interconnection severely limits LUMA's ability to have full visibility for control or isolation of all potential sources of energy in a given work area, placing crews, emergency responders and even customers at risk of encountering feeders (or lines) that appear to be deenergized, but remain live due to DER injection. At the same time, the proliferation of inverter-based resources, such as DERs, is reducing conventional short-circuit levels, distorting conventional protection schemes and increasing the potential for missed fault detection. These conditions reinforce the urgency of prudent regulatory revisions that explicitly address these challenges and impact safety and reliability.

Q. 33 What potential transmission, distribution, and substation improvements are planned to increase reliability and meet minimum standards?

A. As discussed above, LUMA's investment strategy is driven by strategic pillars of system stabilization and asset replacements to improve public and worker safety and equipment and community support, reliability and resilience improvements to address the worst reliability impacts first and harden the grid against resilience threats, while supporting regulatory and community objectives of driving deep decarbonization and supporting distributed energy integration. The activities in the System Stabilization plan include, but are not limited to, restoring out of service transmission lines, and substation transformers, deploying grid automation devices and enabling technologies such as information technology and telecommunications investments, including substation relays and remote terminal units. These will have the near-term impact of improving reliability, but facilities such as transmission lines will not be upgraded to withstand higher wind speeds (as only necessary structural installations necessary to return the lines to service are being implemented).

LUMA also has requested funding in an active Rate Case (NEPR-AP-2023-0003) to begin addressing high priority capacity constrained transmission and distribution circuit thermal and voltage violations, as well as emergent safety and reliability risks due to DERs.

X. TRANSMISSION & DISTRIBUTION IMPLICATIONS OF THE PREFERRED RESOURCE PLAN

Q.34 What is your understanding of the requirements for the portion of the T&D System Planning section of the 2025 IRP that you are sponsoring?

A. With respect to the T&D System section of the 2025 IRP Report, LUMA followed the requirements set forth in Section 2.03(J)(2)(e) of Regulation 9021. This section requires the 2025 IRP to document the T&D implications of the PRP, including an assessment of whether the PRP requires incremental T&D mitigation or changes.

Q.35 Did LUMA receive any clarifications regarding the Energy Bureau's expectation for LUMA's 2025 IRP fulfilling the T&D requirements in Regulation 9021?

A. Yes. On April 15, 2024, the Energy Bureau issued a Resolution and Order in this case, granting a portion of LUMA's request for a waiver of certain specific requirements in Regulation 9021 and denying LUMA's request for waivers to other requirements. In addition, in this R&O, the Energy Bureau clarified that: LUMA cannot provide information it does not have.

Q.36 What portion of the T&D system analysis of the implications of the PRP does your testimony address?

A. As noted above, my testimony addresses the existing state of the T&D system, which was used as input into the analysis of the PRP's impacts on the transmission system (addressed by LUMA witness Ajit Kulkarni). My testimony also addresses the analysis of the PRP implications on the distribution system.

Q.37 What analysis did LUMA perform to assess the implications of the PRP on the distribution system?

A. LUMA did not complete a comprehensive analysis of the implications of the PRP on the distribution system. The inclusion of distributed photovoltaic (DPV) and electric vehicle (EV) charging installations in the PRP reflects forecasts of customer choices for these installations, which are not under LUMA's control and are driven solely by customer choice. Therefore, the location and quantity of the distributed resources are outside LUMA's planned resource deployment and must be addressed reactively in accordance with current laws and regulations.

LUMA has developed recommended smart-inverter settings whose adoption is imperative to improve near-term distribution circuit voltage performance under normal conditions and to support transmission grid stability by enabling inverters to respond to grid frequency and grid voltage disturbances; however, these recommended settings require PREB action to implement. LUMA re-iterates again, that the system is already quickly approaching the physical and technical limit of the distribution system to accommodate incremental distributed generation (evidenced by the prevalence of DG related high voltages, distribution transformer and circuit thermal overloads being identified, and volume of repairs and upgrades that are being newly driven by DPV). These items will need to be considered in any implementation plan to execute the improvements needed for a reliable grid that meets minimum industry requirements.

Given the impossibility of performing a detailed distribution system analysis of the PRP without knowing where on the system the resources may be placed, and the waivers and clarifications granted by the Energy Bureau in its R&O of April 15, 2024, which recognized and waived LUMA's ability to comply with Regulation 9021 when it did not possess the required data, LUMA has requested the Energy

Bureau to waive the requirement of completing the distribution analysis of the PRP.

Q.38 Does this conclude your direct testimony?

A. Yes.

ATTESTATION

Affiant, Pedro A. Meléndez-Meléndez, being first duly sworn, states the following:

The prepared Direct Testimony that I am sponsoring constitutes my Direct Testimony in the above-styled case before the Puerto Rico Energy Bureau. I would provide the answers set forth in the Direct Testimony if asked the questions included in the Direct Testimony. I further state that the facts and statements provided herein are my Direct Testimony and, to the best of my knowledge, are true and correct.

Pedro A. Meléndez-Meléndez

Affidavit No. -34-

Acknowledged and subscribed before me by Pedro A. Meléndez-Meléndez, in his capacity as Chief Capital Programs & Grid Transformation Officer at LUMA Energy ServCo, LLC, of legal age, married, and resident of San Juan, Puerto Rico, who is personally known to me.

In San Juan, Puerto Rico, this 30th day of April 2026.

Lcda. Ashley E. Carrillo Marcano
Abogada - Notario

Notary Public

Exhibit 2

GOVERNMENT OF PUERTO RICO
PUERTO RICO PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE:

REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY INTEGRATED RESOURCE PLAN

CASE NO.: NEPR-AP-2023-0004

Direct Testimony of

~~Daniel Haughton~~

~~Planning and Renewables Integration Director~~Pedro A. Meléndez-Meléndez

Chief Capital Programs & Grid Transformation Officer, LUMA Energy ServCo LLC

~~October 15, 2025 (Revised on November 20, 2025, to include Transmission and Distribution Implications of the Preferred Resource Plan)~~

April ___, 2026

Summary of Prepared Direct Testimony of
~~**DANIEL HAUGHTON**~~
PEDRO A. MELÉNDEZ-MELÉNDEZ
ON BEHALF OF
LUMA ENERGY LLC AND LUMA ENERGY SERVCO, LLC

~~Dr. Daniel Haughton ("Dr. Haughton~~Mr. Pedro A. Meléndez-Meléndez ("Mr. Meléndez") is ~~Planning and Renewables Integration Director~~Chief Capital Programs & Grid Transformation Officer at LUMA Energy ServCo, LLC. In his prepared Direct Testimony, ~~Dr. Haughton~~Mr. Meléndez supports the Transmission and Distribution Plan (Appendix 1) portion of the Integrated Resource Plan, along with the Transmission and Distribution Implications of the Preferred Resource Plan.

Table of Contents

I. INTRODUCTION

A. Witness Identification

Q.1 Please state your name, business address, title, and employer.

A. My name is ~~Daniel Haughton.~~Pedro A. Meléndez Meléndez. My business address is LUMA Energy, PO Box 363508, San Juan, Puerto Rico 00936-3508. I am the ~~Director for Transmission and Distribution Planning~~Chief Capital Programs & Grid Transformation Officer for LUMA Energy LLC and LUMA Energy ServCo, LLC (together “LUMA” or “LUMA Energy”).

Q.2 On whose behalf are you testifying before the Puerto Rico Energy Bureau (“Energy Bureau” or “PREB”)?

A. My testimony is on behalf of LUMA as part of the Commonwealth of Puerto Rico Energy Bureau’s Case No. NEPR-AP-2023-0004, *In re: Review of the Puerto Rico Electric Power Authority [(“PREPA”)] Integrated Resource Plan (“IRP”)*.

B. Qualifications and Professional Background

Q.3 What is your educational background?

~~A. I earned a Bachelor's Degree in Electrical Engineering with a concentration in Electric Power Systems from the University of South Florida in 2006 and a Master’s Degree in Electrical Engineering with a concentration in Electric Power Systems from Arizona State University in 2009. Additionally, I earned a Doctor of Philosophy in Electrical Engineering with a concentration in Electric Power Systems from Arizona State University in 2012, with research focused on modeling and simulation, as well as state estimation of Transmission and Distribution systems with high penetration of distributed renewable energy systems.~~

A. I completed my Bachelor of Science degree in electrical engineering, majoring in power systems, at the University of Puerto Rico-Mayagüez. I received my Master of Science degree in electrical engineering, with a major in power systems and control systems, from Wayne State University.

Q.4 What is your professional experience?

~~A. I have professional, technical, and industry experience in the electric utility industry in various technical, engineering, and leadership roles across transmission, distribution, and large industrial facilities. I spent 11 years at Arizona Public Service ("APS"), an investor-owned utility in Phoenix, Arizona. There, I served as Director of Technical Engineering Support (2022), Director of Customer to Grid Solutions (2021), Manager of Distribution Planning and Engineering (2018), and Manager of Distributed Energy Resource Engineering (2016). Prior to these roles, I held various technical positions at APS encompassing Transmission Planning and Transmission Operations support, including obtaining a Reliability Coordinator ("RC") certification from the North American Electric Reliability Corporation ("NERC") for three years.~~

~~Prior to APS, I worked at Intel Corporation in both Rio Rancho, New Mexico and Chandler, Arizona, as a facilities engineer. I also worked at California Independent System Operator ("CAISO") in Folsom, California, and at Tampa Electric in the Electric Distribution Engineering business. In addition, I have been an adjunct faculty member at Arizona State University, teaching graduate and undergraduate level Electrical Engineering courses since 2014.~~

A. I have more than 20 years of experience in the electric power industry, working across the United States. Prior to joining LUMA, I served as the vice president of planning, engineering, and construction at Jacksonville Electric Authority, the municipal electric, water, and sewer utility for Jacksonville, Florida, where I had executive responsibility for the planning, engineering, and construction of billions of dollars of capital investments to maintain and improve electric, water, and wastewater services. Prior to that, I was the director of transmission and substation operations at NextEra Energy Resources, LLC, the world's leading generator of solar and wind energy. There, I provided leadership for the field and system operations for transmission and substation assets across North America, including 46 states and Canada. Before that, I served in multiple roles of increasing responsibility at ITC Holding Company, which owns and operates high-voltage transmission facilities across the Midwestern United States, including as a director of asset protection and performance. I have also served as an engineer in the system planning and engineering team at DTE Energy, the investor-owned electric utility that serves Detroit and other communities in Michigan.

Q.5 Have you previously testified in adjudicated proceedings before the Energy Bureau?

~~A. No.~~

A. Yes. I have provided testimony under oath in the following adjudicated proceedings: Case No. NEPR-AP-2023-0003, *In re: Puerto Rico Electric Power Authority Rate Review.*

II. SUMMARY OF DIRECT TESTIMONY

Q.6 What is the purpose of your Direct Testimony?

A. The purpose of my testimony is to sponsor: (1) the Transmission and Distribution ("T&D") Plan, Appendix 1 ("Appendix 1"); and (2) a portion of the T&D implications of the 2025 IRP Preferred Resource Plan.

Q.7 Are you sponsoring any statements, schedules, or exhibits in conjunction with your testimony?

A. No.

Q.8 Are there any documents you relied on for your testimony that have not already been produced in this proceeding?

A. Yes, I have relied on the following documents:

1. Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy Study ("PR100 Study"), March 2024;
2. Resolution and Order on the System Stabilization Plan, March 28, 2025, filed in Docket No. NEPR-MI-2024-0005;
3. LUMA's System Remediation Plan, May 8, 2021, filed in Docket No. NEPR-MI-2020-0019; and
4. Expert Report of Synapse Energy Associates, November 23, 2016, filed in Docket No. CEPR-AP-2015-0001.

Q.9 Are any of the materials you are sponsoring confidential?

~~A.~~ A. Yes. The map of the Puerto Rico Transmission system may contain Critical Energy Infrastructure Information ("CEII"). A public version of this map is provided.

In Section 8 of the report, there are also data and results on critical contingencies and critical elements that must be kept confidential to protect the integrity of the fragile Transmission and Distribution networks.

~~IV.~~III. TRANSMISSION AND DISTRIBUTION PLANNING

Q.10 Are there any legal requirements for LUMA to submit its IRP?

A. Yes. LUMA is required to develop its IRP in accordance with the requirements set forth in the *Regulation on Integrated Resource Plan for the Puerto Rico Electric Power Authority*, Regulation No. 9021 of the Energy Bureau, dated April 20, 2018 ("Regulation 9021").

Q.11 What is your understanding of what Regulation 9021 mandates, as it pertains to your testimony~~??~~?

A. As it pertains to T&D System Planning, Regulation 9021 mandates that LUMA describe the existing and planned electric transmission, distribution systems, and advanced grid technologies, and analyze the T&D system's stability, reliability, and compliance with applicable standards.

Q.12 What analyses must the IRP include regarding the T&D system?

A. Table 1 below sets forth a detailed breakdown of the requirements.

Table 1: Regulation 9021 – Transmission and Distribution Planning

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(a)	**Existing Transmission Facilities Descriptions - The** IRP shall include a brief narrative description of the existing electric transmission system and identify any transmission constraints and critical contingencies. The information shall include at a minimum:
Regulation 9021	2.03(J)(1)(a)(i)	A summary of the characteristics of all existing transmission and sub-transmission facilities of thirty-eight kilovolts (38 kV) or higher;
Regulation 9021	2.03(J)(1)(a)(ii)	A discussion of whether the transmission system constrains the transfer of electricity from existing projects, potential new projects, or projects under development or consideration, including a description of its ability to interconnect intermittent renewable generation projects and microgrids, as applicable, and with as much specificity as practical;
Regulation 9021	2.03(J)(1)(a)(iii)	A schematic map of the transmission and sub-transmission network showing transfer limits, which shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time; and
Regulation 9021	2.03(J)(1)(a)(iv)	A map showing the actual, physical routing of the transmission and sub-transmission, geographic landmarks, major metropolitan areas, and the location of substations and generating plants, and interconnections with distribution substations. The IRP shall include two copies of this map on a 1:250,000 scale. Such map shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(b)	**Existing Distribution Facilities Description** - The IRP shall include a brief narrative description of the distribution system, including description of its ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and its ability to receive new loads overtime, such as, for example, increasing penetrations of electric vehicles. In addition, the IRP shall provide PREPA's current distribution system design criteria. Information of PREPA's current distribution system shall include:
Regulation 9021	2.03(J)(1)(b)(i)	Load flow or other system analysis by voltage class of the electric utility's distribution system performance that identifies and considers each of the following:
Regulation 9021	2.03(J)(1)(b)(i)(A)	Any thermal overloading of distribution circuits and equipment.
Regulation 9021	2.03(J)(1)(b)(i)(B)	Any voltage variations on distribution circuits that do not comply with the current version of the American National Standard Institute ("ANSI") Standard C 84.1, Electric Power Systems and Equipment Voltage Ratings or Standard as later amended.
Regulation 9021	2.03(J)(1)(b)(i)(C)	[The utility] shall identify any portion of this analysis that it deems Confidential Energy Infrastructure Information. The Commission will handle it in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(b)(ii)	Adequacy of the electric utility distribution system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(c)	**Existing Advanced Grid Technologies Description** - The IRP shall identify the areas within the service territory where advanced meters and other advanced grid technologies have been installed, along with any plans to expand the integration of any such technologies into its system. The IRP shall include a brief description of the installed advanced grid technologies.
Regulation 9021	2.03(J)(1)(d)	**Planned Transmission Facilities Description** - The IRP shall provide a detailed narrative description of any planned electric transmission and sub-transmission, and a description of the plans for development of facilities during the next ten years of the Planning Period. The description shall include, at a minimum, all information regarding:
Regulation 9021	2.03(J)(1)(d)(i)	New lines, including any requirements of new rights-of-way;
Regulation 9021	2.03(J)(1)(d)(ii)	Lines in which changes in capacity, either in terms of current, voltage or both, are scheduled to take place; and
Regulation 9021	2.03(J)(1)(d)(iii)	Other changes in transmission lines or rights-of-way, which would be considered as substantial additions.
Regulation 9021	2.03(J)(1)(d)(iv)	A listing of all proposed substations including size and location;
Regulation 9021	2.03(J)(1)(d)(v)	The transmission forecast shall include maps of the planned transmission system as follows: A. A map showing the planned transmission lines, substation, and generating plants as they will tie into the existing system to provide as complete a picture of the system as is possible.
Regulation 9021	2.03(J)(1)(d)(vi)	[The utility] shall submit a justification of its transmission development plans, including: A. Description and transcription diagrams of the base case load flow studies, one for the current year and one as projected five and ten years into the future, and provide base case load flow studies in a standard industry format (such as PSS/E or PSLF) along with transcription diagrams for the base cases. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(d)(vii)	A tabulation of and transcription diagrams for a representative number of contingency cases studied along with brief statements concerning the results.
Regulation 9021	2.03(J)(1)(d)(viii)	Adequacy of [the utility's] transmission system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(d)(ix)	A high-level analysis of [the utility's] transmission system's ability to permit power interchange with microgrids and other independent power producers. [The utility] should provide examples of interconnection studies from recent renewable integration projects.

Code	Subsection	Description
Regulation 9021	2.03(J)(1)(d)(x)	A diagram showing [the utility's] import and export transfer capabilities and identifying the limiting element(s) during each season of the next ten years. In addition, [the utility] will provide a listing of transmission loading relief (TLR) procedures called during the last two seasons for which actual data are available. For each TLR event, the listing shall include the maximum level, and the duration at the maximum level, and the magnitude (in MW) of the power curtailments.;
Regulation 9021	2.03(J)(1)(d)(xi)	A description of any studies regarding transmission system improvement, including, but not limited to, any studies of the potential for reducing line losses, thermal loading, and low voltage, and for improving access to alternative energy resources.
Regulation 9021	2.03(J)(1)(d)(xii)	A one-line diagram of the transmission network. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time.
Regulation 9021	2.03(J)(1)(e)	**Planned Distribution Facilities Description -** The IRP shall provide a detailed narrative description of any planned changes in approach, standard practice, or broadly applicable substation, circuit, or feeder design for [the utility's] distribution system for the next ten years. This description shall address any changes in distribution facilities that impact the ability to accommodate incremental penetration of distributed generation, including intermittent distributed generation, and the ability to receive new loads over time. [The utility] shall submit a substantiation of distribution development plans, including, if available:
Regulation 9021	2.03(J)(1)(e)(i)	Load flow or other system analysis by voltage class of the electric utility's distribution system performance that identifies and considers each of the following: A. Any thermal overloading of distribution circuits and equipment. B. Any voltage variations on distribution circuits that do not comply with the current version of the American National Standard Institute ("ANSI") Standard C 84.1, Electric Power Systems and Equipment Voltage Ratings or Standard as later amended.
Regulation 9021	2.03(J)(1)(e)(ii)	Adequacy of the electric utility distribution system to withstand natural disasters and overload conditions.
Regulation 9021	2.03(J)(1)(e)(iii)	Analysis and consideration of any studies regarding distribution system improvement, including, but not limited to, any studies of the potential for reducing line losses, thermal loading and low voltage or any other problems, and for improving access to alternative resources.
Regulation 9021	2.03(J)(2)(a)	**Transmission and Distribution System Analysis** - The IRP shall identify [the utility's] transmission standards and shall confirm that the [the utility's] transmission standards are in compliance with the standards of the North American Electric Reliability Corporation. If any of [the utility's] transmission standards are inconsistent with standards from the North American Electric Reliability Corporation, then [the utility] shall identify each such inconsistent standard and provide the explanation and rationale for the inconsistency.
Regulation 9021	2.03(J)(2)(b)	The IRP shall include a System Stability Analysis, which shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI- 2016-0009 as currently amended and may be amended from time to time. The analysis shall provide operational criteria, define Ancillary Services requirements, and demonstrate least-cost mitigation solutions to maintain system stability;
Regulation 9021	2.03(J)(2)(c)	The IRP shall identify thermal and voltage reliability issues in [the utility's] transmission system and distribution systems. Such information shall be treated as Critical Energy Infrastructure Information and handled in accordance with the procedures set forth in CEPR-MI-2016-0009 as currently amended and may be amended from time to time;
Regulation 9021	2.03(J)(2)(d)	The IRP shall identify transmission, distribution, and substation potential improvements to increase reliability and meet minimum transmission standards;
Regulation 9021	2.03(J)(2)(e)	The IRP shall document the transmission and distribution implications of the Preferred Resource Plan, including assessing if the plan requires incremental transmission or distribution mitigation or changes.

Q.13 Please briefly explain the difference between LUMA's transmission and distribution systems.

A. The transmission system is the critical backbone of higher voltage towers, lines, and substations that connect major generation resources to denser urban load centers. The distribution system, by contrast, is an expansive network of over 340 distribution substation transformers and over 1,100 distribution circuits that directly serve customer loads, feed new load requests, and integrate distributed generation that connects to customer rooftops.

Q.14 Please summarize LUMA's methodology for planning the transmission and distribution systems.

A. The strategic objectives driving LUMA include: system stabilization, updating end-of-life assets, reliability improvement, generation and renewable integration, and resilience hardening. Investment priorities are defined after completing thorough assessments that include~~:~~ asset and field condition verification; operational experiences; transmission planning analysis and studies; studies in support of customer load requests; and studies ~~in support of~~supporting generation and renewable projects.

LUMA's methodology for planning the transmission system includes first stabilizing the system by restoring critical out-of-service facilities~~ to service~~, then addressing critical performance deficiencies through reconfiguration and redesign, and finally optimizing the grid's performance by rebuilding and hardening critical assets. These factors must all ~~account~~be accounted for when integrating ~~both~~ new customer loads, and ~~renewable energy, as well as~~ new generation projects, which are growing rapidly across the system. The system must be planned to achieve essential reliability performance based on NERC Transmission Planning criteria (TPL-001-5) and related reliability standards; for example, loss of a single transmission line, substation breaker, transformer or busbar (known as N minus 1 or “N-1”) should not result in consequential load loss.

The distribution system planning methodology, in order of emphasis for distribution circuits, includes: (i) focus on restoration of critical out-of-configuration circuits, circuit breakers at substations, and substation transformers; (ii) focus on worst-performing reliability circuits and distribution automation device deployments to improve customer experience and reliability; and (iii) rebuilding and hardening of circuit backbones and selected branches to address reliability deficiencies.

Substations that supply distribution circuits are also a major focus including rebuilding of existing substations that are in poor physical condition and those with a history of operational deficiencies~~;~~, and mitigating flood risk with barriers, elevation or relocation of substation assets as practicable. ~~-~~Also, ~~in~~at individual substations, LUMA focuses on reinforcing and upgrading existing system infrastructure to improve reliability, including replacing aging transformers, oil circuit breakers, distribution circuit breakers, other high-voltage equipment, and other systems as necessary to improve asset performance, system reliability, and safety.

~~V.~~IV. THE EXISTING TRANSMISSION AND DISTRIBUTION SYSTEM

Q.15 Please describe the state of the T&D system when LUMA assumed operational responsibility.

A. The T&D System was operated and maintained exclusively by PREPA prior to LUMA’s commencement of operations on June 1, 2021. By all accounts, LUMA inherited a T&D System that was significantly deteriorated, in bankruptcy, and being operated in a manner inconsistent with Prudent Utility Practices;, i.e., operational indicators, such as reliability metrics, price, wait times, and billing accuracy, indicated that PREPA was not performing at the same level as its comparable utilities. The T&D System was fragile, having suffered decades of neglect.

The Puerto Rico Legislature included findings on the dire state of the T&D System when it enacted both Act 120-2018, which allowed the process to select a private operator for the T&D System and laid the groundwork for the transformation of Puerto Rico's electric power system, and Act 17-2019. For example, in enacting Act 120-2018, the legislature stated that "[p]ractically no infrastructure maintenance was performed during the past decade." The Puerto Rico legislature also stated that Puerto Rico's electric power generation and distribution systems were deficient and obsolete.

The 2017 Rate Order[1] and the 2020 Fiscal Plan also acknowledged PREPA's chronic underinvestment in the system. Specifically, the 2017 Rate Order notes that PREPA's infrastructure spending was not based on actual system needs.[2] The 2020 Fiscal Plan stated that, "in recent years, capital investments in the T&D System were limited to the most urgent projects to avoid imminent system failure rather than to proactively improve the grid for the future."[3]

Though these conditions were known, and therefore, not entirely unanticipated, the severity of the deterioration and consequent challenges that LUMA

[1] Resolution and Order dated January 10, 2017, as amended in reconsideration in Case No. CEPRAPCEPR-AP-2015-0001 ("2017 Rate Order").

[2] *See* 2017 Rate Order, at p. 3.

[3] *See* 2020 Fiscal Plan for the Puerto Rico Electric Power Authority as Certified by the FOMB on June 29, 2020 ("2020 Fiscal Plan"), at p. 14, available at https://docs.pr.gov/files/AAFAF/Financial_Documents/Fiscal%20Plans/CERTIFIED%20FISCAL%20PLANS/2020-PREPA-Fiscal-Plan-as-Certified-by-FOMB-on-June-29-2020.pdf.

still faces cannot be overstated. A 2016 Study commissioned by the Energy Bureau in PREPA's last rate case, which was conducted by Synapse Energy Economics, Inc. ("Synapse T&D Study") found that the T&D System was "falling apart quite literally"[4] due, in part, to capital constraints and an inability to replace and construct lines. Lack of funds forced PREPA to play "a catch-up game on maintenance – following outages, instead of improving the fundamental system."[5]

During the Front-End Transition Period ("FET"),[6] LUMA conducted a system-wide gap assessment and identified over 1,000 gaps.[7] Over 600 initiatives were identified toTo address those "gaps" (i.e., these conditions, LUMA developed the difference between the state of the T&D System, work practices, procedures, Remediation Plan (SRP) that provides and processes at the time of the FET compared toappropriately transitions toward Prudent Utility Practice, applicable codes and standards, and thecompliance with T&D OMA).[8] provisions. The gap assessment spanned the entire T&D System, including physical infrastructure, operational

[4] Synapse Report at 18, *see also* at 12, 26, *available at* https://energia.pr.gov/wp-content/uploads/sites/7/2016/11/Expert-Report-Revenue-Requirements-Fisher-and-Horowitz-Revised-20161123.pdf.

[5] *Id.* at 33.

[6] The FET was the period of time from and including the Effective Date (that is, June 22, 2020) and until Commencement Date (this period, the "Front-End Transition Period") as defined by the Puerto Rico Transmission and Distribution System Operations and Maintenance Agreement and the Supplemental Agreement ("T&D OMA") executed among PREPA, the Puerto Rico Public Private Partnership Authority, and LUMA dated June 22, 2020. During the FET, LUMA was required to provide "Front-End Transition Services" to ensure an orderly transition of the responsibility for the management, operation, maintenance, repairs, restoration and replacement of the T&D System, without disruption ofdisrupting customer service and business continuity. The Front-End Transition Services waswere included in the T&D OMA to complete the transition and handover to LUMA of the operation, management and other rights and responsibilities with respect to the T&D System.

[7] *See* System Remediation Plan at p. 1, *available at* https://energia.pr.gov/wp-content/uploads/sites/7/2021/05/Motion-in-Compliance-with-Order-Submitting-Revised-Redacted-Version-of-SRP-and-Redacted-Attachments-to-Responses-to-RIs-NEPR-MI-2020-0019.pdf.

[8] *Id.*

procedures and protocols, supporting infrastructure and information systems, and administrative practices (including employee training and certifications).

These legislative findings, the findings of the Energy Bureau, LUMA's FET evaluation and independent studies, reflect a consistent theme: the decades-long degradation of Puerto Rico's energy system is predominantly driven by a well-documented historical lack of investment in the grid, resulting from both poor planning and insufficient funding.

Q.16 What has LUMA done since assuming operational responsibility to improve the T&D system?

A. In compliance with Section 4.1(d)(ii) of the T&D OMA, LUMA developed a System Remediation Plan ("SRP"). At the highest level, the SRP provides a roadmap for the transition from a state in which utility assets and activities are not in compliance with Contract Standards and Prudent Utility Practices, to one where the minimum conditions are met to achieve the vision of providing safe and reliable electric service to customers. The SRP was approved by the Energy Bureau in Case No. NEPR-MI-2020-2019.[9]

Since the approval of the SRP, LUMA has implemented multiple programs ~~that focus on improving~~to improve the T&D System, ~~which have resulted~~resulting in tremendous progress across all facets of Puerto Rico's electric grid. Examples include:

[9] Case No.: NEPR-MI-2020-0019, Determination on LUMA's Proposed System Remediation Plan, Resolution & Order of June 23, 2021.

- **Strengthened the energy system against storms and hurricanes**: by replacing more than 32,400 utility poles with new stronger poles able to withstand winds of ±160 mph.

- **Reduced the size and the impact of outages:** by installing over 10,500 grid automation devices, which have served to avoid over 460 million service interruption minutes for our customers;

- **Addressed the largest cause of outages:** by clearing vegetation from over 6,491 miles of powerlines and electric infrastructure;

- **Improved community safety and energy efficiency:** by replacing over 84,000 streetlights as part of LUMA's Community Streetlight Initiative;

- **Enabled the adoption of Distributed Solar Photovoltaics ("DPV"):** by connecting over 175,000 customers to rooftop solar, representing 1,282 MW of clean, renewable energy for Puerto Rico, along with a recorded 153,000 Battery Energy Storage Systems representing 850 MW and 2,600 MWh of energy storage capacity, and;

- **Improved reliability during generation shortfalls:** by launching the Customer Battery Energy Sharing ("CBES") initiative to aggregate customer home batteries to provide system support during known generation shortfall events. By October 2025, CBES had over 80,000 participants reliably providing up to 65 MW of response over 4-hour events during the summer of 2025.

V. Existing Transmission System

Q.17 Please describe the existing transmission system.

A. Puerto Rico's electric transmission system includes approximately 424 miles of 230kV, 711 miles of 115kV and 1,563 miles of 38kV transmission lines and 299 substation sites spread across eight transmission planning zones spanning the Island.

Q.18 Please summarize the transmission constraints and critical contingencies on the existing system.

A. The detailed technical analysis used to evaluate the performance of the transmission network identified 26 critical contingencies that lead to significant thermal overloads for loss of a single element, and another 17 critical contingencies that lead to significant voltage violations across areas of the Puerto Rico grid. ~~ ~~These thermal and voltage issues are so significant that they can lead to area-wide disturbances~~,~~ or have ~~been shown~~ historically ~~to cause~~caused cascading failures that can impact large regions of the island. Examples include ~~for~~ a single 115/38kV transformer tripping, multiple elements ~~overload~~overloaded by ~~as much as~~up to 190% of rated capacity, potentially triggering cascading failures ~~of~~in other lines and transformers.

Q.19 Has LUMA conducted a system analysis to assess the adequacy of the existing transmission system to withstand natural disasters and overload conditions?

A. ~~Yes.~~ LUMA has conducted physical assessments of field assets to ~~determine~~identify those at risk ~~which likely would~~of not ~~withstand~~withstanding high winds ~~in~~during natural disasters. Note that a detailed engineering 'Pole Loading Analysis' would be required to calculate a structure's probability to withstand specified wind speeds; however, visual inspections only identified the at-risk assets that would be highly likely to fail in high winds. ~~ ~~LUMA has also conducted an assessment ~~involving~~that included extensive load~~-~~ flow simulations, including 982 N-1 and 77,006 N-1-1 contingencies. These simulations evaluated the transmission system's performance under various operational scenarios and identified potential vulnerabilities. The contingencies consider a broad listing of equipment ~~type~~types, including transmission line segments, substation transformers, generators, buses, breakers, and other equipment. The guidance in LUMA's Transmission Planning Criteria document ~~are~~is derived directly from the North American Reliability Corporation ("NERC") Transmission Planning (TPL 001-05) active standard for transmission planning entities.

~~B.~~ VI. Existing Distribution System

Q.20 Please describe the existing distribution facilities.

A. Puerto Rico's electric distribution system includes 342 distribution substations that supply loads to 1,127 distribution circuits (also referred to as feeders). ~~-~~The source of the substation is fed from either 115 or ~~38kV~~38 kV transmission, and the load side of substations and feeders are energized at one of five primary voltage levels: 13.2 kV, 8.32 kV, 7.2 kV, 4.8 kV or 4.16 kV. LUMA manages six operational regions across Puerto Rico: Arecibo, Bayamón, Caguas, Mayaguez, Ponce and San Juan. Section 5.1 of Appendix 1 ~~provides a description~~describes of the existing distribution system.

Q.21 Please summarize the existing distribution system's ability to accommodate incremental penetration of distributed generation and its ability to receive new loads over time.

A. LUMA has worked to incorporate and mitigate the impact of distributed energy resources ("DERs") on Puerto Rico's system through both corrective action and forward-looking strategies. On one hand, LUMA continues to identify required upgrades, such as service transformers, voltage regulators and thermal capacity improvements. On the other hand, a proactive approach is being implemented through the adoption of Smart Inverter Settings, aligned with Institute of Electrical and Electronics Engineers (IEEE~~-2018.~~) -1547 standard. These settings were developed through robust stakeholder engagement~~ and were~~, informed by operational data and system simulations~~,~~ and are designed to improve grid stability and reliability. However, LUMA is quickly approaching the physical and technical ~~limit~~limits of the distribution system to accommodate incremental distributed generation.~~–~~ Without significant intervention, the distribution grid will collapse under the current pace of interconnections. This means that LUMA will be unable to manage system voltage, control thermal loads, and ensure the safety and reliability of the distribution circuit infrastructure.

The safety aspect of this condition is significant. The presence of customer-owned generation throughout the distribution system means de-energized conditions can no longer be assumed during outages or maintenance activities, as DERs could potentially continue to provide power to isolated portions of the system. This situation places service personnel— and even customers at an increased level of risk due to unexpected energization and limits LUMA's ability to verify that these areas are free from all energy sources prior to performing repairs. As penetration rises, so does the operational complexity of managing these conditions safely.

Q.22 Has LUMA conducted a system analysis to assess the adequacy of the existing distribution system to withstand natural disasters and overload conditions?

A. Yes. The analysis reveals that portions of the network are well equipped to withstand natural disasters (e.g., those with underground or covered conductors and rebuilt infrastructure). However, it also reveals that a large portion of the network is very exposed to natural disasters. The analysis also reveals that a significant number of circuits and circuit sections are experiencing thermal overloads and ~~need to be rebuilt~~require rebuilding to accommodate existing and planned future growth.

~~C.~~ VII. Advanced Grid Technologies

Q.23 Please describe the current state of advanced grid technologies employed on the existing T&D system.

A. LUMA is in the process of advancing its grid modernization efforts by deploying automated switchgear, fault sensors, and advanced monitoring technologies across its distribution and transmission systems to enhance reliability and resilience. The program includes the installation of three-phase and single-phase smart reclosers with microprocessor-based controllers, enabling remote monitoring and control via Supervisory Control and Data Acquisition ("SCADA"), as well as the deployment of communicating Fault Circuit Indicators ("FCIs") to improve fault location accuracy and ~~speed up~~expedite service restoration. The initiative also involves upgrading outdated protection devices and implementing feeder automation schemes that allow for automatic isolation and restoration of feeder segments, thereby minimizing outages. Additionally, LUMA is integrating advanced sensor technologies such as Phasor Measurement Units ("PMUs") to provide high-speed, synchronized data for real-time system monitoring, event analysis, and support for renewable energy integration. These technologies are being deployed in substations, on feeders, and as part of microgrid projects in Vieques and Culebra, where they will enhance situational awareness, power quality monitoring, and operational flexibility. Collectively, these efforts are designed to create a more reliable, efficient, and future-ready electric grid for Puerto Rico.

Q.24 Does LUMA have plans to expand the integration of advanced grid technologies?

A. Yes. As of September 2025, LUMA has ~~already~~ installed a total of 308 three-phase reclosers and 674 single-phase reclosers under its distribution automation initiative, impacting 156 distribution feeders. LUMA has plans to deploy over 13~~ thousand~~,000 single-phase reclosers and over 3~~ thousand three~~,000three-phase reclosers by FY2035. Additionally, LUMA has already installed thousands of FCIs and plans to continue expanding this deployment through 2029, with optimal device placement determined by reliability studies.

Q.25 Are there any other conclusions you would like to draw from the existing T&D System?

A. Yes. Puerto Rico is at a critical juncture where the ~~policy~~policies, laws and regulations ~~impacting~~that impact the integration of distributed renewable energy systems must be updated to reflect the pace and volume of existing conditions, and to allow for the hardening of the grid to accommodate these installations before future installations are deployed. LUMA stands ready to support accelerated deployment of customer owned resources, but the balanced approach must include: (a.) enabling customer technologies and leveraging their capabilities like smart inverter settings, (b.) protecting the grid from physical damage so safety and reliability are available to all customers, and (c.) ensuring costs are equitably assigned to protect the affordability of both technology adopters and non-participants alike.

~~VI.~~VIII. PLANNED TRANSMISSION AND DISTRIBUTION FACILITIES

~~Q.26~~ Q.26 Please describe the electric transmission and sub-transmission facilities planned to be installed during the 2025 IRP planning period.

~~A.~~ The electric transmission and sub-transmission facilities in LUMA infrastructure plans during the 2025 IRP planning period can be divided into two categories: (1) those that were developed prior to commencement of the 2025 IRP; and (2) those that arise from the selection of the Preferred Resource Plan.

With respect to the first category, Appendix 1 outlines LUMA's comprehensive five-year strategy to enhance Puerto Rico's transmission and sub-transmission infrastructure, driven by: (a.) System Stabilization efforts to restore out-of-service transmission and substation infrastructure, and (b.) findings from the 2025 Transmission Planning Assessment. The assessment identified a range of projects to address reliability, resilience, and the integration of renewable energy, including the construction of new transmission lines, reconductoring to increase the capacity of existing lines, restoring additional facilities to service, rebuilding and reconfiguring substations, and adding and restoring out-of-service transformers.

Extensive load flow simulations and contingency analyses (N-1 and N-1-1) were conducted to ~~pinpoint~~identify system vulnerabilities and thermal or voltage violations ~~under~~across various operational scenarios, including natural disasters and peak loading conditions. Key planned transmission line rebuild projects are listed in Section 4.3.4., which are anticipated to utilize FEMA funding. Additionally, $89.6-$129M have been requested in an ongoing Rate Case Filing for the next three fiscal years to address the thermal overloads and voltage violations needing immediate mitigation. No new substations were proposed as a result of the 2025 Transmission Planning assessment.

With respect to the second category of planned transmission projects to support the Preferred Resource Plan, these will be identified concurrent with LUMA's PSS®E analysis, which ~~will be~~was filed with the Energy Bureau on November 21, 2025.

Q.27 Please describe the planned changes in approach, practice, and design of the distribution system over the 2025 IRP planning period.

A. As with LUMA's proposed changes to the transmission system, the changes to the distribution system fall into two categories: (1) those planned before release of the 2025 IRP; and (2) those needed as a result of the Preferred Resource Plan selected in the 2025 IRP. With respect to the first category, the planned changes span substation and feeder rebuilds, automation, reliability upgrades, and targeted infrastructure improvements, as detailed below:

- Substation Rebuilds and Upgrades: The Substation Rebuild program focuses on the rebuilding of existing substations that are in poor physical condition, the rebuilding of substations with a history of operational deficiencies, the mitigation of flood risk where applicable, and the relocation of substations with a high risk of flooding when flood mitigation alone is not an option.

- Substation Reliability: This program will reinforce and upgrade existing system infrastructure to improve reliability, including replacing aging transformers, oil circuit breakers, distribution circuit breakers, other high-voltage equipment, alternating current/direct current (AC/DC) systems, standby generators, relays, remote terminal units, and auxiliary systems. It will also include protection and control upgrades and procurement of emergency spares.

- Distribution Line Rebuilds: The Distribution Line Rebuild program focuses on rebuilding distribution feeders with poor reliability performance and those that serve critical power facilities, targeting the worst-performing feeders first. This program will result in significant ~~system~~short-term improvements ~~in the short term~~ and incremental improvements ~~for~~over the remainder of the ~~remaining~~ program~~ duration~~.

- Distribution Pole and Conductor Repair: This program focuses on minimizing ~~the~~ safety hazards caused by distribution poles, equipment, and conductors that ~~must be repaired~~require repair or ~~replaced~~replacement. Major repairs and ~~replacement~~replacements will be based ~~upon~~on the results of assessments of the distribution system and on an analysis by engineers to schedule ~~the~~ repair or ~~replacement~~replacements based on the ~~structure~~structure's criticality. Following this process, safety hazards and priority poles will be replaced, along with damaged equipment, conductors, and hardware.

- Distribution Automation: This program involves deploying automated switchgear and fault sensors on distribution feeders to improve grid reliability. It will take place as part of LUMA's efforts to enhance system performance through remote operations, fault detection, and faster service restoration, utilizing advanced communication tools and system analysis.

- Distribution Grid Reliability: This program focuses on reducing outages, improving response times, and ensuring the delivery of safe and reliable electricity to customers. Assessing the worst performing feeders, targeting localized reliability concerns, and performing reliability system upgrades, such as integrating FCIs and fuse coordination are the three main drivers of this program.

~~Distribution Streetlighting: This program deals with upgrading and replacing distribution streetlights that are a physical and safety hazards scheduled for repair or replacement based on their criticality. Along with increasing the number of distribution streetlights in service, this process will include light-emitting diode ("LED") replacements and geographic information system ("GIS") data entry of all streetlights.~~

~~The second category of planned distribution changes will be identified concurrent with LUMA's PSSE analysis, which will be filed with the Energy Bureau on November 21, 2025.~~

LUMA did not conduct a distribution-system analysis for the PRP because DPV and EV charging installations are driven entirely by customer choice and therefore cannot be forecast with the location- specific detail required for a meaningful assessment. The distribution system is already nearing technical limits due to increasing distributed generation. Given the absence of necessary data and the impracticality of performing a detailed analysis without knowing resource locations, LUMA has requested a waiver of the requirement to complete the distribution analysis.

~~VII.~~IX. TRANSMISSION AND DISTRIBUTION SYSTEM ANALYSIS

Q.28 Please describe the transmission system standards LUMA adheres to.

A. LUMA's transmission system standards are covered in two documents – (i.) Transmission Planning Criteria and (ii.) LUMA Transmission Design Criteria and Manual. The Transmission Planning Criteria document is derived from the NERC reliability standards and incorporates best practices from other Regional Reliability Organizations. The Transmission Design Criteria document provides the physical and structural requirements for designs to meet or exceed current American Society of Civil Engineers ("ASCE") and Institute of Electrical and Electronics Engineers ("IEEE") codes and standards, ~~which include~~including wind loading and other parameters such as ground and ~~structure~~structural clearances. These two together ensure that transmission network performance meets essential reliability and applicable codes and standards.

Q.29 Is the transmission system that LUMA inherited in compliance with those standards?

A. No. As discussed previously, transmission planning criteria is not met, as 26 critical contingencies produce thermal violations and 17 critical contingencies produce widespread voltage violations.~~ ~~ Also, present transmission design criteria ~~was~~were not the standard in place ~~at the time~~when most transmission facilities were constructed, so poles, structures, and associated infrastructure do not meet current codes and standards ~~today~~. For example, Act 17 - 2019 requires wind loading of 155 mph, but very few transmission structures are designed or built to this existing requirement.

Q.30 Did LUMA conduct a system stability analysis of the T&D system?

A. Yes. The discussion and results of the System Stability Analysis are located in Section 7.0 of Appendix 1.

Q.31 What thermal and voltage reliability issues were identified in the T&D systems?

A. For the "as operated" transmission system, 26 critical contingencies cause major overloads on neighboring transmission facilities, with overloads greater than 190% of a line rating in some cases. These cause cascading overloads ~~of~~on other facilities ~~that can result~~resulting in regional or island-wide instability and outages. Additionally, another 17 critical contingencies cause major voltage disturbances that can impact regions or lead to island-wide instability and outages. Due to the sensitive nature of these facilities, LUMA requests ~~to treat~~that these critical contingencies be treated as CEII.~~ ~~ Transmission analysis concludes that the Puerto Rico grid is not in compliance with NERC Transmission Planning standards for system performance.

Distribution substation analysis discussed in Section 5.3.1 identified 25 distribution substations at a loading of 90% of the ~~transformer~~transformer's maximum thermal loading or higher.~~ ~~ When including already requested new business customers, an additional 22 transformers would exceed 90% or more of the ~~transformer~~transformer's maximum thermal loading or higher. This means that significant increases in transformer capacity~~ increases~~ or new distribution substations will be required over the 3-year and 10-year investment planning horizons.

Distribution circuit analysis discussed in Section 5.3.1 identified approximately 304 of 1,127 circuits with notable voltage violations~~ due~~, especially due to night-time and evening peaks in hot summer months, and 164 circuits with thermal overloads.

Q.32 Are there specific issues on the distribution system with respect to DER

integration? .

A. Yes, it was also found that DER and the bi-directional flows during daytime, and during lightly loaded shoulder months ~~also~~ contribute to violations in 660 feeders, split into 285 voltage issues, and 638 thermal issues including service transformer overloads and primary circuit conductors in neighborhoods across the island. -Note, the timeframe of study for DER and PV injection impacts (light load, often in February – April) and mid-day load and generation levels means that these violations are mostly unique from the evening peak thermal and voltage violations that occur when PV is not producing, and demand is high, especially in the summer months (June – October). Beyond their impact on system performance metrics, sustained thermal overload and persistent voltage excursions of this nature carry direct safety consequences that go beyond ordinary grid reliability concerns. Most critical is the risk of unintentional islanding. This is a condition where portions of the distribution system remain energized by customer-owned DERs even after being electrically isolated from the main system. Although current interconnection regulations include anti-islanding requirements, the sheer volume and geographic density of DERs across the system has significantly increased the complexity of verifying de-energized conditions in the field. The decentralized and uncontrolled nature of interconnection severely limits LUMA's ability to have full visibility for control or isolation of all potential sources of energy in a given work area, placing crews, emergency responders and even customers at risk of encountering feeders (or lines) that appear to be deenergized, but remain live due to DER injection. At the same time, the proliferation of inverter-based resources, such as DERs, is reducing conventional short-circuit levels, distorting conventional protection schemes and increasing the potential for missed fault detection. These conditions reinforce the urgency of prudent regulatory revisions that explicitly address these challenges and impact safety and reliability.

~~Q.32~~ Q. 33 **What potential transmission, distribution, and substation improvements are planned to increase reliability and meet minimum ~~transmission~~ standards?**

A. As discussed above, LUMA's investment strategy is driven by strategic pillars of system stabilization and asset replacements to improve public and worker safety and equipment and community support, reliability and resilience improvements to address the worst reliability impacts first and harden the grid against resilience threats, while supporting regulatory and community objectives of driving deep decarbonization and supporting distributed energy integration. The activities in the System Stabilization plan include, but are not limited to, restoring out of service transmission lines, ~~restoring out of service~~and substation transformers, deploying grid automation devices and enabling technologies ~~like~~such as information technology and telecommunications investments~~ and enabling technologies like~~, including substation relays and remote terminal units. -These will have the near-term impact of improving reliability, but facilities ~~like~~such as transmission lines will not be upgraded to withstand higher wind speeds (as only necessary ~~structure~~structural installations necessary to return the lines to service are being implemented).

LUMA also has requested funding in an active Rate Case (NEPR-AP-2023-0003) to begin addressing high priority capacity constrained transmission and distribution circuit thermal and voltage violations, as well as emergent safety and reliability risks due to DERs.

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~~VIII.~~X. TRANSMISSION & DISTRIBUTION IMPLICATIONS OF THE PREFERRED RESOURCE PLAN

~~Q.33~~ Q.34 What is your understanding of the requirements for the portion of the T&D System Planning section of the 2025 IRP that you are sponsoring?

A. With respect to the T&D System section of the 2025 IRP Report, LUMA followed the requirements set forth in Section 2.03(J)(2)(e) of Regulation 9021. This section requires the 2025 IRP to document the T&D implications of the PRP, including ~~assessing if~~an assessment of whether the PRP requires incremental T&D mitigation or changes.

~~Q.34~~ Q.35 Did LUMA receive any clarifications regarding the Energy Bureau's expectation for LUMA's 2025 IRP fulfilling the T&D requirements in Regulation 9021?

A. Yes. On April 15, 2024, the Energy Bureau issued a Resolution and Order in this case, granting a portion of LUMA's request for a waiver of certain specific requirements in Regulation 9021 and denying ~~LUMA~~LUMA's request for waivers to other requirements. In addition, in this R&O, the Energy Bureau clarified that: LUMA cannot provide information it does not have.

~~Q.35~~ Q.36 What portion of the T&D system analysis of the implications of the PRP does your testimony address?

A. As noted above, my testimony addresses the existing state of the T&D system, which was used as ~~inputs~~input into the analysis of the PRP's impacts ~~to~~on the transmission system (addressed by LUMA witness Ajit Kulkarni). My testimony also addresses the analysis of the PRP implications on the distribution system.

~~Q.36~~ **Q.37 What analysis did LUMA perform to assess the implications of the PRP on the distribution system?**

A. LUMA did not complete a comprehensive analysis of the implications of the PRP on the distribution system. The inclusion of distributed photovoltaic (DPV) and electric vehicle (EV) charging installations in the PRP ~~represent~~reflects forecasts of customer choices for these installations~~ that~~, which are not under ~~the~~LUMA's control~~ of LUMA~~ and are driven solely by customer choice. Therefore, the location and quantity of the distributed resources ~~is not within~~are outside LUMA's planned resource deployment ~~but~~and must be addressed reactively ~~addressed according to present~~in accordance with current laws and regulations.

LUMA has developed recommended smart-inverter settings whose adoption is imperative to improve near-term distribution circuit voltage performance under normal conditions~~,~~ and ~~also~~to support transmission grid stability by ~~having~~enabling inverters to respond to grid frequency and grid voltage disturbances; however, these recommended ~~smart-inverter~~ settings require PREB action to implement. LUMA re-iterates again,~~ as stated in response to question 22~~ that the system is already quickly approaching the physical and technical limit of the distribution system to accommodate incremental distributed generation (evidenced by the prevalence of DG related high voltages, distribution transformer and circuit thermal overloads being identified, and volume of repairs and upgrades that are being newly driven by DPV). These items will need to be considered in any implementation plan to execute the improvements needed for a reliable grid that meets minimum industry requirements. Given the impossibility of performing a detailed distribution system analysis of the PRP without knowing where on the system the resources may be placed, and the waivers and clarifications granted by the Energy Bureau in its R&O of April 15, 2024, which recognized and waived LUMA's ability to comply with Regulation 9021 when it did not possess the required data, LUMA has requested the Energy Bureau to waive the requirement of completing the distribution analysis of the PRP.

~~Q.37~~ **Q.38 Does this conclude your direct testimony?**

A. Yes.

ATTESTATION

Affiant, ~~Daniel Haughton~~Pedro A. Meléndez-Meléndez, being first duly sworn, states the following:

The prepared Direct Testimony that I am sponsoring constitutes my Direct Testimony in the above-styled case before the Puerto Rico Energy Bureau. I would provide the answers set forth in the Direct Testimony if asked the questions included in the Direct Testimony. I further state that the facts and statements provided herein are my Direct Testimony and, to the best of my knowledge, are true and correct.

____

~~Daniel Haughton, Ph.D. SMIEEE~~Pedro A. Meléndez-Meléndez

Affidavit No. ___

Acknowledged and subscribed before me by ~~Daniel Haughton~~Pedro A. Meléndez-Meléndez, in his capacity as ~~Planning and Renewables Integration Director of~~Chief Capital Programs & Grid Transformation Officer at LUMA Energy ServCo, LLC, of legal age, married, and resident of San Juan, Puerto Rico, who is personally known to me.

In San Juan, Puerto Rico, this ~~20th~~ __th day of ~~November 2025~~April 2026.

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Notary Public