GUAM POWER AUTHORITY **STANDARD OPERATING PROCEDURE**	Prepared By: Operations
TITLE: System Restoration During Partial or Complete IWPS Blackout	Concurred By: 5/14/18 Melinda C. Mafnas, P.E. Asst. GM, Operations
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1.0 PURPOSE

This Standard Operating Procedure provides guidelines for the safe and efficient restoration of power after a partial outage or a complete IWPS blackout.

2.0 SCOPE

This procedure shall apply to all personnel involved with IWPS restoration, most especially to the Generation, PSCC, T&D, and Engineering Divisions.

3.0 DEFINITIONS

3.1 Partial Outage: a partial outage is an outage affecting a number of circuits and plants, but not the entire IWPS. For the purposes of this SOP, this term is used to denote an outage where system restoration is required for baseload units to come online.

3.2 Blackout: an outage affecting all circuits, which is generally characterized by all generating plants being isolated from the IWPS.

3.3 Black Start Capability: the ability of a generating plant to start up on its own, independently of the power grid. For larger generating plants, an appropriately sized generator is used to provide power to auxiliary equipment to start up the plant.

4.0 OBJECTIVES

System restoration shall be accomplished in an expedient and orderly fashion by adhering to the guidelines concerning the following:

a. Personnel Response
b. Communication Protocol
c. Restoration Procedure
d. Generating Units Start Up Procedure
e. Event Reporting

5.0 PERSONNEL RESPONSE

5.1 A blackout declaration shall be made by the AGMO or his/her designee. A blackout is declared once all generating units have been placed offline and no load is being supported by the IWPS.

5.2 The order of blackout notification by the PSCC Dispatcher shall be as follows:

Priority	Position
0	AGMO
1	General Manager
2	Generation Manager
	Assistant Generation Manager
	Plant Superintendent, Cabras 1&2
	Assistant Plant Superintendent, Cabras 1&2
	Assistant Plant Superintendent, CT's
	Assistant Plant Superintendent, Diesel
	Assistant Plant Superintendent, Water System Diesel
3	T&D Manager
	Assistant T&D Manager
	T&D Substation Superintendent
	T&D Meter/Relay Superintendent
	T&D Substation Supervisor
	T&D Relay Supervisor
4	PSCC Manager
	Chief Dispatcher
5	Engineering Manager
	Engineering Supervisor, Substation/Transmission
	System Protection Engineer
6	Public Information Officer
7	GWA Dispatcher
8	Navy Power System Dispatcher

Once the System Dispatcher has reached at least one person in each of the numbered priority listing, the person reached is responsible for notifying other personnel upstream or downstream, dependent on his/her position in the listing. For example, if the Dispatcher fails to reach the Generation Manager, he then tries to reach the Assistant Generation Manager. If again, this person is also unavailable, he then tries to reach the Plant Superintendent of Cabras 1&2. Once he contacts the Superintendent, he continues to 3, 4, 5, and 6 of the priority listing. The Plant Superintendent of Cabras 1&2 then is responsible for contacting the Generation Manager and Assistant Generation Manager, Assistant Plant Superintendent, etc.

5.3 Once a blackout is declared the following personnel are required to report immediately as designated:

a. PSCC: AGMO, Generation Manager, PSCC Manager, T&D Manager, and Chief Dispatcher
b. Generating Plants (Baseload, CTs, and Diesel Units): All standby generation personnel shall be mobilized by their respective assistant plant superintendents.
c. T&D shall maintain a list of switchmen, linemen, and primary and auxiliary relay response teams. This list shall be updated accordingly and provided to PSCC.
d. T&D Substation on-duty switchmen shall be dispatched to the relevant substation(s) by Control. T&D Substation Superintendent or T&D Substation Supervisor shall designate assignments to substation personnel to cover critical substations to include Agana, Piti, Cabras, Harmon, and Tamuning, as well as to substations with generating units such as Dededo, Macheche, Yigo, Pulantat, Tanguisson, and Tenjo.
e. T&D Relay primary and auxiliary response teams will be dispatched to the relevant substation(s) by Control. All other T&D Relay personnel shall report to T&D to receive their assignments from the T&D Meter/Relay Superintendent or T&D Relay Supervisor.

5.4 Preliminary Outage Analysis

a. All relay targets activating a circuit breaker shall be reported immediately to Control. Relay targets are trip set points that are pre-programmed in the relay in accordance with the Relay Protection Guidelines.
b. PSCC shall have all relevant sequence of events ready within the hour of the blackout for the GM and AGMO's perusal.
c. Engineering shall retrieve all transient data monitoring generation output and response.
d. Engineering personnel shall compile relevant data as soon as available and keep the GM and AGMO informed at regular intervals during the blackout restoration.

6.0 COMMUNICATION PROTOCOL

6.1 All communication regarding switching and tagging of lines shall be through GPA's VHF radio system and shall be recorded. Constant communication and close coordination with all power plant personnel and field personnel shall be maintained at all times.

6.2 All radio communication for critical switching and coordination shall be performed on Channel 1. Additionally, all personnel are required to monitor Channel 1 for important broadcasts. Other non-critical communication may be performed on Channel 4. Once this communication is complete, radios must be turned back to Channel 1 for monitoring.

6.3 Should these channels not be available, the Electric Power System Dispatcher shall broadcast the channel for critical switching and coordination and the channel for non-critical communication.

7.0 RESTORATION PROCEDURE

7.1 All distribution (13.8 kV) feeder breakers shall be opened at each and every substation. Main power transformer breakers shall remain closed.

7.2 All sub-transmission (34.5 kV) line breakers, except for those that are identified by the Control Dispatcher as being needed to supply energy from one generating plant to another for startup purposes shall be opened.

7.3 Any and all faulted transmission (115 kV) and sub-transmission (34.5 kV) lines, breakers, buses, and power transformers identified or suspected as being the cause of a blackout or partial blackout shall be isolated and tagged. Each individual plant operator (PMC's, IPP's, and GPA operated plants) shall clear its power interchange transformer.

7.4 Once clearance is given, transmission and sub-transmission breakers shall be closed one at a time to energize substation power transformers as available generation permits.

7.5 Individual power plant start up procedures shall be followed as outlined in Section 9.0.

7.6 While a generating unit is being synchronized to the system, no distribution feeder breaker shall be operated, as this action may cause a disruption of system voltage and system frequency.

7.7 Distribution feeder breakers shall only be closed after obtaining approval from the on-duty Plant Operator whose plant is regulating system frequency. The Control Dispatcher shall monitor and maintain system frequency between 59.85 to 60.10 Hz.

7.8 Restoration of feeders shall be performed in consideration of critical loads and maintaining system frequency to prevent reversion of the blackout event. Circuit restoration shall consider the following:

a. Hospitals
b. Under frequency Load shedding scheme Stage 1 Feeders
c. Under frequency Load shedding scheme Stage 2 Feeders
d. Department of Defense Critical Loads
e. GIAA
f. Civilian Critical Loads
g. Waterwells

PSCC will prioritize restoration of feeders based on existing contractual agreements and critical loads without backup generators.

7.9 System recovery shall be performed in a thoughtful and methodical fashion to avoid further system collapse and to avoid compromising personnel and equipment safety.

7.10 Once all available steam units are online and stabilized, system operation reverts to routine operation.

8.0 PLANTS WITH BLACK START CAPABILITIES

The plants with black start capabilities are listed in order of priority below:

a. Piti #7 CT (40 MW)
b. Yigo CT (22 MW)
c. Dededo CT (22 MW and 23 MW, 45 MW total)
d. Macheche CT (22 MW)
e. Tenjo Diesel (4.4 MW/unit, 26.4 MW total)
f. Talofofo Diesel (4.4 MW/unit, 8.8 MW total)
g. Manenggon Diesel (5.3 MW/unit, 10.6 MW)

These units shall be used initially to provide station power to the baseload units prior to placing any customer loads on the system after a blackout.

9.0 PLANT START UP PROCEDURE

9.1 Cabras Steam Power Plant, Units 1 & 2: Approximately 6 MW is needed for the start up of Cabras 1&2's large 4.16 kV motors such as the boiler feed pump, circulating water pump, force draft fan, and other auxiliary equipment.

9.1.1 The following start up times are expected for Cabras 1 & 2:

Power Provided to the Plant	Start Up Time 1st Unit (Hours)	Start Up Time 2nd Unit (Hours)
1 hour after blackout	3	3
2 hours after blackout	3	3
3 hours after blackout	3-4	3-4
4 hours after blackout	3-4	3-4
5 hours after blackout	4	4
6 hours after blackout	5	5
Cold Standby	8 to 12	8 to 12

9.1.2 Any combustion turbine unit may be used to power up Cabras 1&2 power plant. However, due to its proximity to Cabras, the Piti 7 is the preferred unit.

9.1.3 The diesel units can be utilized to provide station power at Cabras. However, special care must be taken to ensure that enough diesel units are synchronized and placed online to provide the 6 MW requirement. Additionally, system frequency should be maintained between 59.85 to 60.10 Hz with plant auxiliary voltage at 4.1 kV.

9.1.4 If there are no faults on the Harmon – Piti and Piti – Cabras 115 kV lines, then these lines may be utilized during the start up of Cabras 1&2, while isolating all unneeded power interchange transformers.

9.1.5 At Cabras 115 kV Switchyard, 115 kV to 120 kV at 60 Hz must be maintained during the start up process.

9.1.6 Once Cabras power plant is synchronized to the system and stabilized, the plant shall be loaded gradually only after obtaining approval from the on-duty plant operator or supervisor. The unit should generate above 8 MW and boiler controls should be stabilized.

9.1.7 If available, the second steam unit shall be prepared for start up by plant personnel.

9.1.8 Once the second unit at Cabras is synchronized to the system and cleared for operation, additional load may be carried.

9.2 MEC 8 & 9 Slow-Speed Diesel: Approximately 1 MW is needed for the start up of one MEC generating unit, involving auxiliary equipment such as lube oil pumps, blowers, jacket water pumps and other equipment. The units can be brought online within 45 minutes to 1 hour after receiving station power.

9.2.1 Once the grid is energized with system frequency at 60 Hz and voltage delivery at MEC is at 13.8 kV, one unit may be started, placed online and raised to 22.0 MW. Once the homogenizer is placed in service, the unit can be cleared for full load dispatching (44 MW).

9.2.2 As soon as the first unit is online, start up preparation will be made for the second unit.

9.3 Combustion Turbine (CT) Power Plant: Dededo CT1 and CT2, Macheche CT, and Yigo CT require approximately 0.75 MW (Dededo CT, each unit), 0.75 MW (Macheche CT), and 0.57 MW (Yigo CT) for startup. Each unit is capable of going online within 20 minutes of start-up.

9.3.1 Any CT generator breaker may be closed on a dead bus to provide power to other generating stations.

9.3.1.1 The Dispatch Control Operator shall prioritize providing power to the baseload units for start up purposes.

9.3.1.2 After the power station needs of a baseload unit is satisfied, a CT may be loaded by distribution feeders taking care to choose lightly loaded feeders in increments of 3 to 5 MW, but not to exceed a total of 12 MW.

9.3.1.3 After one CT is loaded at 12 MW, a second CT may be synchronized and loaded also at 12 MW.

9.3.1.4 The third CT may now be placed online with the first two units and loaded to full capacity.

9.3.1.5 The diesel units may also be synchronized after the steps above.

9.4 Manenngon Diesels: Generation personnel shall immediately man the Manenngon Diesel plant upon a system black out or the loss of the Pulantat substation. The units shall be islanded and the LeoPalace Resort feeders shall be immediately restored in accordance with GPA's contractual obligations. This shall be the mode of operation for the Manenggon Diesels until such time as the IWPS is stable. PSCC shall notify the diesel plant operators once the plant can tie back in to the IWPS.

10. EVENT REPORTING

All events related to the blackout, inclusive of system restoration, shall be reported in accordance with SP-144, Major/Significant Outage Reporting.