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

IN RE: INTERRUPCIÓN DE SERVICIO ELÉCTRICO DE 21 DE FEBRERO DE 2022	**CASE NO. NEPR-IN-2022-0001** **SUBJECT:** **Submission in Compliance with Request for Information on February 21st Incident and Request for Confidential Treatment**

MOTION SUBMITTING PRELIMINARY REPORT ON FEBRUARY 21ST INCIDENT AND REQUEST FOR CONFIDENTIAL TREATMENT

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

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

1. On February 22, 2022, this Honorable Puerto Rico Energy Bureau ("Energy Bureau") issued a Resolution and Order whereby it initiated a confidential investigation on the incident that took place on February 21, 2022 ("February 22nd Order"). The incident caused the shutdown of certain generation units, including Central San Juan, Palo Seco, and Aguirre unit 2, operated by the Puerto Rico Electric Power Authority ("PREPA") (hereinafter, the "February 21st Incident") and multiple outages of the electric system as well as service interruption for many customers in northeast Puerto Rico.

2. The February 22nd Order instructs LUMA to submit on or before February 25, 2022, at noon the following information:

i. a summary of the incident including, but not limited to, a chronological description of the events and their effect, if any, on PREPA's generation fleet, as well as investigative, corrective, or other actions taken by LUMA and PREPA;

ii. any information received, obtained, or gathered in the course of investigative, corrective, or other efforts undertaken by LUMA and/or PREPA, its agents, attorneys, or consultants to determine the cause of the incident and its effect, if any, on PREPA's generation fleet;

iii. Any document produced, prepared, or received by LUMA and/or PREPA, its agents, attorneys, or consultants in the course of investigative, corrective, or other efforts undertaken to determine the cause of the incident including, but not limited to, the root cause report of the incident and its effect, if any, on PREPA's generation fleet; and

iv. any information, data, video, audio, photos, report, or document submitted to federal or local authorities regarding the incident and its effect on PREPA's generation fleet.

3. Earlier today, LUMA filed a *Request for a Brief Extension of Time to Comply with February 22nd Resolution and Order on February 21st Incident Investigation*. Therein, LUMA requested the Energy Bureau a brief extension until today, February 25, 2022, at 5:30 p.m. AST to submit a preliminary report in compliance with the February 22nd Order.

4. In compliance with the February 22nd Order, and to be transparent with its customers and regulators about its operations, LUMA hereby submits a preliminary public report

of the February 21st Incident. *See* Exhibit 1. The preliminary report includes the information that LUMA has gathered thus far and preliminary findings and assessments of the February 21st Incident. As detailed in the filing, because of its utility workers' hard work and professionalism, LUMA, working in conjunction with PREPA and other generators, restored power to nearly all customers – or ninety-eight percent of the total customers affected by the outage – within three hours.

5. The preliminary report filed as Exhibit 1 to this Motion, includes the following:

i. Summary information on the February 21st Incident;

ii. Incident chronology;

iii. Affected assets;

iv. Summary of corrective actions taken to stabilize the situation and restore service;

v. Investigation;

vi. Summary of further actions being taken.

6. LUMA is working on the investigation of the February 21st Incident. The preliminary analysis points to the failure of substation equipment subject to years of neglect that predate LUMA. The specific fault occurred in the 115 kV transmission line between the substation adjacent to PREPA's San Juan generation facilities and the Viaducto Transmission Center. It is respectfully submitted that, given the nature of the February 21st Incident, LUMA cannot provide at this time additional documentation to the information submitted in the report that is being filed as Exhibit 1 to this Motion. Since the February 21st Incident, LUMA has focused on safety, restoring service to customers, restoring system stability, and assuring the continuation of service within operating parameters. There has not been sufficient time to process or review all relevant

data and/or summarize such information beyond that provided to the Energy Bureau in Exhibit 1 to this Motion.

7. Although it is not possible at this juncture to establish a fixed date to complete the root cause investigation and analysis and issue the initial report of the February 21st Incident, in good faith, LUMA informs that the initial report on the incident will take an estimated six weeks for issuance from today's date. LUMA is committed to, in due course, providing the Energy Bureau with relevant data and other information as part of its investigation into the February 21st Incident.

8. Exhibit 1 includes several confidential figures and tables. *See* Exhibit 1 on pages 3 (Figure 1), 4 (Figure 2), 5-6 (Table in Section 3.1), 7 (Table in Section 3.2), 11 (Figures 4 and 5), and 13 (Table in Section 5.4). They are being submitted under seal of confidentiality as they constitute Critical Energy Infrastructure Information ("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), and the Bureau's Policy on Management of Confidential Information. *See* Energy Bureau's Policy on Management of Confidential Information, CEPR-MI-2016-0009 ("Policy on Management of Confidential Information"), issued on August 31, 20216, as amended by the Resolution dated September 16, 2016.

9. Under separate cover and expediently, within the next ten days, as allowed by Section A.2 of the Energy Bureau's Policy on Management of Confidential Information," LUMA will submit a memorandum of law in support of this request to file the aforementioned portions of the report of the February 21st Incident under seal of confidentiality.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned, **accept** the report of the February 21st Incident that is being filed as Exhibit 1 to this Motion, **accept and treat confidentially** the figures and tables included at pages 3 (Figure 1), 4 (Figure 2), 5-6 (Table in Section 3.1), 7 (Table in Section 3.2), 11 (Figures 4 and 5), and 13 (Table in Section 5.4) of Exhibit 1, and **deem** that LUMA complied with the February 22nd Order.

RESPECTFULLY SUBMITTED.

We hereby certify that we filed this motion using the electronic filing system of this Energy Bureau and that we will send an electronic copy of this motion to the attorneys for PREPA, Idelisa Carerro, icarrero@diazvaz.law; and Katiuska Bolaños-Lugo, kbolanos@diazvaz.law.

In San Juan, Puerto Rico, this 25th day of February 2022.

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Exhibit 1
Incident Preliminary Report

NEPR-IN-2022-0001
February 25, 2022

February 21, 2022 Power Outage Preliminary Investigation Report

INCIDENT SUMMARY

Name	21FEB2022 Outage – Line 38100 breakers in San Juan Steam Plant fail to operate
Date	February 21, 2022
Time	13:19
Location	Lines 38100 & 38400 near San Juan Steam Plant (SP): 18.420589, -66.093437
Description	Due to a temporary transmission fault on 115kV Lines 38100 and 38400, breakers failed to operate due to a lack of Direct Current (DC) supply (38140-0084) in San Juan SP and caused widespread transmission and generation outages. Approximately 592,000 customers lost service in the San Juan Metro area and surrounding communities. Power was restored to approximately 98% of the affected customers within three hours. LUMA is prioritizing the detailed event analysis to determine root causes and next steps, striving for the continuous improvement of the Puerto Rico grid.

RESUMEN DEL EVENTO

Nombre	Evento 21FEB2022 – Interruptores de la línea 38100 en San Juan SP no operaron
Fecha	21 febrero 2022
Hora	13:19
Localización	Líneas 38100 y 38400 cerca de la planta San Juan SP: 18.420589, -66.093437
Descripción	Debido a una falla temporera en las líneas 38100 y 38400 del sistema de 115kV, los interruptores (38140-0084) no operaron por falta de alimentación en Corriente Directa (DC) en la planta San Juan SP. Esto causó la desconexión de varias líneas de transmisión y de unidades de generación. Mas de 592,000 clientes en el área metropolitana de San Juan y comunidades aledañas perdieron servicio. Al 98% de los clientes afectados se les restauró el servicio en menos de tres horas. El análisis de este evento es una prioridad para LUMA para identificar las causas y ejecutar los próximos pasos necesarios para mejorar continuamente la red eléctrica de Puerto Rico.

Table of Contents

1.0 INTRODUCTION

On February the 21st, 2021 at 13:19 a fault occurred in the 115kV lines 38100 and 38400 that connect San Juan SP to Viaducto Transmission Center (see Figure 1). The fault was detected by the line relays. Though the circuit breakers at Viaducto Transmission Center and San Juan SP for line 38400 operated correctly, the circuit breakers 38140-0084 at San Juan SP for line 38100 failed to operate due to a lack of DC supply.

Due to the failure of the breakers to operate, and the non-performance of the breaker failure protection in San Juan SP, the 115kV circuits in San Juan SP had to open to clear the fault, resulting in tripping of multiple generation units and subsequent outage events across the power system in Puerto Rico. After review, the estimated number of customers affected by this outage is approximately 592,000. (Figure 2)

At 16:12, approximately three hours after the event, over 98% of the affected customers had service restored with only 1.3% of the customers who had lost power still out of service.

This preliminary report for the Puerto Rico Energy Bureau includes the findings to date. LUMA has prioritized the analysis of this event and is actively working to determine the root causes and the improvements needed to avoid similar incidents in the future.

The report covers LUMA's response to the event and the identified technical details of the 3 stages of the power outage.

- Initial Fault on line 38100, and the ensuing fault on the parallel line 38400 from Viaducto Transmission Center to San Juan SP
- Breakers fail to operate in San Juan SP due to the aging of the DC circuit
- System wide outage

Figure 1 – 115kV and 230kV lines in the Metro Area – faulted lines 38100/38400 highlighted

Figure 2 shows the affected area.

Figure 2 – Highlighted in yellow is the area affected by the Power Outage. Not to scale

All items in this report are based on preliminary information and are subject to verification and may be modified, deleted and/or added to as a result of full investigation.

2.0 CHRONOLOGY OF LUMA RESPONSE TO THE OUTAGE

The following chronology describes LUMA's immediate actions in response to the outage.

2.1 ACTIONS ON MONDAY, FEBRUARY 21, 2022

Pre-event, the Bulk Power System was operating at nominal, stable, and steady-state conditions and within generation dispatch and system parameters. There was sufficient generation capacity available for dispatch.

At 13:19, Feb. 21, 2022, a disturbance on the transmission system was detected by LUMA's System Transmission Operating Center (TOC). The events are as follows:

- 13:19 – A temporary disturbance in the transmission system was detected. The TOC began the analysis of the magnitude of the event, including of the transmission lines, transmission centers and generation units that were without service and started stabilizing the System. In a preliminary review of the Sequence of Events (SOE) in TOC, a relay indicated that a "line protection activated" alarm on Line 38100 at San Juan SP. This was the first alarm in the SOE.
- 13:20 –LUMA Reliability Engineering Team connected remotely to the transient recorders and confirmed a major outage. Reliability Engineering team supported restoration and preliminary identification of line 38100 as the source of the faults using transient recorder data and SCADA alarms.
- 13:37 - TOC started testing and energizing transmission lines and transmission centers, starting with Line 39000 Aguas Buenas to Monacillos and the 230/115kV transformer at Bayamon TC (BTC).
- 13:40 – The 230/115kV transformer at Sabana Llana Transmission Center was energized.
- 13:42 – Power to the Centro Médico Hospital was restored.

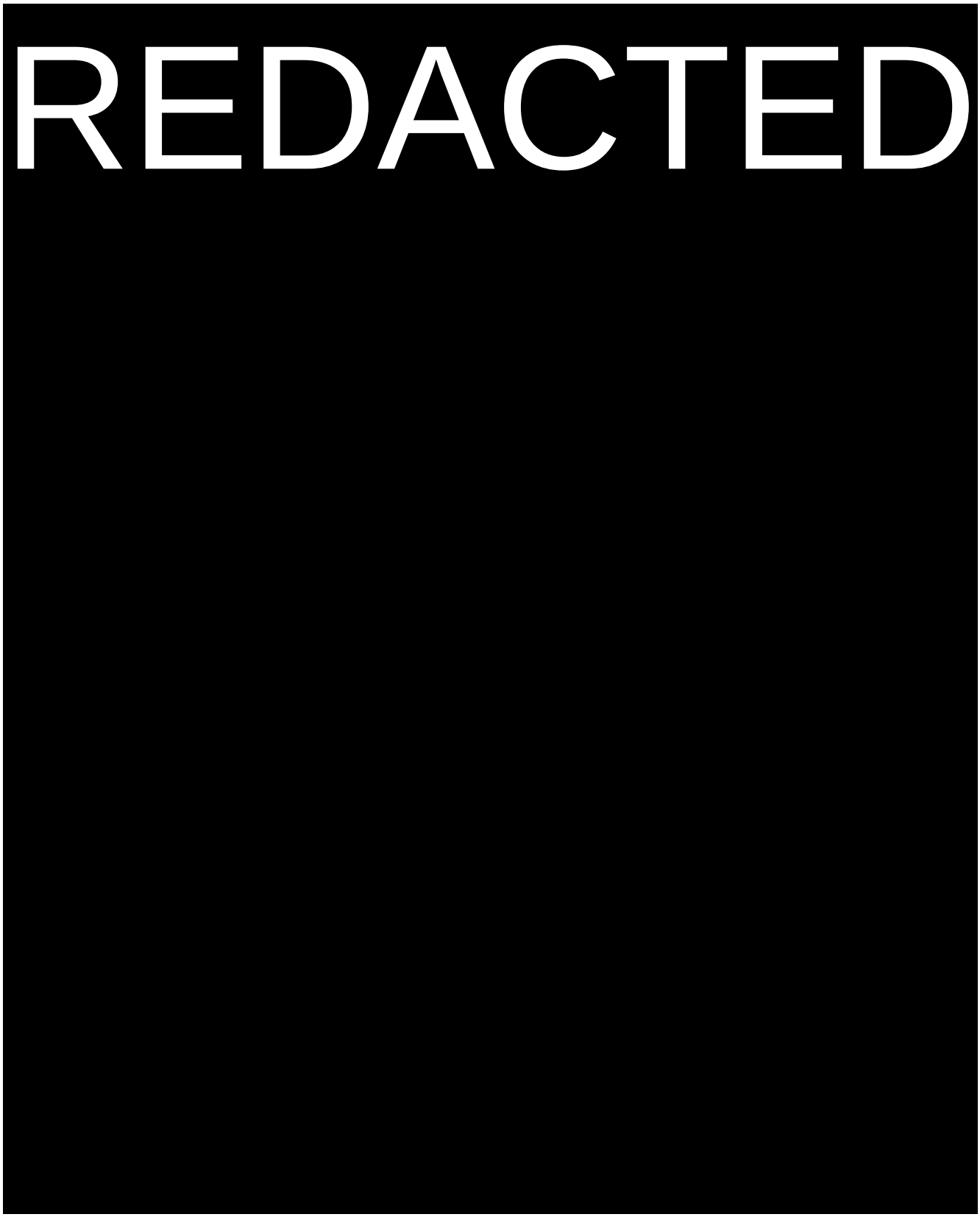
- 13:58 – Inspection of Line 38100 SJSP - Viaducto TC was requested by TOC.
- 14:09 – Following testing, the lines 38500 and 40400 SJSP to Hato Rey TC in addition to 38600 SJSP to BTC were energized. Lines 41200 and 36800 Sabana Llana to Canóvanas were tested and energized.
- 14:18 – A helicopter was dispatched for inspection in Line 38100 SJSP to Viaducto TC and 36200 Monacillos to Juncos (suspecting an open jumper).
- 14:26 – Following testing, lines 37700 Palo Seco to Bayamon TC and 37900 Sabana Llana to Encantada were energized.
- 14:28 – Following testing, the lines 36100 Bayamon TC to Cana and 36200 Fajardo to Daguao were energized.
- 14:33 –Helicopter inspection of line 38100 San Juan SP to Viaducto Transmission Center was completed. No evidence of a fault was found, and TOC was notified.
- 14:35 - As the helicopter did not find any evidence of a fault during the patrolling, the event on line 38100 was retrieved by substation personnel and analyzed to verify that the short circuit current was compatible with a fault on that line.
- 14:37 – Following testing, the line 37800 Monacillos to Caguas was energized.
- 14:44 – Following testing, the lines 37400 Bayamón to Dorado and 41500 Dorado to Piñas TC were energized
- 14:50 – Following testing, the line 38900 Sabana Llana to Escorial was energized
- 15:07 – Following testing, the line 37500 BTC- Rio Bayamón was energized.
- 15:30 - Line 38100 San Juan SP to Viaducto TC was tested and energized. It was found that the protection of the line did not have DC voltage and the TOC proceeded to deenergize the line. Substation personnel started troubleshooting, analysis and repairs.
- 16:56 – Operations to restore system-wide service were completed.

LUMA prioritized restoration of critical customers, such as Centro Medico, early in the process of re-energization of the system in accordance with the System Operation Principles and Procedure 16 - Critical Loads and Procedure 28 - Emergency Response Execution, for restoration of load after an event.

3.0 AFFECTED ASSETS

3.1 SUMMARY OF BREAKERS OPENED

This list was distributed for initial investigations and may not include the complete list of devices that operated.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3.2 GENERATION ASSETS

LUMA is working with generators to review information and has received PREPA's report "Informe de Disturbio en el Sistema Eléctrico – 21 de febrero de 2020" dated 2/23/2022. The generation events status is provided below.

LUMA will analyze the information received from PREPA and include it in the full investigation report. An initial review shows that the sequence of events matches LUMA data, although time stamps are not identical due to separate timing sources.

4.0 SUMMARY OF CUSTOMERS RESTORED

Before the event LUMA reported approximately 2,500 customers out of service (OOS).

The estimated number of customers OOS at the beginning of the event is 592,150.

Region Caguas	
Districtos	**Clientes**
Districto Caguas	4,355
Districto Humacao	0
Districto Cayey	0
Districto Barranquitas	0
TOTAL	**4,355**

Region Bayamon	
Districtos	**Clientes**
Districto Bayamon	81,814
Districto Vega Baja	39,641
Districto Palo Seco	46,494
Districto Corozal	37,702
TOTAL	**205,651**

Region Carolina	
Districtos	**Clientes**
Districto Carolina	39,679
Districto Canovanas	61,420
Districto Fajardo	38,691
TOTAL	**139,790**

Region San Juan	
Districtos	**Clientes**
Districto Monacillos	74,758
Districto Guaynabo	71,652
Districto Rio Piedras	95,944
TOTAL	**242,354**

Region Mayaguez	
Districtos	**Clientes**
Districto Mayguez	0
Districto San German	0
Districto Aguadilla	0
Districto San Sebastian	0
TOTAL	**0**

Region Ponce	
Districtos	**Clientes**
Districto Ponce	0
Districto Guayama	0
Districto Yaoco	0
Districto Santa Isabel	0
TOTAL	**0**

Region Arecibo	
Districtos	**Clientes**
Districto Arecibo	0
Districto Manati	0
Districto Aguadilla	0
Districto Quebradillas	0
Districto Utuado	0
TOTAL	**0**

	Clientes
Total a nivel isla	592,150
	40.33%

The estimated number of customers OOS at 15:00 is 409,863.

Region Caguas	
Districtos	**Clientes**
Districto Caguas	0
Districto Humacao	0
Districto Cayey	0
Districto Barranquitas	0
TOTAL	**0**

Region Bayamon	
Districtos	**Clientes**
Districto Bayamon	75,595
Districto Vega Baja	40,867
Districto Palo Seco	46,494
Districto Corozal	30,434
TOTAL	**193,390**

Region Carolina	
Districtos	**Clientes**
Districto Carolina	23,330
Districto Canovanas	55,128
Districto Fajardo	23,396
TOTAL	**101,854**

Region San Juan	
Districtos	**Clientes**
Districto Monacillos	12,551
Districto Guaynabo	54,686
Districto Rio Piedras	47,355
TOTAL	**114,592**

Region Mayaguez	
Districtos	**Clientes**
Districto Mayguez	0
Districto San German	0
Districto Aguadilla	0
Districto San Sebastian	0
TOTAL	**0**

Region Ponce	
Districtos	**Clientes**
Districto Ponce	0
Districto Guayama	0
Districto Yaoco	0
Districto Santa Isabel	0
TOTAL	**0**

Region Arecibo	
Districtos	**Clientes**
Districto Arecibo	0
Districto Manati	0
Districto Aguadilla	0
Districto Quebradillas	0
Districto Utuado	0
TOTAL	**0**

	Clientes
Total a nivel isla	409,836
	27.91%

The estimated number of customers OOS at 16:00 is 18,864.

Region Caguas	
Districtos	**Clientes**
Districto Caguas	0
Districto Humacao	0
Districto Cayey	0
Districto Barranquitas	0
TOTAL	**0**

Region Bayamon	
Districtos	**Clientes**
Districto Bayamon	0
Districto Vega Baja	0
Districto Palo Seco	12,509
Districto Corozal	0
TOTAL	**12,509**

Region Carolina	
Districtos	**Clientes**
Districto Carolina	0
Districto Canovanas	0
Districto Fajardo	0
TOTAL	**0**

Region San Juan	
Districtos	**Clientes**
Districto Monacillos	5,937
Districto Guaynabo	418
Districto Rio Piedras	0
TOTAL	**6,355**

Region Mayaguez	
Districtos	**Clientes**
Districto Mayguez	0
Districto San German	0
Districto Aguadilla	0
Districto San Sebastian	0
TOTAL	**0**

Region Ponce	
Districtos	**Clientes**
Districto Ponce	0
Districto Guayama	0
Districto Yaoco	0
Districto Santa Isabel	0
TOTAL	**0**

Region Arecibo	
Districtos	**Clientes**
Districto Arecibo	0
Districto Manati	0
Districto Aguadilla	0
Districto Quebradillas	0
Districto Utuado	0
TOTAL	**0**

	Clientes
Total a nivel isla	18,864
	1.28%

5.0 INVESTIGATION OF THE POWER SYSTEM OUTAGE

5.1 FAULT ON LINE 38100

At 13:19 a phase-to-ground short circuit on line 38100 has been identified as the initiating event of this power outage, approximately one mile from San Juan SP. A second later, the fault evolved to the line 38400 Viaducto TC – San Juan SP. Lines 38100 and 38400 are on a shared structure at this location.

This fault was recorded by the line relay in Viaducto TC. The distance to the fault was calculated using the relay data and was corroborated by field operations.

In addition, the security cameras of a private business recorded the probable fault on video. A cell phone recording after the fault shows a small brush fire started by the short-circuit.

The coordinates of the video location are: 18.420589,-66.093437. This area is accessible and right beside line 38100/38400 right-of-way. LUMA completed an investigation on-site. The distance to the fault has been determined to be 1.08 miles, matching the calculated value from the event data.

Initial reports point to a flashover from the line to vegetation below the line.

The fault was detected by the Line Differential relay SEL-311L in Viaducto and the line circuit breaker 38190 opened in 6 cycles (100 ms) as shown in the top graph in Figure 3.

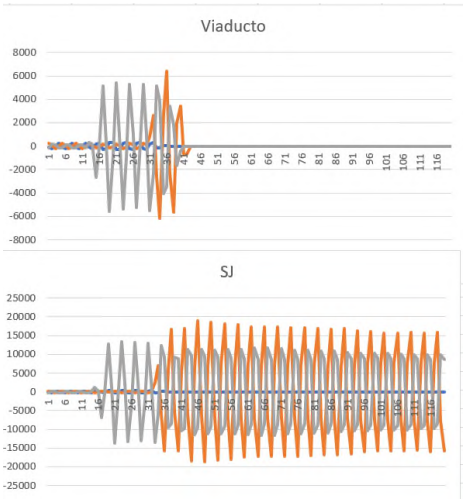


Figure 3 - Fault location with data from SEL-311L 87L2 38100_02-21-22_13.12.10.5

Top graph – local terminal in Viaducto TC shows breaker opening

Bottom graph – remote terminal in San Juan SP with sustained fault due to breakers not opening

The line relays and circuit breakers for line 38400 properly detected and cleared the fault.

Figure 4 illustrates the two faulted lines at the Viaducto TC.

Figure 4 – Viaducto single line diagram indicating faulted lines

5.2 BREAKER FAILURE IN SAN JUAN SP

San Juan SP has a breaker-and-a-half configuration. Figure 5 shows the faulted lines. For line 38100, the line protection should trip breakers 38140 and 0084 but both of these failed to operate which led to a sustained fault on line 38100.

Figure 5 – 115kV bus San Juan SP - single line diagram indicating faulted lines

The cause of the breaker failure to operate was the lack of DC power to the three circuit breakers in the bay: 38140, 0084, and 0086.

LUMA is troubleshooting the installation to find the cause for this loss of DC. In the meantime, the breakers have been supplied with temporary DC power from a different circuit.

The lack of operation by the breaker failure protection function implemented in San Juan is being investigated. This function should have opened all the fault current contributing sources on the 115kV bus. LUMA continues to analyze the sequence of events to determine the behavior of the breaker failure protection.

With a sustained fault on line 38100, and no local clearing, all of the line backup protection at the remote ends of the 115 kV lines into San Juan SP had to clear the fault.

LUMA is creating a timeline of the circuit breaker openings, and relays that operated. A preliminary timeline is included in section 5.4.

The fault on line 38100 occurred one (1) second after the original fault to the parallel line 38400. Initial analysis points to an initial arc flashover from Line 38100 to the trees and a subsequent flashover between lines 38100 and 38400.

The second fault on line 38400 was cleared properly by the line protection.

5.3 SYSTEM WIDE OUTAGE

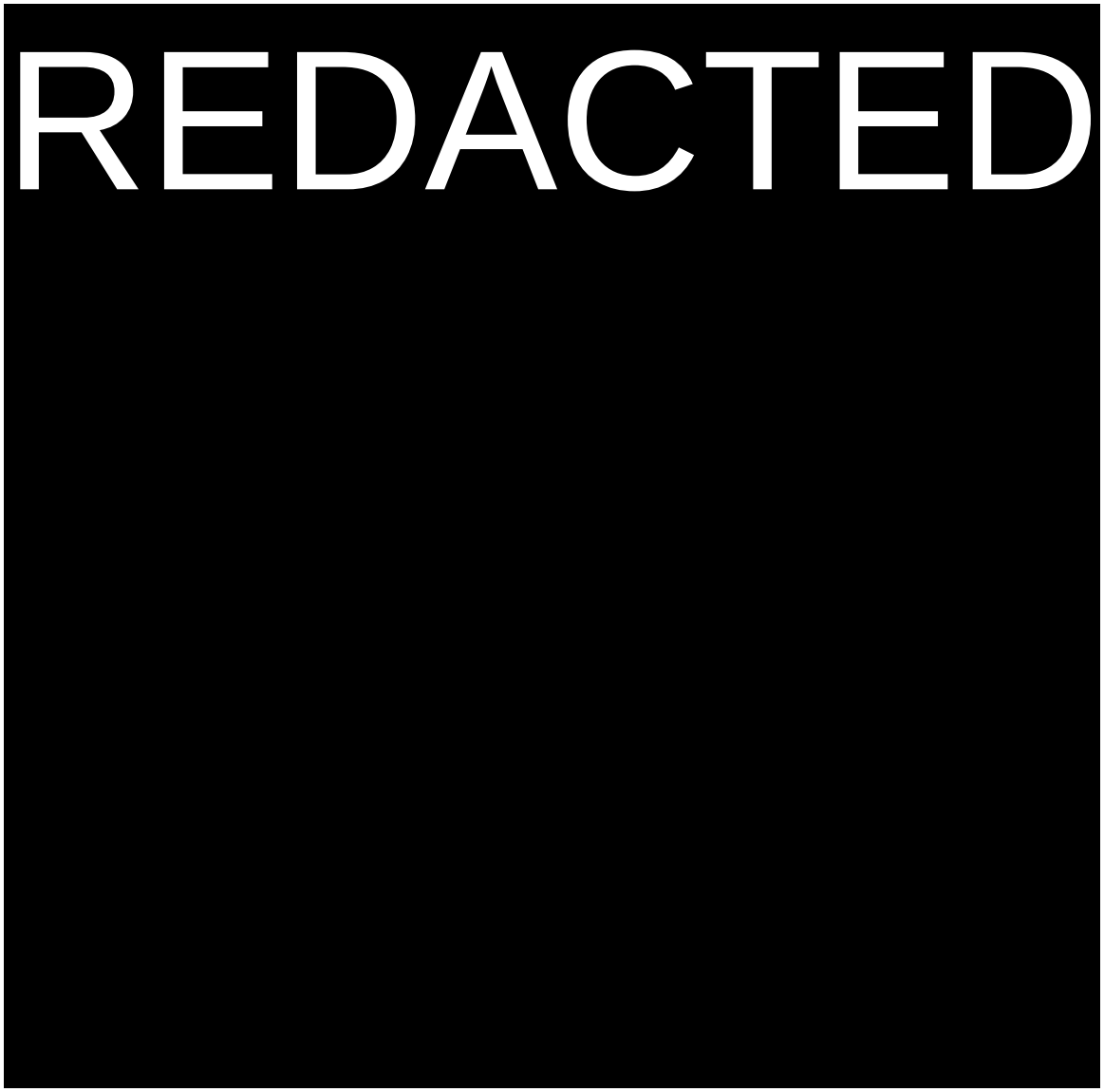
The sudden loss of multiple 115 kV lines, along with the losses of the San Juan SP units 6 and 9, and the Palo Seco generation unit 3, created system instability in the Metro area.

System frequency increased to 60.61Hz and remained in an alarmed state for approximately 20 minutes. It took another 20 minutes to reach a normal state. The extent of the outage reached the following points:

- To the west: Vega Alta in the 38kV system and Vega Baja in the 115kV system
- To the East: Daguao in the 38kV system and Fajardo in the 115kV system
- In addition, the disconnection of the two 230/115 kV transformers in Bayamon TC and Sabana Llana TC prevented flow of generation from the south to the Metro region.
- Furthermore, Aguirre generation unit 2 tripped offline at 13:22.

5.4 TIMELINE OF OPERATIONS

The following timeline details the circuit breaker operations. The information is subject to be revised once further analysis is completed.



6.0 NEXT STEPS

LUMA continues to collect the field data to determine the complete sequence of events and causes of each tripped circuit. LUMA is in contact with PREPA and other relevant parties, including appropriate law enforcement agencies, collecting the data required to complete the analysis. It is premature to draw conclusions at this time with regards to root causes.

A complete analysis of the collected data, including corrective actions and lessons learned is anticipated to take approximately 30 - 45 days.

7.0 CONCLUSION

Since the event, LUMA has focused on safety, restoration of service to customers, restoring system stability, and assuring continuation of service within operating parameters. There has not been sufficient time to process or review all relevant data, and or summarize such information beyond what is being provided in this document.

What is apparent is that despite the aging of the DC circuit, and the large-scale outages that occurred, power was restored to virtually all customers within three hours. LUMA continues to collect all relevant data and analyze the situation to inform continued plans to rebuild the grid in Puerto Rico and prevent such incidents in the future.

LUMA will provide relevant data along with other information as part of its investigation into the incident. The full investigation report on the incident is currently estimated to take four weeks for issuance, but it is not possible to give a definitive timeline at this time. We will continue to communicate with the Energy Bureau with regards to progress on the investigation.