



PUBLIC

WESM Manual

Management Procedure for Load Shedding Issue 2

Abstract	This document covers method and procedures in managing load shedding.
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Document Approval

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Reference Documents

Document ID	Document Title
	WESM Rules
	Philippine Grid Code
	Philippine Distribution Code
WESM-DP	Dispatch Protocol Manual

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SECTION 1 INTRODUCTION

1.1. BACKGROUND

- 1.1.1. *WESM Rules* Clause 3.9.1 states that the *System Operator* may direct a *WESM Member* to conduct *load shedding* in response to the following
- a) An overall shortage of energy in a region specified in the market network model; or
 - b) An overall shortage of energy at a node specified in the market network model; or
 - c) Other network conditions, as determined by the *System Operator* in accordance with the procedures established under the Grid Code and Distribution Code.
- 1.1.2. *WESM Rules* Clause 3.9.2 states that the *Market Operator* shall inform the *System Operator* on the likelihood of *load shedding* based on the results of the Day-Ahead Projections and Real-Time Dispatch, particularly for nodes that indicate that nodal energy prices are expected to be equal to, or exceed, Nodal VoLL at any customer nodes in the market network model.
- 1.1.3. *WESM Rules* Clause 3.9.3 states that the *System Operator* shall consider the following criteria in initiating load shedding-
- a) Initiate load shedding at the nodes based on information provided by the Market Operator, or at other nodes after taking account of the load shedding targets from the relevant dispatch optimization, and any other considerations which they consider relevant under the Grid Code and Distribution Code and any other applicable regulatory instrument.
 - b) Initiate load shedding in response to any other circumstances which it reasonably considers necessitates such action under the Grid Code and Distribution Code or any other applicable regulatory instrument.
- 1.1.4. Based on the Grid Code and Distribution Code, *load shedding* can either be in the form of an *automatic load dropping* (ALD), a *manual load dropping* (MLD), or both.
- 1.1.5. For clarity in the procedures to be followed by the *System Operator*, the terms *automatic load dropping* and *manual load dropping* shall be used. Also, the procedures were formulated separately as the two events have different courses of action to be undertaken by the *System Operator*.
- 1.1.6. For the *System Operator*, *load shedding* is instigated when the demand for electricity exceeds the supply capacity of the system, to prevent voltage sags or voltage instability and to restore transmission voltages to allowable limits, and/or to prevent the overloading of line or equipment. It is resorted to when available options to

address the supply-demand imbalance, severe under-voltage or impending voltage sag or voltage instability condition, and/or line/equipment overloading have been exhausted.

1.1.7. Pursuant to *WESM Rules* Clause 3.9.7, the *System Operator* and the *Market Operator* shall manage all aspects of dispatch and pricing during periods when *load shedding* is required in accordance with the detailed procedures to be developed by the *System Operator* and the *Market Operator*, in consultation with WESM Participants, and subject to approval by the *PEM Board*.

1.1.8. This *Market Manual* was made consistent with the Grid Code and Distribution Code

1.2. PURPOSE

This document is intended to establish the responsibilities of the *WESM Members* and provide work procedures to the *System Operator* in managing supply shortfall, severe under-voltage and/or line or equipment overloading. It also aims to provide a consistent and equitable approach that uses best endeavors to balance the need for continued power system security and reliability with the electricity needs of the customer. And finally, it seeks to ensure that no *WESM Member* is treated unreasonably in the application of load shedding.

1.3. SCOPE

This management procedure applies to all *WESM Members* and shall be implemented in the Luzon and Visayas power systems and later in the Mindanao power system once an electricity market is established there.

SECTION 2 DEFINITIONS, REFERENCES, AND INTERPRETATION

2.1. DEFINITIONS

Unless otherwise defined or the context implies otherwise, the italicized terms used in this Manual that are defined in the *WESM Rules* shall bear the same meaning as defined in the *WESM Rules*. In addition, the following words and phrases as used in this Manual shall have the following meaning -

- 2.1.1. ***Load shedding*** refers to the reduction or disconnection of load from the system as exercised by the *System Operator* in response to the following.
- a) An overall shortage of energy at a node or in a region specified in the market network model
 - b) A severe under-voltage or voltage instability at one or more nodes
 - c) Other network conditions, as determined by the System Operator in accordance with the procedures established under the Grid Code and the Distribution Code.
- 2.1.2. ***Automatic Load Dropping (ALD)*** refers to the process of automatically and deliberately removing pre-selected loads from a power system in response to an abnormal condition in order to maintain the integrity of the system
- 2.1.3. ***Manual Load Dropping (MLD)*** refers to the process of manually and deliberately removing pre-selected loads from a power system in response to an abnormal condition in order to maintain the integrity of the system.
- 2.1.4. ***Red Alert*** refers to an alert issued by the System Operator when the grid contingency reserve is zero, a generation deficiency exists, or there is critical loading or imminent overloading of transmission lines or equipment.
- 2.1.5. ***Normal state*** refers to the grid operating condition when the system frequency, voltage, and transmission line and equipment loading are within their normal operating limits, the operating margin is sufficient, and the grid configuration is such that any fault current can be interrupted and the faulted equipment isolated from the grid.
- 2.1.6. ***Cascading outage*** refers to the uncontrolled successive loss of system elements triggered by an incident at any location.
- 2.1.7. ***Contingency*** refers to the unexpected failure or outage of a system component, such as a generator, transmission line, power transformer, bus, circuit breaker, or

other electrical element. A contingency may also include multiple components, which are related by situations leading to simultaneous component outages.

- 2.1.8. **Demand Control** refers to the reduction in demand for the control of frequency when the grid is in an emergency state. This includes automatic load dropping, manual load dropping, demand reduction upon instruction by the System Operator, demand disconnection initiated by users, customer demand management, and voluntary load curtailment.
- 2.1.9. **Demand Control Imminent Warning** refers to a warning from the System Operator, not preceded by any other warning, which is issued when demand reduction is expected within thirty (30) minutes.
- 2.1.10. **Disturbance** refers to an unplanned event that produces an abnormal system condition.
- 2.1.11. **Frequency control** refers to a strategy used by the System Operator to maintain the frequency of the grid within the limits prescribed by the Grid Code by the timely use of frequency regulating reserve, contingency reserve and demand control.
- 2.1.12. **Island grid** refers to a portion of a power system or several power systems that is electrically separated from the interconnection due to the disconnection of transmission system elements.
- 2.1.13. **Multiple outage contingency** refers to an event caused by the failure of two or more components of the grid including generating units, transmission lines, and transformers.
- 2.1.14. **Operating margin** refers to the available generating capacity in excess of the sum of the system demand plus losses within a specified period of time.
- 2.1.15. **Pmin** refers to the minimum stable loading of generating units in the WESM.
- 2.1.16. **Reliability** refers to the performance of the elements of the bulk electric system that results in electricity being delivered to customers within accepted standards and in the amount desired. Reliability may be measured by the frequency, duration, and magnitude of adverse effects on the electric supply.
- 2.1.17. **Security** refers to the ability of the electric system to withstand sudden disturbances such as electric short circuits or unanticipated loss of system elements.
- 2.1.18. **Stability** refers to the ability of the dynamic components of the power system to return to a normal or stable operating point after being subjected to some form of change or disturbance.

2.1.19. **Voltage collapse** refers to an event that occurs when an electric system does not have adequate reactive support to maintain voltage stability. Voltage collapse may result in outage of system elements and may include interruption in service to customers.

2.1.20. **Voltage control** refers to any action undertaken by the System Operator or user to maintain the voltage of the grid within the limits prescribed by the Grid Code such as, but not limited to, adjustment of generator reactive output, adjustment in transformer taps or switching of capacitors or reactors.

2.1.21. **Voltage instability** refers to a condition that results in grid voltages that are below the level where voltage control equipment can return them to the normal level.

2.1.22. **Voltage sag** refers to a short-duration voltage variation where the RMS value of the voltage decreases to between 10 percent and 90 percent of the nominal value.

2.2. REFERENCES

This *Market Manual* shall be read in association with the *WESM Rules*

2.3. INTERPRETATION

Any reference to a section or clause in any Chapter of this *Market Manual* shall refer to the particular section or clause of the same Chapter in which the reference is made, unless otherwise specified or the context provides otherwise.

SECTION 3 RESPONSIBILITIES

- 3.1.** The *System Operator* shall be responsible for the following
- 3.1.1. Establish the demand requirement for *load shedding* in order to limit the consequences of a major loss of generation in the grid.
 - 3.1.2. Recognize the operating state to be in an *emergency* condition when it determines the existence of a situation, which has an adverse material effect on electricity supply or which poses as a significant threat to system security.
 - 3.1.3. Issue a *Red Alert* Warning as may be necessary
 - 3.1.4. Intervene in the spot market if either (a) an *emergency*, (b) a *threat to system security*, or (c) a *force majeure event* manifests in the grid.
 - 3.1.5. Prepare, implement, and monitor the compliance of *WESM Members* with their load shedding schedule.
 - 3.1.6. Give directions and coordinate with the *Market Operator* and *WESM Members* the actions to be taken in order to restore normal operation of the power system.
 - 3.1.7. Provide the necessary notifications in accordance with the *WESM Rules* under clause 6.5.1.2.
 - 3.1.8. Establish a *load shedding* program based on agreed priorities and equitable load-sharing between the distribution utilities, directly connected customers and cooperatives as shown in Appendix A.
 - 3.1.9. Annually review the *load shedding* program in coordination with the *Market Operator* and the *WESM Members* subject to the approval of the *PEM Board*.
- 3.2.** The *Market Operator* shall be responsible for the following
- 3.2.1. Inform the *System Operator* of the likelihood of initiating *load shedding* under clause 3.9.2 of the *WESM Rules*.
 - 3.2.2. Coordinate actions with the *System Operator* in the resumption of the spot market to normal operation.
 - 3.2.3. Issue market advisory to *WESM Members*

3.3. The *WESM Members* shall be responsible for the following

3.3.1. Comply with the *emergency* directions given by the *System Operator*, unless it reasonably believes that an *emergency* direction poses a real and substantial risk of damage to its equipment, to the safety of its employees or the public, or if undue injury to the environment.

3.3.2. Provide information required by the *System Operator* in order to address the *emergency* condition.

3.3.3. Generating Entities shall see to it that its units remain in synchronism for operating conditions as specified under the Grid Code.

3.4. *Network Service Providers* shall have a load shedding program prepared in consultation with the *System Operator* with established priority and based on equitable load allocation.

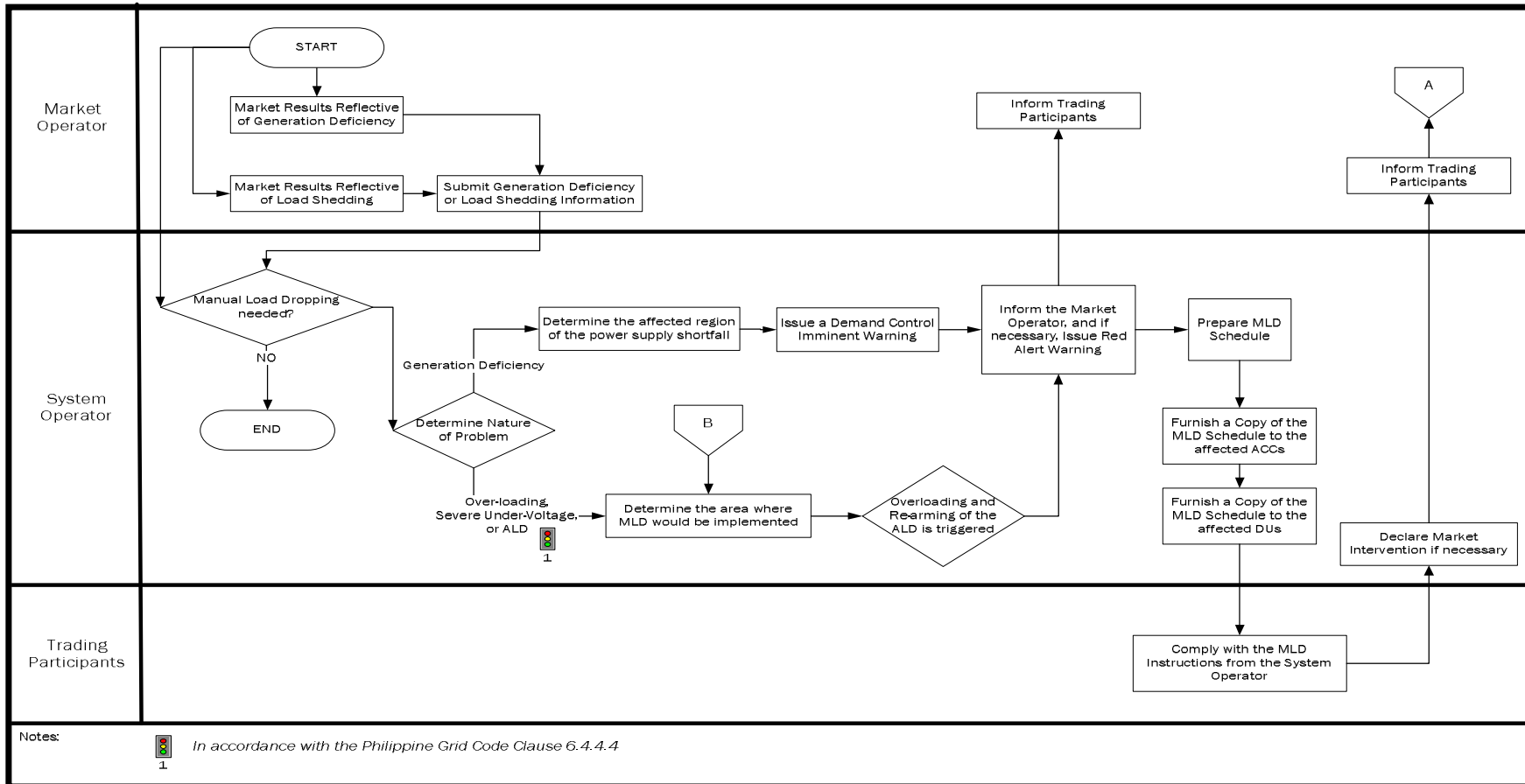


SECTION 4 LOAD SHEDDING PROCEDURES
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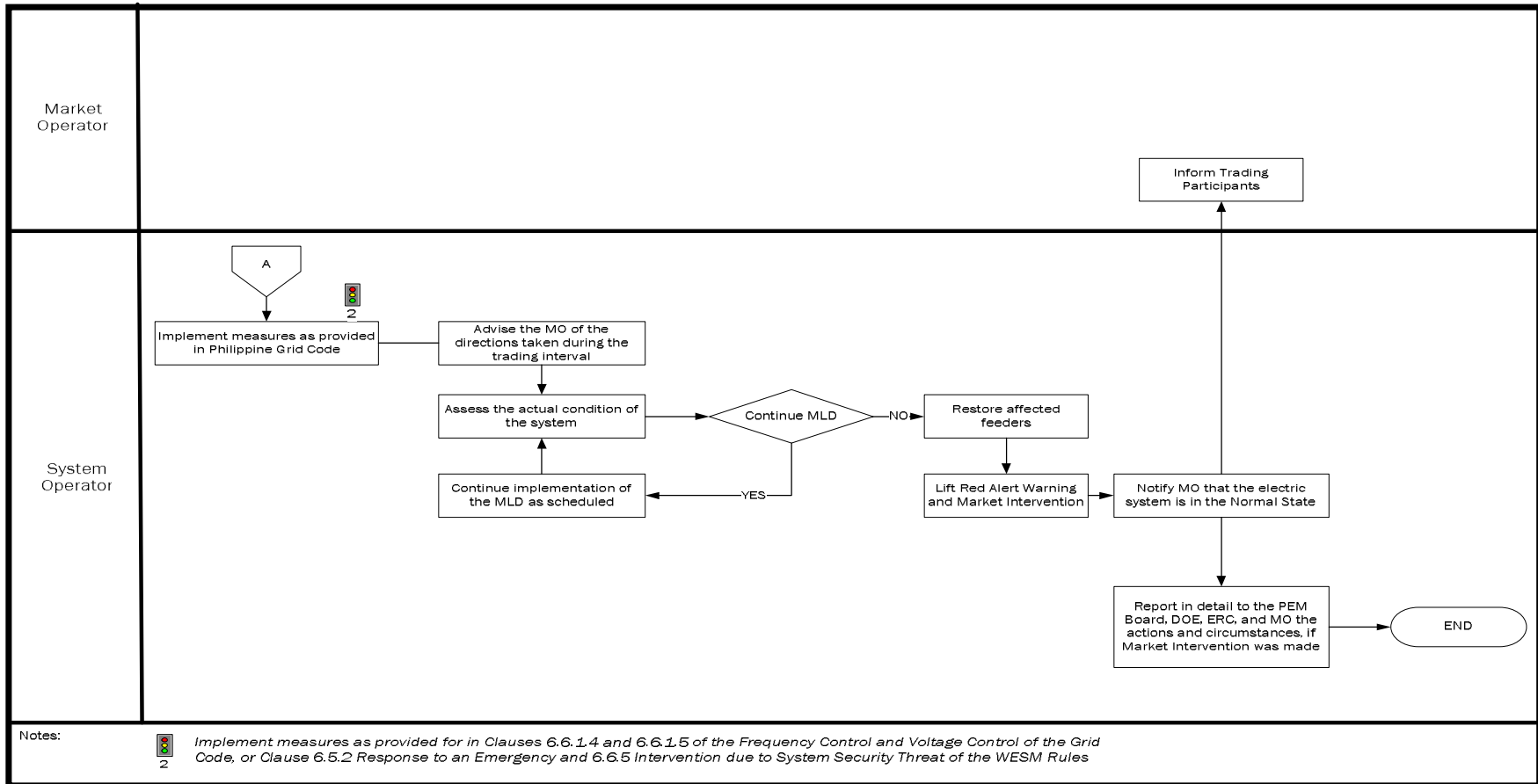
4.1. PRECONDITIONS / PRE-REQUIREMENTS

- 4.1.1. The nodal prices are reflective of the Nodal Volt price based on *market projections* or dispatch optimization performed prior to commencement of each trading interval.
- 4.1.2. Within a trading interval, a power supply shortfall in the electric system, a region, or a node unexpectedly happened.
- 4.1.3. If either (a) an *emergency*, (b) a *threat to system security*, or (c) a *force majeure event* manifests in the grid.
- 4.1.4. The grid is under *Red Alert*.

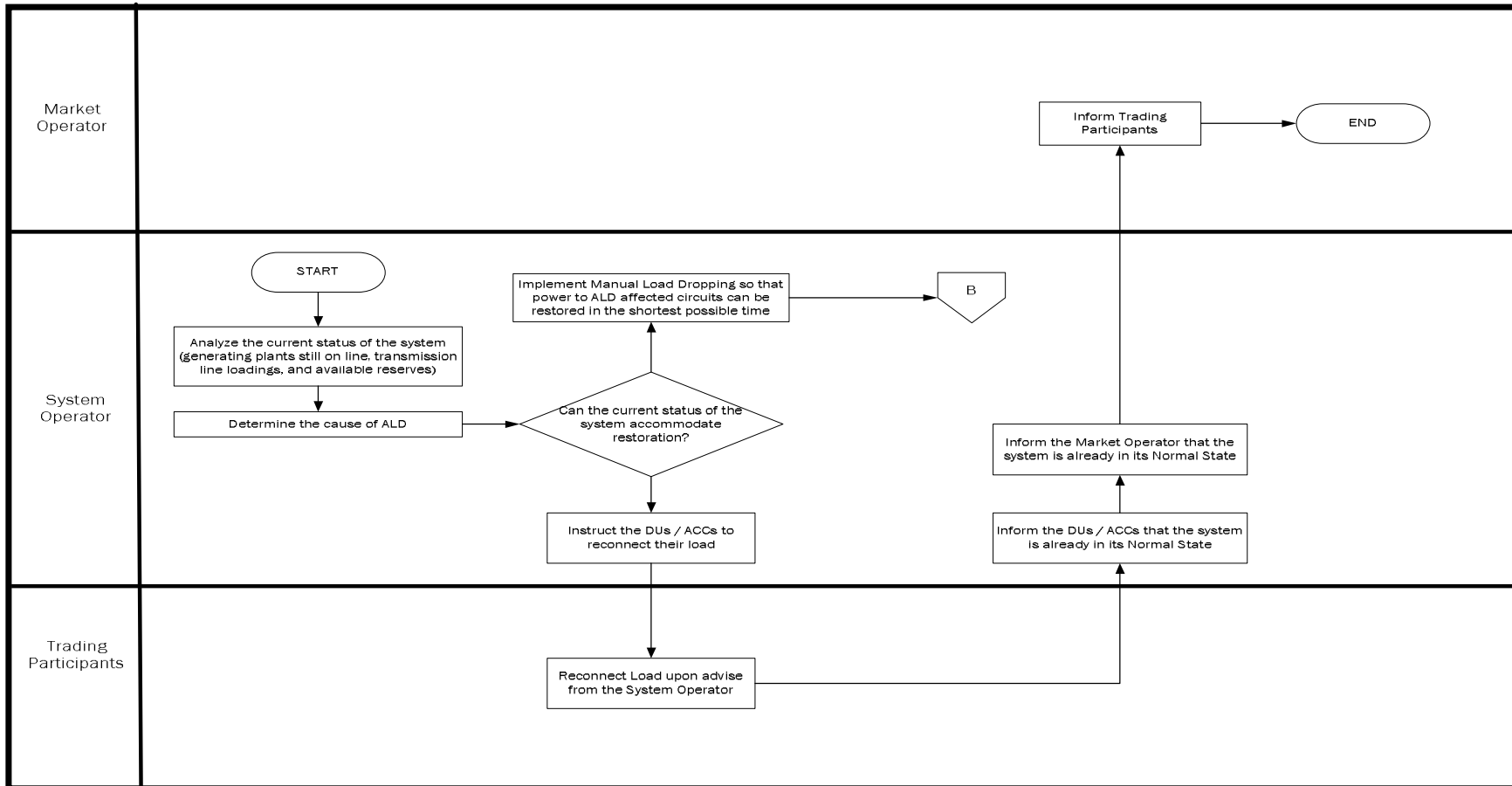
4.2. PROCEDURE FOR MANUAL LOAD SHEDDING



4.3. PROCEDURE FOR SYSTEM RESTORATION AFTER MANUAL LOAD DROPPING



4.4. PROCEDURE AFTER AN AUTOMATIC LOAD DROPPING



SECTION 5 AMENDMENT, PUBLICATION AND EFFECTIVITY

5.1. AMENDMENTS TO THIS MANUAL

Any amendment to, or revision to this Manual shall be approved by the PEM Board.

5.2. PUBLICATION AND EFFECTIVITY

Upon approval of the PEM Board, this Manual shall take effect fifteen (15) days from its publication, or such later date as the PEM Board determines, in accordance with the WESM Manual of Procedures for Changes to the WESM Rules (WESM-RCM).

SECTION 6 APPENDIX

Appendix A. Load Shedding Allocation Program

A. Luzon Grid

The Manual Load Shedding, if needed, shall be implemented on the following customers with the given order of priority below:

8:00AM – 5:00PM	5:01PM – 7:59AM the following day
Residential	VLC (voluntary load curtailment)
Commercial	Residential
Industrial	Commercial
	Industrial

The Load Shedding requirement (kWh) shall be distributed among Distribution Utilities in direct proportion to their respective actual demand on an hourly basis.

B. Visayas and Mindanao Grids

The Manual Load Shedding, if needed, shall be implemented on the following customers with the given order of priority below:

1. Residential
2. Commercial
3. Industrial

The Load Shedding requirement (kWh) shall be distributed among Distribution Utilities in direct proportion to their respective actual demand on an hourly basis.