



PUBLIC

WESM Manual

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

Issue 3.0 | 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.

Approval Date: 12-Jan-2024 | Publication Date: 29-Jan-2024

PEMC Website Posting Date: 05-Mar-2024 | Effective Date: 13-Feb-2024

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

Document Change History

Issue No.	Proponent	Date of Effectivity	Reason for Amendment
1.0	PEMC	15 June 2017	Initial Version
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
2.1	PEMC	25 November 2022	Urgent Amendments on matters relating to enforcement proceedings and actions (Effectivity extended per PEM Board Resolution Nos. 2023-62-03 and 2023-66-04)
3.0	PEMC	13 February 2024	Reflect amendments relating to enforcement proceedings and actions

*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.
1.0	01 June 2016	RCC-RESO-16-08	10 November 2016	PEMC Board Resolution No. 2016-30	20 March 2017	DC2017-03-0002
1.1	21 June 2019	2019-11	31 July 2019	2019-14-08	16 March 2021	DC2021-0003
2.0	N/A	N/A	N/A	N/A	25 June 2021	2021-06-0015*
2.1	18 Nov 2022	2022-13	23 Nov 2022	2022-54-06	N/A	N/A
3.0	19 May 2023	2023-05	27 Jun 2023	2023-61-02	12 January 2024	DC2024-01-0005

*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
DOE DC2022-05-0015	Supplementing Department Circular No. DC2021-06-0013 on the Framework Governing Test and Commissioning of Generation Facilities for Ensuring Readiness to Deliver Energy to the Grid or Distribution Network

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SECTION 1 INTRODUCTION

1.1 BACKGROUND

- 1.1.1 The *WESM Rules* requires *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 requires *must-dispatch generating units* to comply with forecast accuracy standards in respect of their *projected outputs*¹.
- 1.1.3 A *Generation Company* that has secured a Final Certificate of Approval to Connect for completing the conduct of *test and commissioning* but with pending issuance of Certificate of Compliance from the *ERC* for its *must-dispatch generating unit* shall comply with the *forecast accuracy standards* in respect of its *projected outputs*.²
- 1.1.4 A *Generation Company* that has an *expansion unit* shall likewise comply with the *forecast accuracy standards* following the parameters set forth in Section 4.2.8 of this Manual.
- 1.1.5 A *Trading Participant* referred to in Sections 1.1.2, 1.1.3, and 1.1.4 hereof, which fails to meet the requisite *forecast accuracy standards* based on the results of an annual assessment, shall be liable for sanctions imposed under Clause 7.2 of the *WESM Rules*³ and the *WESM Penalty Manual*.
- 1.1.6 The *Enforcement and Compliance Office* shall report to the *PEM Board*, the *Compliance Committee*, the *ERC*, and the *DOE* the annual compliance of each *must-dispatch generating unit* to the *forecast accuracy standards* with respect to its *projected outputs*⁴.

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 Clause 3.5.5.8, *WESM Rules*

² Section 4.4.5 of the DOE DC2022-05-0015 “Supplementing Department Circular No. DC2021-06-0013 on the Framework Governing Test and Commissioning of Generation Facilities for Ensuring Readiness to Deliver Energy to the Grid or Distribution Network” Published in June 2022

³ Clause 3.5.5.11, *WESM Rules*

⁴ Clause 3.5.5.12, *WESM Rules*

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.

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) **Expansion Unit.** It shall refer to the expanded capacity of a *must-dispatch generating unit* which may be built in phases and designed to utilize the same plant substation and revenue meter being used by the existing capacity unit.
 - b) **Forecast Accuracy Standards Report.** Reports which are prepared and issued by the *Enforcement and Compliance Office*, as prescribed in Section 4.4 of this Manual.
 - c) **Forecast Percentage Error (FPE).** 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.
 - d) **Initial loading.** Loading (in MW) at the beginning of the *dispatch interval* assumed in, or estimated by, the dispatch optimization performed prior to the beginning of that *dispatch interval*.
 - e) **Mean Absolute Percentage Error (MAPE).** Mean of the *forecast percentage errors* of a *must-dispatch generating unit* over a certain period calculated in accordance with Section 4.2.1.
 - f) **Percentile 95 of the Forecasting Error (PERC95).** It shall mean that 95% of all the *FPEs* during the period shall not exceed the standard set forth in Section 4.1.1 of this Manual
 - g) **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.

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*.

SECTION 3 RESPONSIBILITIES

3.1 ENFORCEMENT AND COMPLIANCE OFFICE

- 3.1.1 The *Enforcement and Compliance Office* shall assess, evaluate, and issue the cumulative results of *MAPE* and *PERC95* to each *must-dispatch generating unit* on a monthly and annual basis in accordance with the procedures set forth in Section 4.4 hereof.

The *Enforcement and Compliance Office* shall, for this purpose, establish a detailed process or procedure of compliance monitoring and assessment and prescribe a reply format or template that may be accomplished by the *Generation Company* as part of the monitoring process.

- 3.1.2 The *Enforcement and Compliance Office* shall report to the *PEM Board*, the *Compliance Committee*, the *ERC*, and the *DOE* its evaluation on the annual compliance of each *must-dispatch generating unit* to the *forecast accuracy standards* as set forth in Section 4.4.6 of this Manual.

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*⁵ 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*⁶.

⁵ Clause 3.8.2.2(g)(i), *WESM Rules*

⁶ *WESM Manual on Metering Standards and Procedures*

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*⁷.
- 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*.
- 3.4.3 *Generation companies* shall coordinate with the *Enforcement and Compliance Office* for matters, data, or information necessary to establish, validate, and verify the incidents or circumstances referred to in Section 4.3, and such other matters, data, or information relative to the calculation of *MAPE* and *PERC95*.

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*.
- 3.5.2 The *Market Operator* shall provide to the *Enforcement and Compliance Office* all the market data and information, including the *System Operator*-validated individual and aggregated forecast data, necessary for the calculation of *MAPE* and *PERC95* and for verification or validation of data, when necessary.

⁷ Clause 3.5.5.8, WESM Rules

SECTION 4 FORECAST ACCURACY STANDARDS, PROCEDURES, AND SANCTIONS

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 every *billing period* in cumulative results and shall be reported to each *Generation Company* within the timeline prescribed in Section 4.4 hereof. Subject to the provisions of Section 4.6 of this Manual, the annual cumulative results covering the period 26th of December of a year and ending on the 25th of December of the succeeding year shall be determined with finality by the *Enforcement and Compliance Office* within the period prescribed in Section 4.4.6 of this Manual.
- 4.1.3 Subject to Sections 4.5 and 4.6 of this Manual, the *Generation Companies* of the *must-dispatch generating units* which fail to meet the requisite *forecast accuracy standards* based on the annual *Forecast Accuracy Standards Report* shall be considered in *breach* of Section 4.1.1 of this *Manual* and shall be liable for sanctions imposed under Clause 7.2 of the *WESM Rules*⁸ and 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*

⁸ Clause 3.5.5.11, 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 method⁹.

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*

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

⁹ Refer to 0 for a detailed discussion on the NIST method

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*. The non-submission of *projected output* referred to in this section shall exclude submission of zero (0) MW nomination or cancellation of nomination based on the zero projection or load profile of the *must-dispatch generating unit*.
- 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).
- 4.2.8 For generating plants with *expansion unit* that is on test and commissioning but is awaiting the issuance of the Final Certificate of Authority to Connect, *Certificate of Compliance* or the Provisional Authority to Operate, the following rules shall apply during the specific intervals that they are determined to be on test and commissioning:
- a) A zero (0) FPE shall be imposed if the *projected quantity* is less than the combined metered quantity.
 - b) A one hundred (100) FPE shall be imposed if the *projected quantity* is greater than the combined metered quantity.

For this purpose, the combined metered quantity shall refer to the sum of the *metered quantity* of the existing capacity unit and that of the *expansion unit*.

4.3 EXCLUSIONS AND OTHER BASIS FOR RECALCULATION

- 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*¹⁰;
 - b) the output of the *must-dispatch generating unit* was restricted by the *System Operator*¹¹ as indicated in the *System Operator's* report submitted to the *Market Operator* in accordance with the *WESM Rules*¹²;
 - 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.

¹⁰ Clause 3.6.1.7, WESM Rules

¹¹ Clause 3.8.3.4, WESM Rules

¹² Clause 3.8.2.2(g)(i), WESM Rules

- 4.3.2 Any variance in the market data used in the calculation of *MAPE* and/or *PERC95* that may be discovered during the monitoring and assessment must be properly addressed, validated, and verified within the prescribed timeline. The *Generation Company* shall provide adequate supporting documents to substantiate any claim of data variance. Only those data that have been proven and verified to be inaccurate, inconsistent, or erroneous shall be considered in the recalculation of the results.

4.4 MONITORING, REPORTING, AND REVIEW

- 4.4.1 The *Enforcement and Compliance Office* shall monitor the compliance of the *Generation Company* of each *must-dispatch generating unit*, calculate the *MAPE* and *PERC95* and issue the *Preliminary Forecast Accuracy Standards Reports* including the data used in the calculation within 30 business days from the end of the calendar month of the covered monitoring period. For instance, the *Preliminary Forecast Accuracy Standards Report* for September billing period shall be issued not later than 30 October.
- 4.4.2 The *Generation Company* shall provide a reply or confirmation of the *MAPE* and *PERC95* results, as the case may be, to the *Enforcement and Compliance Office* within fifteen (15) *business days* from receipt of the *Preliminary Forecast Accuracy Standards Report*. If any of the circumstances fall within the exclusions and data variance under Section 4.3 of this *Manual*, the *Generation Company* shall likewise provide and submit the documents or proof thereof as a basis for recalculation of the results.
- 4.4.3 The *Enforcement and Compliance Office* shall assess, validate, and verify the responses and documents submitted by the *Generation Company*. It may also consult the *Market Operator*, the *System Operator*, or the *Metering Service Provider*, as necessary, to ascertain the truthfulness of the claim or allegations of the *Generation Company*. The *Enforcement and Compliance Office* shall perform the recalculation, as may be appropriate.
- 4.4.4 The *Enforcement and Compliance Office* shall issue the *Final Forecast Accuracy Standards Report* within seventy (70) *business days* from the end of the calendar month of the covered monitoring period regardless of whether a reply or confirmation is submitted by the concerned *Generation Company* or whether a recalculation of the results was performed for a particular *must-dispatch generating unit*.
- 4.4.5 The *Enforcement and Compliance Office* shall submit a consolidated monthly report to the *PEM Board*, the *Compliance Committee*, the *ERC*, and the *DOE* containing the status of the compliance of each *must-dispatch generating unit* to the *forecast accuracy standards* as of the most recent *Billing Period* based on the *Final Forecast Accuracy Standards Report* within the same timeline provided in Section 4.4.4 of this *Manual*.
- 4.4.6 The *Enforcement and Compliance Office* shall likewise submit an annual consolidated report to the *PEM Board*, the *Compliance Committee*, the

ERC, and the DOE on or before 31 March of the year following the covered monitoring period.

- 4.4.7 The *Market Operator* or the *Enforcement and Compliance Office*, in consultation with the *System Operator*, shall review annually the *forecast accuracy standards* set in Section 4.1 and shall provide a recommendation to the *PEM Board* and the *DOE*.

4.5 PENALTIES AND SANCTIONS

- 4.5.1 One *breach* is counted for each category of *forecast accuracy standard* that was not complied with based on the *Annual Forecast Accuracy Standards Report*. The breach of *MAPE* and *PERC95* shall be counted as separate breach even if they occur on the same period subject to penalty under Clause 7.2 of the *WESM Rules* and the relevant provisions of *WESM Penalty Manual*.

- 4.5.2 The *Generation Company* with *must-dispatch generating unit* that is in operation for less than a year and is found in breach of *MAPE* or *PERC95*, shall be:

- a) imposed a penalty in proportion to the number of months the *must-dispatch generating unit* is in operation during the covered monitoring year. For instance, the plant commenced operation on 26 March, the financial penalty to be imposed shall be in proportion to the nine (9) billing months over the twelve (12) month-period.
- b) exempted from liability, if it commences operation within three (3) months prior to the end of the covered monitoring year.

A *must-dispatch generating unit* shall be considered in operation, for purposes of this Section, upon commencement of its operation or participation in the *WESM* either by virtue of the Final Certificate of Approval to Connect or the commercial operation registration in the *WESM*, whichever is applicable.

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

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 N measurements as follows: for the p_{th} percentile, set $p(N+1)$ equal to $k+d$ for k an integer, and d, a fraction greater than or equal to 0 and less than 1.</p> <ol style="list-style-type: none"> 1. For $0 < k < N$, $Y_{(p)} = Y_{[k]} + d(Y_{[k+1]} - Y_{[k]})$ 2. For $k=0$, $Y_{(p)} = Y_{[1]}$ <p style="padding-left: 40px;">Note that any $p \leq 1/(N+1)$ will simply be set to the minimum value.</p> <ol style="list-style-type: none"> 3. For $k \geq N$, $Y_{(p)} = Y_{[N]}$ <p style="padding-left: 40px;">Note that any $p \geq N/(N+1)$ 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 60th 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}

$$\begin{aligned}
 P_p &= Y_{[k]} + d \times (Y_{[k+1]} - Y_{[k]}) \\
 P_{60} &= Y_{[3]} + d \times (Y_{[4]} - Y_{[3]}) \\
 P_{60} &= 12\% + 0.6 \times (15\% - 12\%) \\
 \mathbf{P_{60} = 13.8\%}
 \end{aligned}$$