LUMA

Black Start

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1.0 Executive Summary

This Black Start procedure addresses the restoration plan for the Bulk Power System, including the procedures, documentation, training, and testing for reliable system restoration following a major or total blackout.

In the event of a Black Start situation, the Black Start Service Provider **shall** be required to start up its main generator(s) to power up sections of the Bulk Power System and distribution network. This direction **shall** be initiated under the instruction of LUMA personnel and proceeds under the general guidance of a site-specific restoration plan coordinated by System Operations. The Black Start Service Provider may also be required to provide start up power supply to other power stations as the system restoration progresses and **shall** eventually be required to synchronize to other power islands.

2.0 Objective/Scope/Roles

2.1 Objective

Define how Black Start services will restore the Bulk Power System and by providing blocks of generation to re-energize the 230 kV, 115 kV and 38 kV transmission lines.

2.2 Scope

This procedure describes how Black Start Service Provider’s provide black start capability to be used to start main blocks of generation from on-site actions, without reliance on external site power supplies. It further describes action taken once the Black Start Service Provider black start gas turbine has reached complete sequence (also called full speed, no load) and how the system then must be able to close the main generator output breaker.

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2.3 Roles and Responsibilities

2.3.1 Manager Energy Management (MEM) Is responsible for the collection, aggregation, and draft of GFO reports, generation capability, black start testing results and maintain policies that the interconnected facilities must adhere to.

2.3.2 Generator Facility Operator (GFO)

- Is the Interconnected facility's designee, in accordance with the Plant Level Communications (PLC), responsible to conduct activities for each Interconnected Facility related to system operations principles and procedure.
- Specifically, is contact person for reports generator capability and is the main point of communication to the SSE.

2.3.3 Generator Facility Operator – Back-Up Contact (GFOBU)

- The backup of the designated contact for the Interconnected facility's designee, and in accordance with the PLC, responsible to conduct activities for each Interconnected Facility related to this and other procedures related to communication of generator capability and communication.

2.3.4 Senior Shift Engineer (SSE)

- The SSE is responsible for dispatch of real and reactive power, as well as ancillary services, for all interconnected facilities.
- The SSE is also responsible for communication with primary contacts for all power plants and Transmission Operators.
- The SSE is responsible for the overall operation of the system and works directly with the TO's to manage the overall technical operation of all interconnected facilities in a real-time setting.
- The operation of both the Monacillo and the Ponce control centers.
- Supervisor of the TO during the shift.

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2.3.5 Senior Transmission Operator (STO)

- The STO is responsible for the routing and balance of real and reactive power through the 230 kV and 115 kV transmission lines and working with the SSE to jointly manage energy needs.
- The STO is also responsible for coordinating with the SSE regarding frequency regulation, transmission flows and the current state of outages and recall times for assets and interacts with SSE.

2.3.6 Transmission Operator (TO)

- The TO is responsible for the routing and balance of real and reactive power through the 38 kV transmission lines and working with the SSE to jointly manage energy needs.
- The TO is also responsible for coordinating with the SSE regarding frequency regulation, transmission flows and the current state of outages and recall times for assets and interacts with SSE.

2.3.7 Field Personnel

- The Field Personnel is the individual responsible to assist 38 kV operations at the Transmission Operations Center (TOC) regarding loads available to island the black start generators including Critical Loads and performing switching duties as required.

3.0 Procedure

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- RE[redacted]CTED
- [redacted]
- [redacted]
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REDACTED

3.1.1 Black Start Service Resources

REDACTED

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3.1.2 Black Start Testing Procedures

REDACTED

3.1.3 Black Start Resource Testing Requirements

REDACTED

-
-
-
-

3.1.4 Black Start Testing Frequency

REDACTED

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3.1.5 Documentation of Black Start Testing

REDACTED

REDACTED

3.1.6 Scheduling a Test

REDACTED

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Appendix A: Glossary

Term	Definition
Black Start	A black start is the process of restoring an electric power station and the entire electric grid to operation without relying on the external electric power transmission network to recover from a total or partial shutdown
Bulk Power System (BPS)	Refers to the transmission and distribution system and related facilities, equipment and other assets related to the transmission and distribution system.
Dead Line Charge Test	This test confirms the service provider's ability to charge a dead part of the network and its ability to control parameters at the remote end.
Busbar	The node point on a transmission system is where transmission lines come together electrically.
Critical Transmission Line	A critical transmission line plays an important role in maintaining the security and stability of the power system. When it is removed from service or trips off line, the system may suffer a serious impact, and even have a high probability of cascading trips.
Distribution Operations Center (DOC)	A center that is used to control local distribution under 38 KV. There are 4 of these centers in the BPS
District Technician	Technician within a specified district of the BPS
Genset	*Genset* is short for generator set, often used interchangeably with the more familiar term, generator.
Black Start Generation Resource	The technical requirements are fundamentally describing the following significant activities undertaken during restoration: ▪ The ability to start up independent of external supplies. ▪ The ability to energize part of the network with MVAr export only (i.e., at 0MW). ▪ The ability to block load local demand.

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Term	Definition
Islanding	Islanding is a scheme in a power system designed in such a way that, in case of major Grid disturbance as sensed by the protection element, a portion of system is isolated by tripping the predefined tie lines/transmission lines, thus, isolating the part of system from the remaining Grid.
Black Start Service Provider (BSSP)	A generation provider which has the capability to start with no support from the Bulk Electric System.
Remote Synchronous Test (RST)	A Remote Synchronous Test (RST) requires the Black Start Service Provider (BSP) to start the black start generation resource with no power available from the transmission system, energize from dead a local busbar, a circuit(s), a transformer(s) and a remote busbar and then synchronize onto a live busbar that is already synchronized to the transmission system. The BSP may be required to operate for up to one hour at no load at synchronous speed while the Black Start generation resource's ability to control voltage and frequency on the system is verified.
Generator Facility Operator (GFO)	The generator facility operator is the Interconnected facility's designee, in accordance with the PLC (plant-level Communications), responsible to conduct activities for each Interconnected Facility related to system operations principals and procedure. More specifically is contact person for reporting of generator capability and main point of communication between LUMA TOC and Interconnected Facility.
Transmission Operations Center (TOC)	Main operations center that controls both the 230/115 and 38 KV on the Bulk Power System

Appendix B: Notification of Non-Capability & Restoration

[NAME OF BLACKSTART SERVICE PROVIDER]

Station .....Telephone:

Standby Tel:

NOTIFICATION TIME

HRS:MINS	DD/MM/YY

CONFIRMATION OF A TELEPHONE CONVERSATION? ✓	
BETWEEN OF **LUMA** AND OF [NAME OF **BSP**]	

PERIOD OF NON-CAPABILITY	TIME (hrs:mins)	DATE (dd/mm/yy)
COMMENCEMENT OF NON-CAPABILITY		
*ESTIMATED TIME/DATE OF RESTORATION		

* Indicate estimated time/date of restoration and re-notify actual time/date of restoration when known using table below.

REASON FOR NON-CAPABILITY

RESTORATION OF-CAPABILITY	TIME (hrs:mins)	DATE (dd/mm/yy)
TIME/DATE OF RESTORATION		

Signature: ..... Date: ..... Time: .....

Appendix C: Black Start Resource

[NAME OF BLACKSTART SERVICE PROVIDER]

Station .....Telephone:

Standby Tel:

NOTIFICATION TIME

HRS:MINS	**DD/MM/YY**

CONFIRMATION OF A TELEPHONE CONVERSATION? ✓	
BETWEEN OF **LUMA** AND OF [NAME OF **BSP**]	

OWER OUTPUT LEVELS (MW)	
1 [ ] MW WITHIN [ ] MINS	
2 [ ] MW WITHIN [ ] MINS	
3 [ ] MW WITHIN [ ] MINS	

REACTIVE POWER RANGE (MVARs) **AT MIN OUTPUT/GEN STATOR TERMINALS**		
[ ] LEADING TO [ ] LAGGING		

TIME TO CONNECTION EVENT (MINS)	

(Print name) at **GFO:**

Signature: ..... Date: ..... Time: .....

Acknowledged by **LUMA**

Signature: ..... Date: ..... Time: .....

Appendix D: 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			X			X	X							
Telemetry														
Cybersecurity														
Root Cause Analysis and Corrective Actions														
Public Reporting														
Performance Reporting														
Stakeholder Management														
Policy On Reserves														
Reducing Risk Exposure to Contingencies														
Critical Loads														
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, Scheduling & 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		X			X	X	X	X		X				X	X
Telemetry															
Cybersecurity															
Root Cause Analysis and Corrective Actions															
Public Reporting															
Performance Reporting															
Stakeholder Management															
Policy On Reserves															
Reducing Risk Exposure to Contingencies															
Critical Loads															
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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