

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

NEPR

Received:

Aug 22, 2022

11:15 PM

IN RE: INTERRUPCIÓN DE SERVICIO
ELÉCTRICO DE 17 DE AGOSTO DE 2022

CASE NO. NEPR-IN-2022-0004

SUBJECT:

**Motion Submitting Preliminary Report on
August 17th Incident and Request for
Confidential Treatment**

**MOTION SUBMITTING PRELIMINARY REPORT ON AUGUST 17TH 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 August 17th 2022, a failure in the electric system led to a power outage event, which affected customers on the southeast area of the Island (hereinafter, the “August 17th Incident”).
2. On the same day, this Honorable Puerto Rico Energy Bureau (“Energy Bureau”) issued a Resolution and Order whereby it initiated a confidential investigation of the August 17th Incident (“August 17th Order”).
3. Among other things, the August 17th Order instructed LUMA to submit on or before August 18th, 2022, at noon, a preliminary report on the causes of the August 17th Incident and the corrective actions taken by LUMA (the “Preliminary Report”).

4. Further, the August 17th Order instructed LUMA to submit on or before August 31st 2022, a final and more detailed report on the August 17th Incident with the following information (the “Final Report”):

- (i) A summary of the incident including, but not limited to, a chronological description of the events and their effect, if any, on the Puerto Rico Electric Power Authority’s (“PREPA”) generation fleet, other energy producers, and the transmission and distribution system, as well as investigative, corrective, or other actions taken by LUMA;
- (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 and the transmission and distribution system;
- (iii) Any document produced, prepared, or received by LUMA and/or PREPA, its agents, attorneys, or consultants in the course of investigative, corrective, or any other efforts were 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 the transmission and distribution system;
- (iv) Repercussions, consequences, or effects that clients and the electricity system will face in the short or long term because of the incident; and
- (v) Any information, in digital or tangible format regarding the incident in possession of LUMA and/or PREPA, which includes, but is not limited to, data, graphs, maps, videos, audios, photos, reports, or documents related to the incident and its effect on the electric service, the generation fleet, and the electricity transmission and distribution system of Puerto Rico.

5. On August 18, 2022, LUMA filed with the Energy Bureau a *Request for a Brief Extension of Time to Comply with the August 17th Resolution and Order on the August 17th Incident Investigation* (“August 18th Motion”). Therein, LUMA requested the Energy Bureau a brief extension until the end of Monday, August 22, 2022, to submit the Preliminary Report in compliance with the August 17th Order.

6. In compliance with the August 17th Order, and to be transparent with its customers and regulators about its operations, LUMA hereby submits the Preliminary Report of the August 17th Incident. *See* Exhibit 1. The Preliminary Report includes the information LUMA has gathered thus far and preliminary findings and assessments of the August 17th Incident.

7. The Preliminary Report filed as Exhibit 1 to this Motion, includes the following:

- (i) Executive Summary of the August 17th Incident
- (ii) Incident Chronology
- (iii) LUMA's Response to the Outage
- (iv) Action Plan and Next Steps

8. The Preliminary Report includes one (1) confidential figure *See* Figure 2. The figure is being submitted under seal of confidentiality as it constitutes 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, 2016, as amended by the Resolution dated September 20, 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 portion of the Preliminary Report of the August 17th Incident under seal of confidentiality.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **take notice** of the aforementioned and **accept** the Preliminary Report of the August 17th Incident that is being filed as Exhibit 1 to this Motion and **treat confidentially** the portion identified as such herein.

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 attorney for the Puerto Rico Electric Power Authority, Katuska Bolaños-Lugo, kbolanos@diazvaz.law.

In San Juan, Puerto Rico, this 22nd day of August 2022.



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Exhibit 1



17 AUG 2022 – 230kV Lines to AES Outage, Load Shed Event and Restoration Report

August 17, 2022

Version

CONFIDENTIAL/PROPRIETARY: In the interests 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.

VERSION HISTORY:

Version	Date	Description
0.1	8/17/22	Initial draft

Incident Summary

Name: 17AUG2022 Major Outage Event –
AES 230kV Line 50700 Outage, Loss of Generation and Load Shedding Event

Date: August 17, 2022

Time: 11:07

Location: AES Generation and 230kV Switchyard and 230kV lines

Description: The 50700 230kV line from AES to Yabucoa tripped due to high impedance fault, and the AES to Aguirre line tripped due to an open jumper. This isolated the AES generation from the grid, causing the frequency of the system to drop and initiating a load shedding event. Delays in the return of the Aguirre generation plant from a previously planned outage by the generation plant posed increased stress on the transmission system, and this led to additional load shedding needed to stabilize the system and a longer restoration process. LUMA immediately took action to stabilize the system, identify the cause, repair, and restore the damaged lines and jumpers. All facilities and customers were back in service by 18:31 hours.

Resumen Del Evento

Nombre: 17AGO2022 Evento de Interrupción de Servicio –Líneas 50700 -230kV, Desconexión, Pérdida de Generación y Relevo de Carga.

Fecha: 17 de Agosto de 2022

Hora: 11:07

Localización: Generación AES, patio de interruptores de 230kV y líneas de 230kV

Descripción: La línea 50700 de 230kV de AES a Yabucoa se disparó debido a una falla de alta impedancia y la línea de AES a Aguirre se disparó debido a un puente abierto. Esto aisló la generación de AES de la red eléctrica haciendo que la frecuencia del sistema cayera e iniciando un evento de relevo de carga. Los retrasos en la disponibilidad de la planta de generación de Aguirre de una interrupción previamente planificada por dicha central generatriz causaron un estrés mayor en el sistema de transmisión, lo cual condujo a un relevo de carga adicional necesario para estabilizar el sistema y a un proceso de restauración de mayor duración. LUMA tomó acción inmediata logrando estabilizar el sistema, identificar la causa, reparar y restaurar las líneas y los puentes afectados. Todas las instalaciones y los clientes recuperaron el servicio a las 18:31 horas.

Executive Summary

Any significant outage, no matter the cause, is a deeply frustrating event for all customers impacted. The August 17th event represents a clear reminder that the electric system remains incredibly fragile and that much more work remains to be done to reduce the risk of such events. While there are many factors that may contribute to such large-scale outage events, the one consistency remains that the electric grid, after decades of operational neglect, remains vulnerable to any fault or issue. The ultimate preventative solution to such systemic events will require a focus on both rebuilding the T&D electric grid and addressing persistent challenges in the generation system. LUMA, as well as PREPA and other generators, must address these challenges together if we are to build the reliable, sustainable, and resilient energy system that the people of Puerto Rico expect and deserve.

In this case, there were challenges that occurred in both the generation system as well as the transmission grid, which ultimately resulted in the load shed affecting our customers. Specifically, delays in the return of the Aguirre generation plant from a previously planned outage by the generation plant posed increased stress on the transmission system, and this led to additional load shedding needed to stabilize the system and a longer restoration process. In order to reduce future outage events, it is essential that a clear-eyed evaluation is conducted of what precisely causes these outages, and how they can best be avoided. As part of our commitment to transparency, LUMA has made it clear that it is providing updates during its investigations, and working with PREPA, other generators, and relevant stakeholders to gather the necessary evidence for root cause analyses.

This report is based on an analysis of the outages affecting portions of the grid, including the 230 kV lines 50700 from AES Plant to Yabucoa Transmission Center (Yabucoa) and Aguirre Steam Plant Substation (Aguirre) that created a load shed event on August 17, 2022.

Sequence of events:

Before the fault, AES generators were supplying 447 MW to the electrical system.

At 11:07:24, line 50700 from Yabucoa to AES tripped due to a high impedance type fault caused by vegetation.

At 11:08:27, 230 kV circuit breaker 50780 from Yabucoa was reclosed by the Control Center to restore service, but the line tripped again, indicating a permanent fault at the line. The protection cleared both faults instantly from the system. Following this line trip, the system enters in the Alert state. (Conceptually, system operating conditions are classified by EPRI into five states: *Normal*, *Alert*, *Emergency*, *In extremis*, and *Restorative*).

At 11:10:47, an open jumper occurred at line 50700 near Aguirre to AES. The open jumper contacted the 230 kV structure. The line differential protection tripped instantly 230 kV circuit breakers 50730-0052 at Aguirre and 50710-0052 at AES. During this event, 230 kV circuit breaker 0074 at Aguirre opened for unknown reasons.

With the AES generation loss, the system entered the emergency state when the frequency dropped. Due to prior system conditions, including the lack of generation on the system, and the failure of line 50200, a

contingency load shed operation was required to maintain system stability. The total load shed operation affecting approximately 300,000 customers was necessary to stabilize and then restore the electric system.

LUMA Responsive Actions Taken

In response to the outage event on August 17th, LUMA took a series of actions, including:

- Responded to this event immediately at 11:07, and within minutes began mobilizing crews to address the loss of lines and generation at AES.
- Mobilized helicopter crews for line patrols, sent crews to various substations, and dispatched vegetation management crews to the AES to Yabucoa line.
- LUMA opened the Emergency Operations Center (LEOC), which coordinated restoration activities and external communications to partners across the island.
- Repairs of the lines, jumpers, and other substation equipment were completed by 18:23 and led to the restoration of all customers by 18:31.

As part of its commitment to improving future outage response, LUMA is currently verifying the specificity of the timeline and system performance during the transmission lines and the subsequent generation outages. Generators must be able to “ride through” system disturbances such as line outages. Confirmation of these details will help support further actions about what can and must be done going forward to avoid future such events.

Lastly, we want to express our deep appreciation to our 1.5 million customers for their patience. We share their frustration when any outage occurs and cannot stress enough how committed the 3000 men and women are to making the necessary infrastructure improvements that will build a better and more reliable energy future for Puerto Rico.

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1. Overview of Event

1.1 Event Details

An initial vegetation fault in line 50700 from Yabucoa to AES was properly cleared by the protection systems. All the generation from AES remained online, served via the remaining 50700 line to Aguirre. A subsequent open jumper in this line, caused the disconnection of the line, followed by the disconnection of the generators at AES, and a load shedding to achieve generation-load balance. The estimated number of customers affected is approximately 300,000. All customers were back online at 18:31. LUMA Emergency Operations Center remained active to monitor the system.

- Event name: OE2208-29
- Outage date: August 17th, 2022
- Outage time: 11:07:24
- Number of customers impacted by event: approximately 300,000.
- Number of customers impacted by the contingency and manual load sheds: approximately 150,000 (this occurred after customers were being restored from the initial load shed action above)

1.2 Overview of Event

Before the event, the system was in the normal state. The AES generators were supplying approximately 447 MWs to the grid. The 230 kV line 50100 from Cambalache to Manatí was out of service for repairs.

At 11:07:24, line 50700 from Yabucoa to AES tripped due to a high impedance fault caused by vegetation. With line 50700 from AES to Yabucoa open, all the generation from AES was served via the remaining 50700 line to Aguirre. At 11:08:27, 230 kV circuit breaker 50780 from Yabucoa was reclosed by the Control Center to restore service, but the line tripped again, indicating a permanent fault at the line. The protection cleared both faults instantly from the system. With this line trip, the system enters the Alert state.

At 11:10:47, an open jumper occurred at line 50700 near Aguirre to AES. The open jumper contacted the 230 kV structure. For this reason, the line differential protection tripped instantly 230 kV circuit breakers 50730-0052 at Aguirre and 50710-0052 at AES. During this event, 230 kV circuit breaker 0074 at Aguirre opened for unknown reasons.

With the AES generation loss, the system entered the emergency state when the frequency dropped. The system entered the *In Extremis* state when automatic load shed was necessary as the frequency continued to descend to a minimum 58.28 Hz. This load shed that affected approximately 300,000 customers was necessary to stabilize the system. Due to prior system conditions, including the lack of generation on the system, and the subsequent failure of line 50200, a contingency load shed operation was required to maintain system stability and security.

1.3 Timeline of Events

The following chart is a summary of the various events that occurred leading to the load shed.

Table 1 - Timeline of Events

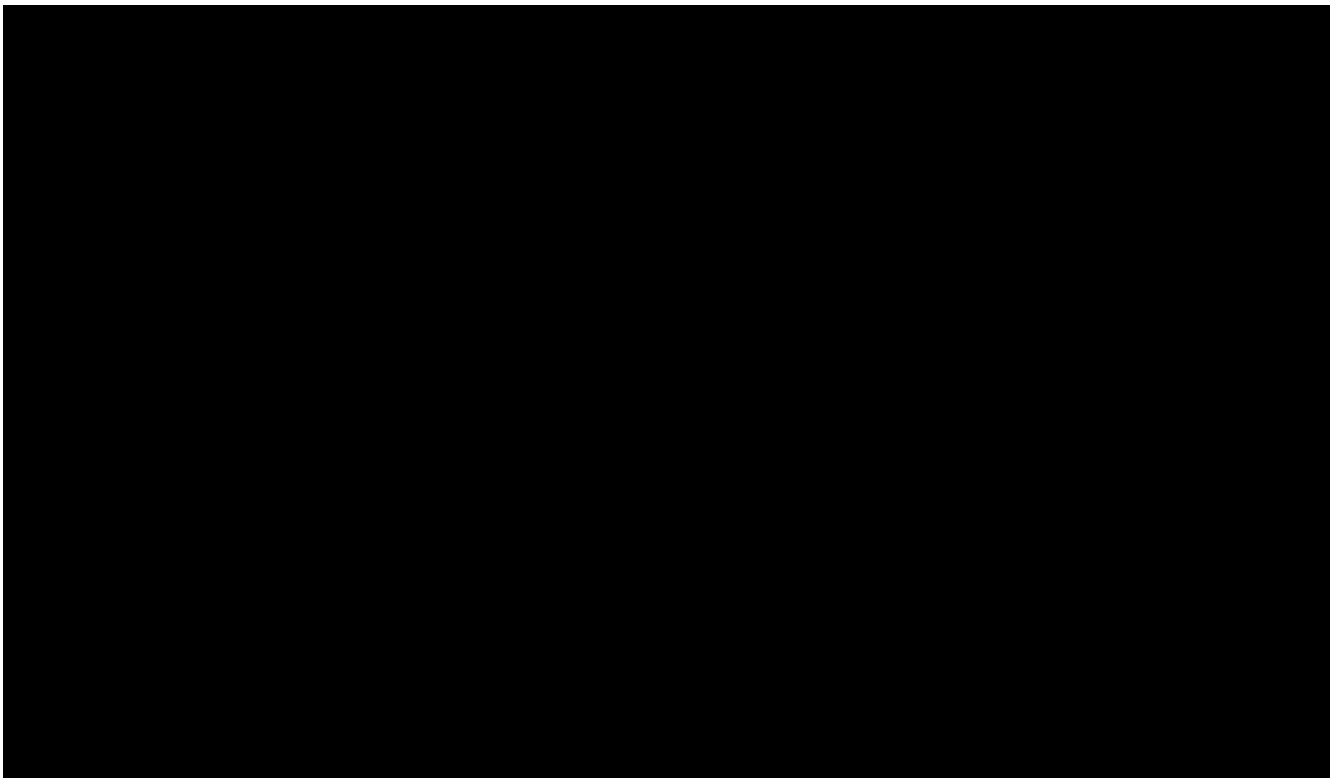
Time	Event
11:07:24.992	Phase A to ground fault due to vegetation was sensed by the system at line 50700 from AES to Yabucoa.
11:07:25.092	230kV circuit breakers 50720-0062 (SEL-321 Zone 1, A-G, RFL-9300) at AES trip in 0.1 seconds.
11:07:25.099	230kV circuit breakers 50780-0070 (SEL-321 Zone 1, A-G, RFL-9300) at Yabucoa opened in 0.107 seconds to clear the fault at line 50700 from the system.
11:08:27.625	230kV circuit breaker 50780 at Yabucoa was remotely closed by the Control Center, the fault at line 50700 was present.
11:08:27.710	230kV circuit breaker 50780 at Yabucoa tripped in 0.085 seconds and stayed open as a permanent fault was detected at line 50700. AES generation to the loads remained via line 50700 to Aguirre.
	System recovered to normal state
11:10:47.375	An open jumper at line 50700 near Aguirre contacted the 230 kV structure creating a Phase B to ground fault of maximum short circuit current magnitude of 37,000 amperes.
11:10:47.451	230 kV circuit breakers from line 50700 at AES and Aguirre open to clear the fault at line 50700. Generation from AES was isolated from the system and the system frequency started to decrease. The system entered the emergency state.
11:10:51.260	The frequency continued to decrease, and the electrical system entered the <i>In extremis</i> state as the automatic load shed was necessary to recover stability. The frequency was below 58.6 Hz.
11:10:51.630	The system frequency decreased below 58.5 Hz as the load shed continued.
11:10:53.480	The system frequency decreased below 58.4 Hz as the load shed continued.
11:10:55.710	The system frequency decreased below 58.3 Hz as the load shed continued.
11:10:56.440	The system frequency reached the lowest frequency at 58.286 Hz and started to recover.
	System in restoration state

1.4 System Status Prior to Event

The electrical system was in the normal state. AES generators #1 and #2 were supplying a combined 447 MW. Lines 50700 from AES to Yabucoa and AES to Aguirre were in service. The 230 kV line 50100 from Cambalache to Manatí was out of service for repairs. Generator Unit 1 in Aguirre, which would typically supply 450 MW, was on a planned outage with a delayed return. It had been expected to return to service on June 8th, but remains out of service.

The AES Plant single-line diagram with line segments 50700 is presented in the figure below.

Figure 2 - 230 kV bus # 1 and # 2 at AES



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2. LUMA's Response to the Outage

LUMA responded to this event immediately by mobilizing crews to address loss of lines and generation at AES. Mobilized helicopter crews for line patrols, sent crews to various substations, and dispatched vegetation management crews to the AES to Yabucoa line.

In addition, LUMA opened the Emergency Operations Center (LEOC), which coordinates the external communications to partners across the island and directed stabilization and restoration activities.

Throughout the day, the LEOC coordinated with agency partners, including FEMA, Department of Public Safety and PREMB, ES12, and Department of Homeland Security, as well as other government agencies, to ensure they had the latest information and were aware of the ongoing restoration efforts.

3. Affected Assets

3.1 List of Affected Equipment

The table below reflects the equipment that operated during this event.

Table 2 - Major Equipment Operations at Load Shed

Breaker	Location	Relay Targets	Description
50720-0062	L50700 - AES - YABUCOA	SEL 321	VEGETATION
50780-0070	L50700 - YABUCOA - AES	SEL 321	VEGETATION
50710-0052	L50700 - AES – AGUIRRE	SEL 321	OPEN JUMPER – TOWER CONTACT
50730-0052	L50700 - AGUIRRE – AES	SEL 321	OPEN JUMPER - TOWER CONTACT
0074	AGUIRRE CICLO COMBINADO #1		UNKNOWN CAUSE. CC#1 REMAINED IN SERVICE
3054	CAGUAX SECT.	ITE-81	UNDERFREQUENCY. 58.6 HZ.
9340	GAUTIER BENITEZ SECT.	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
3050	JUNCOS T.C.	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
3070	JUNCOS T.C.	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
9320	JUNCOS T.C.	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
0060	JUNTOS T.C.	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
5336	LAS PIEDRAS	MICOM-942	UNDERFREQUENCY. 58.6 HZ.
5280	CAGUAS T.C.	MICOM-942	UNDERFREQUENCY. 58.6 HZ.
5460	RIO BLANCO	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
3060	RIO BLANCO	MiCOM-P942	UNDERFREQUENCY. 58.6 HZ.
5350	HUMACAO T.C.	ITE-81	UNDERFREQUENCY. 58.5 Hz

10450	HUMACAO T.C.	ITE-81	UNDERFREQUENCY. 58.5 Hz
12550	HUMACAO T.C.	ITE-81	UNDERFREQUENCY. 58.5 Hz
0250	JOBOS T.C.	ITE-81	UNDERFREQUENCY. 58.5 Hz
3750	JOBOS T.C.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
0210	PONCE T.C.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
0160	SANTA ISABEL SECT.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
0330	TORO NEGRO # 1	ITE-81	UNDERFREQUENCY. 58.5 HZ.
6530	TORO NEGRO # 1	ITE-81	UNDERFREQUENCY. 58.5 HZ.
6520	COMERIO T.C.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
6510	COMERIO T.C.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
4110	COMERIO T.C.	ITE-81	UNDERFREQUENCY. 58.5 HZ.
7930	TORO NEGRO # 1	ITE-81	UNDERFREQUENCY. 58.5 HZ.
6560	BARRANQUITAS SECT.	MICOM-942	UNDERFREQUENCY. 58.5 HZ.
18410	BARRANQUITAS T.C.	TNR	UNDERFREQUENCY. 58.5 HZ.
6550	BARRANQUITAS SECT.	TNR	UNDERFREQUENCY. 58.5 HZ.
3740	HUMACAO T.C.	TNR	UNDERFREQUENCY. 58.5 HZ.
3410	MONACILLOS T.C.	ITE-81	UNDERFREQUENCY. 58.4 HZ.
3510	MONACILLOS T.C.	ITE-81	UNDERFREQUENCY. 58.4 HZ.
3520	CAPARRA SECT.	ITE-81	UNDERFREQUENCY. 58.4 HZ.
4310	CAPARRA SECT.	ITE-81	UNDERFREQUENCY. 58.4 HZ.

Preliminary Findings

3.2 Equipment Issues

The figure below shows the open jumper on the 230kV Line 50700 AES to Aguirre.

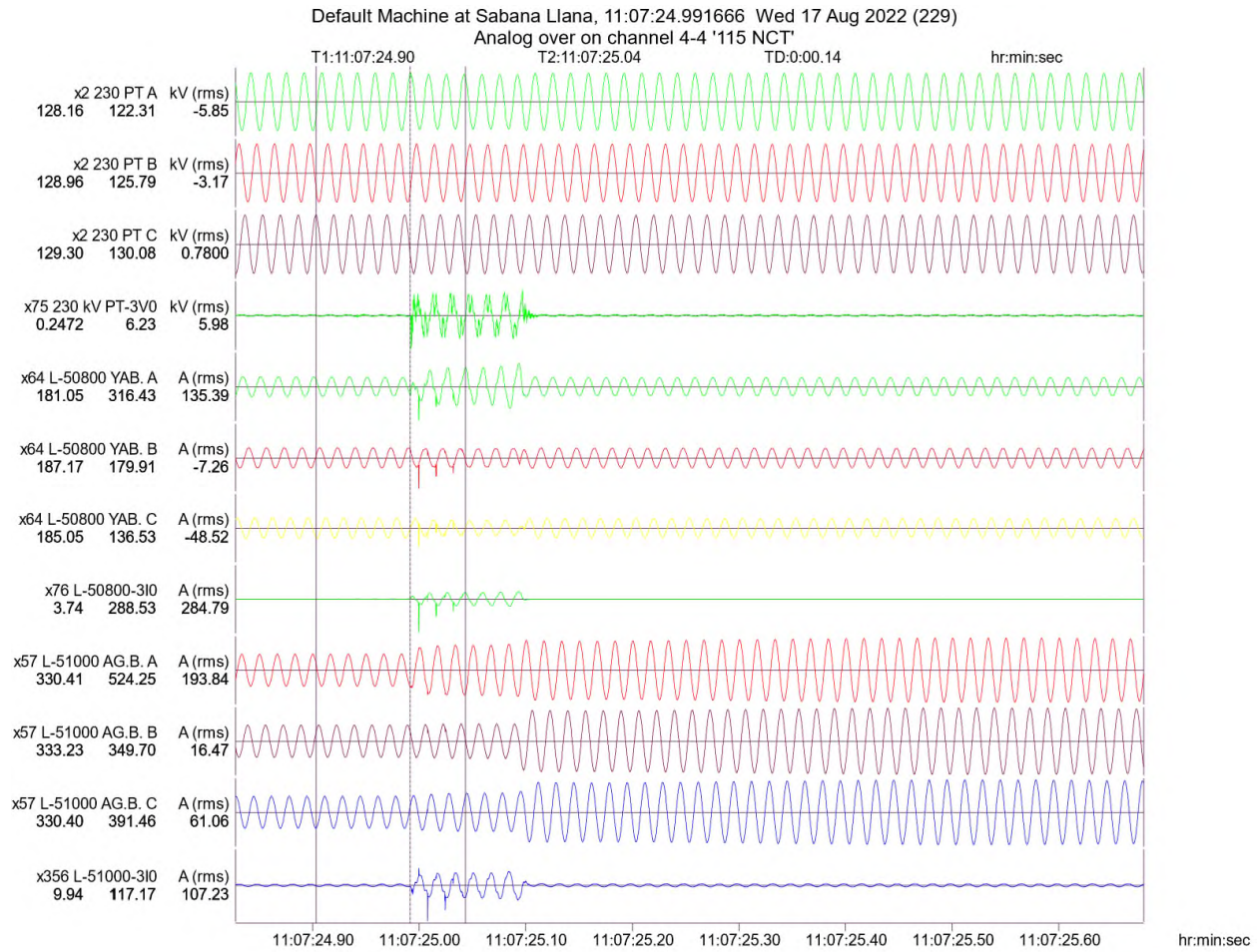
Figure 3- Line 50700 Aguirre to AES – Open Jumper



3.3 August 17, 2022 – Digital Fault Recorder Events

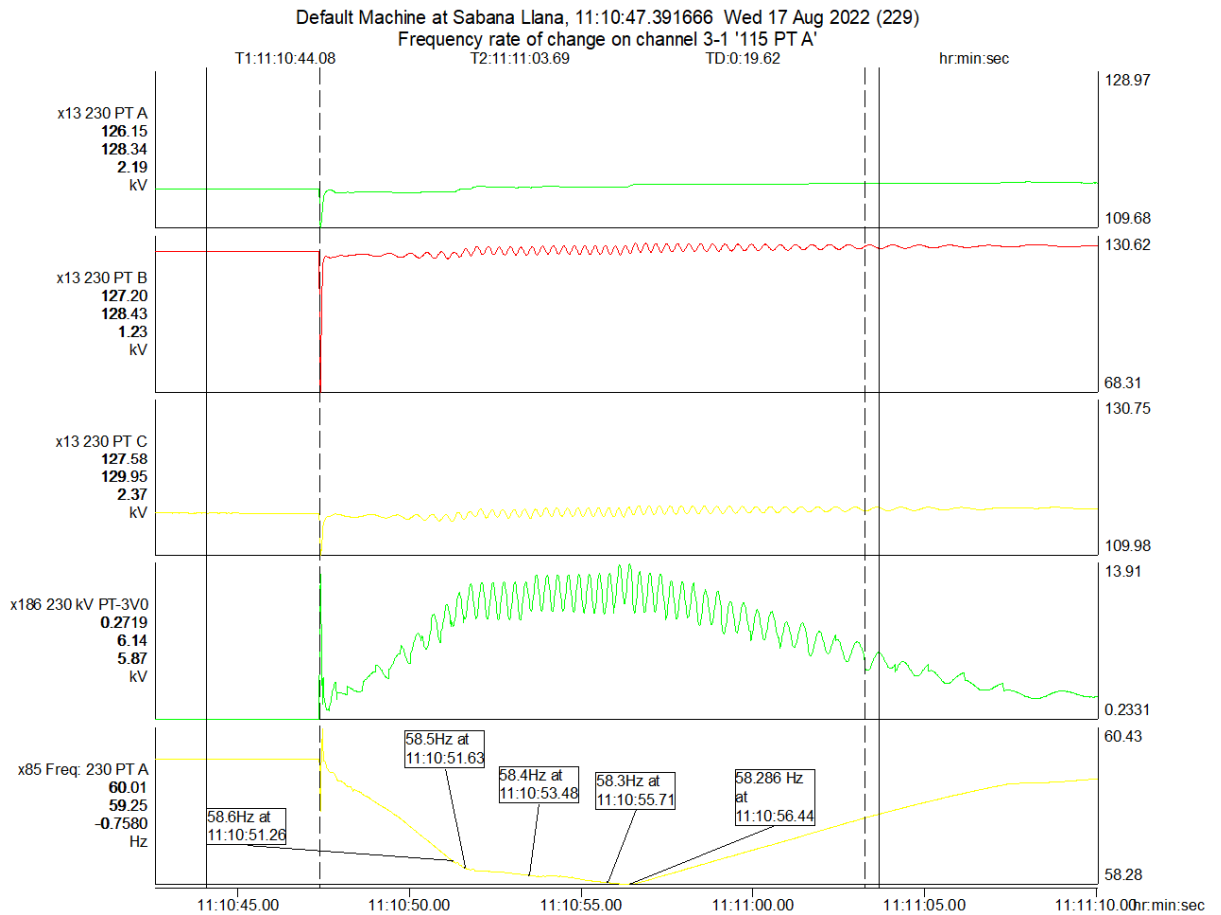
The Sabana Llana transient recorder captured the fault at 230kV, as depicted in the figure below.

Figure 5 - Phase to Phase fault event in 230kV at Sabana Llana DFR



The following traces show how the frequency was decaying during the event (from the transient recorder):

Figure 6 - Frequency Changes during the Event



- At 11:10:51.26 the frequency was 58.6Hz
- At 11:10:51.63 the frequency was 58.5Hz
- At 11:10:53.48 the frequency was 58.4Hz
- At 11:10:55.71 the frequency was 58.3Hz
- At 11:10:56.44 the frequency was 58.2Hz

4. Root Cause and Restorative Actions

4.1 Preliminary analysis

Vegetation has been identified as one of the causes of the event at line 50700 from AES to Yabucoa (breakers 50720 and 0062 at AES). A contributory cause of the event was the open jumper on the 50700 line near Aguirre to AES (breakers 50710 and 0052 at AES). These two events caused the loss of AES generation and initiated the load shed event. The delayed return to service of Aguirre unit 1 exacerbated the magnitude of the load shed event, and the additional 450 MW of power that it would have provided could have potentially accelerated the restoration process.

4.2 Restorative Actions

All customers have been restored, and no immediate further action is needed.

4.3 Next Steps

LUMA will continue to collect and analyze information to support a more detailed analysis and identify and execute additional corrective actions.