



PUBLIC

WESM Manual

# **Procedures for the Monitoring of Forecast Accuracy Standards for Must Dispatch Generating Units**

Issue 2.0 | WESM-FASMD

This manual establishes the procedures for the monitoring, reporting, and review of the forecast accuracy standards for compliance of must dispatch generating units.

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In case of inconsistency between this document and the DOE Circulars, the latter shall prevail.

## Document Change History

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2.0	PEMC	26 Jun 2021	Align with the operation of the new Market Management System and to provide a more appropriate calculation for the forecast percentage error*
			Revised formatting for the commencement of the enhanced WESM design and operations per DOE Department Circular No. DC2021-06-0015

\*Previously tagged as Issue 1.1. Per DOE, this version is Issue 2.0.

## Document Approval

Issue No.	RCC Approval	RCC Resolution No.	PEM Board Approval	PEMC Board Resolution No.	DOE Approval	DOE DC No.
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\*Declaring the Commercial Operations of Enhanced WESM Design and Providing Further Policies

## Reference Documents

Document ID	Document Title
	WESM Rules
ERC Resolution No.7 Series of 2013	A Resolution Adopting and Approving Addendum to Amendment No. 1 of the Philippine Grid Code (PGC), Establishing the Connection and Operational Requirements for Variable Renewable Energy (VRE) Generating Facilities
	Philippine Grid Code
WESM-MSP	WESM Manual on Metering Standards and Procedures

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## SECTION 1 INTRODUCTION

### 1.1 BACKGROUND

- 1.1.1 The *WESM Rules* require *generation companies* to submit to the *Market Operator* *projected outputs* in respect of their *must dispatch generating units* for each *dispatch interval*.
- 1.1.2 Consistent with the *Grid Code*, the *WESM Rules* also require *must dispatch generating units* to comply with forecast accuracy standards in respect of their *projected outputs*<sup>1</sup>.
- 1.1.3 A *Trading Participant* who fails to meet the requisite forecast accuracy standards in respect of *projected outputs* for a *must dispatch generating unit* may be liable for sanctions imposed under Clause 7.2 of the *WESM Rules*<sup>2</sup>.
- 1.1.4 Moreover, the *Enforcement and Compliance Office* is required by the *WESM Rules* report to the *PEM Board* and the *DOE* the annual compliance of each *must dispatch generating unit* to the forecast accuracy standards with respect to its *projected outputs*<sup>3</sup>.

### 1.2 PURPOSE

- 1.2.1 This *Market Manual* shall establish the forecast accuracy standards that *must dispatch generating units* are required to comply with.
- 1.2.2 This *Market Manual* shall provide the equations that will be used in determining the compliance of *must dispatch generating units* with the forecast accuracy standards.
- 1.2.3 This *Market Manual* shall specify the procedures for the monitoring and reporting of the compliance of *must dispatch generating units* with the forecast accuracy standards.

### 1.3 SCOPE

- 1.3.1 This *Market Manual* only provides the standards and procedures for *must dispatch generating units* registered in the *WESM*.
- 1.3.2 This *Market Manual* covers the implementation of the forecast accuracy standards.

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<sup>1</sup> Clause 3.5.5.8, *WESM Rules*

<sup>2</sup> Clause 3.5.5.10, *WESM Rules*

<sup>3</sup> Clause 3.5.5.11, *WESM Rules*

## SECTION 2 DEFINITIONS, REFERENCES AND INTERPRETATION

### 2.1 DEFINITIONS

2.1.1 Unless otherwise defined in Section 2.1.2 of this document or unless the context provides otherwise, all terms used in this *Market Manual* that are defined in the *WESM Rules* shall take the meaning as so defined in the *WESM Rules*.

#### 2.1.2 Glossary

- a) **Forecast percentage error.** Error (in %) of the *projected output* submitted by a *must dispatch generating unit* with respect to its maximum *metered quantity* over a *billing period* as dependable capacity and calculated in accordance with Section 4.2.3.
- b) **Initial loading.** Loading (in MW) for the beginning of the *dispatch interval* assumed in, or estimated by, the dispatch optimization performed prior to the beginning of that *dispatch interval*.
- c) **MAPE.** Abbreviation of *mean absolute percentage error*.
- d) **Mean absolute percentage error.** Mean of the *forecast percentage errors* of a *must dispatch generating unit* over a certain period calculated in accordance with Section 4.2.1.
- e) **Must dispatch generating unit.** A *generating unit* so designated by the *Market Operator* under clause 2.3.1.5 of the *WESM Rules* and is provided *Must Dispatch*. For brevity and when the context applies, this also refers to a *generation company* that operates a *must dispatch generating unit* in this *Market Manual*.
- f) **Perc95.** Abbreviation of *percentile 95 of the forecasting error*.
- g) **Percentile 95 of the forecasting error.** The value (in %) not exceeding 95% of the *forecast percentage errors* of the *must dispatch generating unit* during a certain period (see Section 6, Appendix A of this Manual).
- h) **Projected quantity.** Estimated *generation* of a *must dispatch generating unit* over a *dispatch interval* based on its submitted *projected output* assuming linear ramping calculated in accordance with Section 4.2.4.
- i) **Transition Period.** The period specified by the *DOE* wherein the provisions under Section 4.5 shall apply.

### 2.2 REFERENCES

2.2.1 This *Market Manual* should be read in association with Chapter 3 of the *WESM Rules* and other *Market Manuals*, including but not limited to the reference documents listed in the Reference Documents table. Other references are also stated in relevant sections of this *Market Manual*.

## 2.3 INTERPRETATION

- 2.3.1 The rules on interpretation set out in Chapter 9 of the *WESM Rules*, as these may be amended from time to time, shall govern the interpretation of this *Market Manual*.

<b>SECTION 3 RESPONSIBILITIES</b>
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### 3.1 ENFORCEMENT AND COMPLIANCE OFFICE

- 3.1.1 The *Enforcement and Compliance Office* shall evaluate annually the compliance of each *must dispatch generating unit* to the forecast accuracy standards in this *Market Manual*<sup>4</sup>.
- 3.1.2 The *Enforcement and Compliance Office* shall report to the *PEM Board* and the *DOE* its evaluation on the annual compliance of each *must dispatch generating unit* to the forecast accuracy standards with respect to each *must dispatch generating unit's projected outputs*<sup>5</sup>.

### 3.2 SYSTEM OPERATOR

- 3.2.1 The *System Operator* shall advise the *Market Operator* of any output restrictions imposed by the *System Operator* on *must dispatch generating units* in accordance with the *WESM Rules*<sup>6</sup> and the *Grid Code*.

### 3.3 METERING SERVICES PROVIDERS

- 3.3.1 *Metering Services Providers* of *must dispatch generating units* shall submit settlement-ready *metering data* of *must dispatch generating units* in accordance with the timeline provided in the relevant *Market Manual*<sup>7</sup>.

### 3.4 GENERATION COMPANIES

- 3.4.1 *Generation companies* shall comply with the forecast accuracy standards in this *Market Manual* in respect of the *projected outputs* of their *must dispatch generating units* submitted in accordance with the *WESM Rules*<sup>8</sup>.
- 3.4.2 *Generation companies* shall immediately advise the *System Operator* and *Market Operator* of any circumstances which threaten a significant probability of material adverse change in the state of their facilities in any *dispatch interval* of any *trading day* in the current *week-ahead market horizon*. After the occurrence of the significant event referred to above, the *Generation Company* shall submit a written report to the *Market Operator* with supporting data immediately within the following *trading day*.

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<sup>4</sup> Clause 3.5.5.9, *WESM Rules*

<sup>5</sup> Clause 3.5.5.11, *WESM Rules*

<sup>6</sup> Clause 3.8.2.2(g)(i), *WESM Rules*

<sup>7</sup> *WESM Manual on Metering Standards and Procedures*

<sup>8</sup> Clause 3.5.5.8, *WESM Rules*

### 3.5 MARKET OPERATOR

- 3.5.1 The *Market Operator* shall advise the *must dispatch generating units* of their *real-time dispatch schedules*, and any output restrictions imposed as a result of the dispatch scheduling process or by the *System Operator*.

## SECTION 4 FORECAST ACCURACY STANDARDS AND PROCEDURES

### 4.1 STANDARDS

- 4.1.1 Each *must dispatch generating unit* shall comply with the following standards with respect to its *mean absolute percentage error (MAPE)* and *percentile 95 of the forecasting error (Perc95)* determined in accordance with Section 4.2 and calculated over the period specified in Section 4.1.2:

Technology	Standards	
	MAPE	Perc95
Solar	< 18%	< 30%
Wind		
Run of River Hydro	< 9%	< 30%

- 4.1.2 The *MAPE* and *Perc95* of each *must dispatch generating unit* shall be calculated over the period starting on the 26<sup>th</sup> of December of a year and ending on the 25<sup>th</sup> of December of the succeeding year.
- 4.1.3 Subject to Section 4.5 of this *Market Manual*, *must dispatch generating units* who fail to meet the requisite forecast accuracy standards set out in Section 4.1.1 of this *Market Manual* may be liable for sanctions imposed under Clause 7.2 of the *WESM Rules*<sup>9</sup>, and in accordance with the *WESM Penalty Manual*.

### 4.2 CALCULATIONS

- 4.2.1 The *MAPE* of a *must dispatch generating unit* for a period shall be calculated using the following formula:

$$MAPE_{i,p} = \frac{\sum_{t=1}^{n_p} FPE_{i,t}}{n_p}$$

Where,

$MAPE_{i,p}$  mean absolute percentage error (in %) of *must dispatch generating unit i* for period *p*

$n_p$  number of *dispatch intervals* within period *p* wherein *forecast percentage errors* were calculated

<sup>9</sup> Clause 3.5.5.10, *WESM Rules*

$FPE_{i,t}$       *forecast percentage error (in %) of must dispatch generating unit i for dispatch interval t calculated in accordance with Section 4.2.3*

4.2.2      The *Perc95* of a *must dispatch generating unit* for a period shall refer to the value (in %) not exceeding 95% of the *forecast percentage errors* of the *must dispatch generating unit* during the period and shall be calculated using the NIST method<sup>10</sup>.

4.2.3      The *forecast percentage error* for a *dispatch interval* of a *must dispatch generating unit* shall be calculated using the following formula:

$$FPE_{i,t} = \left| \frac{PQ_{i,t} - MQ_{i,t}}{MQ_{\max,i,bp,t}} \right| \times 100\%$$

Where,

$FPE_{i,t}$       *forecast percentage error (in %) of must dispatch generating unit i for dispatch interval t*

$PQ_{i,t}$       *projected quantity (in MWh) of must dispatch generating unit i for dispatch interval t calculated in accordance with Section 4.2.4*

$MQ_{i,t}$       *metered quantity (in MWh) of must dispatch generating unit i for dispatch interval t as provided by the Metering Services Provider*

$MQ_{\max,i,bp,t}$       *maximum metered quantity (in MWh) of must dispatch generating unit i during billing period bp where dispatch interval t belongs as provided by the Metering Services Provider*

4.2.4      The *projected quantity* for each *dispatch interval* of a *must dispatch generating unit* shall be calculated using the following formula:

$$PQ_{i,t} = \frac{1}{n} \times \frac{IL_{i,t} + PO_{i,t}}{2}$$

Where,

$PQ_{i,t}$       *projected quantity (in MWh) of must dispatch generating unit i for dispatch interval t*

$IL_{i,t}$       *initial loading (in MW) of must dispatch generating unit i for each dispatch interval t used in the scheduling process*

$PO_{i,t}$       *projected output (in MW) of must dispatch generating unit i for each dispatch interval t used in during the scheduling process*

$n$       *number of dispatch interval(s) within an hour*

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<sup>10</sup> Refer to Appendix A for a detailed discussion on the NIST method



- 4.2.5 A one hundred (100) percent FPE shall be imposed to a must dispatch generating unit on a particular dispatch interval where its maximum metered quantity is equal to zero (0) and a projected quantity is not equal to zero (0).
- 4.2.6 A one hundred (100) percent FPE shall be imposed to a must dispatch generating unit for non-submission of projected output.
- 4.2.7 A zero (0) percent FPE shall be imposed to a must dispatch generating unit on a particular dispatch interval where its projected quantity and maximum metered quantity are equal to zero (0).

#### 4.3 EXCLUSIONS

- 4.3.1 *Forecast percentage errors* occurring on the following conditions shall be excluded from the calculation of the *MAPE* and *Perc95* of *must dispatch generating units*:
- a) the *dispatch target* of the *must dispatch generating unit* was restricted below its *projected output*<sup>11</sup>;
  - b) the output of the *must dispatch generating unit* was restricted by the *System Operator*<sup>12</sup> as indicated in the *System Operator's* report submitted to the *Market Operator* in accordance with the *WESM Rules*<sup>13</sup>;
  - c) a *market suspension* or *market intervention* was declared for the *dispatch interval*;
  - d) an *outage* resulted in its derating; or
  - e) a natural calamity (e.g., typhoon, landslide) affected the ability of the *must dispatch generating unit* to forecast accurately.

#### 4.4 MONITORING, REPORTING, AND REVIEW

- 4.4.1 The *Enforcement and Compliance Office* shall report to the *PEM Board* and the *DOE* the annual compliance of each *must dispatch generating unit* to the forecast accuracy standards with respect to its *projected outputs* within two (2) calendar months after the end of the period specified in Section 4.1.2.
- 4.4.2 The *Enforcement and Compliance Office* shall report to the *PEM Board* and the *DOE* the status of the compliance of each *must dispatch generating unit* to the *forecast accuracy standards* as of the most recent *Billing Period* with a *final statement* on a monthly basis.
- 4.4.3 The *Market Operator* shall review annually the forecast accuracy standards set in Section 4.1 and shall provide recommendation to the *PEM Board* and the *DOE*.

#### 4.5 TRANSITION PERIOD

- 4.5.1 A *transition period* covering the period specified by the *DOE* shall be implemented. The sanction on the non-compliance with the forecast accuracy

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<sup>11</sup> Clause 3.6.1.7, WESM Rules

<sup>12</sup> Clause 3.8.3.4, WESM Rules

<sup>13</sup> Clause 3.8.2.2(g)(i), WESM Rules

standards shall be implemented upon the commercial operation of the enhanced WESM design and operations.

- 4.5.2 During the *transition period*, *must dispatch generating units* who fail to meet the requisite *forecast accuracy standards* set out in Section 4.1.1 of this *Market Manual* shall not be liable for sanctions imposed under this *Market Manual*.
- 4.5.3 Before the end of the *transition period*, the *Market Operator* shall submit to the DOE and other concerned government agencies a report on the compliance of *must dispatch generating units* to the forecast accuracy standards, and it shall inform the *must dispatch generating units* on their performance with respect to the forecast accuracy standards.
- 4.5.4 Unless otherwise specified, all other provisions in this *Market Manual* shall apply during the *transition period*.

## SECTION 5 AMENDMENT, PUBLICATION AND EFFECTIVITY

### 5.1 AMENDMENTS

- 5.1.1 The *Market Operator*, the *System Operator*, or any *WESM member*, or interested entity may propose amendments to this *Market Manual* by submitting proposals to the *WESM Rules Change Committee*, following procedures for changes to *Market Manuals* set out in the *WESM Rules* and in the relevant *Market Manual*.
- 5.1.2 Amendments to this *Market Manual* shall be approved by the DOE following the procedures for changes to *Market Manual* set out in the *WESM Rules* and in the relevant *Market Manual*.

### 5.2 PUBLICATION

- 5.2.1 This *Market Manual*, as it may be amended from time to time, shall be published in the *WESM market information website*.

### 5.3 EFFECTIVITY

- 5.3.1 This *Market Manual* or any amendments thereto shall become effective upon approval of the DOE in accordance with the *WESM Rules* Clause 8.6.4. The date of effectivity shall be indicated in this document.

## SECTION 6 APPENDICES

### APPENDIX A NIST Method for Calculating Percentiles

This appendix provides the NIST Method for calculating percentiles. The NIST Method estimates the percentile using the procedure below and may result to values that are not in the original set of values. The definition below is an excerpt from the following source:

### 7.2.6.2 Percentiles (<http://www.itl.nist.gov/div898/handbook/prc/section2/prc262.htm>)

<i>Estimation of percentiles</i>	<p>Percentiles can be estimated from <math>N</math> measurements as follows: for the <math>p_{th}</math> percentile, set <math>p(N+1)</math> equal to <math>k+d</math> for <math>k</math> an integer, and <math>d</math>, a fraction greater than or equal to 0 and less than 1.</p> <ol style="list-style-type: none"> <li>1. For <math>0 &lt; k &lt; N</math>, <math>Y_{(p)} = Y_{[k]} + d(Y_{[k+1]} - Y_{[k]})</math></li> <li>2. For <math>k=0</math>, <math>Y_{(p)} = Y_{[1]}</math></li> </ol> <p>Note that any <math>p \leq 1/(N+1)</math> will simply be set to the minimum value.</p> <ol style="list-style-type: none"> <li>3. For <math>k \geq N</math>, <math>Y_{(p)} = Y_{[N]}</math></li> </ol> <p>Note that any <math>p \geq N/(N+1)</math> will simply be set to the maximum value.</p>
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#### Example:

Sample list:  $Y_{[k]} = \{5\%, 12\%, 3\%, 20\%, 15\%\}$ ;  $N = 5$

Sample ordered data:  $Y_{[k]} = \{3\%, 5\%, 12\%, 15\%, 20\%\}$ ;  $N = 5$

To calculate for the 60<sup>th</sup> percentile ( $p = 0.6$ ),

Step 1: Calculate  $p \times (N + 1)$

$$0.6 \times (5 + 1) = 3.6$$

Step 2: Get  $k$  and  $d$

From 3.6,  $k = 3$  and  $d = 0.6$

Step 3: Get  $P_{60}$

$$P_p = Y_{[k]} + d \times (Y_{[k+1]} - Y_{[k]})$$

$$P_{60} = Y_{[3]} + d \times (Y_{[4]} - Y_{[3]})$$

$$P_{60} = 12\% + 0.6 \times (15\% - 12\%)$$

$$\mathbf{P_{60} = 13.8\%}$$