PUBLIC

WESM Market Manual

Procedures for the Monitoring of Forecast Accuracy Standards for Must Dispatch Generating Units Issue 1.0

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

Document Change History

Issue No.	Proponent	Date of Effectivity	Reason for Amendment
1.0	PEMC		Initial Version

Document Approval

Issue No.	RCC Approval	RCC Resolution No.	PEM Board Approval	PEM Board Resolution No.
1.0	01 June 2016	RCC-RESO-16-08		

Reference Documents

Document ID	Document Title
	WESM Rules (As amended)
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-MSDM-MM-10	WESM Manual on Metering Standards and Procedures: Issue 10.0
DC2016-01-0002	Adopting Further Amendments to the WESM Rules (Provisions for the Must Dispatch and Priority Dispatch Generating Units)

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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* on an hourly basis[1].

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*[2].

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*[3].

1.1.4   Moreover, the *Market Operator* is required by the *WESM Rules* report to the *PEM Board* and *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.

1.3 SCOPE

1.3.1   This *Market Manual* only provides the standards and procedures for *must dispatch generating units* registered in the *WESM*.

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[1] Clause 3.5.5.5, WESM Rules
[2] Clause 3.5.5.8, WESM Rules
[3] Clause 3.5.5.10, WESM Rules
[4] Clause 3.5.5.11, WESM Rules

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) **Forecast percentage error.** Error (in %) of the *projected output* submitted by a *must dispatch generating unit* with respect to its *installed capacity* calculated in accordance with Section 4.2.3.

b) **Initial loading.** Loading (in MW) assumed for the beginning of the *trading interval* assumed in, or estimated by, the *dispatch optimization* performed prior to the beginning of that *trading interval* as indicated in Clause 3.13.5.1 of the *WESM Rules.*

c) **Installed capacity.** Refers to the *Nameplate Rating* of a *generating unit.*

d) **Installed capacity quantity.** *Generation* by a *generating unit* at its *installed capacity* for a *trading interval* calculated in accordance with Section 4.2.3.

e) **MAPE.** Abbreviation of *mean absolute percentage error.*

f) **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.

g) **Must dispatch generating unit.** A g*enerating 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*.

h) **Perc95.** Abbreviation of *percentile 95 of the forecasting error.*

i)   **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).

j)   **Projected quantity.** Estimated *generation* of a *must dispatch generating unit* over a *trading interval* based on its submitted *projected output* assuming linear ramping calculated in accordance with Section 4.2.4.

k)   **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*.

SECTION 3 RESPONSIBILITIES

3.1 MARKET OPERATOR

3.1.1   The *Market Operator* shall review annually the forecast accuracy standards in this *Market Manual*[5].

3.1.2   The *Market Operator* shall report to the *PEM Board* and *DOE* the compliance of each *must dispatch generating unit* to the forecast accuracy standards in this *Market Manual* with respect to its *projected outputs*[6]. Furthermore, the *Market Operator* shall make available a copy of said report in the market information website.

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[5] Clause 3.5.5.9, WESM Rules
[6] Clause 3.5.5.11, WESM Rules

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*[7] 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*[8].

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*[9].

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 trading 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.

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:

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[7] Clause 3.8.2.2(g)(i), WESM Rules
[8] WESM Manual on Metering Standards and Procedures
[9] Clause 3.5.5.8, WESM Rules

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

* subject to the determination of the ERC/Grid Management Committee

4.1.2   The *MAPE* and *Perc95* of each *must dispatch generating unit* shall be calculated over the period starting on the 26th of December of a year and ending on the 25th 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*[10].

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 *trading intervals* within period p wherein *forecast percentage errors* were calculated

$FPE_{i,t}$ *forecast percentage error* (in %) of *must dispatch generating unit* i for *trading 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[11].

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[10] Clause 3.5.5.10, WESM Rules
[11] Refer to Appendix A for a detailed discussion on the NIST method

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

$$FPE_{i,t}=\left|\frac{PQ_{i,t}-MQ_{i,t}}{ICQ_i}\right|\times100\%$$

Where,

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

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

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

ICQ_i *installed capacity quantity* (in MWh) of *must dispatch generating unit* i calculated by multiplying the *installed capacity* (in MW) of *must dispatch generating unit* i provided during registration in the *WESM* by the duration of a *trading interval* (in hours)

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

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

Where,

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

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

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

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*[12];

b) the output of the *must dispatch generating unit* was restricted by the *System Operator*[13] as indicated in the *System Operator*'s report submitted to the *Market Operator* in accordance with the *WESM Rules*[14];

c) a *market suspension* or *market intervention* was declared for the *trading 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 *Market Operator* shall report to the *PEM Board* and *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 *Market Operator* shall report to the *PEM Board* and *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.

4.5 TRANSITION PERIOD

4.5.1   A *transition period* covering the period specified by the *DOE* shall be implemented.

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 the proposed forecast accuracy standards to be implemented after the *transition period*.

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[12] Clause 3.6.1.7, WESM Rules
[13] Clause 3.8.3.4, WESM Rules
[14] Clause 3.8.2.2(g)(i), WESM Rules

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 *market information website* maintained by the *Market Operator*[15].

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)

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[15] www.wesm.ph

Estimation of percentiles	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. 1. For $0<k<N$, $Y_{(p)}=Y_{[k]}+d(Y_{[k+1]}-Y_{[k]})$ 2. For $k=0$, $Y_{(p)}=Y_{[1]}$ Note that any $p \leq 1/(N+1)$ will simply be set to the minimum value. 3. For $k \geq N$, $Y_{(p)}=Y_{[N]}$ Note that any $p \geq N/(N+1)$ will simply be set to the maximum value.

Example:

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

To calculate for the 60th percentile (p = 0.6),

       Step 1: Calculate p × (N + 1)

          0.6 × (5 + 1) = 3.6

       Step 2: Get k and d

          From 3.6, k = 3 and d = 0.6

       Step 3: Get P$_{60}$

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