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

IN RE: APRIL 16, 2025, Bluesky Total Blackout	**CASE NO. NEPR-IN-2025-0003** **SUBJECT: Submission of Preliminary Outage Report in Compliance with Resolution and Order of April 22, 2025, Request for Confidential Treatment and Memorandum of Law in Support of such Request**

MOTION SUBMITTING PRELIMINARY OUTAGE REPORT IN COMPLIANCE WITH RESOLUTION AND ORDER OF APRIL 22, 2025, REQUEST FOR CONFIDENTIAL TREATMENT AND MEMORANDUM OF LAW IN SUPPORT OF CONFIDENTIAL TREATMENT OF EXHIBIT 1

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

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

I. Relevant Procedural Background

1. On April 22, 2025, this Puerto Rico Energy Bureau of the Public Service Regulatory Board ("Energy Bureau") issued a Resolution and Order ("April 22nd Order") whereby it initiated the captioned proceeding pursuant to Act 57-2014, as amended[1], to investigate an outage event affecting the Puerto Rico electric system which occurred on April 16, 2025, at approximately 12:38 p.m., which caused an island-wide blackout (the "Event"). *See* April 22nd Order on p.1.

[1] Known as the *Energy Transformation and Relief Act* ("Act 57-2014"), 22 LPRA §1051.

2. In the April 22nd Order, the Energy Bureau indicated that the purpose of this investigation ("Investigation") is to conduct an exhaustive analysis of the continuous failures of the transmission and distribution systems. *Id*.

3. For purposes of the Investigation, the Energy Bureau ordered LUMA to provide, on or before April 24, 2025, a preliminary outage report of the cause of the Event. The Energy Bureau stated that, following the submission, it would issue a formal Requirement of Information, including a detailed Root Cause Analysis of the Event. *Id*. on p. 2.

4. This motion aims to submit the preliminary outage report requested in the April 22nd Order.

II. The Energy Bureau's Authority to Conduct Investigations

5. Act No. 57-2014 delegates to the Energy Bureau the power to investigate persons and entities under its jurisdiction, including certified electric power companies that provide services in Puerto Rico. *See* Art. 6.3 (pp) (7), 22 LPRA § 1054b (2024); Art. 6.4 (b)(1), LPRA § 1054c (2024), *see also* Art. 6.3 (o), 22 LPRA § 1054b(o) (2024).

6. In its Article XV, Regulation No. 8543 implements the power delegated by law to the Energy Bureau to conduct investigations. Section 15.01 of Regulation 8543 provides, among others, that the Energy Bureau may also conduct investigations to obtain information regarding matters related to the industry or electric service. These investigations may be initiated by the Energy Bureau, at its discretion, *motu proprio* or upon request, in accordance with the rules laid down in Article XV. *See id*, Section 15.02

7. Article XV sets out the rules governing the investigation process, providing, among others, that the Energy Bureau shall issue a report with the results to which the investigated party has the right to respond and may take other action set forth in the Regulation in attention to its

findings. *See id*., Sections 15.07-15.09. The regulation further provides that records of ongoing investigations shall remain confidential until the investigation is concluded and shall be available to the general public once the investigation report is notified to the investigated party or upon conclusion of the investigation. Any information "classified as privileged during the course of the investigation, or any information that may violate the fundamental rights of third parties or the right to privacy of the person investigated, shall be duly protected". *See id*., Section 15.10.

III. Submittal of Preliminary Report

8. In compliance with the April 22nd Order, LUMA hereby submits, as *Exhibit 1*, the preliminary outage report ("Preliminary Report") containing the information that LUMA has gathered thus far regarding the April 16th Event. LUMA notes that the Preliminary Report is based on information and data collected as of the date of submission and reflects LUMA's preliminary assessment of such information and data. The Preliminary Report, and its content, are subject to material change based on additional information and data collected, and analysis conducted by LUMA.

9. LUMA's investigation is ongoing as LUMA is still in the process of collecting relevant information from multiple external and internal sources that require analysis or verification. In addition, an external consultant was engaged to conduct a root cause analysis of the Event ("Root Cause Analysis"), which is currently underway and will provide updated information on the April 16th Incident.

10. As indicated, the information presented in the attached Preliminary Report is preliminary and subject to revision as additional details become available. LUMA reserves the right to present amendments or supplements to the Preliminary Report or any other reports

submitted in the investigation if new information arises regarding LUMA that needs to be addressed.

IV. Request for Confidentiality and Supporting Memorandum of Law

11. As mentioned, pursuant to Section 15.10 of Regulation No. 8543 (which provides that documents will be maintained confidential during investigations conducted under Article XV of said regulation until an investigation is concluded), LUMA respectfully requests that the Preliminary Report in *Exhibit 1* and other submittals or records in the investigation commenced by the Energy Bureau remain confidential during the investigation process and until its conclusion.

12. In addition, LUMA respectfully submits that *Exhibit 1* contains confidential information, including graphs, diagrams, and information that should be protected as Critical Energy Infrastructure Information ("CEII") that garners protection from public disclosure pursuant to federal statutes and regulations, *see, e.g.,* 6 U.S.C. §§ 671-674; 18 C.F.R. § 388.113 (2020), and the Energy Bureau's Policy on Management of Confidential Information, CEPR-MI-2016-0009, issued on August 31, 2016, as amended on September 21, 2016 ("Policy on Management of Confidential Information"). Therefore, LUMA further submits that this information must be protected from disclosure during and after the conclusion of the Investigation.

13. In compliance with the Policy on Management of Confidential Information, LUMA includes below the corresponding Memorandum of Law stating the legal basis for which the unredacted version of *Exhibit 1* should remain under seal of confidentiality when the investigation concludes.

V. Memorandum of Law in Support of Request for Confidentiality

A. Applicable Laws and Regulation to submit information confidentially before the Energy Bureau

14. Section 6.15 of Act 57-2014 regulates the management of confidential information filed before this Energy Bureau. It provides, in pertinent part, that: "[i]f any person who is required to submit information to the Energy [Bureau] believes that the information to be submitted has any confidentiality privilege, such person may request the Commission to treat such information as such . . . ." 22 LPRA § 1054n. If the Energy Bureau determines, after appropriate evaluation, that the information should be protected, "it shall grant such protection in a manner that least affects the public interest, transparency, and the rights of the parties involved in the administrative procedure in which the allegedly confidential document is submitted." *Id.,* Section 6.15 (a).

15. In connection with the duties of electric power service companies, Sections 1.10 (i) and (ix) of Act 17-2019 further provide that electric power service companies shall submit information requested by customers, except for: (i) confidential information in accordance with the Rules of Evidence of Puerto Rico; [...]; and (ix) matters of public security involving threats against PREPA, its property or employees. 22 LPRA § 1141i.

16. Access to the confidential information shall be provided "only to the lawyers and external consultants involved in the administrative process after the execution of a confidentiality agreement." *Id.*, Section 6.15(b), 22 LPRA § 1054n. Finally, Act 57-2014 provides that this Energy Bureau "shall keep the documents submitted for its consideration out of public reach only in exceptional cases. In these cases, the information shall be duly safeguarded and delivered exclusively to the personnel of the [Energy Bureau] who needs to know such information under nondisclosure agreements. However, the [Energy Bureau] shall direct that a non-confidential copy be furnished for public review". *Id.,* Section 6.15(c).

17. The Energy Bureau's Policy on Confidential Information details the procedures that a party should follow to request that a document or portion thereof be afforded confidential

treatment. In essence, the Energy Bureau's Policy on Confidential Information requires identifying confidential information and filing a memorandum of law explaining the legal basis and support for a request to file information confidentially. *See* CEPR-MI-2016-0009, Section A, as amended by the Resolution of September 16, 2016, CEPR-MI-2016-0009. The memorandum should also include a table that identifies confidential information, a summary of the legal basis for confidential designation, and a summary of the reasons why each claim or designation conforms to the applicable legal basis of confidentiality. *Id.,* paragraph 3. The party who seeks confidential treatment of information filed with the Energy Bureau must also file both a "redacted" or "public version" and an "unredacted" or "confidential" version of the document that contains confidential information. *Id.,* paragraph 6.

18. The Energy Bureau's Policy on Confidential Information also states the following with regards to access to Validated Confidential Information on the ground of being Critical Energy Infrastructure Information ("CEII"):

> The information designated by the [Energy Bureau] as Validated Confidential Information on the ground of being CEII may be accessed by the parties' authorized representatives only after they have executed and delivered the Non-Disclosure Agreement.
>
> Those authorized representatives who have signed the Non-Disclosure Agreement may only review the documents validated as CEII at the [Energy Bureau] or the Producing Party's offices. During the review, the authorized representatives may not copy or disseminate the reviewed information and may bring no recording device to the viewing room.

Id. Section D (on Access to Validated Confidential Information).

19. Relatedly, Energy Bureau Regulation 8543 includes a provision for filing confidential information in adjudicatory proceedings before this Honorable Energy Bureau. To wit, Section 1.15 provides that "a person has the duty to disclose information to the [Energy Bureau] considered to be privileged pursuant to the Rules of Evidence, said person shall identify the allegedly

privileged information, request the [Energy Bureau] the protection of said information, and provide supportive arguments, in writing, for a claim of information of privileged nature. The [Energy Bureau] shall evaluate the petition and, if it understands [that] the material merits protection, proceed accordingly to . . . Article 6.15 of Act No. 57-2015, as amended."

B. Request for Confidentiality

20. *Exhibit 1* includes CEII information that, under relevant federal law and regulations, is protected from public disclosure and garners confidential treatment to protect critical infrastructure from threats that could undermine the system and have negative repercussions in electric power services to the detriment of the interests of the public, customers, and citizens of Puerto Rico.

21. Generally, CEII or critical infrastructure information is exempted from public disclosure because it involves assets and information, that pose public security, economic, health, and safety risks. Federal Regulations on CEII, particularly, 18 C.F.R. § 388.113, states that:

> Critical energy infrastructure information means specific engineering, vulnerability, or detailed design information about proposed or existing critical infrastructure that:
> (i) Relates details about the production, generation, transportation, transmission, or distribution of energy;
> (ii) Could be useful to a person in planning an attack on critical infrastructure;
> (iii) Is exempt from mandatory disclosure under the Freedom of Information Act, 5 U.S.C. 552; and
> (iv) Does not simply give the general location of the critical infrastructure.

Id.

22. Additionally, "[c]ritical electric infrastructure means a system or asset of the bulk-power system, whether physical or virtual, the incapacity or destruction of which would negatively affect national security, economic security, public health or safety, or any combination of such matters." *Id.* Finally, "[c]ritical infrastructure means existing and proposed systems and assets,

whether physical or virtual, the incapacity or destruction of which would negatively affect security, economic security, public health or safety, or any combination of those matters." *Id.*

23. The Critical Infrastructure Information Act of 2002, 6 U.S.C. §§ 671-674 (2020), part of the Homeland Security Act of 2002, protects critical infrastructure information ("CII").[2] CII is defined as "information not customarily in the public domain and related to the security of critical infrastructure or protected systems...." 6 U.S.C. § 671 (3).[3]

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[2] Regarding protection of voluntary disclosures of critical infrastructure information, 6 U.S.C. § 673, provides in pertinent part, that CII:

> (A) shall be exempt from disclosure under the Freedom of Information Act;
> (B) shall not be subject to any agency rules or judicial doctrine regarding ex parte communications with a decision making official;
> (C) shall not, without the written consent of the person or entity submitting such information, be used directly by such agency, any other Federal, State, or local authority, or any third party, in any civil action arising under Federal or State law if such information is submitted in good faith;
> (D) shall not, without the written consent of the person or entity submitting such information, be used or disclosed by any officer or employee of the United States for purposes other than the purposes of this part, except—
>
> (i) in furtherance of an investigation or the prosecution of a criminal act; or
> (ii) when disclosure of the information would be--
>
> (I) to either House of Congress, or to the extent of matter within its jurisdiction, any committee or subcommittee thereof, any joint committee thereof or subcommittee of any such joint committee; or
>
> (II) to the Comptroller General, or any authorized representative of the Comptroller General, in the course of the performance of the duties of the Government Accountability Office;
>
> (E) shall not, be provided to a State or local government or government agency; of information or records;
>
> (i) be made available pursuant to any State or local law requiring disclosure of information or records;
>
> (ii) otherwise be disclosed or distributed to any party by said State or local government or government agency without the written consent of the person or entity submitting such information; or
>
> (iii) be used other than for the purpose of protecting critical Infrastructure or protected systems, or in furtherance of an investigation or the prosecution of a criminal act.
>
> (F) does not constitute a waiver of any applicable privilege or protection provided under law, such as trade secret protection.

[3] CII includes the following types of information:

> (A) actual, potential, or threatened interference with, attack on, compromise of, or incapacitation of critical infrastructure or protected systems by either physical or computer-based attack or other similar conduct (including the misuse of or unauthorized access to all types of communications and data transmission systems) that violates Federal, State, or local law, harms interstate commerce of the United States, or threatens public health or safety;
> (B) the ability of any critical infrastructure or protected system to resist such interference, compromise, or incapacitation, including any planned or past assessment, projection, or estimate of the vulnerability of

24. *Exhibit 1* includes figures and diagrams containing: transmission line diagrams identifying critical areas and power lines involved in the power outage; automatic sensor data that includes GPS coordinates and other geographical information; GPS coordinates in certain pictures of the location where the fault occurred, SCADA and Digital Fault Recorder ("DFR") data; information pertaining to line protection for certain power lines; gas circuit breaker conditions and maintenance information; and a table listing hot spots pending repairs between Cambalache GP and Costa Sur SP. The diagrams and images described above contain details on design and/or engineering information of critical electric system assets and/or other information that, if disclosed, may reveal vulnerabilities of the electric system. Therefore, these diagrams and figures constitute CEII that garners protection from public disclosures pursuant to federal statutes and regulations. *See e.g.,* 6 U.S.C. §§ 671-674; 18 C.F.R. § 388.113 (2020).

25. The CEII designation of these diagrams and figures is a reasonable and necessary measure to protect critical infrastructure and enable LUMA to leverage the information and assessment of critical infrastructures without external threats. Given the importance of ensuring the safe and efficient operation of the generation assets and the T&D System, LUMA respectfully submits that these materials constitute CEII that should be maintained confidentially to safeguard their integrity and protect them from external threats.

26. It is respectfully submitted that the protection of all of the confidential information discussed above does not affect the public's or the Energy Bureau's review of the present filing

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critical infrastructure or a protected system, including security testing, risk evaluation thereto, risk management planning, or risk audit; or
(C) any planned or past operational problem or solution regarding critical infrastructure or protected systems, including repair, recovery, construction, insurance, or continuity, to the extent it is related to such interference, compromise, or incapacitation.

nor interfere with processes before this Energy Bureau. Therefore, on balance, the public interest to protect CEII, weighs in favor of protecting the relevant portions of Exhibit 1 from disclosure.

VI. Identification of Confidential Information

27. In compliance with the Energy Bureau's Policy on Management of Confidential Information, CEPR-MI-2016-0009, below is a table identifying the confidential information and summarizing the hallmarks of this request for confidential treatment:

Document	**Pages, Figures in which Confidential Information is Found, as applicable**	**Description**	**Reasons and Summary of Legal Basis for Confidentiality Protection**	**Date Filed**
Exhibit 1 – Preliminary Report	Pages 2-5, 7-10, 12-15	Identification number or other identifying information of transmission lines, substations, transformers, circuit breakers, and related equipment	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. This information is all part of the forensic analysis undertaken (and still underway) to determine the causes of the Incident. This information, seen in conjunction with other information in the report, may reveal vulnerabilities of the transmission or other components of the electric system and could be useful to a person in planning an attack on the critical electric transmission infrastructure.	April 24, 2025

Document	Pages, Figures in which Confidential Information is Found, as applicable	Description	Reasons and Summary of Legal Basis for Confidentiality Protection	Date Filed
Exhibit 1 – Preliminary Report	Pages 9-10	Electricity measurements of certain transmission equipment (amperes, Hz, among others), including percentages of these measurements	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. This information is all part of the forensic analysis undertaken (and still underway) to determine the causes of the Incident. This information, seen in conjunction with other information in the report, may reveal vulnerabilities of the transmission or other components of the electric system and could be useful to a person in planning an attack on the critical electric transmission infrastructure.	April 24, 2025
Exhibit 1 – Preliminary Report	Page 4, Figure 1-1	Transmission line diagram identifying critical areas involved in the 4/16/205 power outage	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains details of line capacity, functioning and/or configuration of the system that, if disclosed, may reveal potential vulnerabilities affecting critical electric system assets and may expose the system to external threats.	April 24, 2025

Document	Pages, Figures in which Confidential Information is Found, as applicable	Description	Reasons and Summary of Legal Basis for Confidentiality Protection	Date Filed
Exhibit 1 – Preliminary Report	Page 5, in the text below "The system generated the following automatic record:" and above "The protection line relays…"	Automatic record generated by the system identifying the fault's location	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains specific location (GPS coordinates, Google Maps location, and precise distance between nearby powerplants) of a vulnerable area of the transmission line which may reveal vulnerabilities of the transmission system and may expose the system to external threats.	April 24, 2025
Exhibit 1 – Preliminary Report	Page 6, Figure 2-2 (partial)	Image with an arrow indicating the nearby location of a tree removed by LUMA crews on 4/16/25	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains specific location (GPS coordinates and Google Maps location) of area of transmission line which may reveal vulnerabilities of the transmission system and may expose the system to external threats.	April 24, 2025

Document	Pages, Figures in which Confidential Information is Found, as applicable	Description	Reasons and Summary of Legal Basis for Confidentiality Protection	Date Filed
Exhibit 1 – Preliminary Report	Page 7, Figure 2-3	Map diagram of the lines that tripped during the Event noted in black.	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains details of line capacity, functioning and/or configuration of the system that, if disclosed, may reveal potential vulnerabilities affecting critical electric system assets and may expose the system to external threats.	April 24, 2025
Exhibit 1 – Preliminary Report	Page 11, Figure 4-1 (partial)	Before and after pictures of the tree that initiated the line fault. Ground level perspective	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains specific location (GPS coordinates and Google Maps location) of vulnerable area of transmission line which may reveal vulnerabilities of the transmission system and may expose the system to external threats.	April 24, 2025
Exhibit 1 – Preliminary Report	Page 11, Table 4-1	Historical Line Inspection Schedules for 50100	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains details of transmission lines' condition which may reveal potential vulnerabilities and if disclosed may expose the transmission system to external threats.	April 24, 2025

Document	Pages, Figures in which Confidential Information is Found, as applicable	Description	Reasons and Summary of Legal Basis for Confidentiality Protection	Date Filed
Exhibit 1 – Preliminary Report	Page 14, Table 4-2	Gas Circuit Breaker Data and Maintenance Information	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains details of transmission lines' condition which may reveal potential vulnerabilities and if disclosed may expose the transmission system to external threats.	April 24, 2025
Exhibit 1 – Preliminary Report	Page 14, Table 4-3	Hot Spots Pending Repairs at Cambalache GP and Costa Sur GP	Critical Energy Infrastructure Information 18 C.F.R. §388.113; 6 U.S.C. §§ 671-674. Contains details of transmission lines' condition which may reveal potential vulnerabilities and if disclosed may expose the transmission system to external threats.	April 24, 2025

28. LUMA submits as *Exhibit A*, herein, a redacted version of *Exhibit 1*, in which the above identified information is redacted. LUMA respectfully requests the Energy Bureau to accept *Exhibit A* herein as the public version of *Exhibit 1*, which can become the public version once the Investigation is concluded. In the meantime, LUMA respectfully requests that *Exhibit 1* and Exhibit A remain confidential during the investigation per Section 15.10 of Regulation 8543.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned; **accept** *Exhibit 1* in compliance with the April 22nd Order; and **grant** LUMA's request to maintain *Exhibit 1* confidential during and after the Investigation concludes.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 24th day of April 2025.

We hereby certify that we filed this notice and request using the electronic filing system of this Energy Bureau.

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Exhibit 1

Preliminary Report

[Submitted under Seal of Confidentiality]

Exhibit A

Redacted Version Exhibit 1

Preliminary Facts of April 16th, 2025, Island-wide Outage Event

In the interest of protecting the electric infrastructure of Puerto Rico, portions of this document are protected from disclosure as Critical Energy Infrastructure Information ("CEII"), in accordance with 6 U.S.C. §§671-674; 18 C.F.R. §388.113 (2020), and pursuant to the Puerto Rico Energy Bureau's Policy on Management of Confidential Information, CEPR-MI-2016-0009, issued on August 31, 2016, as amended by the Resolution dated September 16, 2016.

This preliminary report is based on information and data collected as of the date of its submission and reflects LUMA's preliminary assessment of such information and data. This report, and its content, is subject to material change based on additional information and data collected and analyses conducted by LUMA. Accordingly, it does not include any conclusions as to the root cause or contributing factors of the April 16, 2025, Island-wide Outage Event nor corrective or mitigating actions. LUMA has engaged a third-party independent engineering firm to determine the root cause and contributing factors to the Island-wide Outage Event.

VERSION HISTORY:

Version	Date	Description
000	04/19/2025	Initial preliminary information report.

Event Summary

Outage Name: 16 APR 2025 Island-wide Outage Event

Event Number: OE2504-108

Outage Date: April 16, 2025

Outage Time: 12:38:46 p.m.

Location: Island wide electric system

Description: To ensure the reliable and safe operation of electric systems, protection systems play an essential function to safeguard power equipment and isolate them from disturbances (e.g. faults, failures, etc). The electric industry has set standards to address various aspects of protection and controls systems, including installation, monitoring, maintenance and the coordination of protection systems with other aspects of power system operation such as cascading events.

At 12:38:46 p.m., on Wednesday, April 16, 2025, a fault occurred on the 230 kV transmission line [redacted] from Cambalache GP - Manatí TC, initiated by vegetation close to Manatí TC. System load prior to the event was approximately [redacted] MW.

Protection systems at both ends of the line detected the fault and issued trip commands. The two transmission line breakers at Manatí TC opened; however, only one of the two-line breakers at Cambalache GP operated correctly, while another failed to operate. The backup protection for breaker failure function designed to operate under this scenario at Cambalache GP also failed to operate. Inspections revealed damaged relay control wiring as the apparent cause. Evidence of external debris for further analysis was found in the relay cabinet where the damaged cable was observed.

After the 230 kV breaker and the backup breaker failure protection at Cambalache did not operate, additional transmission lines operated as a third layer of backup protective action. The 230 kV line [redacted] GP operated, and line [redacted] tripped by backup protection attempted to isolate the fault. Line [redacted] did not trip.

Tripping of line [redacted] disconnected EcoEléctrica generating facility which resulted in system frequency decline and then the subsequent disconnection of AES and Costa Sur [redacted], creating the conditions for a system collapse. The system collapsed 19.5 seconds after the initial fault on the transmission line [redacted] Cambalache GP - Manati TC. The initial fault was still present at the time of system collapse.

At approximately 2:15 a.m., of Friday, April 18, 2025, 1,450,367 customers had been restored, representing 98.8% of the customer base.

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1.0 Introduction

At 12:38:46 p.m., on Wednesday, April 16, 2025, a fault occurred on the 230 kV transmission line 50100 from Cambalache GP - Manatí TC, initiated by vegetation close to Manatí TC. System load prior to the event was approximately [redacted] MW.

The protection systems at both ends of the line detected the fault and issued trip commands. The two transmission line breakers at Manatí TC opened. Only one of the two line-breakers at Cambalache GP operated correctly, while another failed to operate. The backup protection for breaker failure function designed to operate under this scenario at Cambalache GP also failed to operate. Inspections revealed damaged relay control wiring as the apparent cause for both the primary and backup protection misoperations. Evidence of external debris was found in the relay cabinet where the damage was observed.

After the 230 kV breaker and the backup breaker failure protection at Cambalache did not operate, additional transmission lines operated as a third layer of backup protective action. The 230 kV line [redacted] Mayagüez TC - Mora TC - Cambalache GP operated, and line [redacted] tripped by backup protection attempted to isolate the fault. Line [redacted] did not trip. Figure 1-1shows the affected lines and substations. 230 kV lines are shown in blue. The yellow arrow indicates the approximated fault location. Yellow circles indicate the substations of interest.

Tripping of line [redacted] disconnected the EcoEléctrica generating facility resulted in a frequency decline and subsequent disconnection of AES and Costa Sur Unit [redacted], creating the conditions for a system collapse. The system collapsed 19.5 seconds after the initial fault on the transmission line [redacted] Cambalache GP - Manatí TC, resulting in an island wide power outage.

[redacted]

2.0 Preliminary Information

At 12:38:46 p.m., on Wednesday, April 16, 2025, a fault occurred on the 230 kV transmission line [redacted] from Cambalache GP - Manatí TC, initiated by vegetation close to Manatí TC. Figure 2-1 illustrates the identified vegetation on the transmission line [redacted] Cambalache GP – Manatí TC. Figure 2-2 illustrates the location of a nearby tree removed by LUMA crews on April 16, 2025. Sensors installed by LUMA in April 2023 at disconnecting switch [redacted] in 230 kV line [redacted] detected the fault and identified its location.

The system generated the following automatic record:



The protection line relays in the Manatí TC terminal detected the fault and tripped breakers [redacted] and [redacted] in 78 milliseconds.

The protection line relays in the Cambalache GP terminal detected the fault and issued a trip command to breakers [redacted] and [redacted]. Breaker [redacted] failed to operate due to cable damage identified during the investigation. Figure 2-3 illustrates the lines that tripped during the event.

Helicopter line patrols were dispatched immediately after the event, taking off around 1:50 pm. The aviation inspection confirmed evidence of vegetation near the line in the area pinpointed by the line sensors.



Figure 2-1. Vegetation with yellowing and burn marks in the area where the fault occurred



Figure 2-2. Arrow indicates nearby location of a tree removed by LUMA crews on 4/16/25

Local breaker failure protection in Cambalache GP designed as backup to isolate a fault if the breaker fails to operate did not activate to open the 230 kV bus breakers at Cambalache.

Remote back-up protection to Cambalache tripped as follows:

- Three terminal Line [redacted] opened at Mayagüez TC and Mora TC. Backup protection is torque-controlled overcurrent and operated correctly.
- Line [redacted] did not trip. Backup protection is torque-controlled overcurrent. Since this relay is closer to the fault, it is commonly designed to operate before EcoEléctrica for this fault scenario, preventing the EcoEléctrica trip. Further studies are needed to clarify the coordination of this operation that happened on an N-3 contingency.

Line [redacted] EcoEléctrica zone 3 protection activated and tripped. Backup protection is zone 3 distance protection. The Zone 3 setting and line trip of [redacted] operated for this situation and location of the fault; however, it was not coordinated with Costa Sur relay settings.

Further evaluation of the EcoEléctrica protection systems is necessary to determine if they were a contributing factor to this event.

[redacted]

With EcoEléctrica disconnected, the system frequency started to decline, further impacting stability of the system.

AES and Costa Sur Generating Unit [redacted] tripped due to underfrequency, leading to a system collapse resulting in an island wide power outage.

The cause of trips at other generators are still under investigation. An automatic underfrequency load shedding performance analysis is pending.

3.0 Sequence of Events

The timeline of events was compiled using the following:

- SCADA Open and Close signal time stamps
- Costa Sur, Ponce, Mayagüez, Manatí, Cambalache, Aguirre, Monacillos, Bayamón and Palo Seco digital fault recorder (DFR) data
- Available protection relay events or targets

The timeline reference, T0 for the complete event is the initiation of the fault that preceded the power outage.

Time	T-T0	Description
12:38:46.062	**T0**	An overgrown tree clearance breached 230 kV line [redacted] from Manatí to Cambalache creating a phase A to ground fault.
12:38:46.133	00:00:00.078	230kV CB#s [redacted] and [redacted] at Manatí trip to clear the fault from that terminal.
12:38:46.690	00:00:00.557	The back-up protection from line [redacted] at Cambalache sends trip signals: 230kV CB# [redacted] opens as expected 230kV CB# [redacted] did not open. The fault on line 50100 remained energized
12:38:47.99	00:00:01.930	The fault at line [redacted] evolved to phase A to B to ground still sourced from Cambalache due to failure of CB# [redacted] to open
12:38:48.18	00:00:02.12	230/115kV transformer at Cambalache trips as remote back-up. Proper operation at Cambalache

12:38:48.25	00:00:02.19	230 kV CB# [redacted] at Mora opens as back-up protection to open the [redacted] line from Mayagüez – Mora TC – Cambalache TC.
12:38:49.60	00:00:03.54	230kV CB# [redacted] and CB# [redacted] at Mayagüez opens as back up protection to open the [redacted] line from Mayagüez – Mora TC – Cambalache TC.
12:38:50.07	00:00:04.01	230kV line [redacted] from EcoEléctrica - Costa Sur opens as the back up protection system operates. Approximately [redacted] of generation are removed from the system resulting in frequency decline. The initial fault at line [redacted] is still present.
12:38:55.93	00:00:09.86	System frequency drops below [redacted] Hz activating instantaneous automatic load shed protection scheme blocks.
12:38:56.11	00:00:10.04	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks.
12:38:56.35	00:00:10.28	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks.
12:38:56.60	00:00:10.54	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks.
12:38:56.97	00:00:10.91	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks.
12:38:57.08	00:00:11.02	System frequency below [redacted] Hz activating instantaneous automatic load shed protection scheme blocks.

12:38:57.17	00:00:11.11	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks.
12:38:57.25	00:00:11.19	System frequency declines below [redacted] Hz activating instantaneous automatic load shed protection scheme blocks.
12:38:57.30	00:00:11.24	System frequency declines below [redacted] activating instantaneous automatic load shed protection scheme blocks. This is the last load shed block. Frequency declines beyond this point trigger generation underfrequency protection trips.
12:39:01.78	00:00:15.72	System frequency declines below [redacted] Hz and the remaining large generation trips.
12:39:02.00	00:00:15.94	AES generation trips [redacted] MW
12:39:02.38	00:00:16.32	Costa Sur Unit [redacted] trips [redacted] MW
12:39:05.53	00:00:19.47	Total system power outage

4.0 Completed Actions and Next Steps

4.1 Line [redacted]

Line [redacted] at this location, has a delta configuration with phase A being the lower conductor at 25 to 30 ft from the ground when deenergized.

Helicopter patrols of the affected lines were completed on April 16, 2025. A castor bean tree - “Higuereta” or Ricinus Communis - was found at the conductor. Vegetation crews cleared the area affected in line [redacted] removing the tree that initiated the line fault. See Figure 41.

Foot patrol by the line operations team to the affected area of line [redacted] was completed on April 17, 2025.



Figure 4-1. Before and after pictures of the tree that initiated the line fault. Ground level perspective.

Historical line inspection records timeline for Line [redacted] is shown in Table 4-1.

[redacted]

Table 4-1. Historical Line Inspection Schedules For [redacted]

PLI = Power Line Inspection (visual)
HLA = High Level Assessment (visual)

The summary of thermography and thermal hot spot findings is as follows:

[redacted]

- Thermography Assessments
  - 02/30/2024 - No hot spots identified
  - 12/31/2024 - No hot spots identified
  - 01/21/2025 - No hot spots identified
  - 04/11/2025 - No hot spots identified

[redacted]

- Thermography Assessments
  - 09/27/2025 - No hot spots identified
  - 12/9/2024 - No hot spots identified
  - 04/8/2025 - No hot spots identified
- Hot Spots
  - 2 hot spots identified on 11/9/2022 and both hot spots were repaired on 12/4/2022

During the inspections several vegetation reports were generated.

- On 12/30/2024 ten preventive (P30) locations were identified, 8 of 10 have been confirmed addressed.
- On 01/21/2025 no new locations were identified.
- On 04/11/2024 eight new preventive (P30) locations were identified, none of these were addressed prior to the event on 04/16.
- On 4/17/2025 two priority (P20) locations were identified, and these were both addressed the same day.

Note that vegetation issues have 3 levels of priority. All the reported issues have been addressed as per defined times – Imminent Threat (P10): vegetation crews evaluate as soon as possible, usually on the same day; Priority (P20): addressed in 10 days; and Preventive (P30): addressed in 30 days.

4.2 Protective Relaying

LUMA teams are collecting data related to substation equipment maintenance and the current status of settings of protective relays including:

- Line [redacted] protective relays activated in Cambalache GP. Breaker [redacted] opened but breaker [redacted] failed to operate. A detailed inspection on April 17, 2025, identified damaged wiring on breaker [redacted]. This is the apparent cause of the breaker's failure to operate after a protective relay trip command. The damaged negative circuit prevented the breaker trip coil from operating. Evidence of debris in the cabinet was identified. See Figure 4-2.

  Line [redacted] has two redundant protection systems. Primary protection is a distance scheme with teleprotection. The carrier channel used for teleprotection is out of service and the line was operating without primary protection.



Figure 4-2. Damaged control cable at [redacted] control cabinet

- Breaker failure scheme failed to operate in Cambalache GP. The breaker failure initiate signal is associated with the damaged cable.
- The backup protection scheme in EcoEléctrica operated, disconnecting the generators from the grid. Backup protection in Costa Sur SP is torque controlled overcurrent. Backup protection in EcoEléctrica is zone 3 distance protection. Costa Sur and EcoEléctrica are 1.6 km apart and both over 80 km away from the initial fault. Testing will be required to identify any issues with settings, calibration, and/or CT tolerances that may have created miscoordination, considering that the system was in an N-3 contingency.

  Currently, line [redacted] at EcoEléctrica only has a single relay in service which is a SEL 311L. The SEL 221 backup relay has been out of service due to failure and the RFL carrier relay went out of service in September 2024. Completion of this work requires coordination with EcoEléctrica scheduled outage and thus remains pending. Further investigation is necessary to determine the potential contribution to the power outage event. This line protection upgrade is a high priority project and will resolve any coordination issues with the 230 kV lines in Costa Sur SP.

4.3 Cambalache GP: Circuit Breakers

4.3.1 Gas Circuit Breaker - GCB [redacted]

Last completed full breaker maintenance was in 2015.

- SF6 gas sampling performed in 2023. Acceptable.
- Power Factor and Capacitance (PF & CAP) testing performed in 2022. Deemed normal.
- Relay functional testing records indicate last tests in October 2022. Need to review additional paper records.

Nothing outstanding in terms of condition. See Table 4-2 for more details on breaker maintenance.

4.3.2 Gas Circuit Breaker - GCB [redacted]

Last completed full breaker maintenance was in 2019.

- Functional testing records indicate last tests in October 2022. Need to review additional paper records.

Nothing outstanding in terms of condition. See Table 4-2 for more details on breaker maintenance.

[redacted]

4.4 Station Thermography Scans

Table 4-3 includes the latest hot spots detected indicated as still pending at Cambalache GP and Costa Sur SP.

[redacted]

4.5 Next Recommended Steps

The following includes, but is not limited to, next steps from this event:

- Replace damaged cable and complete functionality checks- in progress
- Complete field implementation of the 230kV Wide Area Protection Coordination study
    - Being implemented as part of event response activities
- Conduct a root cause investigation of the event with additional information
- Assess the 230kV vegetation management inspections and determine improvement on inspection activities.
- Evaluate the protection scheme at Cambalache GP for redundancy upgrades, including replacement of failed primary protection by line differential using available fiber optic channels, and opportunities to segregate trip coil circuits. Replace solid state breaker failure relay and revise wiring scheme.
- Complete protection upgrades at EcoEléctrica. Testing of backup line protection in Costa Sur SP and EcoEléctrica can verify coordination issues with present scheme, but the solution is to complete the proposed upgrades.
- Complete maintenance and electrical testing as per LUMA Standard 4801.064 Circuit Breaker Maintenance Standard OCB & GCB to breakers [redacted] & [redacted] in Cambalache GP
- Perform visual and thermal inspections with (1) actual low-load state to detect any issues present at these levels, and (2) repeat again when at “normal” load levels. Perform on the following:
    - Cambalache GP site
        - Whole site, but with emphasis around the associated equipment with lines [redacted] and [redacted].
    - Costa Sur SP site
        - Whole site, but with emphasis around associated equipment with line [redacted].
    - Line [redacted]
    - Line [redacted]
    - Determine causes of trips at other generators under the investigation.

An automatic underfrequency load shedding performance investigation is also needed to prioritize its recommended implementation.

5.0 Event Response

Since the event occurred, LUMA has focused on safety, restoration of service to customers, and the electrical system's stability including assuring continuation of service within operating parameters. Sufficient time has not passed yet to process and review all relevant data and to summarize such information beyond what is being provided in this document.

LUMA continues to collect all relevant data and analyze the situation to inform, to continue with plans to rebuild and modernize the grid of Puerto Rico while working to prevent such incidents from occurring in the future.

LUMA is committed to being transparent with our customers and regulators about our operations and the successes and challenges we face in delivering more reliable energy. LUMA will provide relevant data along with other information obtained resulting from its investigation of the incident. LUMA has engaged the services of external protection/coordination experts to analyze the protection scheme operations. LUMA has also engaged the services of an external consultant to perform an in-depth root cause analysis into the event. LUMA is collecting the information and evidence necessary for the consultant to complete their analysis.