Republic of the Philippines
DEPARTMENT OF ENERGY
(Kagawaran ng Enerhiya)

DEPARTMENT CIRCULAR NO. DC2022-11-0032

ADOPTING FURTHER AMENDMENTS TO THE WHOLESALE ELECTRICITY SPOT MARKET (WESM) RULES AND MARKET MANUALS FOR THE IMPLEMENTATION OF RESERVE MARKET

WHEREAS, Section 30 of Republic Act No. 9136 otherwise known as the Electric Power Industry Reform Act of 2001 (EPIRA) provides that within one (1) year from the effectivity of the Act, the Department of Energy (DOE) shall establish a Wholesale Electricity Spot Market (WESM) composed of the WESM participants;

WHEREAS, Section 37 of the EPIRA further mandates the DOE to, among others, supervise the restructuring of the electricity industry and jointly with the electric power industry participants, establish the WESM and formulate the detailed rules governing the operations thereof;

WHEREAS, on 28 June 2002, pursuant to its mandate, in consultation with the electric power industry participants, the DOE promulgated Department Circular DC2002-06-0003 or the WESM Rules, as amended, which provides that any changes, amendments, and modifications to the WESM Rules, Retail Rules, and Market Manuals shall be undertaken in accordance with the provisions of Chapter 8 thereof;

WHEREAS, Clause 3.3.3.2 of the WESM Rules mandates the System Operator to provide adequate Ancillary Services for each region by entering into contracts with Ancillary Services Provider and/or competitive Spot Market trading;

WHEREAS, on 23 October 2015, the DOE promulgated Department Circular No. DC2015-10-0015 providing policies for the enhancements to WESM Design and operations which include among others the change from a 1-hour dispatch interval to a 5-minute dispatch interval and the implementation of the co-optimized Energy and Reserve Market;

WHEREAS, on 04 December 2019, the DOE promulgated Department Circular No. DC2019-12-0018 providing the general policy framework governing the provision and utilization of Ancillary Services in the grid which specified among others, the criteria for the commercial operation of the WESM Reserve Market;

WHEREAS, on 13 May 2021, the DOE promulgated Department Circular No. DC2021-03-0009, providing the policy framework for the operationalization of the Reserve Market and mandating the Market Operator to submit rules changes necessary for the co-optimized Energy and Reserve Market;

WHEREAS, on 02 December 2021, after due process, the PEM Board formally endorsed the proposal for the DOE's consideration and approval of its proposed

changes to the WESM Rules and affected Market Manuals for the implementation of the co-optimized Energy and Reserve Market;

WHEREAS, on 04 January 2022, the DOE posted on the DOE website the draft Department Circular adopting the proposed amendments to solicit comments from the market participants and other interested parties;

WHEREAS, on 10 and 11 February 2022, the DOE conducted nationwide virtual public consultations on the abovementioned proposed amendments to solicit inputs and consider comments of stakeholders in the finalization of the same;

NOW THEREFORE, from the foregoing premises, after careful review of the proposal and due consideration of the comments and recommendations received on the same, and having found the same consistent with the objectives of the EPIRA and the WESM Rules, the DOE hereby adopts, issues, and promulgates the following:

Section 1. Amendments to the WESM Rules on the Implementation of the Reserve Market. The following provisions in the WESM Rules are hereby amended:

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1.3.4 Responsibilities of the System Operator

Under these Rules, the *System Operator* shall have the following functions and responsibilities:

(a) xxx xxx xxx

(b) xxx xxx xxx

(c) Procure reserves through firm contracts and *WESM Reserve Market* for the *settlement* of such transactions pursuant to prevailing rules, regulations and issuances promulgated by the *DOE* and the *ERC*;

(d) Contribute towards the development of procedures, processes, or systems, or assist with any aspect of the operation of the *Spot Market*, in coordination with the *Market Operator*;

(e) Implement the transitory provisions specified in Chapter 10; and

(f) Perform those actions that are required to be taken prior to the *Spot Market* commencement date as specified in the *WESM Rules* and Clause 10.4.

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2.3.5 Registration – Ancillary Services Provider is amended to read as:

2.3.5.1 xxx xxx xxx

(a) xxx xxx xxx

(1) xxx xxx xxx

(2) xxx xxx xxx

(3) The *reserve facility categories* applicable to the *reserves* intended to be provided by each of the *reserve facilities* registered under Clause 2.3.5.1 (a) (1) and as authorized by the *System Operator* under Clause 2.3.5.3.

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2.3.5.3 Prior to the registration of a *Trading Participant* or a *Network Services Provider* as an *Ancillary Services Provider* eligible to provide *reserves* in accordance with Clause 2.3.5.1, the *System Operator* shall:

(a) Certify that the relevant *reserve facility* can provide the *reserve* categories individually and/or simultaneously for which registration is sought, in accordance with the *Grid Code* and *Distribution Code*;

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2.3.5.5 *Ancillary Services Providers* shall comply with the *Dispatch Conformance Standards* developed pursuant to Clause 3.8.5 and the *Reserve Conformance Standards* developed pursuant to Clause 3.8.7.

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3.3.4.2 The reserve categories to be traded in the *Spot Market* shall include:

(a) *Regulating Reserve*, readily available and dispatchable generating capacity that is allocated exclusively to correct deviations from the acceptable nominal *frequency* caused by unpredicted variations in demand or generation output;

(b) *Contingency Reserve*, synchronized generation capacity from *Qualified Generating Units*, and *Qualified Interruptible Loads* allocated to cover the loss or failure of a synchronized generating unit or a transmission element or the power import from a circuit interconnection;

(c) *Dispatchable Reserves*, generating capacity readily available for *dispatch* to replenish the *Contingency Reserves* whenever a generating unit trips or a loss of a single transmission interconnection occurs; and

(d) Such other *reserve categories* as may, from time to time, be promulgated by the DOE through a policy and subsequently prescribed by the ERC in the Philippine Grid Code and other relevant issuances.

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3.3.5.2 The costs of *reserves* are to be recovered from the *System Operator* through the *Reserve Trading Amounts* calculated by the *Market Operator* under Clause 3.13.8 in accordance with the cost recovery formula under Clause 3.13.9.

3.3.6 Provision of Ancillary Services

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3.3.7.3 Any proposed changes to the *Ancillary Services* categories, *Ancillary Services* arrangements, *Ancillary Services cost recovery formula, reserve categories, reserve regions* or locationally specific *reserve* requirements that will affect the fees of *Ancillary Services* shall be filed by the *System Operator* with the *ERC* for approval.

3.3.7.4 The *System Operator* shall continuously update the *Reserve Effectiveness Factors* for each *reserve facility category*, and the quantum of the *reserve* to be scheduled to meet each locationally specific *reserve requirement* by the *Market Dispatch Optimization Model*, to accurately reflect the *power system* under existing or future conditions, within the relevant *market* time frames, as advised by the *System Operator* under Clause 3.5.3.1.

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3.5.8.1 This section shall apply only upon commencement of the *Spot Market* for reserves established under Clause 3.3.4 with the *Ancillary Service* certification by the *System Operator* or any qualified third party and upon promulgation of accreditation guidelines by *ERC*.

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3.8.7 Reserve Conformance Standards

3.8.7.1 The *Market Operator*, in consultation with the *System Operator* and the *Enforcement and Compliance Office (ECO)*, shall develop *Reserve Conformance Standards* to be set forth in the relevant *Market Manual* which shall be consistent with the *Grid Code* and *Distribution Code*.

3.8.7.2 The *Market Manual* under Clause 3.8.7.1 shall set out the following:

(a) *Reserve Conformance Standards* that will apply to *Ancillary Service Providers;*

(b) procedures for monitoring and notifying *Ancillary Service Providers* of the non-compliance by their generating units or interruptible load facilities with their *reserve schedules*; and

(c) Procedures for identifying and checking non-conformance with the *Reserve Conformance Standards* taking into consideration any emergency directions issued to dispatched *Ancillary Service Providers.*

3.8.7.3 The *Market Operator* shall implement the procedures in Clauses 3.8.7.1 and 3.8.7.2 through a system and transmit the generated data to *ECO* for its monitoring and enforcement.

3.8.7.4 The *Market Operator,* in consultation with the *System Operator, the ECO,* and the *Trading Participants*, shall periodically review the *Reserve Conformance Standards* and the procedures set out in Clause 3.8.7.1 and 3.8.7.2.

3.8.7.5 The *Market Operator* shall publish the *Market Manual* setting out the *Reserve Conformance Standards.*

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3.10.6 Determination of Reserve Price

When applicable, the *reserve price* for a *reserve category* in a particular *reserve zone* for each *dispatch interval* shall be determined as the *Shadow Price* on the relevant *reserve requirement constraint*, defined in accordance with Clause 3.6.1.4 (e), in the *dispatch* optimization for that *dispatch interval* and published by the *Market Operator* before the start of that *dispatch interval.*

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3.13.8 Determining the Reserve Trading Amount

For *settlement* purposes, the *Reserve Trading Amount* for a *settlement interval* of a *Trading Participant* who supplies *reserve* for a particular *reserve category* in a *reserve region* shall be determined as the aggregate of the product of the *reserve price* and the *reserve settlement quantity* multiplied by the fraction of the duration of *dispatch interval* relative to the duration of a *settlement interval* for that *Trading Participant* in that *reserve category* in the *reserve region* for all *dispatch intervals* within that *settlement interval.*

3.13.9 Determining the Reserve Cost Recovery Amount

For *settlement* purposes, the *Reserve Cost Recovery Amount* for every *reserve category* and *reserve region* shall be determined as the negative of the aggregate sum of the *Reserve Trading Amounts* of the *Trading Participants* who supplied for that *reserve category and reserve region* in each *settlement interval.*

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3.13.11 Settlement Amounts for Trading Participants and the System Operator

3.13.11.1 For each *billing period*, the *Market Operator* shall determine the *settlement amount* for each *Trading Participant* as the sum of the aggregate *trading amounts* for the *settlement intervals* in that *billing period*, determined in accordance with Clause 3.13.11.2: plus

(a) xxx xxx xxx

(b) xxx xxx xxx

(c) Any other amounts payable by that *Trading Participant* to the *Market Operator* in respect of that *billing* period.

3.13.11.2 The aggregate *trading amount* for a *Trading Participant* for a *settlement interval* equals the sum of:

(a) The *Energy Trading Amounts* for that *Trading Participant* calculated in accordance with Clause 3.13.8 (which may be positive or negative for any *Trading Participant)*; *plus*

(b) The *Reserve Trading Amounts* for each *reserve region* into which that *Trading Participant* contributes *reserve* calculated in accordance with Clause 3.13.8 (which will always be positive for both *Generation Companies* and *Customers)*; *and*

(c) The *Transmission Right Trading Amounts* for each *transmission right* held by the *WESM Participant* calculated in accordance with Clause 3.13.10 (which will typically be positive for any *Trading Participant*).

3.13.11.3 The *Market Operator* shall develop and implement, subject to approval by the *ERC*, the appropriate pricing and *settlement* methodology for compensation of *Trading Participants* whose *generating units* are designated as *must-run units* and the corresponding recovery mechanism for the same.

3.13.11.4 For *each billing period*, the *Market Operator* shall determine the *settlement amount* for the *System Operator* as the sum of the aggregate *reserve recovery amounts for* the *settlement intervals* in that *billing period.*

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Chapter 11 Glossary

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Dispatch. The act by which the *System Operator* initiates all or part of the response offered or bid by a scheduled *generating unit* or *scheduled load* in accordance with Clause 3.8.2.

Dispatchable Reserve. Generating capacity that are readily available for *dispatch* in order to replenish the *Contingency Reserves* service whenever a generating unit trips or a loss of a single transmission interconnection occurs.

Dispatch Conformance Standards. Standards that set the criteria and procedures for determining whether the *scheduled generating units* and the *priority dispatch generating units* comply with their *dispatch schedules* and which are required to be set out in a *Market Manual* in accordance with Clause 3.8.5.

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Pumped-Storage Unit. A *facility* or group of facilities that act as a *load* while using *energy* to pump water to higher elevation reservoirs, and then act like generators by producing electric *energy* when water is released back to the lower reservoir.

Qualified Generating Unit. A Generating Unit tested, certified by the *System Operator* or any qualified third-party *Ancillary Services* capability testing entity accredited by *the ERC;* and monitored by the *System Operator* to provide specific types of *Ancillary Services.*

Qualified Interruptible Load. A *Load* that is tested, certified and monitored by the *System Operator* to provide an applicable type of *Ancillary Service.*

Ramp Rate. The rate of change in electricity production or consumption from a *generating unit or scheduled load.*

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Reserve. *Ancillary services* that are traded in the *WESM.*

Reserve Conformance Standards. Standards that set the criteria and procedures for determining whether the *Ancillary Service Providers* comply with their *reserve* schedules, and which are required to be set out in a *Market Manual* in accordance with Clause 3.8.7.

Reserve Cost Recovery Amount. The amount to be recovered from the *System Operator* pertaining to the negative of the aggregate sum of the *Reserve Trading Amounts* of the *Trading Participants* who supplied for *reserves.*

Reserve Cost Recovery Charges. Charges to recover the costs incurred in purchasing reserve, to be determined by a formula approved by the *ERC.*

Reserve Cost Recovery Zone. A zone within which *reserve cost recovery* charges may be recovered to meet each locationally specific requirement.

Reserve Effectiveness Factor. A performance indicator that measures the *reserve facility's* adequacy, accuracy, and timeliness in its actual reserve response with respect to the expected operating parameters set for a specific type of reserve.

Reserve Facility. A facility capable of providing *reserves.*

Reserve Facility Category. A particular type of *reserve facility*, characterized by its technology (e.g., interruptible load, synchronized generation, non-synchronized generation) which is reflected in the type of offer it can make.

Reserve Offer. A *standing offer*, or *market offer* to *supply reserves,* submitted, or revised by a *Customer or Generation Company* in accordance with Clause 3.5.7, 3.5.8, 3.5.10 or 3.5.11.

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Section 2. Amendments to the Market Manual on Price Determination Methodology. The following provisions in the Market Manual on Price Determination Methodology are hereby amended:

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Section 1.3 Scope

This *Market Manual* provides the following:

a. Methodology by which *energy* and *reserves* shall be priced and settled in accordance with the market design principles as issued by the *DOE;*

b. Methodology by which *energy* and *reserves* in the *WESM* shall be priced, including the determination of prices when there is extreme price separation due to *network congestion*, and determination of *administered prices* during *market suspension* and *market intervention;*

c. Methodology by which *energy* and *reserves* shall be settled in the *WESM*, the determination of additional compensation, as applicable, and the determination and allocation of *Net Settlement Surplus;* and

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Section 4.11 Reserves

4.11.1 *Reserve* and *energy dispatch schedules* shall be determined in a co-optimized manner in the *Market Dispatch Optimization Model*. An illustrative example of the co-optimization of *energy* and *reserve* is provided in Appendix F of this *Market Manual*.

4.11.2 The *reserve regions* shall initially consist of the Luzon, Visayas, and Mindanao Grids.

4.11.3 The *reserve price* for each *reserve region* and *reserve category* shall be determined as the *Shadow Price* on the relevant *reserve requirement constraint* in the *dispatch* optimization for that *reserve region* and *reserve category* in that *dispatch interval*.

Section 4.12 Application of WESM Prices

4.12.1 In general, the nodal prices resulting from the *real-time dispatch market run* as determined in Section 4.4.4, and, as applicable, Section 4.4.5, shall be used as *final nodal energy prices* and *reserve prices* in the calculation of *settlements* except if there are non-zero constraint violation variable values or pricing error notices:

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Section 5.2 Automatic Pricing Re-Run

5.2.1 *Automatic pricing re-runs* for *market projections* and *real-time dispatch* shall ensure that the *energy prices* and *reserve prices reflect* the marginal costs of supplying *energy* at each node, regional, or island level and the marginal costs of supplying *reserves*.

5.2.2 The *automatic pricing re-run* of the *Market Dispatch Optimization Model* shall determine the prices for *energy* and *reserves* with relaxed *constraints* and shall have approximately the same *dispatch schedules*.

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5.2.5 The following table shows each type of *constraints* with their corresponding *constraint* relaxation formulas during pricing re-runs:

Soft Constraint	Violation	Constraint Relaxation during Pricing Re-Run	Re-run Price
Thermal Base Case	x	x + delta	EDP and RP

Soft Constraint	Violation	Constraint Relaxation during Pricing Re-Run	Re-run Price
Transmission Group	x	x + delta	EDP and RP
Self-Scheduled Generation *Constraint*	x	x + delta	EDP and RP
System Energy Balance (Over-generation and under-generation)	x	x + delta	EDP and RP
Nodal Value of Lost Load or Nodal Energy Balance	x	x + delta	EDP and RP
Thermal Contingency	x	x + delta	EDP and RP
Reserve Requirement	x	x + delta	EDP and RP

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6.4.2 In cases where a *region/s* with congestion has no interconnection with other *regions*, or has no exchange of power with other *regions*, the provisions of Clause 6.4.1 shall apply only to the region/s with congestion.

Section 6.5 Price Substitution Methodology for Reserve Prices

In cases where price substitution methodology is applied, the *reserve price* for a certain *reserve category* in a *reserve region* shall be calculated as the sum of the *constrained solution*'s marginal *reserve offer* price and the opportunity cost calculated based on the *unconstrained solution*. It shall be determined as the *Shadow Price* calculated based on the unconstrained solution.

SECTION 7 ADMINISTERED PRICES

Section 7.1 Scope

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7.1.2 The *administered price* shall be established by the *Market Operator* in accordance with the following guiding principles:

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b. *Administered prices* shall be determined and shall replace *market prices* for *energy* and *reserve, i.e. energy administered prices* shall replace the *nodal energy dispatch prices,* and *reserve administered prices* shall replace the *reserve prices.*

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Section 7.4 Reserve Administered Price

7.4.1 In case two (2) or more of the four (4) most recent similar *trading days* and similar *dispatch intervals* have not been administered, the *reserve administered price* for each *reserve category* in every *reserve region* shall be computed as follows:

a. The aggregate *reserve dispatch schedule*-weighted average of the *reserve prices* for each *reserve category* in every *reserve region* of the four (4) most recent similar *trading days* and similar *dispatch intervals* that have not been administered, as set out in the following formula:

$$\mathbf{RAP}_{\mathbf{r,a,D,i}} = \frac{\sum_{\mathrm{d=D\text{-}1}}^{\mathrm{D\text{-}n}} \left(\mathrm{RP}_{\mathrm{r,a,d,i}} * \sum_{\mathrm{k \epsilon K_{r,a,d,i}}} \boldsymbol{RDS}_{k,r,a,d,i} \right)}{\sum_{\mathrm{d=D\text{-}1}}^{\mathrm{D\text{-}n}} \sum_{\mathrm{k \epsilon K_{r,a,d,i}}} \boldsymbol{RDS}_{k,r,a,d,i}}$$

Where:

$RAP_{r,a,D,i}$	refers to the reserve *administered price* for *reserve category* r in *reserve region* a at *dispatch interval* i within *trading day* D
$RP_{r,a,d,i}$	refers to the *reserve price* for *reserve category r* in *reserve region a* at *dispatch interval i* within *trading* day *d*
$RDS_{k,r,a,d,i}$	refers to the *reserve dispatch schedule* for *reserve provider* resource *k* for *reserve category r* in *reserve region a* at *dispatch interval i* within *trading day d*
D	refers to the *trading day* with *dispatch interval* under *market intervention* or *market suspension*
$d = D - n$	refers to the n^{th} most recent non-administered similar *trading day* and similar *dispatch interval*
n	refers to the number of similar *trading days* and *dispatch intervals* that have not been administered

from the four (4) most recent similar *trading days* and *dispatch intervals*

7.4.2 In case three (3) or all of the four (4) most recent similar *trading days* and similar *dispatch intervals* have been administered, the *reserve administered price* for each *reserve category* in every *reserve region* shall be computed as follows:

a. *The aggregate reserve dispatch schedule*-weighted average of the *reserve administered prices* of similar *trading days* and similar *dispatch intervals* as set out in the following formula:

$$\mathrm{RAP}_{k,D,i} = \frac{\sum_{d=D-1}^{D-n}\left(\mathrm{RAP}_{k,d,i} * \sum_{k \epsilon K_{r,a,d,i}} \boldsymbol{RDS}_{k,r,a,d,i}\right)}{\sum_{k \epsilon K_{r,a,d,i}} \boldsymbol{RDS}_{k,r,a,d,i}}$$

Where:

$RAP_{k,D,i}$	refers to the *reserve administered price* for *reserve provider* resource *k* at *dispatch interval i* within *trading day D*
$RAP_{k,d,i}$	refers to the *reserve administered price* for *reserve provider* resource *k* for *dispatch interval i* within *trading day d*
$RDS_{k,r,a,d,i}$	refers to the *reserve dispatch schedule* for *reserve provider* resource *k* for *reserve category r* in *reserve region a* at *dispatch interval i* within *trading day d*
D	refers to the *trading day* with *dispatch interval* under *market intervention* or *market suspension*
$d = D - n$	refers to the n^{th} most recent similar *trading day* of *D*
n	refers to the number of similar *trading days* and *dispatch intervals* that have not been administered from the four (4) most recent similar *trading days* and *dispatch intervals*

7.4.3 For each *reserve provider* resource, the *reserve dispatch schedule* shall be set to the *reserve schedules* determined by the *System Operator* for the *dispatch interval* under *market suspension* or *market intervention.*

7.4.4 Similar *trading days* refer to each day of the week (i.e., Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday) while similar *dispatch intervals* refer to the same period within the same *settlement interval.*

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Section 8.2 Trading Amounts

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8.2.2 Reserve Trading Amount

a. The *reserve quantity* for any *reserve provider* resource in any *dispatch interval* shall be determined by the *Market Operator* as the *reserve dispatch schedule* less *reserve* contracted quantities, as shown in the following formula:

$$RQ_{j,r,a,i} = \left(RDS_{j,r,a,i} - RBCQ_{j,r,a,i}\right)$$

Where:

$RQ_{j,r,a,i}$ refers to the *reserve quantity* of *reserve provider* resource *j* for *reserve category r* and *reserve region a* at *dispatch interval i*

$RDS_{j,r,a,i}$ refers to the *reserve dispatch schedule* of *reserve provider* resource *j* for *reserve category r* and *reserve region a* at *dispatch interval i*

$RBCQ_{j,r,a,i}$ refers to the *bilateral contract quantity* for *reserve provider* resource *j* for *reserve category r* and *reserve region a* at *dispatch interval i*

b. The *Reserve Trading Amount* for each *Trading Participant* that supplies reserve to a particular *reserve region* in a *settlement interval* shall be determined as the *reserve prices* for that *reserve region* multiplied by the *reserve quantities* for that *Trading Participant* in that *reserve region* for the *dispatch intervals* of the relevant *settlement interval.*

$$RTA_{p,r,a,h} = \sum_{i \in h}\left[\frac{1}{n}\sum_{j \in J_p}\left(RP_{r,a,i} * RQ_{j,r,a,i}\right)\right]$$

Where:

$RTA_{p,r,a,h}$ refers to the *Reserve Trading Amount* of *Trading Participant p* for *reserve category r* and *reserve region a* at *settlement interval h*

$RP_{r,a,i}$ refers to the *reserve price* for *reserve category r* and *reserve region a* at *dispatch* interval *i* in *settlement interval h*

$RQ_{j,r,a,i}$ refers to the reserve quantity of *reserve provider* resource *j* for *reserve category r* and *reserve region* a at *dispatch interval i* in *settlement interval h*

J_p refers to the set of *reserve provider* resources under *Trading Participant p*

n refers to the number of *dispatch intervals* within a *settlement interval*, which is 12 for a five-minute market

8.2.3 Reserve Cost Recovery Amount

a. The *reserve cost* shall be recovered from the *System Operator.*

b. The *reserve cost recovery amount* for every *reserve category* and *reserve region* shall be determined as the negative of the aggregate sum of the *Reserve Trading Amounts* of the *Trading Participants* who supplied for that *reserve category* and *reserve region*, using the formula represented as:

$$RRCost_{r,a,h} = (-1)\sum_{p \in P} RTA_{p,r,a,h}$$

Where:

$RRCost_{r,a,h}$ refers to the *reserve cost* for *reserve category r* in *reserve region a* at *settlement interval h*

$RTA_{p,r,a,h}$ refers to the *Reserve Trading Amount* of *Trading Participant p* for *reserve category r* and *reserve region a* at *settlement interval h*

P refers to the set of *Trading Participants*

8.2.4 Aggregate Trading Amount

a. The aggregate *trading amount* for a *Trading Participant* for a *settlement interval* shall be determined as follows:

(1) Energy Trading Amounts, which may be positive or negative for any *Trading Participant.*

(2) Reserve Trading Amounts

b. This is provided in the following formula:

$$TA_{p,h} = ETA_{p,h} + RTA_{ph}$$

Where:

$TA_{p,h}$ refers to the aggregate *trading amount* of *Trading Participant p* for *settlement interval h*

$ETA_{p,h}$ refers to the *Energy Trading Amount* of *Trading Participant p* at *settlement interval h*

RTA_{ph} refers to the *Reserve Trading Amount* of *Trading Participant p* at *settlement interval h*

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8.4 Settlement Amounts

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8.4.3 For each *billing period*, the *Market Operator* shall determine the *settlement amount* for the *System Operator* as the sum of the aggregate *reserve recovery amounts* for the *settlement intervals* in that *billing period*. This is provided in the following formula:

$$SA_{so,r,a,m} = \sum_{h \in H} \sum_{a \in A} \sum_{r \in R} RRCost_{r,a,h}$$

Where:

$SA_{so,r,a,m}$ refers to the *settlement amount* of the *System Operator* for *billing period m*

$RRCost_{r,a,h}$ refers to the *reserve cost* for reserve category *r* in *reserve region a* at *settlement interval h*

H_m refers to the *settlement interval* under billing period m

R refers to the set of *reserve categories*

A refers to the set of *reserve regions*

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Section 11 Appendices

Appendix A

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2.2 Regional Reserve Requirements

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Contingency, Dispatchable, and other Reserve Requirements

2.2.5 Analogously to *Regulating Reserve Raise* and *Regulating Reserve Lower* minimal requirements, regional minimum requirements can be specified for other *Ancillary Services* (AS) and for each time interval:

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4.3. Reserve Model

4.3.1 Core parts of the Reserve Model are:

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f. Constraints on Simultaneous Provisions of Reserve

4.3.2 Resource Reserve Capacity Limits

4.3.2.1 In addition to limits imposed by *reserve offer* limits, there are physical unit limits that affect *reserve* award. One example is for *Contingency* and *Dispatchable Reserves* limitation by Governor response. While Governor response also depends on *frequency* deviation, it is usually one curve provided for Market purpose, where response is given as function of *energy* output only. Typical Governor response curve is provided below:

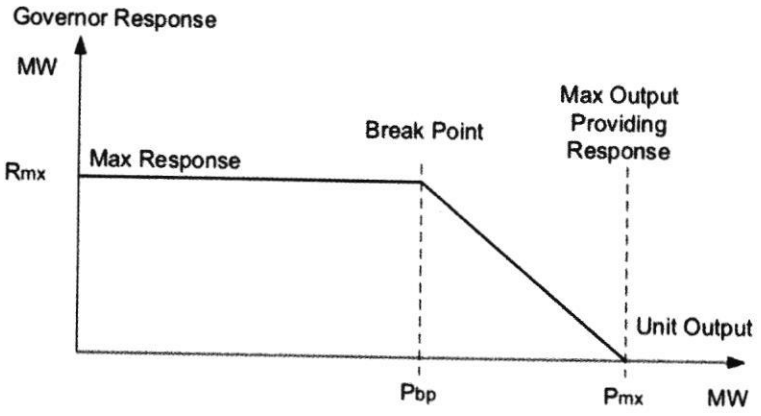


Figure 2: Governor *n* second raise droop characteristic

4.3.2.2 Each two-piece characteristic comprises:

a. Maximum response amount which applies between zero *energy dispatch* and the contracted *energy dispatch* breakpoint and;

b. Above the *energy dispatch* breakpoint there is linear decrease in response amount from the contracted maximum response amount down to zero maximum response at the maximum *energy* capacity.

4.3.2.3 The mathematical formulation using the variable designation from Figure 2 are as follows:

$$Res_{unit}^{t} = R_{mx} * (P_{mx} - P^{t})/(P_{mx} - P_{bp}) \forall P \geq P_{bp}$$
$$Res_{unit}^{t} = P_{mx} \forall P < P_{bp}$$

4.3.2.4 In addition to maximum quantity, contracted generators might be subject to mandatory governor response, which is modeled as *reserve* self-schedule and protected with penalty in Scheduling Run (i.e. treated as price taker). Such self-schedule also contributes to regional *reserve requirements*.

4.3.3 Resource AS Ramping Limits

The individual *reserve* ramping constraint can be posted for each resource and each time interval. These *constraints* are expressed in time domain as follows (equation is provided for Regulation Raise, but analogous equation applies for each *reserve:*

$$\frac{Reg_{unit}^{Raise;t}}{RR_{unit}^{RegUp}} \leq T^{AS}; \quad unit \in G; t \in T$$

meaning that the *Reserve* ramping cannot exceed the specified *reserve* ramping (default 5 minutes).

4.3.4 Resource Combined Energy and Reserve Capacity Limits

4.3.4.1 Multiple market services can be provided by the same resource at the same time, but the total resource capacity is limited. For example, the capacity range of online *generation* resources can be used for *energy*, regulation raise capacity and *Contingency Reserve*.

4.3.4.2 The capacity range binding *energy* and *reserve* depends on the services involved. For example, for combined *Energy* and *Regulating Reserves*, the regulating range is Binding.

$$En^t_{unit} + RegRaise^t_{unit} \leq Rh^t_{unit}$$
$$En^t_{unit} - RegLower^t_{unit} \geq RL^t_{unit}$$

4.3.4.3 In a scenario when regulating limits are not separately registered for a resource, the operating limits are used instead of regulating in the above equations.

4.3.4.4 For combined *Energy* and Contingency (*Frequency* Response) Service, the sum of the scheduled *energy* and the scheduled FCAS response $PSRaise^t_{unit}$ must be less than or equal to the Governor Droop Raise Capacity $GDRH^t_{unit}$ of that unit for each of the services:

$$En^t_{unit} + PSRaise^t_{unit} \leq GDRH^t_{unit}$$

4.3.4.5 Analogous capacity limits are posted on *load* entities. For example of *Contingency Reserve*:

$$En^t_{load} + SRes^t_{load} \leq EL^t_{load}$$

4.3.5 Resource Combined Energy and Reserve Ramping

If the *reserve* awards were dispatched for *contingency,* they would be converted into *energy* that needs to ramp, thus taking away ramping capability of dispatched *energy* award. The energy ramping period is the same as *dispatch interval*, so if it was fully utilized for energy ramping, there would be no room for additional *energy* ramping needed if *reserve* was activated. Therefore, the *reserve* awards have to be taken into account in *energy* ramping model. *Energy* ramping capacity based on *energy ramp rate* is adjusted to address the impact from *reserve* awards. The upward and downward ramping equations can be expressed as:

$$P_i(t) - P_i(t-1) \leq RLU_i^{En}(t) - ASUp_i(t)$$

$$P_i(t-1) - P_i(t) \leq RLD_i^{En}(t) - ASDn_i(t)$$

where: ASUp and ASDn is upward/downward *reserve* impact to *energy* ramping capacity.

4.3.6 Other Operational Modes of Generators, Loads or Similar Facilities

4.3.6.1 Hybrid resources or other operational modes of generators, loads, or similar facilities include hydro *pumped storage* and non-generating resources (NGR)38 like batteries, flywheel, compressed air facilities, and other forms of primary *energy* storage.

4.3.6.2 Potential models for the treatment of these resources may incorporate variability of both *supply* offers and *demand bids* for more optimal economic results.

4.3.7 Constraints on Simultaneous Provision of Reserve

4.3.7.1 Limitations on the provision of *reserve awards* are also considered in the *MDOM*.

4.3.7.2 If it is defined in the *MDOM* where regulation and *Contingency Reserve* schedules cannot be awarded at the same time for a resource, then the *MDOM* will choose the most optimal *reserve category* the resource should be scheduled at, in consideration of the optimization objective defined in the *MDOM*

4.3.7.3 Different ramping constraints when operating in different modes of operation (e.g., *Automatic Generation Control*, *Governor Control Mode*).

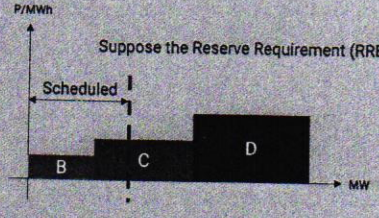
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Appendix F - Overview of Co-optimization of Energy and Reserve

Decentralized Scheduling of Capacities

- Suppose we have four generators that have the following capacities
- The System Operator contracts some of these generators to provide reserve
- On a Day-Ahead, these generators nominate capacities for reserve (typically up to their contract)

Generator	Pmax, MW	Nomination, MW
A	400.0	–
B	300.0	100.0
C	250.0	250.0
D	300.0	300.0



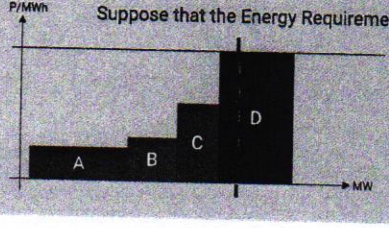
The System Operator then determines the reserve schedules based on the projected reserve requirement

Decentralized Scheduling of Capacities

After obtaining the reserve schedules a day ahead...

Generator	Pmax, MW	Reserve Schedule, MW	Energy Offer	
			Quantity, MW	Price, P/MWh
A	400.0	0.0	400.0	0.0
B	300.0	100.0	200.0	3,000.0
C	250.0	100.0	150.0	5,000.0
D	300.0	0.0	300.0	12,000.0

- Generators will then offer their remaining capacities in the real-time energy market
- Those with no bilateral contracts for energy would normally attempt to maximize their earnings in the energy market



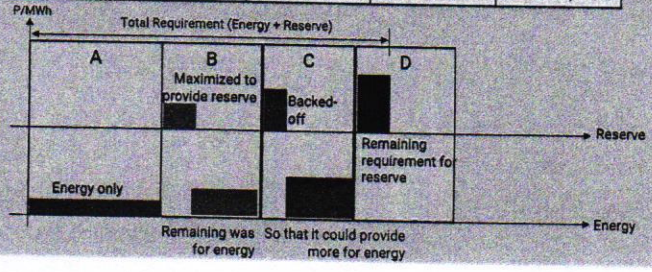
Co-Optimization: Simultaneous Scheduling

...and such capacities may be fully scheduled to provide energy

Generators should offer the capacity they are willing to set aside for reserve

All capacities should be reflected in a joint market

Generator	Pmax, MW	Energy Offer Price, P/MWh	Reserve Offer	
			Quantity, MW	Price, P/MWh
A	400.0	0.0	–	–
B	300.0	3,000.0	100.0	1,000.0
C	250.0	5,000.0	250.0	3,000.0
D	300.0	12,000.0	300.0	3,500.0



Co-Optimization: Simultaneous Scheduling

Sequential Clearing

Generator	Schedules, MW	
	Energy	Reserve
A	400.0	0.0
B	200.0	100.0
C	150.0	100.0
D	50.0	0.0

Resulted to a much more expensive marginal price of P12,000/MWh for energy

Simultaneous Clearing

Generator	Schedules, MW	
	Energy	Reserve
A	400.0	0.0
B	200.0	100.0
C	200.0	50.0
D	0.0	50.0

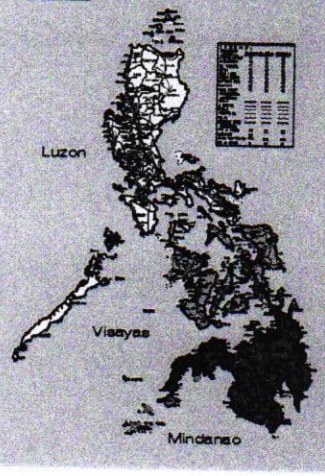
Energy Price = P5,500/MWh
Cost to Produce Cheapest Overall Cost

Reserve Price = P3,500/MWh

Even if the co-optimized solution scheduled a much more expensive resource for reserve (P3,500/MWh)

Overall however, the cost was lower as it resulted to a cheaper marginal price of P5,000/MWh for energy

Zonal Scheduling and Pricing



Scheduling

Region	Requirement	Reserve Offer	Reserve Schedule	Surplus/ Deficit (+/-)
Luzon	647	1000	**647**	353
Visayas	100	80	**80**	-20
Mindanao	135	150	**135**	15

Although Luzon and Visayas are interconnected through the HVDC, the surplus of reserve providers in Luzon will not be scheduled above its requirement to provide the deficit in Visayas

Pricing

- For each reserve type in each reserve region, different zonal prices shall be obtained, which is already inclusive of the clearing price and the opportunity cost

Prioritization of Capacities

Priority	Constraint Violation Coefficient Name
1	Thermal Constraint of Equipment
2	Regulating Reserve
3	N-1 Contingency Constraint
4	Curtailment of Self-Scheduled Generators
5	System-wide Supply Surplus/Deficit
6	Nodal Load Shedding
7	Contingency Reserve
8	Dispatchable Reserve

Prioritization of Capacities

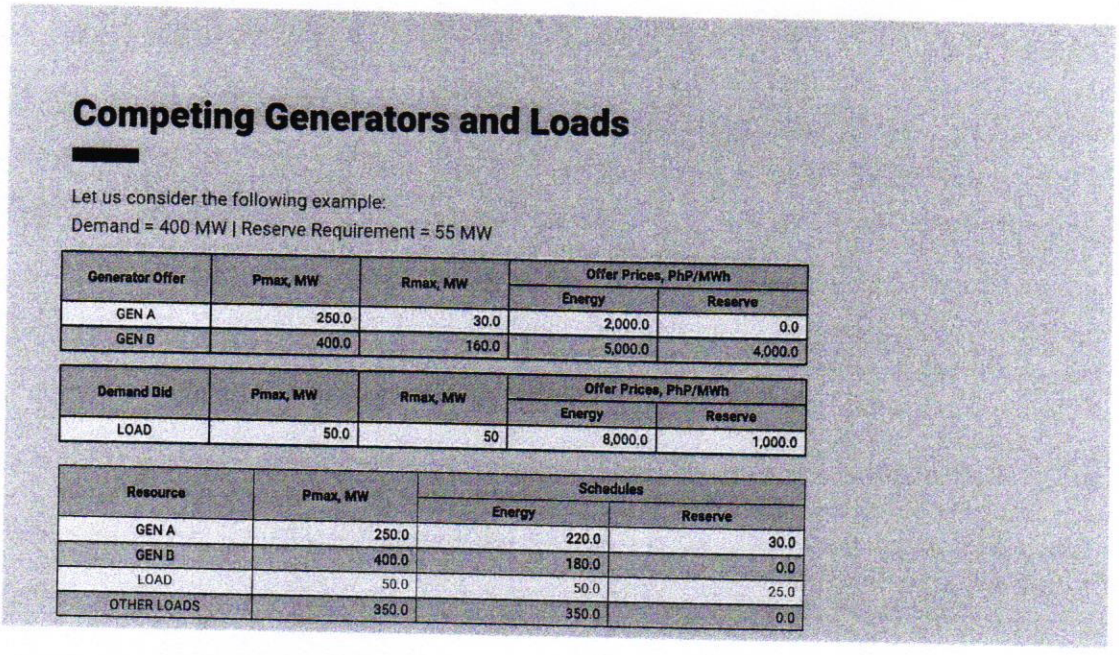
- In the previous CVC Priority Order, the non-violation of the nodal energy requirement constraint is of lower priority than having a deficit in regulation reserve
- Thus, the reserve offers shall be maximized to fulfil the reserve requirement
- Note that automatic pricing re-run shall be activated

Should the forecasted energy requirement be 1020 MW, while the regulation reserve requirement is 40 MW

GEN	PMAX, MW	ENERGY OFFER PRICE, P/MWh	RESERVE OFFER		SCHEDULES, MW	
			QUANTITY, MW	PRICE, P/MWh	ENERGY	RESERVE
A	250	2,000	–	–	250	0
B	230	5,000	160	1,000	190	40
C	240	10,000	90	10,000	240	0
D	300	30,000	100	12,000	300	0
				Total	980	40

Competing Generators and Loads

- Loads should be able to compete with generators in the provision of certain reserve types
- But for loads to be able to compete with generators in these reserve types, they must also submit bids in the energy market (i.e., demand-side bidding)
- The MMS is currently designed to accommodate demand-side bidding, but is not yet implemented in WESM
- The MMS design reflects a co-optimization of energy and reserve for both generators and loads



Competing Generators and Loads

Let us consider the following example:
Demand = 400 MW | Reserve Requirement = 55 MW

Generator Offer	Pmax, MW	Rmax, MW	Offer Prices, PhP/MWh	
			Energy	Reserve
GEN A	250.0	30.0	2,000.0	0.0
GEN B	400.0	160.0	5,000.0	4,000.0

Demand Bid	Pmax, MW	Rmax, MW	Offer Prices, PhP/MWh	
			Energy	Reserve
LOAD	50.0	50	8,000.0	1,000.0

Resource	Pmax, MW	Schedules	
		Energy	Reserve
GEN A	250.0	220.0	30.0
GEN B	400.0	180.0	0.0
LOAD	50.0	50.0	25.0
OTHER LOADS	350.0	350.0	0.0

Section 3. Amendments to the Market Manual on Registration, Suspension and De-Registration Criteria and Procedures. The following provisions in the Market Manual on Registration, Suspension and De-Registration Criteria and Procedures are hereby amended:

xxx xxx xxx

Section 2.5 Registration of Direct WESM Members and Trading Participants

2.5.1 Categories and Qualifications

2.5.1.2 Customers

a. xxx xxx xxx

b. The following are qualified to register as *Customer* –

i. *Distribution Utilities*, xxx xxx xxx;

ii. *Retail Electricity Suppliers* xxx xxx xxx;

iii. *Renewable Energy Suppliers* xxx xxx xxx;

iv. *Bulk Users* or *End Users* xxx xxx xxx; and

v. *System Operator* in its capacity as the entity designated for the procurement of reserves through the *Ancillary Service Procurement Agreement* and *WESM* for *settlement* of such transactions pursuant to prevailing rules, regulations and issuances promulgated by the *DOE* or

the *ERC*. It is provided that the registration of the *System Operator* as single buyer of *reserves* traded in the *WESM* shall be in accordance with the prevailing rules, regulations and issuances of the *DOE* or the *ERC*.

xxx xxx xxx

Section 2.6 Registration of Ancillary Services Providers

2.6.1 Qualifications and Requirements

2.6.1.1 Persons or entities wishing to register as *WESM member* under this category must –

a. Be registered as a *Generation Company* or a *Customer*;

b. Be certified by the *System Operator* or any qualified third party *Ancillary Services* capability testing entity accredited by the *ERC* as qualified to provide *Ancillary Services* in accordance with *WESM Rules* Clause 2.3.5.3;

c. Comply with the membership criteria required of *Trading Participants* and shall be subject to the same requirements set forth in this Manual;

d. Comply with the same technical and commercial requirements required of *Trading Participants*;

e. Comply with the technical requirements for *Ancillary Service Providers* set forth in the *Philippine Grid Code* and any other relevant documents that the *ERC* or *DOE* will promulgate on the provision of *Ancillary Services*; and

f. For *Generation Companies*, only *scheduled generating units, battery energy storage systems,* and *pumped-storage units* can be registered as a *reserve facility*.

2.6.1.2 The application for registration of a *Generation Company* as *Ancillary Services Provider* shall specify the following information for each of its *reserve facility* which has been issued a valid certification to provide Ancillary Services:

a. *Reserve category* or categories which said *generating unit* intends to trade in the WESM;

b. Maximum *reserve* capability as determined in the *Ancillary Services* capability tests conducted by the *System Operator* or the third-party testing entity accredited by the *ERC*. The maximum *reserve* capability should not exceed the *WESM* registered maximum capacity (Pmax); and

c. Validity period for providing *Ancillary Service* for each *reserve* category.

2.6.1.3 *Customers* with load facilities which intend to register in the *WESM* as *Ancillary Services Provider* shall be accredited and comply with the requirements set out in relevant procedures for accreditation promulgated by the *ERC*. They must submit the following information:

a. Projected Maximum Energy Load Requirement

b. *Reserve category* or categories which said load facility intends to trade in the *WESM*;

c. Maximum reserve capability as determined in the *Ancillary Services* capability tests conducted by *System Operator* or the third-party testing entity accredited by the *ERC*; and

d. Validity period for providing *Ancillary Service* for each *reserve* category.

xxx xxx xxx

Section 3.3 Facility-related Changes

3.3.1 Registered Capacities and Reserve Capabilities

Changes in the registered capacities (i.e., Pmin or Pmax) of a *generating unit* and its maximum *reserve* capabilities, if there is any, shall require confirmation by the *Market Operator* before such change can be considered in the *WESM* scheduling and *dispatch* processes.

xxx xxx xxx

3.3.7 New Load Facility

xxx xxx xxx

3.3.8 Ancillary Services Category and Capability

3.3.8.1 A WESM *Member* that is registered as an *Ancillary Services Provider* may update the registered capability or *reserve category* of any of its registered *reserve facility*.

3.3.8.2 The *WESM Member* shall comply with the technical requirements set out in Section 2.6.1, including but not limited to the submission of the certification of the result of the *Ancillary Services* capability test carried out by the *System Operator* or a third-party entity duly accredited by the *ERC*.

3.3.8.3 The *Market Operator* shall assess and approve the request for the change in registered capability or *reserve category* in accordance with the procedures under Section 2.6.2.

3.3.8.4 If a *reserve facility's* validity period for providing *Ancillary Service* in a specific *reserve category* is about to expire, then the *Market Operator* shall inform the *Ancillary Services Provider* and the *System Operator* that the relevant *reserve facility* shall be de-registered for the affected specific *reserve category* at least ninety (90) calendar days prior to the expiration of its validity period. Updated certification may include a letter of extension from the *System Operator*.

a. The *Market Operator* shall not proceed with the de-registration of the reserve category if the *Ancillary Services Provider* is able to provide an updated certification of the result of the Ancillary Services capability test carried out by the *System Operator* or a third-party entity duly accredited by the *ERC* at least seven (7) calendar days prior to the original expiration of its validity period. The *Market Operator* shall inform the *System Operator* if the de-registration shall not proceed.

b. Should the *Ancillary Services Provider* is unable to provide an updated certification of the result of the Ancillary Services capability test carried out by the *System Operator* or a third-party entity duly accredited by the *ERC* within the aforementioned timeline, the *Market Operator* shall effectively de-register the specific reserve category for that *reserve facility* effective on the original expiration of its validity period. The *Market Operator* shall inform the *System Operator* of the de-registration.

xxx xxx xxx

Appendix A - Glossary of Terms

Term	**Definition**
xxx xxx xxx	xxx xxx xxx
Market Management System	The infrastructure which is composed of software, hardware and associated interfaces that support the operations of the WESM and which is operated by the Market Operator.
Maximum reserve capability	The maximum demand in MW that a facility can provide with respect to reserves based on Ancillary Service capability tests.
Maximum Stable Load or Pmax	The maximum demand in MW that a generating unit or generating system or module in the case of a combined cycle power plant, can reliably sustain for an indefinite period, based on the generator capability tests. Also the registered maximum capacity.
xxx xxx xxx	xxx xxx xxx

Section 4. Amendments to the Market Manual on Billing and Settlement. The following provisions in the Market Manual on Billing and Settlement are hereby amended to read as:

xxx xxx xxx

Section 3.2 WESM Members

WESM Members, including *Trading Participants* and the *System Operator*, shall be responsible for complying with the requirements set forth in this *Market Manual* and in the *WESM Rules*, as follows:

a) Retrieve and review *settlement* statement files and supporting data issued by the *Market Operator*. The *Trading Participants* or the *System Operator* shall notify the *Market Operator* if files are not accessible or received within the timetable and if there are discrepancies or errors;

xxx xxx xxx

Section 4.1 Contents of Settlement Statements and Data

4.1.1 Settlement Quantity and Amounts

a) xxx xxx xxx

b) The aggregate *trading amount* for a *Trading Participant* for a trading interval equals the sum of:

i. The *Energy Trading Amounts* for each market trading node for which the *Trading Participants* is responsible calculated in accordance with *WESM Rules* Clause 3.13.7 (which will typically be positive for a Generation Company and negative for a Customer); plus

ii. The *Reserve Trading Amounts* for each *reserve region* into which that *Trading Participant* contributes *reserve* calculated in accordance with *WESM Rules* Clause 3.13.8 (which will always be positive for both *Generation Companies* and *Customers*); and

iii. The *Transmission Right Trading Amounts* for each *transmission right* held by the WESM Participant calculated in accordance with *WESM Rules* Clause 3.13.10 (which will always be positive for both Generation Companies and Customers)

c) For each *billing period*, the *Market Operator* shall determine the *settlement amount* for each *Trading Participant* as the sum of the aggregate *trading amounts* for the *settlement intervals* in that *billing period*, determined in accordance with *WESM Rules* 3.13.11.2 plus:

i. Any amount payable by the *Market Operator* to that *Trading Participant* in respect of that *billing period* and not accounted for in *WESM Rules* Clause 3.13.11.2, including payment for any *Ancillary Services* purchased on behalf of the *System Operator*, less the sum of

ii. Any *market fees* which that *Trading Participant* is required to pay in respect of that *billing period* as determined in accordance with *WESM Rules* Clause 2.10; plus

iv. Any other amounts payable by that *Trading Participant* to the *Market Operator* in respect of that *billing period*.

iv. It is provided, however, that the *Market Operator* may issue a separate settlement statement for the *Reserve Trading Amounts*, if applicable, for that *Trading Participant*.

d) The aggregate *trading amount* for the *System Operator* for a *settlement interval* equals the total *reserve cost recovery amount* with respect to every *reserve category* and *reserve region* in accordance with *WESM Rules* Clause 3.13.9.

e) For each *billing period*, the *Market Operator* shall determine the *settlement amount* for the *System Operator* as the sum of the aggregate *reserve cost recovery amounts* for the *settlement intervals* in that *billing period*, determined in accordance with *WESM Rules* Clause 3.13.11.5.

xxx xxx xxx

4.1.4 The *Market Operator* shall provide by electronic means to the *Trading Participants* their respective *settlement* data along with the preliminary and final statements, which *settlement* data shall include, as may be applicable, the market fee statements, *Energy Trading Amounts*, final *nodal energy dispatch prices*, *energy settlement* quantity, *Line Rental Trading Amount* of participants with *Bilateral Contract Quantity* and each of the participants' *Bilateral Contract Quantity*, final *reserve* prices, *Reserve Trading Amount*, *Net Settlement Surplus* rebated, and line loss and congestion charges.

4.1.5 The *Market Operator* shall provide by electronic means to the System Operator its *settlement* data, along with the preliminary and final statements, which *settlement* data shall include, as applicable, the market fee statements, *reserve* cost recovery *amounts*, final *reserve* prices, *reserve* quantities and *reserve Bilateral Contract Quantities*.

xxx xxx xxx

xxx xxx xxx

Section 5.3 Procedures

5.3.1 Payment by WESM Member

xxx xxx xxx

5.3.2 Payment to the WESM Member

xxx xxx xxx

Section 6.2 Procedures

6.2.1 Default

xxx xxx xxx

e) The WESM Member shall remit the overdue amount to the Market Operator. Such overdue amount shall bear the default interest rate reckoned from the first day such amount is due and payable, up to and including the date on which payment is made, with interest computed based on a 360-day year. The default interest rate is equivalent to the BSP lending rate on date of payment plus 3% will accrue to the remaining unpaid amount until the full payment is received.

f) The amount collected from the defaulting WESM Member, including the default interest, shall be paid by the Market Operator to the WESM Members in accordance with Section 5.3.2 of this Manual.

xxx xxx xxx

Section 7.2 Provisions of Security

xxx xxx xxx

7.2.4 If, under Section 7.2.2 of this Manual, the *Market Operator* has exempted a *WESM Member* from the requirement to provide a security for a period; then the *Market Operator* shall not set a *Trading Limit* for that *WESM Member* for that period during which that exemption applies.

xxx xxx xxx

Section 7.4 Procedures

7.4.1 Initial Assessment of Prudential Requirement

a) xxx xxx xxx

b) The projected *settlement amount* for each *billing period* of a WESM Member shall be calculated using the following formula:

$$PSA = \sum_{i \in I} (PQ_i \times P_i) - \sum_{i \in I} \sum_{c \in C} (PBCQ_{c,i} \times P_{c,i})$$

Where:

PSA	projected *settlement amount* in PhP
PQ_i	either projected *gross energy settlement quantity for energy*, in MWh, or projected *reserve quantity* for *dispatch interval* i
P_i	either projected *final energy dispatch price for energy*, or projected *reserve price* in PhP/MWh, for *dispatch interval* i
$PBCQ_{c,i}$	either projected bilateral contract quantity for energy or projected reserve bilateral contract quantity, in MWh, from counterparty c for *dispatch interval* i
$P_{c,i}$	either projected *final energy dispatch price for energy* or projected *reserve price*, in PhP/MWh, associated with the *bilateral contract* with counterparty c for *dispatch interval* i
I	set of *dispatch intervals* within the *billing period*
C	set of counterparties

c) *The WESM Member* shall submit the following information to the *Market Operator* for each *dispatch interval* in the period defined in Section 7.4.1(a):

(i) Projected *gross energy settlement quantities*; and

(ii) Projected *Bilateral Contract Quantities* from each *Trading Participant* counterparty

The projected *Bilateral Contract Quantity* shall not exceed the projected *gross energy settlement quantity* for each *dispatch interval.*

XXX XXX XXX

l) The *System Operator*'s compliance on *prudential requirement* shall be subject to *ERC* approval.

xxx xxx xxx

Section 12 Appendices

Appendix A Billing and Settlement Timetable

PROCEDURES	TIMETABLE
xxx xxx xxx	xxx xxx xxx
Issuance of Revised Statement	Shall not be more than six (6) months from receipt of the *Market Operator* of written notice of error from the participant or from the discovery of the *Market Operator* of the same.
	Shall not be more than six (6) months from receipt of the *Market Operator* of written notice of error from the participant or from the discovery of the *Market Operator* of the same.
Payment by WESM Members	No later than 3:00 pm on the twenty-fifth day of the calendar month following the *billing period.* If the twenty-fifth day of the calendar month following the billing period falls on a N*on-Working Day*, the payment due date shall be moved to the next immediate *Working Day*.
Payment to WESM Members	On the following *Working Day* after the *Market Operator* is to be paid by WESM Members.
Payment of Adjustments by WESM Members	By no later than the time and date specified by *the Market Operator,* which date shall be not less than ten *business days* and not more than fifteen *business days* after the issue of that revised statement
Payment of Adjustments to WESM Members	On the following *Working Day* on which the *Market Operator* is to be paid by the WESM Members of the adjustments.
Issuance of Default Notice	As soon as practicable
xxx xxx xxx	xxx xxx xxx

Section 5. Amendments to the Market Manual on Dispatch Protocol. The following provisions in the Market Manual on Dispatch Protocol are amended to read as follows:

1.1 Overview of WESM Operations

1.1.1 In the *WESM*, the *Market Operator* provides the *System Operator* with *energy dispatch and reserve schedules* to be implemented by the *System Operator* and the *Trading Participants* for each *dispatch interval* using various inputs such as *load forecasts* and state-estimated data from the *Market Operator*, *reserve* requirements, real-time data and *security constraints* from the *System Operator*, and *demand bids, market offers,* and *self-scheduled nominations* submitted by the *Trading Participants.*

xxx xxx xxx

1.1.6 The scheduling process starts with the *week-ahead projection* (*WAP*) which gives the indicative hourly *dispatch schedules* and spot prices for the next seven (7) days. This projection takes into consideration all available information including nomination of *loading levels*, *projected outputs*, *bids* and *offers* from participants, demand forecasts, *reserve* requirements, *outage* schedules and the current status of the *grid.*

1.1.11 The *System Operator* and the *Trading Participants* implements the RTD schedules for the *dispatch interval.* The *System Operator* issues *re-dispatch instructions* to and ensures compliance by the *Trading Participants* with such instructions and maintains overall *security* of the *power system.*

xxx xxx xxx

3.1.1 The *Market Operator* is responsible for the administration of the *Wholesale Electricity Spot Market* (*WESM)* in accordance with the *WESM Rules.* Among other functions, it is responsible for determining the *dispatch schedule* of all facilities in the *WESM*, which schedule shall be submitted to the *System Operator* and the *Trading Participants.*

xxx xxx xxx

5.2.3 The *System Operator* shall also submit its *over-riding constraint* and *reserve* requirements inputs to the *MDOM* via the Current Operating Plan using the most efficient facility in transferring data to *Market Operator.*

xxx xxx xxx

6.1.6 *Trading Participants* shall also indicate their expected mode of operations (e.g. *Automatic Generation Control*, *Governor Control Mode*) for each *reserve category* when submitting their *reserve offer,* consistent with the requirements of the *Philippine Grid Code.*

6.1.7 *WESM Rules* Clause 3.5.11.2 directs *Generation Companies* that have submitted *self-scheduled nomination* of their *non-scheduled generating units* to revise the same if it reasonably expects that any of its anticipated *loading levels* will differ materially from those previously submitted.

6.1.8 *WESM Rules* Clause 3.5.11.5 requires *Trading Participants* to revise their *bids* or *offers* if they no longer represent a reasonable estimate of either the expected *availability* for the *dispatch interval* of the relevant *generating unit* or *scheduled load* or the *demand bids* or *offers* likely to apply in the *real-time dispatch* optimization for the *dispatch interval*.

6.1.9 Pursuant to *WESM Rules* Clause 3.5.11.6, *Trading Participants* that cancel their *bids* or *offers*, or submit *bids* or *offers* less than the registered capacity or *maximum available capacity* of their *facility* or *generating unit* are required to provide information on the reasons or circumstances of such cancellation or submission.

6.1.10 *Trading Participants* are also required to immediately notify the *System Operator* and the *Market Operator* of any circumstances which threaten a significant probability of material adverse change in the state of their facilities. A non-exhaustive list of events that will be deemed to be or to cause material adverse change is required to be published. In compliance with the foregoing, a non-exhaustive list is provided under Section 6.14 of this *Market Manual* pursuant to *WESM Rules* Clause 3.5.11.8.

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6.9.4 *Trading Participants* shall provide the following information when submitting *reserve offers:*

a. A maximum response level for the relevant *reserve* category (MW);

b. Control mode of operations

c. A maximum proportion of the forecast/*scheduled load*, which may be interrupted;

d. Up to three (3) *reserve offer* blocks (MW/block);

e. A minimum block size of one (1) MW; and

f. Monotonically increasing prices.

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7.8.2 The level of *reserve requirement* shall be based on the provisions of the *Grid Code* and the relevant issuances on *Ancillary Services* from the *DOE* and the *ERC*.

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9.1.1 *WESM Rules* Clause 3.8 sets out the responsibilities of the *Market Operator* in the scheduling of *generation* and *load* in the *WESM*. Among other responsibilities, *WESM Rules* Clause 3.8.1 directs that prior to the commencement of each *dispatch interval,* the *Market Operator* shall use the *Market Dispatch Optimization Model* (MDOM) to determine the target *loading level* in MW for each *non-scheduled generating unit, must dispatch generating unit, priority dispatch generating unit, scheduled generating unit* or each *scheduled load* and for each *facility* for the end of the *dispatch interval* using the latest data from the *System Operator* and the *Trading Participants*.

9.1.2 The *Market Operator* shall submit to the *System Operator* and the *Trading Participants* the *dispatch schedule* containing the *target loading levels* to be achieved at the end of the *dispatch interval.*

9.1.3 The *WESM Rules* defines *loading level* as the instantaneous level of output or consumption in MW of a *generating unit* or *load.* The *target loading level* of a *generator* or *load* is the *loading level* determined as an end-of-period target for that scheduled *generator* or *load*.

9.1.4 The *Market Operator* shall submit to the *System Operator* and the *Trading Participants* the *reserve schedule* containing the *capacity* that can be used by the *System Operator* to maintain the *frequency* of the *grid* within the limits prescribed by the *Grid Code* for the entire *dispatch interval."*

9.1.5 Additionally, the *Market Operator* is required under *WESM Rules* Clause 3.10 to calculate and publish the RTD prices."

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9.3.1 The *Market Operator* shall be responsible for the following:

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c. Preparing and ensuring timely submission to the *System Operator* of the *real-time dispatch schedule,* including the *reserve* schedules and *WMOT,* in preparation for the *dispatch* implementation as set out in the *WESM Rules* and this Dispatch Protocol; and

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9.3.3 *Trading Participants* shall be responsible for:

a. Ensuring submission of *market offers* and *reserve offers* as set out in the *WESM Rules* and in accordance with the *WESM timetable* and the procedures and requirements set forth in this Dispatch Protocol.

b. For *scheduled generating units* and *priority dispatch generating units* who are *dispatched*, generating in accordance with the *dispatch schedule* communicated and within *the Dispatch Conformance Standards* set forth in this *Market Manual.*

c. For *Ancillary Service Providers* who are *scheduled*, ensure *reserve* schedules are available and respond in accordance with the technical requirements expected for each *reserve category* and within the *Reserve Conformance Standards* set forth in this *Market Manual.*

d. Maintaining their respective infrastructure to ensure access to the Market Participant Interface of the *MMS*.

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9.6.1 The *MDOM* simultaneously determines the following:

a. *Target loading levels* in MW for the end of a *dispatch interval*, identified as the RTD schedule;

b. *Reserve* schedules for the entire *dispatch interval*;

c. Associated *energy* prices at all *market trading nodes*; and

d. When applicable, *reserve prices* for all *reserve regions*.

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11.1.7 Dispatch of scheduled *reserves* shall be in accordance with Section 23 of this Manual.

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15.3.1 The *Market Operator* is responsible for monitoring and preparing report on the compliance of each *reserve* provider in the WESM. The compliance monitoring report shall be submitted to the *ECO* based on the provisions of Section 21 of this Manual.

15.3.2 The *Market Operator* is responsible for ensuring that the required *reserve* levels (or reserve requirements) from the *System Operator* are used as inputs in pre-dispatch *market projections* and *real-time dispatch* scheduling processes in the *WESM*. It is also responsible for providing and maintaining the data exchange facility for timely receipt of submissions from the *System Operator*.

15.3.3 *Ancillary Service Providers* are responsible for ensuring that their *reserve schedules* are available to respond to the *frequency control* requirements of the *Grid.*

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15.4.1 Criteria for Determining *Reserve* Requirements. In determining *reserve* requirements for each *reserve* type in accordance with the relevant *DOE* and *ERC* issuances on the procurement of *Ancillary Services,* the *System Operator* shall ensure compliance with the power quality and reliability performance standards set out in those issuances and/or the *Philippine Grid Code*.

15.4.2 The level of *reserve* requirement for *Regulating Reserve* service shall be based on the latest issuances on the procurement of *Ancillary Services* by the *DOE* and the *ERC* and shall be used as reference by the *Market Operator* for the *market projections* and *real-time dispatch schedule*.

15.4.3 For *Contingency Reserve* service and *Dispatchable Reserve*, the *System Operator* shall determine the level of *reserve* requirement in accordance with the latest issuances on the procurement of *Ancillary Services* by the *DOE* and the *ERC.*

15.4.4 The *Market Operator*, in coordination with the *System Operator*, shall formulate and maintain its procedures for determining the MW level of the *reserve* requirements.

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15.6 Deadband Settings

15.6.1 *Reserve facilities* scheduled to provide *Regulating Reserve* shall ensure that their deadband is set within +/- 0.15 Hz.

15.6.2 *Reserve facilities* scheduled to provide *Contingency Reserve* shall ensure that their deadband is set between – 0.15 Hz and - 0.30 Hz.

15.7 Dispatching Ancillary Service Providers through Automatic Generation Control

15.7.1 *Reserve facilities* operating on *Automatic Generation Control* (AGC) shall receive commands from the *System Operator's* Energy Management System (EMS)

15.8 Dispatching Ancillary Service Providers through Governor Control Mode

15.8.1 *Reserve facilities* operating on *Governor Control Mode* (GCM) shall ensure that their deadband setting is configured based on the requirements of Section 15.6 of this Manual to ensure that they respond to requirements of the *Grid* for *frequency control*.

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SECTION 21 MONITORING THE EFFECTIVE PROVISION OF ANCILLARY SERVICES

21.1 Overview

21.1.1 *WESM Rules* Clause 3.3.7.4 states that the *System Operator* shall continuously update the *Reserve Effectiveness Factors* for each *reserve facility category*, and the capacity of reserve for each category according to regions to be scheduled by the *Market Dispatch Optimization Model*, to accurately reflect the *power system*.

21.1.2 The *Reserve Effectiveness Factor* (REF) measures the *reserve facility's* adequacy, accuracy, and timeliness in its actual reserve response with respect to the expected operating parameters set for a specific type of *reserve*.

21.1.3 The technical and operational data to measure the REF shall be acquired from the *System Operator's* SCADA-EMS.

21.2 Responsibilities

21.2.1 The *System Operator* shall continuously monitor the *reserve facility's* REF for each *dispatch interval*.

21.3 Measuring the *Reserve Effectiveness Factor* of *Regulating* Reserves on Automatic Generator Control

21.3.1 The REF for a *Regulating Reserve* facility on Automatic Generator Control (AGC) shall be based on the following criteria:

a. Response Time: At least 75% of the desired generation adjustment is reached at a maximum of 25 seconds; and

b. Regulating Capacity: At least 1% of the scheduled *Regulating Reserve* capacity.

21.3.2 Measuring REF based on Response Time

21.3.2.1 The REF for a *Regulating Reserve* facility on AGC with respect to its response time shall be based on the *reserve facility's* ability to comply with the AGC command sent by the SCADA-EMS within the required time.

21.3.2.2 The following table shows the REFs for each range of time the *Regulating Reserve* facility was able to provide at least 75% of the generation output instructed as AGC command.

Range of Response Time, seconds	REF
0 – 15	1.00
16 – 20	0.95
21 – 25	0.90
26 – 32	0.80
Greater Than 32	0.70
No Response	0.00

21.3.3 REF based on Regulating Capacity

21.3.3.1 The REF for a *Regulating Reserve* facility on AGC with respect to its regulating capacity shall be based on the *reserve facility's* maximum actual generation output and highest generation output instructed as AGC command within a *dispatch interval*. It shall be computed as such:

$$Performance_{REG-AGC,RC,i} = \frac{Maximum\ Actual\ Generation_i}{Highest\ \ Generation\ from\ AGC\ Command_i}$$

Where:

$Performance_{REG-AGC,RC,i}$	refers to the performance of the *Regulating Reserve* facility on AGC with respect to is regulating capacity at *dispatch interval* i
$Maximum\ Actual\ Generation_i$	refers to the maximum actual generation output within *dispatch interval* i
$Highest\ \ Generation\ from\ AGC\ Command_i$	refers to the highest generation output instructed as *AGC* command within a *dispatch interval* i

21.3.3.2 The following table shows the REFs for each performance range calculated in the previous clause:

Performance, %	REF
Greater Than 99%	1.00
95% < Performance ≤ 99%	0.97
90% < Performance ≤ 95%	0.95
85% < Performance ≤ 90%	0.90
80% < Performance ≤ 85%	0.85
75% < Performance ≤ 80%	0.80
0% < Performance ≤ 75%	0.70

0%	0.00

21.3.4 The overall REF for a *Regulating Reserve* facility on AGC shall be computed as such:

$$REF_{REG-AGC,i} = \frac{REF_{REG-AGC,RT,i} + REF_{REG-AGC,RC,i}}{2}$$

Where:

$REF_{REG-AGC,i}$ refers to the REF for *Regulating Reserve* facility on *AGC* at *dispatch interval* i

$REF_{REG-AGC,RT,i}$ refers to the REF for *Regulating Reserve* facility on *AGC* with respect to its response time at *dispatch interval* i

$REF_{REG-AGC,RC,i}$ refers to the REF for *Regulating Reserve* facility on *AGC* with respect to its regulating capacity at *dispatch interval* i

21.4 Measuring the *Reserve Effectiveness Factor* of *Regulating Reserves* on *Governor Control* Mode

21.4.1 The REF for a *Regulating Reserve* facility on *Governor Control Mode* (GCM) shall be based on the following criteria

a. Accuracy: plant's ability to increase or decrease its generation when the *power system frequency* goes beyond the generating unit's *deadband* setting, with respect to its static gain

b. Response Time: plant's ability to increase or decrease its generation within the required response time

21.4.2 Measuring REF based on Accuracy

21.4.2.1 The REF for a *Regulating Reserve* facility on GCM with respect to its accuracy shall be based on its static gain. The static gain shall be computed as such:

$$Static\ Gain_{REG-GCM,i} = \frac{Capacity\ of\ the\ Generating\ Unit_i}{Droop\ Setting\ x\ Nominal\ Frequency}$$

Where:

$Static\ Gain_{REG-GCM,i}$	refers to the static gain of the regulating *reserve facility* on GCM at *dispatch interval* i
$Capacity\ of\ the\ Generating\ Unit_i$	refers to the maximum available capacity of the *reserve facility* at *dispatch interval* i
$Droop\ Setting$	refers to the reference setting to which a *reserve facility's* generation output changes with respect to the change in *frequency*.
$Nominal\ Frequency$	is defined in the *Philippine Grid Code* to be at 60 Hz

21.4.2.2 The performance of a *Regulating Reserve* facility on GCM with respect to its accuracy shall be based on the *reserve* facility's actual MW response and its expected response based on its static gain. It shall be computed as such:

$$Performance_{REG-GCM,ACC} = ABS\left[\frac{Actual\ Response}{Expected\ Response\ based\ on\ Static\ Gain}\right]$$

$$Expected\ Response\ based\ on\ Static\ Gain\ =\ Static\ Gain\ x\ Change\ in\ Frequency$$

21.4.2.3 The following table shows the REFs for each range of the performance calculated for its *reserve* response accuracy:

Performance, x	REF
Within 5%	1.00
5% < x ≤ 15%	0.95
15% < x ≤ 20%	0.90
20% < x ≤ 30%	0.85
x > 30%	0.00

21.4.3 Measuring REF based on Response Time

21.4.3.1 The REF for a *Regulating Reserve* facility on GCM with respect to its response time shall be based on the *reserve* facility's ability to respond within the required time.

21.4.3.2 The following table shows the REFs for each range of time the *Regulating Reserve* facility was able to provide at least 75% of the generation output expected based on static gain, as prescribed in Clause 23.4.2.2 of this *Manual*:

Range of Response Time, seconds	REF
0 – 15	1.00
16 – 20	0.95
21 – 25	0.90
26 – 32	0.80
Greater Than 32	0.70
No Response	0.00

21.4.4 The overall REF for a *Regulating Reserve* facility on GCM shall be computed as:

$$REF_{REG-GCM,i} = \frac{REF_{REG-GCM,ACC,i} + REF_{REG-GCM,RT,i}}{2}$$

Where:

$REF_{REG-GCM,i}$ refers to the REF for *Regulating Reserve* facility on GCM at *dispatch interval* i

$REF_{REG-GCM,ACC,i}$ refers to the REF for *Regulating Reserve* facility on GCM with respect to its accuracy at *dispatch interval* i

$REF_{REG-GCM,RT,i}$ refers to the REF for *Regulating Reserve* facility on GCM with respect to its response time at *dispatch interval* i

21.5 Measuring the REF of Contingency Reserves

21.5.1 The REF for a *Contingency Reserve* facility shall be based on the following criteria

a. Response Time: Maximum of 5 seconds for generators on *Governor Control Mode*
b. Reserve Capacity: At least 1% of the scheduled *Contingency Reserve* capacity

21.5.2 REF based on Reserve Capacity

21.5.2.1 The REF for a *Contingency Reserve facility* with respect to its *reserve* capacity shall be based on the *Contingency Reserve facility's* maximum actual generation output and the expected *reserve* response within a *dispatch interval*. It shall be computed as such:

$$Performance_{CON,RSC,i} = \frac{Maximum\ Actual\ Generation_i}{Expected\ Reserve\ Response_i}$$

Where:

$Performance_{CON,RSC,i}$	refers to the performance of the *Contingency Reserve facility* with respect to is reserve capacity at *dispatch interval* i
$Maximum\ Actual\ Generation_i$	refers to the maximum actual generation output within *dispatch interval* i
$Expected\ Reserve\ Response_i$	refers to the expected response at *dispatch interval* i

21.5.2.2 The following table shows the REFs for each performance range calculated in the previous clause:

Performance, %	REF
Greater Than 99%	1.00
97% < Performance ≤ 99%	0.95
96% < Performance ≤ 97%	0.90
96% < Performance ≤ 95%	0.80
0%	0.00

21.5.3 The overall REF for a *Contingency Reserve facility* shall be computed as such:

$$REF_{CON,i} = REF_{CON,RSC,i}$$

Where:

$REF_{CON,i}$	refers to the REF for *Contingency Reserve facility* at *dispatch interval* i
$REF_{CON,RSC,i}$	refers to the REF for *Contingency Reserve facility* with respect to its reserve capacity at *dispatch interval* i

21.6 Measuring the REF of Dispatchable Reserves

21.6.1 The REF for a *Dispatchable Reserve* facility shall be based on the following criteria:

a. Synchronization Time: Should be synchronized to the *Grid* within 15 minutes from *dispatch instruction*
b. Reserve Capacity: At least 1% of the scheduled *Dispatchable Reserve* capacity

21.6.2 Measuring REF based on Synchronization Time

21.6.2.1 The following table shows the REFs for each range of time the *Dispatchable Reserve facility* was able to synchronize upon issuance of *Dispatch instruction*:

Range of Response Time, x, minutes	REF
$0 < x \leq 15$	1.00
$15 < x \leq 20$	0.90
$20 < x \leq 30$	0.80
$30 < x \leq 45$	0.70
No Response	0.00

21.6.3 REF based on Reserve Capacity

21.6.3.1 The REF for a *Dispatchable Reserve facility* with respect to its *reserve* capacity shall be based on the *Dispatchable Reserve facility's* maximum actual generation output and the expected *reserve* response within a *dispatch interval*. It shall be computed as such:

$$Performance_{DIS,RSC,i} = \frac{Maximum\ Actual\ Generation_i}{Expected\ Reserve\ Response_i}$$

Where:

$Performance_{DIS,RSC,i}$ refers to the performance of the *Dispatchable Reserve facility* with respect to its reserve capacity at *dispatch interval* i

$Maximum\ Actual\ Generation_i$ refers to the maximum actual generation output within *dispatch interval* i

$Expected\ Reserve\ Response_i$ refers to the *dispatch instruction* issued at *dispatch interval* i

21.6.3.2 The following table shows the REFs for each performance range calculated in the previous clause:

Performance, %	REF
Greater Than 99%	1.00
97% < Performance ≤ 99%	0.95
96% < Performance ≤ 97%	0.90
96% < Performance ≤ 95%	0.80
0%	0.00

21.6.4 The overall REF for a *Dispatchable Reserve facility* shall be computed as:

$$REF_{DIS,i} = \frac{REF_{DIS,ST,i} + REF_{DIS,RSC,i}}{2}$$

Where:

$REF_{DIS,i}$ refers to the REF for *Dispatchable Reserve facility* at *dispatch interval* i

$REF_{DIS,ST,i}$ refers to the REF for *Dispatchable Reserve facility* with respect to its synchronization time at *dispatch interval* i

$REF_{DIS,RSC,i}$ refers to the REF for *Dispatchable Reserve facility* with respect to its reserve capacity at *dispatch interval* i

Section 6. Renumbering of Sections 21 and 22 of the Market Manual on Dispatch Protocol. Sections 21 and 22 including the corresponding subsections are renumbered accordingly under Section 22 – Amendment, Publication and Effectivity and Section 23 – Appendix, respectively.

Section 7. Authority to Recover Costs. Pursuant to its mandate under Section 30 of the EPIRA, the Market Operator shall be authorized to recover the costs of implementation of this Department Circular through the collection of market fees, subject to the approval by the ERC.

Section 8. Regulatory Support. Pursuant to its mandate under Section 30 of the EPIRA, the ERC shall review and approve the price determination methodology and the collection of market fees by the Market Operator to defray the cost it may incur in the implementation of this policy.

Section 9. Separability Clause. If for any reason, any section or provision of this Circular is declared unconstitutional or invalid, such parts not affected shall remain valid and subsisting.

Section 10. Repealing Clause. All issuances inconsistent with the provision of this Circular are hereby repealed or amended accordingly.

Section 11. Effectivity. This Circular shall take effect fifteen (15) days following its complete publication in at least two (2) newspapers of general circulation and shall remain in effect until otherwise revoked. Copies thereof shall be filed with the University of the Philippines Law Center – Office of National Administrative Register (UPLC-ONAR).

Issued on NOV 07 2022 2022 at the Energy Center, Rizal Drive, Bonifacio Global City, Taguig City.

RAPHAEL P. M. LOTILLA
Secretary