LUMA

Critical Loads

CRITICAL LOADS

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1.0 Executive Summary

This procedure defines the requirements for System Operations to identify and maintain Critical Loads. It identifies the requirements necessary to mitigate the loss of Critical Loads and to restore service following a system interruption.

2.0 Objectives/Scope/Roles

2.1 Objectives

This procedure describes how to identify and maintain an accurate and comprehensive list of Critical Loads and the steps necessary to maintain service to those loads. In the event of a service interruption, this procedure defines steps to restore service as quickly as possible. Critical Loads are given top priority during restoration.

2.2 Scope

This procedure includes Critical Loads for both transmission and distribution. It defines the tasks for transmission and communication with distribution to ensure that Critical Loads are maintained and reconfigured safely. In the event of a service interruption to a Critical Load, all efforts will be made to restore those loads as expediently as possible.

This procedure shall be executed by the Transmission Operator under the supervision of the Senior Shift Engineer and approved by the Manager, Control Center Operations. Critical load listings will be updated following each trigger event on the basis of the lessons learned procedure or at a minimum of once per year.

2.3 Roles and Responsibilities

Following are key roles and responsibilities for maintaining and restoring Critical Loads:

2.3.1 Manager, Control Center Operations (MCCO)

The MCCO is responsible for the oversight of the Critical Load policies for the Bulk Power System (BPS).

2.3.2 Manager, Control System Support (MCSS)

Is responsible for maintaining the Critical Loads list and updating the SCADA system accordingly.

2.3.3 Senior Shift Engineer (SSE)

The SSE manages the power system and coordinates the supply and demand for electricity. The Senior Shift Engineer takes actions to avoid fluctuations in system frequency and voltage or interruptions of supply to support Critical Loads. The SSE communicates with other areas such as the Distribution Operations Center (DOC)

2.3.4 Transmission Operator (TO)

The TO is responsible for the 38kV transmission system. The TO is responsible for supervising and coordinating the day-to-day activities of the staff that actively operate the 38kV system.

3.0 Procedure

This Critical Loads Procedure identifies Critical Loads customers, describes the steps needed to control the 38kV transmission system as it relates to the management of Critical Loads in the BPS and coordinates with the Distribution System when re-energizing Critical Loads or when Critical Loads are shed or de-energized.

This procedure includes the following tasks:

- Identify, maintain and update the Critical Loads list.
- Respond to a Trigger Event.
- Identify Critical Loads emergency self-generation customers.

3.1 Identify, Maintain and Update the Critical Loads List

The MCCS maintains a current list of Critical Loads in SCADA. This list is established, updated, and in compliance with this procedure.

Identified Critical Loads are prioritized by importance and length of time needed to be kept running during a transmission system failure.

A thorough review of events related to Critical Loads and “lessons learned (per the Root Cause and Lessons Learned Procedure) and is completed with input from the DOC (Four Locations) annually at a minimum and after every disturbance.

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THE CRITICAL LOADS LIST INCLUDES:

3.1.1 Critical Facilities

Typical critical facilities include hospitals, fire stations, police stations, storage of critical records, and similar facilities (FEMA, 2020). These facilities should be given special consideration when formulating emergency response and restoration protocols.

Per the American Hospital Directory (2020), there are 58 non-federal, short-term, or acute care hospitals. Of those, only one is a Level 1 trauma center. There are approximately 84 fire stations (FireCARES, 2020) and 13 jurisdictional regions in the Puerto Rico Police Bureau (United States, 2011). The FEMA Shelter Inventory Map identifies 452 shelters across the 78 municipalities in Puerto Rico. Figure 9 depicts a generalized map of this infrastructure.

LEVEL 1

Critical infrastructure and facilities identified as a Level 1 facility provide services that are *critical* to the health and safety of the public and are tied to at least one of the seven critical community lifelines. These facilities include, but are not limited to the following:

- Hospitals and Emergency Medical Facilities
- Emergency Shelters, Cooling Centers, and Rescue Facilities
- Public Safety Entities: Fire, Police, and Paramedics
- Emergency Management Offices and Emergency Operations Centers
- Water Pumping/Lift Stations and Wastewater Treatment Plants
- Critical Utility and Communications Facilities
- Fuel Transfer and Fuel Loading Facilities (ports)
- Mass Transit (tunnels, bridges, ferry terminals, major rail facilities/rectifier stations)

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- Airports
- Military Bases
- Critical Flood Control Structures

LEVEL 2

Critical infrastructure and facilities identified as a Level 2 facility provide *significant* public services and may include some of the same types of facilities described in Level 1 depending on the event type. These are considered less critical by government agencies and include, but are not limited to the following:

- Nursing Homes and Dialysis Centers
- Facilities to support other critical government functions
- Prisons and Correctional Facilities
- Communications (radio, TV, etc.)

LEVEL 3

Critical infrastructure and facilities identified as a Level 3 facility provide *some* public services and may include some of the same types of facilities described in Level 2 depending on the event type. They include, but are not limited to the following:

- Event Specific Concerns
- High-Rise Residential Buildings
- Customers providing key products and services (food warehouse)
- Managed Accounts, Large Employers, and Other Key Customers
- Prioritization Other Government Buildings, Schools, and Colleges

3.2 Respond to a Trigger Event

A Trigger Event (such as weather, generation shortfalls, faults, or equipment failure) is an incident that can cause abnormal operation of the transmission system (See Trigger Event in Appendix A –Glossary for additional examples.).

The following steps will be taken when a Trigger Event occurs:

- The TO **shall** identify the line or lines that supply Critical Loads which could be affected. This information **shall** be maintained at the Transmission Operation Center (TOC) in the SCADA system. This information is illustrated on a SCADA system graphic as shown in Appendix C – Load Shedding Graphic for Critical Loads sample.
- TO **shall** establish communications with the SSE at TOC, the MCCO, and the DOC to coordinate actions safely and properly re-energize the system so that all faults are cleared and isolated. Operational benefits for segmenting the transmission system into smaller portions that can be re-energized in a shorter timeframe shall be evaluated by the TO and MCCO.
- Upon a line trip and auto reclosure (single reclosure for 38kV and above, three reclosures for distribution 13kV) no action is taken. If the reclosers fail to stay closed, the SSE instructs the DOC to physically verify line integrity and take necessary action.
- The MCCO **shall** confirm the Critical Loads affected and specify the necessary restoration, coordination, and other downstream isolations as needed.
- The MCCO **shall** initiate proper breaker alignment for isolation and initiate Lockout Tagout (LOTO) of downstream isolation devices. Refer to the Power System Work Standards Procedure
- The MCCO **shall** verify and communicate all local protective relay targets and other information needed to re-energize the substation breaker in a safe and orderly manner.

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- The Transmission Operator shall direct the Supervisor Distribution to proceed with the orders to switch and the MCCO Manager shall assign the task of substation inspection to the supervisors responsible for opening the switches out of service locally and the auxiliary switches. Faults are handled in priority order:
    - Sub transmission lines (38kV).
    - Substations and switchyards.
    - Distribution lines.
- The MCCO **shall** email orders to the TOC when the transmission breaker is deemed ready for service. A confirmation **shall** be provided by the TOC to the MCCO to verify the direction.
- In the repair and restoration of the distribution system, priority **shall** be given to lines that serve Critical Loads. These lines **shall** be patrolled as soon as possible. Damaged branch circuits that do not affect the mainline serving the Critical Loads **shall** be removed from service, as necessary. The MCCO **shall** direct the maintenance of programming that prioritizes Load Shedding events to maintain Critical Loads and that Critical Loads are only affected during a Load Shedding event after residential loads are sequentially rotated out of service in a programmed sequence and there is further deterioration of system capacity (See Appendix C – Load Shedding Graphic for Critical Loads.).
- Appropriate follow up after an atmospheric disturbance **shall** include:
    - If the disturbance passes and does not escalate to an emergency, the systematic restoration will be carried out in priority order.
    - If the disturbance escalates to emergency status, all personnel **shall** follow the Emergency Response Execution Procedure.
- Appropriate communication to the public **shall** take place as needed according to the Public Reporting procedure.

3.3 Identify Critical Loads Emergency Self-Generation Customers

A survey of all currently identified Critical Loads having generation facilities **shall** be conducted by the DOCs at a minimum annually and as new facilities in the distribution district are added. Appendix D, Critical Load Generation Capability Survey, which Includes type and rating, fuel type and storage capability, hours capable of operation, etc., is provided for this purpose.

The Critical Load Generation Survey (Appendix D) **shall** be on file at the DOC and TOC to use during a Load Shedding event. The MCCO and the MCSS **shall** direct updates to the survey annually via email or immediately upon the addition or upgrade of such generation.

When a Critical Load is removed or reprioritized, the designated contact person **shall** notify the System Operator via email within 21 business days prior to the change.

Appendix A: Glossary

Term	Definition
Critical Loads	The electrically driven loads backed up by a source independent of the normal grid power supply which are given priority status to maintain and restore power if lost due to a system event, loss of power, or emergency. Critical Loads must survive abnormal electrical supply conditions to support health, essential services, personnel safety, or security. Following are some examples: ▪ Hospitals ▪ Airports ▪ Seaports ▪ Police Stations and Military Installations ▪ Fire Stations ▪ Storm water pumps ▪ Critical water supply/treatment ▪ Shelter/Town Centers ▪ Communication Facilities Restoration within a few hours or survive through a storm (after hardening work). SOP: A prioritized collection of load or customers that are defined as critical for the purposes of avoiding load shed and/or prioritizing restoration. These customers may include hospitals, telecom facilities, wastewater treatment facilities, emergency response facilities and other critical infrastructure.
Trigger Event	An event such as weather, generation shortfalls, faults, or equipment failure that causes an abnormal operation of the transmission system. Specific examples include: • A severe storm causes a transmission system blackout or segmentation. • A generation event (voltage, frequency, insufficiency) causes a transmission system blackout or segmentation. • A transmission line event causes a line to be taken out of service. For example: ○ Line fault (foliage, lightning, etc.) ○ Equipment failure (i.e., breaker, switch, recloser, transformer)

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Term	Definition
Lockout/Tagout	The placement of a lockout device on an energy-isolating device, in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the lockout device is removed.
Load Shedding	The deliberate shutdown of electric power in part of a power-distribution system to prevent the failure of the entire system when the demand strains the capacity of the system.
SCADA	An acronym for the Supervisory Control and Data Acquisition computer system. It is a system of computer-aided tools used by operators of electric utility grids to monitor, control, and optimize the performance of the generation or transmission system.

Appendix B: Procedure Cross-Reference Matrix

Procedure Reference Matrix, Part 1 of 2	Short Term Load Forecasting	New Facility Interconnection	Resource Adequacy Planning	Interconnected Facility Retirements	Legacy T&G Demarcation	Interconnected Facilities Capabilities	Black Start	Telemetry	Cybersecurity	Root Cause Analysis & Corrective Actions	Public Reporting	Performance Reporting	Stakeholder Management	Policy on Reserves
Short Term Load Forecasting														
New Facility Interconnection														
Resource Adequacy Planning														
Interconnected Facility Retirements														
Legacy T&G Demarcation														
Interconnected Facilities Capabilities														
Black Start														
Telemetry														
Cybersecurity														
Root Cause Analysis and Corrective Actions														
Public Reporting														
Performance Reporting														
Stakeholder Management														
Policy on Reserves														
Reducing Risk Exposure to Contingencies														
Critical Loads											X			
Load Shedding														
Contingency and System Operating Limits Response														
Energy Dispatch, Scheduling and Merit Order														
Transmission Operations														
Plant Level Communications														
Balancing Frequency and Voltage														
Demand-Side Resources (Non-Wire Alternatives)														
System Operator Training														
Scheduling Planned T&G Outages														
Forced Outage														
Outage Execution and Closeout														
Emergency Response Execution														
Emergency Response Drills														

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Procedure Reference Matrix, Part 2 of 2	Reducing Risk Exposure to Contingencies	Critical Loads	Load Shedding	Contingency & System Operating Limits Response	Energy Dispatch, Shedding & Merit Order	Transmission Operations	Plant Level Communications	Balancing Frequency & Voltage	Demand Side Resources (NWA)	System Operator Training	Scheduling Planned T&G Outages	Forced Outage	Outage Execution & Closeout	Emergency Response Execution	Emergency Response Drills
Short Term Load Forecasting															
New Facility Interconnection															
Resource Adequacy Planning															
Interconnected Facility Retirements															
Legacy T&G Demarcation															
Interconnected Facilities Capabilities															
Black Start															
Telemetry															
Cybersecurity															
Root Cause Analysis and Corrective Actions															
Public Reporting															
Performance Reporting															
Stakeholder Management															
Policy on Reserves															
Reducing Risk Exposure to Contingencies															
Critical Loads			X			X									
Load Shedding															
Contingency and System Operating Limits Response															
Energy Dispatch, Scheduling and Merit Order															
Transmission Operations															
Plant Level Communications															
Balancing Frequency and Voltage															
Demand-Side Resources (Non-Wire Alternatives)															
System Operator Training															
Scheduling Planned T&G Outages															
Forced Outage															
Outage Execution and Closeout															
Emergency Response Execution															
Emergency Response Drills															

Appendix C: Load Shedding Graphic for Critical Loads

BLK	LUGAR	EQUIPO	PUEBLO	OBSERVACION	FREQ	AREA	BIERT	ERRAI	KV	AMP	MW	TAL	L CLIENT	CARGA CRITICA
1	REDACTED	1530-06	SAN JUAN/GUAYNABO	REDACTED	58.4	N			4.2	**299.0**	2.2		440	REDACTED
1	[redacted]	1530-07	SAN JUAN/GUAYNABO	[redacted]	58.4	N			4.2	**138.0**	1.0		647	[redacted]
1	[redacted]	1530-08	SAN JUAN/GUAYNABO	[redacted]	58.4	N			4.2	**230.0**	1.7		1,092	[redacted]
1	[redacted]	1530-09	SAN JUAN/GUAYNABO	[redacted]	58.4	N			4.2	**353.0**	2.5		1,318	[redacted]
1	[redacted]	6001-01	MAYAGUEZ	[redacted]	0.0	S			4.2	**85.0**	0.6		879	[redacted]
1	[redacted]	6001-03	MAYAGUEZ	[redacted]	0.0	S			4.2	**388.0**	2.8		2,731	[redacted]
1	[redacted]	6001-04	MAYAGUEZ	[redacted]	0.0	S			4.2	**0.0**	0.0		51	[redacted]
1	[redacted]	6001-05	MAYAGUEZ	[redacted]	0.0	S			4.2	**240.0**	1.7	**12.5**	287	[redacted]
3	[redacted]	6802-01	HORMIGUEROS	[redacted]	0.0	S			13.2	**69.0**	1.6		1,104	[redacted]
3	[redacted]	6802-02	HORMIGUEROS	[redacted]	0.0	S			13.2	**311.0**	7.1		3,480	[redacted]
3	[redacted]	6802-04	HORMIGUEROS	[redacted]	0.0	S			13.2	**144.0**	3.3		4,409	[redacted]
3	[redacted]	6802-05	HORMIGUEROS	[redacted]	0.0	S			13.2	**284.0**	6.5		996	[redacted]
3	[redacted]	7801-01	SAN SEBASTIAN	[redacted]	58.1	S			4.2	**243.0**	1.7		3,107	[redacted]
3	[redacted]	7801-02	SAN SEBASTIAN	[redacted]	58.1	S			4.2	**93.0**	0.7		775	[redacted]
3	[redacted]	7801-03	SAN SEBASTIAN	[redacted]	58.1	S			4.2	**137.0**	1.0		1,200	[redacted]
3	[redacted]	7801-04	SAN SEBASTIAN	[redacted]	58.1	S			4.2	**2.0**	0.0	**21.9**	1,784	[redacted]
6	[redacted]	3004-02	CAGUAS	[redacted]	0.0	N			8.3	**2.4**	0.0		1	[redacted]
6	[redacted]	4003-01	GUAYAMA	[redacted]	0.0	S			13.2	**186.0**	4.2		3,364	[redacted]
6	[redacted]	4003-02	GUAYAMA	[redacted]	0.0	S			13.2	**294.0**	6.7		4,307	[redacted]
6	[redacted]	4003-03	GUAYAMA	[redacted]	0.0	S			13.2	**110.0**	2.5		1,958	[redacted]
6	[redacted]	6005-01	MAYAGUEZ	[redacted]	0.0	S			4.2	**207.0**	1.5		1,152	[redacted]
6	[redacted]	6005-02	MAYAGUEZ	[redacted]	0.0	S			4.2	**126.0**	0.9		1,901	[redacted]
6	[redacted]	7002-02	AGUADILLA	[redacted]	0.0	S			4.2	**0.0**	0.0		47	[redacted]
6	[redacted]	7002-03	AGUADILLA	[redacted]	0.0	S			4.2	**230.0**	1.7		1,264	[redacted]
6	[redacted]	7002-04	AGUADILLA	[redacted]	0.0	S			4.2	**0.0**	0.0	**17.6**	562	[redacted]
8	[redacted]	1903-01	BAYAMON	[redacted]	58.1	N			4.2	**195.0**	1.4		295	[redacted]
8	[redacted]	1903-02	BAYAMON	[redacted]	58.1	N			4.2	**160.0**	1.2		317	[redacted]
8	[redacted]	1903-03	BAYAMON	[redacted]	58.1	N			4.2	**113.0**	0.8		217	[redacted]
8	[redacted]	1903-05	BAYAMON	[redacted]	58.1	N			4.2	**411.0**	3.0		1,319	[redacted]
8	[redacted]	6101-02	AÑASCO	[redacted]	0.0	S			4.2	**391.0**	2.8		1,243	[redacted]
8	[redacted]	6101-04	AÑASCO	[redacted]	0.0	S			4.2	**284.0**	2.0		1,837	[redacted]
8	[redacted]	6101-05	AÑASCO	[redacted]	0.0	S			4.2	**166.0**	1.2		3,251	[redacted]
8	[redacted]	8001-01	ARECIBO	[redacted]	58.2	N			4.2	**453.0**	3.3		1,558	[redacted]
8	[redacted]	8001-02	ARECIBO	[redacted]	58.2	N			4.2	**1.2**	0.0		276	[redacted]
8	[redacted]	8001-03	ARECIBO	[redacted]	58.2	N			4.2	**0.0**	0.0	**15.6**	186	[redacted]
9	[redacted]	1418-01	SAN JUAN	[redacted]	58.5	N			4.2	**88.0**	0.6		855	[redacted]
9	[redacted]	1418-02	SAN JUAN	[redacted]	58.5	N			4.2	**383.0**	2.8		899	[redacted]
9	[redacted]	1418-03	SAN JUAN	[redacted]	58.5	N			4.2	**54.0**	0.4		606	[redacted]
9	[redacted]	1418-05	SAN JUAN	[redacted]	58.5	N			4.2	**151.0**	1.1		1,398	[redacted]
9	[redacted]	4602-01	COAMO	[redacted]	57.5	S			4.2	**414.0**	3.0		2,769	[redacted]
9	[redacted]	4602-02	COAMO	[redacted]	57.5	S			4.2	**181.0**	1.3		580	[redacted]
9	[redacted]	4602-03	COAMO	[redacted]	57.5	S			4.2	**368.0**	2.6		2,601	[redacted]
9	[redacted]	4602-04	COAMO	[redacted]	57.5	S			4.2	**147.0**	1.1		1,616	[redacted]
9	[redacted]	4602-05	COAMO	[redacted]	57.5	S			4.2	**25.0**	0.2		29	[redacted]
9-10	[redacted]	3015-05	CAGUAS	[redacted]	58.0	N			13.2	**190.0**	4.3		2,317	[redacted]
9-10	[redacted]	3015-06	CAGUAS	[redacted]	0.0	N			13.2	**116.0**	2.6	**20.0**	1,351	[redacted]
10	[redacted]	8120	ARICAO/ADJUNTAS/LA	[redacted]	58.5	S			38.0	46.0	3.0		4,968	[redacted]

Appendix D: Critical Load Generation Capability Survey

CRITICAL LOAD DIESEL ENGINE – GENERATOR PLANT				
Owner:				
Project No.:		**Station:**	**Date:**	
Superintendent/Operator:			**Total Engines at Station:**	
Unit Number	**1**	**2**	**3**	**4**
Operation & Maintenance Records Available				
Plant Exterior Appearance				
Plant Interior and Equip. Appearance				
Jacket Water Supply Source				
Plant Operating/Maintenance Personnel:				
DIESEL ENGINE DATA				
Engine Manufacturer:				
Model, Type:				
Serial Number:				
Size, hp:				
Bore x Stroke, in x in:	X	X	X	X
Number of Cylinders:				
Dual Fuel or Diesel:				
Speed, rpm:				
Outboard Bearing Type:				
GENERATOR DATA				
Generator Manufacturer:				
Frame – Type:				
Serial Number:				
Exciter Manufacturer:				
Speed, rpm:				
DC/V belt:				
Rating, kw/KVA:				
OPERATING DATA				
Date Purchased:				
Date Installed:				
Hours Operated:				
Engine Observed in Operation:				
Fuel Consumption: Diesel: Gallons per hour:				
On-site Fuel Storage (gallons)				

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