Notice of Market Rules Modification

Paper No.:	EMC/RCP/148/2025/RC393
Rule Reference:	Chap 3, Sec 3.3.1.5; Chap 6, Sec 10.2.9; App 6I; App 6M
Proposer:	EMC, Market Admin
Date Received by EMC:	9 April 2025
Status:	Approved by EMA
Effective Date:	TBA

This paper proposes Market Rule modifications related to compensation for energy storage systems (ESS).

The proposed modifications allow ESS to claim compensation for periods with market energy price revision, in a way that is consistent with other generation registered facilities (GRFs).

The RCP discussed the proposed modifications at its 148th meeting and the panel **unanimously supported** the proposed modifications.

Date considered by Rules Change Panel:	15 May 2025
Date considered by EMC Board:	28 June 2025
Date considered by Energy Market Authority:	17 July 2025
Proposed rule modification:	See attached paper

Reasons for rejection/referral back to Rules Change Panel (if applicable):

PAPER NO.	:	**EMC/BD/CIR/2025/10**
RCP PAPER NO.	:	**EMC/RCP/148/2025/RC393**
SUBJECT	:	**COMPENSATION FOR ENERGY STORAGE SYSTEMS**
FOR	:	**DECISION**
PREPARED BY	:	**LIM CHERN YUEN** **SENIOR ECONOMIST**
REVIEWED BY	:	**POA TIONG SIAW** **SVP, MARKET ADMINISTRATION**
DATE OF MEETING	:	**15 MAY 2025**

Executive Summary

This paper proposes Market Rule modifications related to compensation for energy storage systems (ESS).

The proposed modifications allow ESS to claim compensation for periods with market energy price revision, in a way that is consistent with other generation registered facilities (GRFs).

EMC recommends that the RCP:

a) support the proposed modifications as set out in Annex 1; and

b) recommend that the EMC Board adopts the proposed modifications as set out in Annex 1.

At the 148th RCP meeting held on 15th May 2025, the RCP unanimously supported EMC's recommendations.

The RCP recommends that the EMC Board:

a) **adopt** the proposed modifications as set out in Annex 1; and

b) **seek the EMA's approval** of proposed modifications as set out in Annex 1.

1. Introduction

This paper proposes Market Rule modifications to allow for energy storage systems (ESS) to claim compensation for periods with market energy price revision, consistent with other generation registered facilities (GRFs).

2. Background

2.1 Price revision in the Singapore Wholesale Electricity Market (SWEM)

In general, the SWEM adopts ex-ante pricing where settlement prices are determined by the market clearing engine (MCE) just prior to the start of each dispatch period[1].

Nevertheless, ex-post price revision is permitted under specified circumstances, as shown in Table 1 below[2]. Under these circumstances, the revised prices are used for settlement.

TABLE 1: Price Revision Types

Price Revision Types	Description
Type 1	The MCE has failed to produce a real-time schedule (RTS) for a dispatch period for any reason other than a real-time market suspension
Type 2	The MCE has used input data that are not what should have been supplied to it, at the time the RTS for a dispatch period was produced
Type 3	The MCE has used reduced load forecasts which account for planned load shedding, as specified by the PSO for a dispatch period
Type 4	The MCE has applied a constraint violation penalty (CVP) for a line constraint for a dispatch period, and the PSO has subsequently confirmed that there was no physical load shed in that period
Type 5	The MCE has produced prices which do not reflect their respective locational system marginal price

Appendix 6M of the Market Rules specifies the criteria and calculation for compensation to GRFs arising from Type 1/2/4/5 price revisions. Section 2.2 below elaborates on this.

Appendix 6I of the Market Rules specifies the criteria and calculation for compensation to GRFs arising from Type 3 price revision. Section 2.3 below elaborates on this.

2.2 Appendix 6M – compensation arising from market energy price (MEP) revision

In the SWEM, GRFs are encouraged to offer at their true marginal costs[3]. Thus, within a price-quantity pair for a GRF offer, the offer price should reflect the minimum price to generate the corresponding offered quantity. If a GRF generates based on an erroneous (ex-ante) high price signal, then gets paid at a revised (ex-post) price that is lower than its offer price (reflecting marginal costs), the GRF may incur losses.

As illustrated in the 4th and 5th columns in Figure 1 below, if there was some quantity of energy that was scheduled and injected based on the original (higher) price but would not have been injected based on the revised (lower) price, the GRF shall be due compensation. That compensation should be based on the difference between the offer and revised prices for the relevant quantities. In Figure 1 below, the amount of compensation due is represented by the red highlighted area, deemed equivalent to the amount of losses incurred by generating at a high

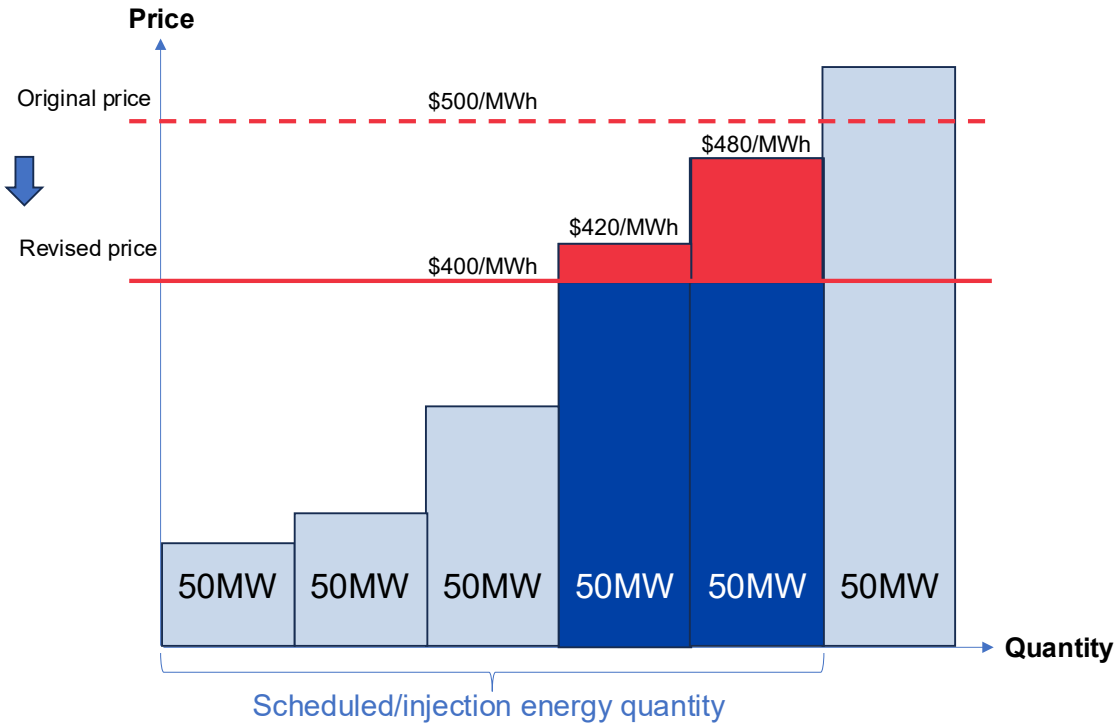
[1] Meanwhile, settlement quantity is determined ex-post (i.e., actual metered quantity rather than scheduled quantity).

[2] Teo, W. G., & Tan, L. C. (2008). *Review of price revision in the NEMS.* Energy Market Company. https://www.home.emcsg.com/publications/-/media/Comms/Thought-Leadership-Articles/Review_of_Price_Revision_in_the_NEMS.pdf

[3] If a GRF offers above its true marginal cost, there is a risk of not being scheduled and losing out on potential profit; if a GRF offers below its true marginal cost, there is a risk of being scheduled and paid at a price below the true marginal cost, resulting in the GRF incurring a loss.

marginal cost (i.e., $420/MWh and $480/MWh) while being paid a low revised price (i.e., $400/MWh).

Figure 1: Compensation for generators arising from MEP revision



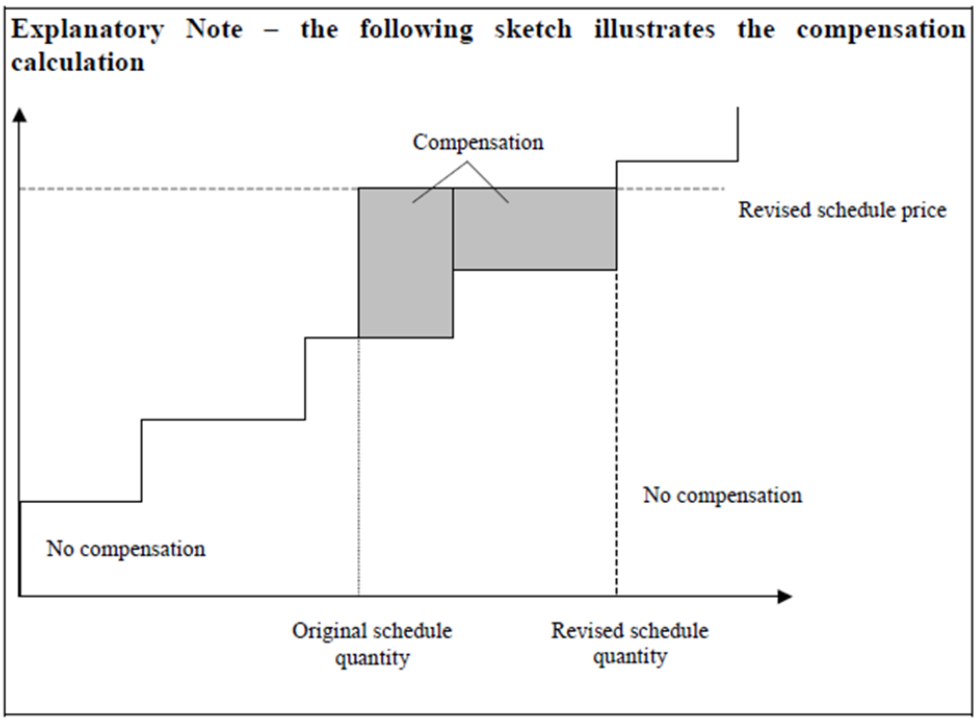
2.3 Appendix 6I – compensation in the event of planned load shedding

When there is planned load shedding as specified by the PSO, nodal load forecasts used in the real-time dispatch schedule are adjusted downwards (to reflect the load shedding), and GRFs are dispatched according to the reduced load. Subsequently, an MCE rerun is conducted as if there was no load shedding, to ensure that prices paid out to generators reflect the energy shortfall in that dispatch period.

Even though prices are (typically) adjusted upwards after the MCE rerun, some quantity of energy may have been scheduled based on the higher forecast load (and earned a profit), but was not scheduled based on the lower forecast load (thus did not earn a profit).

Appendix 6I of the Market Rules currently relates to compensation for this “lost profit” due to reduced scheduled quantities, because of the downward adjustment of nodal load forecasts, as illustrated in Figure 2 below.

Figure 2: Compensation for generators in the event of load shedding[4]



3. Analysis

3.1 Issues identified

3.1.1 ESS are currently unable to claim compensation under Appendix 6M and 6I

Current compensation formulae in Appendix 6M and 6I only refer to GRFs with *energy offers*, which excludes ESS with *energy storage offers*.[5] Thus, under Appendix 6M and 6I, compensation is currently not provided for ESS.

For consistent treatment between ESS (that are GRFs) and other GRFs, if the ESS is discharging, similar compensation formulae should apply to ESS. Conversely, if the ESS is charging, new compensation formulae should apply to ESS.

3.1.2 Current compensation formulae do not account for ESS offer format

Furthermore, current compensation formulae in Appendix 6M and 6I are based on GRF offers containing 10 price-quantity pairs for injection (i.e., positive quantities). These are not appropriate for ESS offers, which contain 5 price-quantity pairs for discharging (i.e., positive quantities) and 5 price-quantity pairs for charging (i.e., negative quantities).

Modifications are therefore required to address the above and ensure that compensation formulae are appropriate for ESS.

[4] Market Rules Appendix 6I Explanatory Note

[5] Within rule change paper EMC/RCP/139/2024/RC383: Modelling of Energy Storage Systems, *energy storage offer* and *energy offer* are defined in Chapter 8 Definitions to be mutually exclusive.

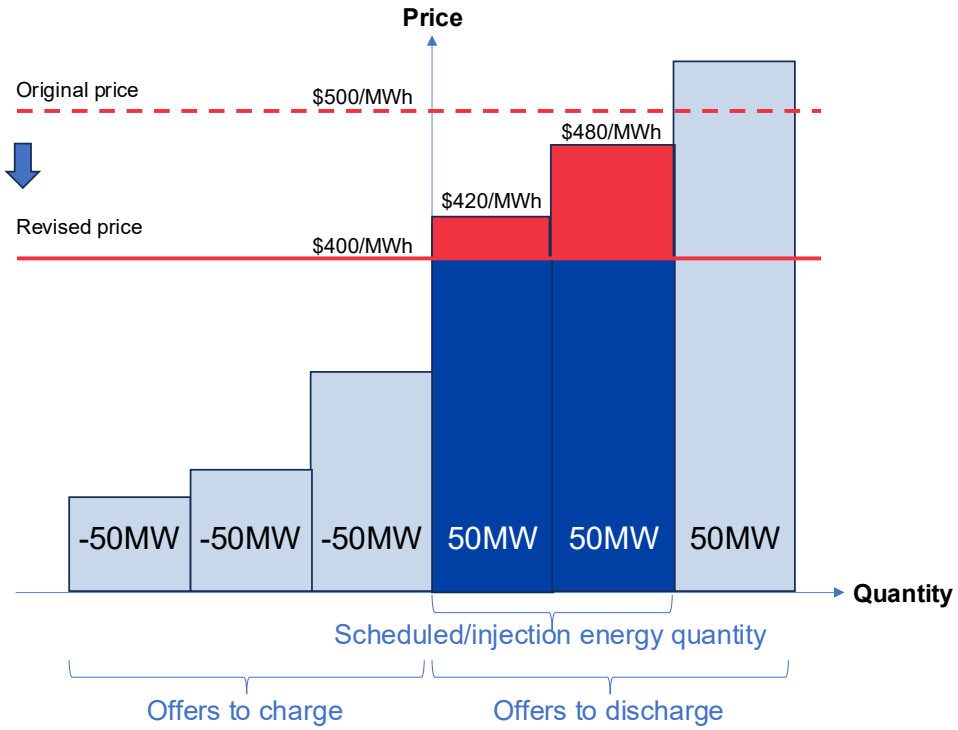
3.2 Proposed conceptual solutions

3.2.1 Appendix 6M – compensation for ESS scheduled to discharge with downward price revision

Consistent with compensation for other GRFs, ESS should be due compensation if it was scheduled to discharge, and there was subsequent downward price revision.

As illustrated in the 4th and 5th columns in Figure 3 below, if there was some quantity of energy that was scheduled and discharged based on the original (higher) price but would not have been discharged based on the revised (lower) price, the ESS should be due compensation. That compensation should be based on the difference between the offer price and revised price for the relevant quantities. In Figure 3 below, the amount of compensation due is represented by the red highlighted area.

Figure 3: Compensation for ESS scheduled to discharge with downward price revision

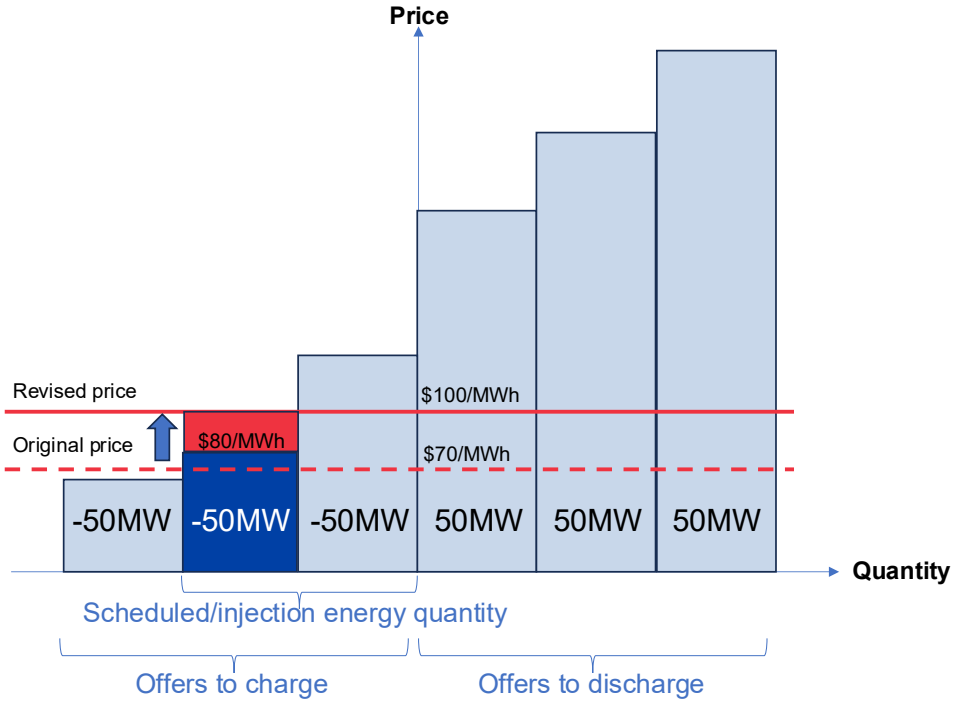


3.2.2 Appendix 6M – compensation for ESS scheduled to charge with upward price revision

With the introduction of ESS charging offers, it is also possible that an ESS was scheduled to charge, and there was subsequent upward price revision.

As illustrated in the 2nd column in Figure 4 below, if there was some quantity of energy that was scheduled and charged based on the original (lower) price but would not have been charged based on the revised (higher) price, the ESS should be due compensation. That compensation should be based on the difference between offer price and revised price for the relevant quantities. In Figure 4 below, the amount of compensation due is represented by the red highlighted area.

Figure 4: Compensation for ESS scheduled to charge with upward price revision

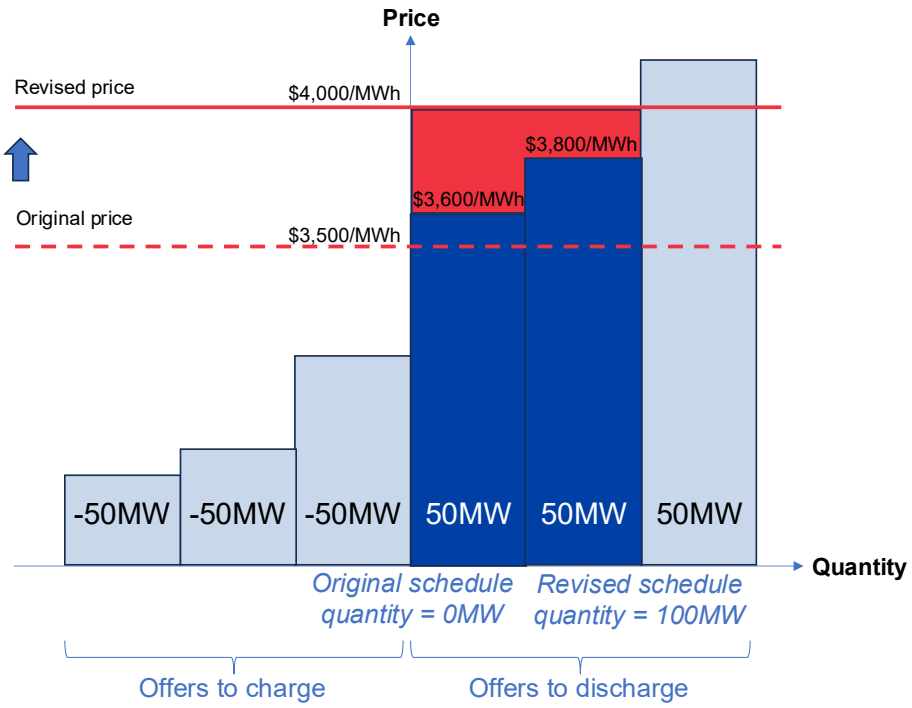


3.2.3 Appendix 6I – compensation for ESS scheduled to discharge with upward price revision

Consistent with compensation for other GRFs, ESS should be due compensation if it was scheduled to discharge, and there was subsequent upward price revision due to planned load shedding.

As illustrated in the 4th and 5th columns within Figure 5 below, if there was some quantity of energy that would have been scheduled and discharged based on the revised (higher) price but was not discharged based on the original (lower) price, the ESS should be due compensation. That compensation should be based on the difference between offer price and revised price for the relevant quantities. In Figure 5 below, the amount of compensation due is represented by the red highlighted area.

Figure 5: Compensation for ESS scheduled to discharge with upward price revision

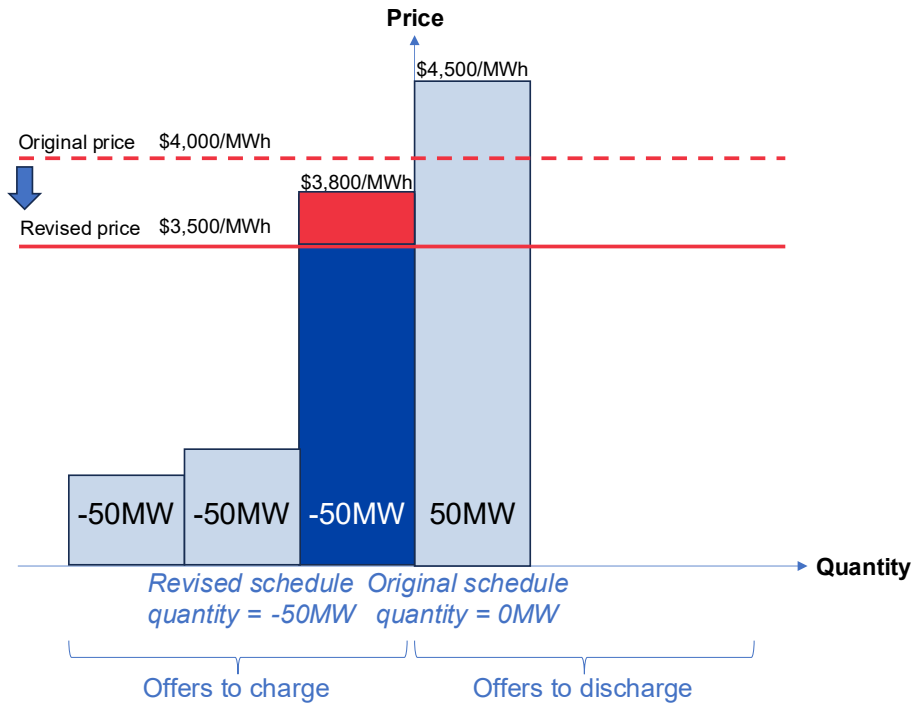


3.2.4 Appendix 6I – compensation for ESS scheduled to charge with downward price revision

While unlikely, it is also possible that following planned load shedding, a higher load forecast during the MCE rerun results in downward price revision. Under such a scenario, ESS should be due compensation if it was scheduled to charge, and there was subsequent downward price revision due to planned load shedding.

As illustrated in the 3rd column in Figure 6 below, if there was some quantity of energy that would have been scheduled and charged based on the revised (lower) price but was not charged based on the original (higher) price, the ESS should be due compensation. That compensation should be based on the difference between offer price and revised price for the relevant quantities. Within Figure 6 below, the amount of compensation due is represented by the red highlighted area.

Figure 6: Compensation for ESS scheduled to charge with downward price revision



4. Proposed Market Rule Modifications

Table 1 below provides a summary of the proposed rule modifications. Detailed modifications are set out in Annex 1.

TABLE 1: Summary of Proposed Market Rule Modifications

S/N	Chapter / Section	Proposed Modifications	Reasons for Modifications
1	Chapter 3, Section 3.3.1.5	Include reference to section 10.2.9 of Chapter 6	To include requests for compensation in the event of planned load shedding (as described in Chapter 6, Section 10.2.9, in turn referring to Appendix 6I) within the scope of disputes that shall be resolved by the dispute resolution process, and to subject such compensation claims to the same procedure as described in Chapter 3, Section 3.11.
2	Chapter 6, Section 10.2.9	Simplify and combine with existing Appendix 6I, Section I.2	Align with Chapter 6, Section 10.2.10
3	Appendix 6I	Introduce criteria and calculation for compensation to ESS in the event of planned load shedding	Allow ESS to claim compensation when it is discharging and the energy price was revised upward, as well as when it is charging and the energy price was revised downward.
4	Appendix 6M	Introduce criteria and calculations for compensation to ESS arising from market energy price revision	Allow ESS to claim compensation when it is discharging and the energy price was revised downward, as well as when it is charging and the energy price was revised upward.

5. Consultation

The proposed modifications were published for consultation on 10 April 2025. No comments were received.

6. Legal Review

The text of the proposed modifications has been vetted by EMC's internal legal counsel, whose opinion is that the proposed modifications to the Market Rules by way of the amendments in Annex 1:

1) reflect the intent of the proposals, as described in the analysis section of the paper; and
2) (subject to the amendments being adopted by the EMC Board and approved by the EMA) are effective upon them coming into force in accordance with the Market Rules.

This endorsement does not relate to whether the modifications to the Market Rules are effective from any operational, financial, tax or commercial perspective.

7. Conclusion

The proposed modifications allow ESS to claim compensation for periods with market energy price revision, in a way that is consistent with other generation registered facilities (GRFs).

8. RCP's Decision at the 148th RCP Meeting

At the 148th meeting, the RCP **unanimously supported** the proposed modifications as set out in Annex 1.

9. Recommendation

The RCP recommends that the EMC Board:

a. **adopt** the proposed modifications as set out in Annex 1; and

b. **seek the EMA's approval** of the proposed modifications as set out in Annex 1.

ANNEX 1: Proposed Market Rule Modifications

<table>
<tr><th>Proposed Market Rule Modifications
(deletions represented by strikethrough text and additions represented by double underlined text)</th><th>Reasons for Modification</th></tr>
<tr><td colspan="2">CHAPTER 3 – ADMINISTRATION, SUPERVISION & ENFORCEMENT</td></tr>
<tr><td>
3.3 <u>SCOPE</u>

3.3.1 Disputes that shall be resolved by the dispute resolution process in section 3 are shown in the table below:
<table>
<tr><td>3.3.1.5</td><td>- EMC and a market participant
- EMC and a market support services licensee
- PSO and a market participant
- PSO and a market support services licensee</td><td>- request for compensation made under any of the following:
- section 4.7.3 of Chapter 5
- section 5.4.3 of Chapter 5
- section 5.6.2 of Chapter 5
- section 7.7.3 of Chapter 5
- section 8.4.3 of Chapter 5
- section 8.6.2 of Chapter 5
- section 9.1.7 of Chapter 5
- section 9.3.7 of Chapter 5
- section 9.7.3 of Chapter 5
- section 10.4.1 of Chapter 5
- <u>section 10.2.9 of Chapter 6</u>
- section 10.2.10 of Chapter 6</td></tr>
</table>
</td><td>To include requests for compensation in the event of anticipated load shedding (as described in Chapter 6, Section 10.2.9, in turn referring to Appendix 6I) within the scope of disputes that shall be resolved by the dispute resolution process, and to subject such compensation claims to the same procedure as described in Chapter 3, Section 3.11.</td></tr>
<tr><td colspan="2">CHAPTER 6 – MARKET OPERATION</td></tr>
<tr><td>10.2.9 ~~Where the EMC determines revised values pursuant to section 10.2.8, the EMC shall also calculate, in accordance with Appendix 6I, compensation payments for market participants with generation registered facilities that were scheduled to produce less energy in the real-time dispatch schedule described in section 9.2.1 than in the revised~~</td><td>Align with Chapter 6, Section 10.2.10</td></tr>
</table>

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
~~*real-time dispatch schedule* produced by re-running the *market clearing engine* pursuant to section 10.2.8. Such compensation shall be paid to applicable *market participants* by means of a credit on the next applicable *preliminary settlement statement* and shall be recovered by the *EMC* pursuant to section I.2 of Appendix 6I.~~ Where the *EMC* has determined revised values for the *settlement* data pursuant to the provisions under sections 10.2.7 and 10.2.8, a *market participant* with one or more *generation registered facilities* may make a request to the *EMC* for compensation in accordance with section 3.11 of Chapter 3. Such request shall be submitted in such form as may be prescribed by the *EMC* and the compensation amount shall be calculated in accordance with Appendix 6I. For the purposes of section 3.11.2 of Chapter 3, the timeline within which a request under this section must be submitted shall commence from the date that the *final settlement statement* for the *trading day* which the compensation request relates is issued.	
APPENDIX 6I – COMPENSATION IN THE EVENT OF LOAD SHEDDING	
I.1 COMPENSATION AMOUNTS I.1.1 For this section I.1 the following definitions apply: … spq = index of a specific *price-quantity pair* in an *energy offer* or *energy storage offer* pq = index of the *price-quantity pairs* in an *energy offer* or *energy storage offer*, which are ordered by increasing price $Q^{m,pq}$ = quantity of the *price-quantity pair* pq for the *energy offer* or *energy storage offer* from the *GRF* m for the relevant *dispatch period*	To augment definitions, facilitating subsequent changes in Appendix 6I

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification

$P^{m,pq}$	=	price of the *price-quantity pair* pq for the *energy offer* <u>or *energy storage offer*</u> from the *GRF* m for the relevant *dispatch period*
$\sum_{pq=x}^{y} Q^{m,pq}$	=	<u>0, for x>y</u>
$COMP^{m,pq}$	=	compensation payable in relation to the *price-quantity pair* pq of the *energy offer* <u>or *energy storage offer*</u> from the *GRF* m for the relevant *dispatch period*
$COMP^{m}$	=	~~compensation paid in relation to energy offer from the *GRF* m for the relevant *dispatch period*.~~ <u>compensation payable to *GRF* m for the relevant *dispatch period*.</u>

I.1.3 Subject to I.1.4, the compensation due under each *price-quantity pair* spq of the *energy offer* shall be calculated as:

I.1.3.1 If $\sum_{pq=1}^{spq} Q^{m,pq} \leq OS^{m}$, then:

$$COMP^{m,spq} = 0$$

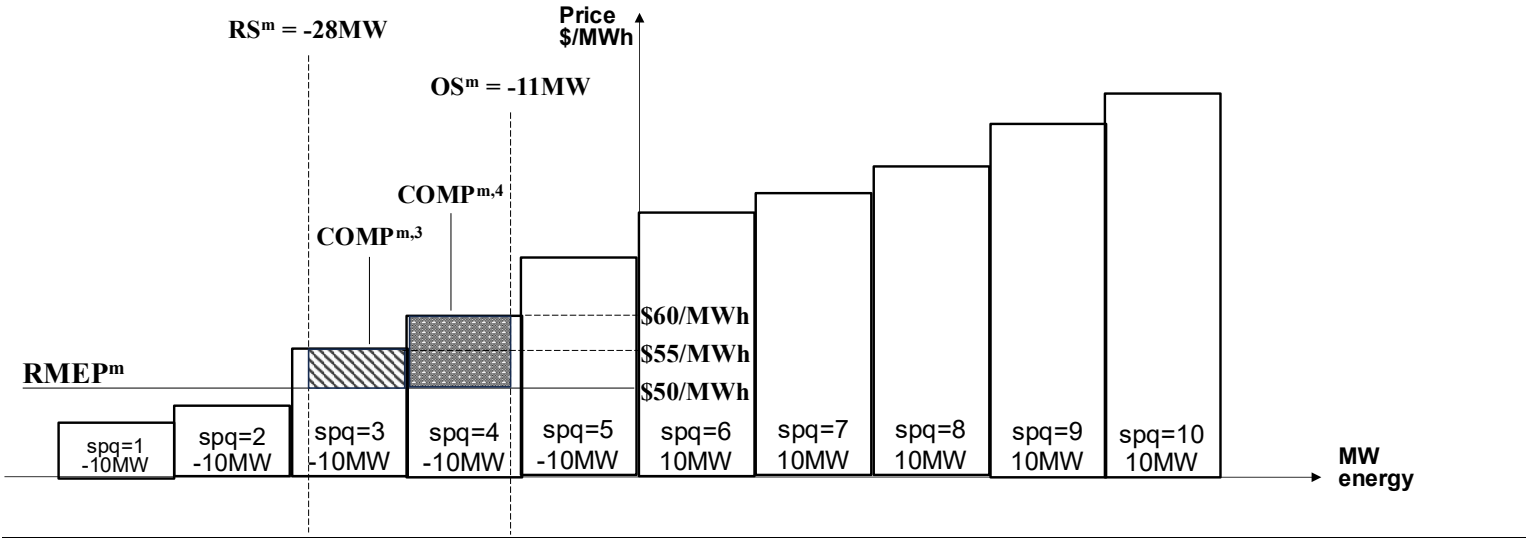
Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
I.1.3.2 If $\sum_{pq=1}^{spq-1} Q^{m,pq} \geq RS^{m}$, then: $COMP^{m,spq} = 0$ I.1.3.3 Otherwise, compensation paid for *price-quantity pair* spq is: $COMP^{m,spq} = \underline{\max[(RMEP^{m} - P^{m,spq}), 0] \times [\min(\sum_{pq=1}^{spq} Q^{m,pq}, RS^{m}) - \max(\sum_{pq=1}^{spq-1} Q^{m,pq}, OS^{m})] \times 0.5}$ ~~$(RMEP^{m} - P^{m,pq}) \times \left(\min\left(\sum_{pq=1}^{spq} Q^{m,pq}, RS^{m}\right) - \max\left(\sum_{pq=1}^{spq-1} Q^{m,pq}, OS^{m}\right)\right)$~~	Correction of compensation formula
<u>I.1.3A Subject to I.1.4, the compensation due under the 1st to 5th *price-quantity pair* spq of the *energy* storage *offer* shall be calculated as:</u> <u>I.1.3A.1 If $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq} Q^{m,pq} < RS^{m}$, then:</u> <u>$COMP^{m,spq} = 0$</u> <u>I.1.3A.2 If $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq-1} Q^{m,pq} \geq OS^{m}$, then</u> <u>$COMP^{m,spq} = 0$</u>	Specify calculation of compensation amount to ESS when it is charging

I.1.3A.3 Otherwise, compensation paid for *price-quantity pair* spq is:

$$COMP^{m,spq} = \max[(P^{m,spq} - RMEP^{m}), 0] \times [\min(\sum_{spq+1}^{5} Q^{m,pq}, OS^{m}) - \max(\sum_{spq}^{5} Q^{m,pq}, RS^{m})] \times 0.5$$

Explanatory Note:

The following example illustrates the compensation calculation for the 1st to 5th price-quantity pairs of an energy storage offer



$COMP^{m,1} = 0$ (Based on section I.1.3A.1, since $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{1} Q^{m,pq} = -50 - (-10) = -40$, which is less than or equal to RS^{m})

$COMP^{m,2} = 0$ (Based on section I.1.3A.1, since $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{2} Q^{m,pq} = -50 - (-20) = -30$, which is less than or equal to RS^{m})

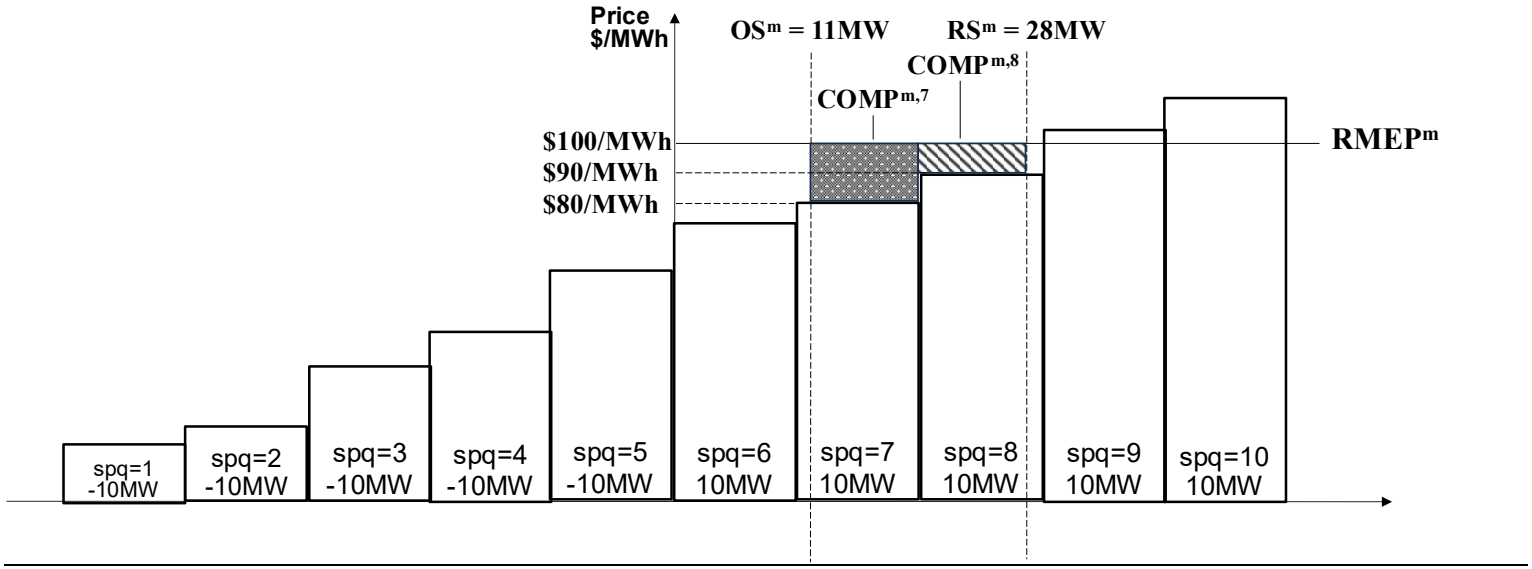
Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
$\underline{COMP^{m,3} = max[(55 – 50), 0] \times [min(-20, -11) – max(-30,-28)] \times 0.5}$ **$\underline{= 5 \times 8 \times 0.5 = \$20}$ (Based on section I.1.3A.3)** **$\underline{COMP^{m,4} = max[(60 – 50), 0] \times [min(-10, -11) – max(-20,-28)] \times 0.5}$** **$\underline{= 10 \times 9 \times 0.5 = \$45}$ (Based on section I.1.3A.3)** **$\underline{COMP^{m,5} = 0}$ (Based on section I.1.3A.2, since $\underline{\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq-1} Q^{m,pq} = -50 - (-40) = -10}$, which is larger than or equal to $\underline{OS^m}$** **Hence, total compensation payable to GRF m is:** **$\underline{COMP^m = COMP^{m,1} + COMP^{m,2} + COMP^{m,3} + COMP^{m,4} + COMP^{m,5}}$** **$\underline{= \$0 + \$0 + \$20 + \$45 + \$0}$** **$\underline{= \$65}$**	
I.1.3B Subject to I.1.4, the compensation due under the 6th to 10th *price-quantity pair* spq of the *energy* storage *offer* shall be calculated as: I.1.3B.1 If $\sum_{pq=6}^{spq} Q^{m,pq} \leq OS^m$, then: $COMP^{m,spq} = 0$ I.1.3B.2 If $\sum_{pq=6}^{spq-1} Q^{m,pq} \geq RS^m$, then $COMP^{m,spq} = 0$	Specify calculation of compensation amount to ESS when it is discharging

I.1.3B.3 Otherwise, compensation paid for *price-quantity pair* spq is:

$$COMP^{m,spq} = \max[(RMEP^{m} - P^{m,spq}), 0] \times [\min(\sum_{pq=6}^{spq} Q^{m,pq}, RS^{m}) - \max(\sum_{pq=6}^{spq-1} Q^{m,pq}, OS^{m}] \times 0.5$$

Explanatory Note:

The following example illustrates the compensation calculation for the 6th to 10th price-quantity pairs of an energy storage offer



$COMP^{m,6} = 0$ (Based on section I.1.3B.1, since $\sum_{pq=6}^{spq} Q^{m,pq} = 10$, which is less than or equal to OS^{m})

$COMP^{m,7} = \max[(100 - 80), 0] \times [\min(20,28) - \max(10,11)] \times 0.5$

$= 20 \times 9 \times 0.5 = \$90$ (Based on section I.1.3B.3)

$COMP^{m,8} = \max[(100 - 90), 0] \times [\min(30,28) - \max(20,11)] \times 0.5$

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
= 10 × 8 × 0.5 = $40 (Based on section I.1.3B.3) **$COMP^{m,9}$ = 0 (Based on section I.1.3B.2, since $\sum_{pq=6}^{spq-1} Q^{m,pq} = 30$, which is larger than or equal to RS^m** **$COMP^{m,10}$ = 0 (Based on section I.1.3B.2, since $\sum_{pq=6}^{spq-1} Q^{m,pq} = 40$, which is larger than or equal to RS^m** **Hence, total compensation payable to GRF m is:** **$COMP^m = COMP^{m,6} + COMP^{m,7} + COMP^{m,8} + COMP^{m,9} + COMP^{m,10}$** **= $0 + $90 + $40 + $0 + $0** **= $130**	
~~**I.2 COMPENSATION PAYMENT AND COST RECOVERY**~~ ~~I.2.1 The compensation payments referred to in section 10.2.9 of this Chapter and calculated in accordance with section I.1, shall appear as an additional item on the *settlements statements* of the *relevant market participants* for the relevant *dispatch day*, and shall be paid by the *EMC* in accordance with the settlement timetable set out in section 5.2 of Chapter 7.~~ ~~I.2.2 The total cost of the compensation payments in each relevant *dispatch period*, referred to in section 10.2.9 of this Chapter and calculated in accordance with section I.1, shall be recovered by the *EMC* from *market participants* by allocating the total cost across *market participants* in proportion to the sum of the *WEQ*s associated with the *settlement accounts* of that *market participant* in the relevant *dispatch period*, and shall appear as an additional item on the *settlements statements* of *market participants* for the relevant *dispatch day*, and shall accordingly be paid by *market participants* in accordance with the settlement timetable set out in section 5.2 of Chapter 7.~~	In tandem with the rule change in Chapter 3, Section 3.3.1.5, the compensation procedure for this Appendix 6I shall be as described in Chapter 3, Section 3.11 instead.

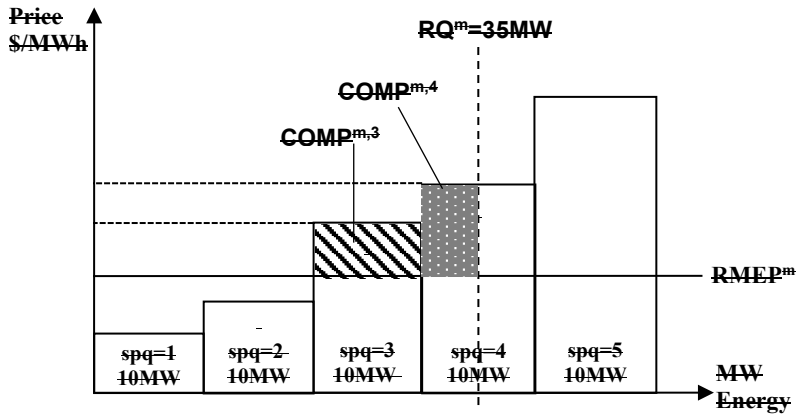
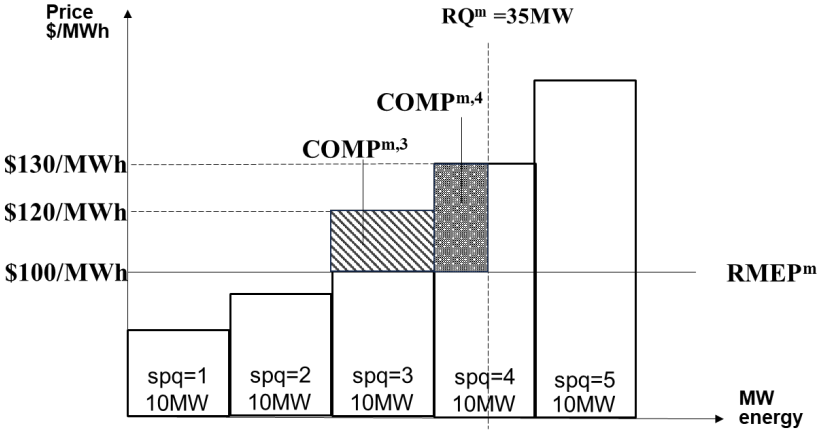
Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
APPENDIX 6M – COMPENSATION ARISING FROM MARKET ENERGY PRICE REVISION	
M.1 PURPOSE AND DEFINITIONS M.1.2 In this Appendix, the following definitions apply:	To augment definitions, facilitating subsequent changes in Appendix 6M

OQ^m	=	*GRF* m's scheduled *energy* output (in MW) for the relevant *dispatch period*, being: its scheduled *energy* output in the *real-time dispatch schedule* that is deemed to be *dispatch instructions* issued by the *PSO* for the relevant *dispatch period*, or if the *PSO* did not use the *real-time dispatch schedule* as the *dispatch instructions* or if the *real-time dispatch schedule* was not available, the ~~highest~~ *energy* output level that *GRF* m was instructed for the relevant *dispatch period*
spq	=	index of a specific *price-quantity pair* in an *energy offer* or *energy storage offer*
pq	=	index of a *price-* or *quantity pair* in an *energy offer* or *energy storage offer*, ordered in ascending order of price
$Q^{m,pq}$	=	quantity of a *price-quantity pair* pq of the *energy offer* or *energy storage offer* of *GRF* m for the relevant *dispatch period*

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
$P^{m,pq}$ = price of a *price-quantity pair* pq for the *energy offer* <u>or *energy storage offer*</u> of *GRF* m for the relevant *dispatch period* $\sum_{pq=1}^{spq-1} Q^{m,pq}$ = ~~0, for spq = 1~~ $\sum_{pq=x}^{y} Q^{m,pq}$ = <u>0, for x>y</u> $COMP^{m,pq}$ = compensation payable in relation to a *price-quantity pair* pq of the *energy offer* <u>or *energy storage offer*</u> of *GRF* m for the relevant *dispatch period*	
M.2 <u>CRITERIA FOR COMPENSATION</u> M.2.1 A *generation registered facility*<u>, that is not an *energy storage facility*</u>, is eligible for compensation referred to in section 10.2.10 of Chapter 6 for a given *dispatch period* if the revised *market energy price* at the *market network node* associated with the *generation registered facility*: M.2.1.1 is lower than that in the *real-time price schedule*; or M.2.1.2 in the event that no *real-time price schedule* was produced, is lower than the price in the *price-quantity pair* spq of its *energy offer* that satisfies the following conditions: a. $\sum_{pq=1}^{spq-1} Q^{m,pq} < OQ^{m}$; and b. $\sum_{pq=1}^{spq} Q^{m,pq} \geq OQ^{m}$.	Specify criteria for compensation to ESS arising from market energy price (downward and upward) revision

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
M.2.2 A *generation registered facility*, that is an *energy storage facility*, is eligible for compensation referred to in section 10.2.10 of Chapter 6 for a given *dispatch period* if the *generation registered facility* is instructed to discharge, and if the revised *market energy price* at the *market network node* associated with the *generation registered facility*: M.2.2.1 is lower than that in the *real-time price schedule*; or M.2.2.2 in the event that no *real-time price schedule* was produced, is lower than the price in the *price-quantity pair* spq of its *energy storage offer* that satisfies the following conditions: a. $\sum_{pq=6}^{spq-1} Q^{m,pq} < OQ^{m}$; and b. $\sum_{pq=6}^{spq} Q^{m,pq} \geq OQ^{m}$. M.2.3 A *generation registered facility*, that is an *energy storage facility*, is eligible for compensation referred to in section 10.2.10 of Chapter 6 for a given *dispatch period* if the *generation registered facility* is instructed to charge, and if the revised *market energy price* at the *market network node* associated with the *generation registered facility*: M.2.3.1 is higher than that in the *real-time price schedule*; or M.2.3.2 in the event that no *real-time price schedule* was produced, is higher than the price in the *price-quantity pair* spq of its *energy storage offer* that satisfies the following conditions: a. $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq} Q^{m,pq} > OQ^{m}$; and b. $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq-1} Q^{m,pq} \leq OQ^{m}$	

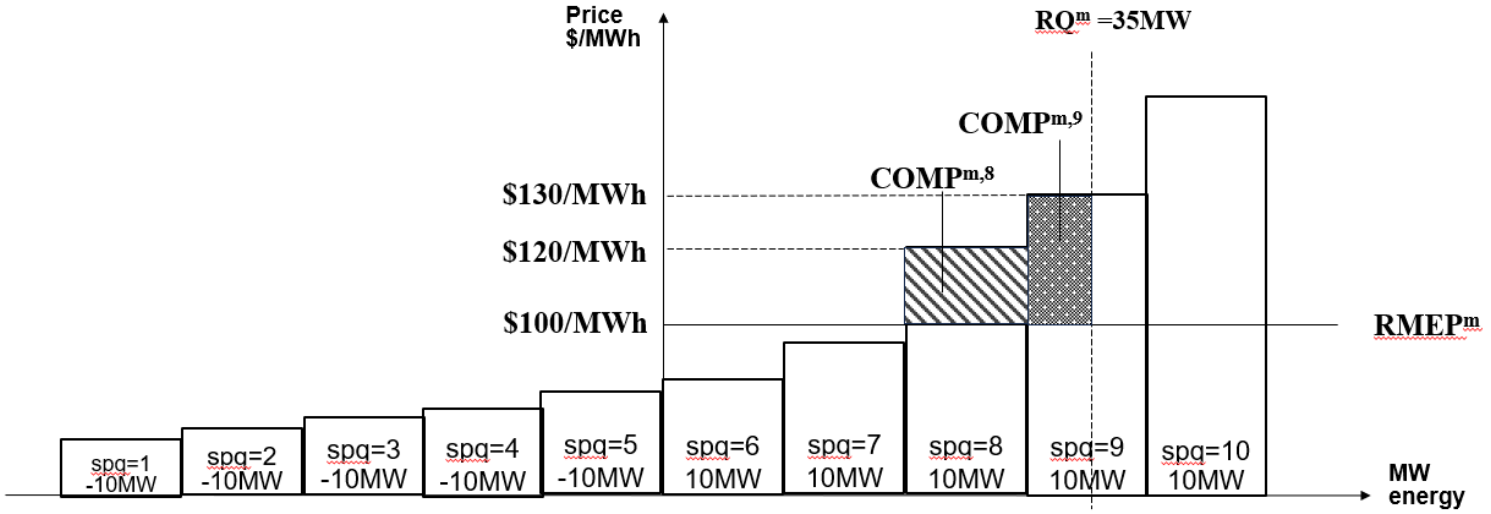
Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
M.3 CALCULATION OF COMPENSATION AMOUNT M.3.1 The reference quantity, RQ^m, for a given *dispatch period* in respect of a *generation registered facility* which meets the criteria in section M.2.1 or M.2.2: M.3.1.1 which was at all relevant times operating under *AGC*, would be ($IEQ^m \times 2$); and M.3.1.2 in all other cases, would be minimum of ($IEQ^m \times 2$) and OQ^m. M.3.1A The reference quantity, RQ^m, for a given *dispatch period* in respect of a *generation registered facility* which meets the criteria in section M.2.3: M.3.1A.1 which was at all relevant times operating under *AGC*, would be ($IEQ^m \times 2$); and M.3.1A.2 in all other cases, would be maximum of ($IEQ^m \times 2$) and OQ^m.	Distinguish calculation of reference quantity between generation facilities that are not energy storage facilities, energy storage facilities scheduled to discharge, and energy storage facilities scheduled to charge.

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
Explanatory Note: **The following example illustrates the compensation calculation, assuming GRF m meets the criteria under section M.2.1.**   	Add y-axis values to diagram

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
M.3.4 For each *generation registered facility* which meets the criteria in section M.2.2, the compensation amount as described in section 10.2.10 of Chapter 6 for that *dispatch period* shall be calculated as follows: $COMP^{m} = \sum_{pq=6}^{10} COMP^{m,pq}$ M.3.5 For the purposes of section M.3.4, the compensation amount for each *price-quantity pair* spq of the *energy storage offer* of a *generation registered facility* shall be calculated as follows: M.3.5.1 If $\sum_{pq=6}^{spq-1} Q^{m,pq} \geq RQ^{m}$ then $COMP^{m,spq} = 0$ M.3.5.2 Otherwise, $COMP^{m,spq} = \max[(P^{m,spq} - RMEP^{m}), 0] \times [\min(\sum_{6}^{spq} Q^{m,pq}, RQ^{m}) - \sum_{6}^{spq-1} Q^{m,pq}] \times 0.5$	Specify calculation of compensation amount to ESS arising from market energy price (downward and upward) revision

Explanatory Note:

The following example illustrates the compensation calculation, assuming GRF m meets the criteria under section M.2.2.



Compensation is not applicable to price-quantity pair spq 1 to spq 5 based on section M.3.4.

$COMP^{m,6} = 0$ (Based on section M.3.5.2, since $P^{m,6} < RMEP^m$)

$COMP^{m,7} = 0$ (Based on section M.3.5.2, since $P^{m,7} < RMEP^m$)

$COMP^{m,8} = \max[(120 - 100), 0] \times [\min(30, 35) - 20] \times 0.5$

$= 20 \times 10 \times 0.5 = \$100$ (Based on section M.3.5.2)

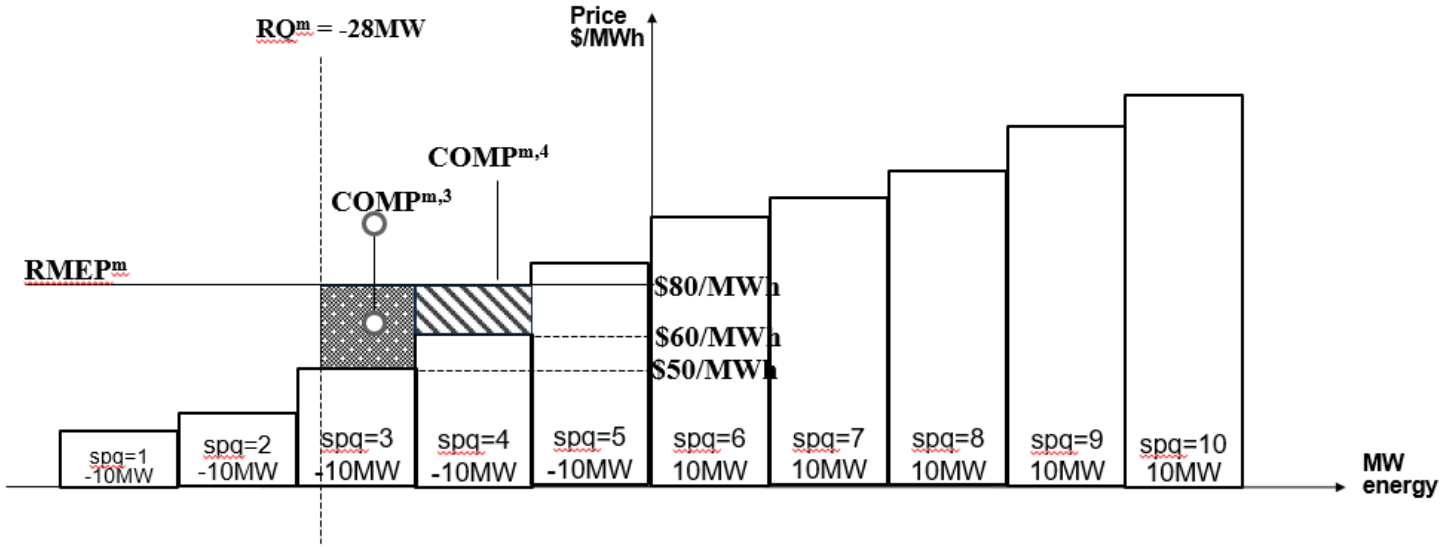
$COMP^{m,9} = \max[(130 - 100), 0] \times [\min(40, 35) - 30] \times 0.5$

$= 30 \times 5 \times 0.5 = \$75$ (Based on section M.3.5.2)

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
$\underline{COMP^{m,10} = 0 \text{ (Based on section M.3.5.1, since } \sum_{pq=6}^{10-1} Q^{m,pq} = 40 \text{, which is more than or equal to } RQ^{m})}$ **Hence, total compensation payable to GRF m is:** **$\underline{COMP^{m} = COMP^{m,6} + COMP^{m,7} + COMP^{m,8} + COMP^{m,9} + COMP^{m,10}}$** **$\underline{= \$0 + \$0 + \$100 + \$75 + \$0}$** **$\underline{= \$175}$** M.3.6 For each *generation registered facility* which meets the criteria in section M.2.3, the compensation amount as described in section 10.2.10 of Chapter 6 for that *dispatch period* shall be calculated as follows: $COMP^{m} = \sum_{pq=1}^{5} COMP^{m,pq}$ M.3.7 For the purposes of section M.3.6, the compensation amount for each *price-quantity pair* spq of the *energy storage offer* of a *generation registered facility* shall be calculated as follows: M.3.7.1 If $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{spq} Q^{m,pq} \leq RQ^{m}$ then $COMP^{m,spq} = 0$ M.3.7.2 Otherwise, $COMP^{m,spq} = \max[(RMEP^{m} - P^{m,spq}, 0] \times [\sum_{spq+1}^{5} Q^{m,pq} - \max(\sum_{spq}^{5} Q^{m,pq}, RQ^{m})] \times 0.5$	

Explanatory Note:

The following example illustrates the compensation calculation, assuming GRF m meets the criteria under section M.2.3.



Compensation is not applicable to price-quantity pair spq 6 to spq 10 based on section M.3.6.

$COMP^{m,1}$ = 0 (Based on section M.3.7.1, since $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{1} Q^{m,pq} = -50 - (-10) = -40$, which is less than or equal to RQ)

$COMP^{m,2}$ = 0 (Based on section M.3.7.1, since $\sum_{pq=1}^{5} Q^{m,pq} - \sum_{pq=1}^{2} Q^{m,pq} = -50 - (-20) = -30$, which is less than or equal to RQ)

$COMP^{m,3}$ = max[(80 – 50), 0] × [-20 – max(-30, -28)] × 0.5

= 30 × 8 × 0.5 = $120 (Based on section M.3.7.2)

$COMP^{m,4}$ = max[(80 – 60), 0] × [-10 −max(-20,-28)] × 0.5

Proposed Market Rule Modifications (deletions represented by strikethrough text and additions represented by double underlined text)	Reasons for Modification
= 20 × 10 × 0.5 = $100 (Based on section M.3.7.2) **$COMP^{m,5}$ = 0 (Based on section M.3.7.2, since $P^{m,5} > RMEP^{m}$)** **Hence, total compensation payable to GRF m is:** **$COMP^{m}$ = $COMP^{m,1} + COMP^{m,2} + COMP^{m,3} + COMP^{m,4} + COMP^{m,5}$** **= $0 + $0 + $120 + $100 + $0** **= $220** M.~~3.4~~3.8 For each request for compensation under section 10.2.10 of Chapter 6 that is received by the *EMC*, the *EMC* may request that the *PSO* provide the following data to the *EMC* in respect of the *generation registered facility* for the *dispatch period* that the compensation request relates: M.3.~~4.1~~8.1 whether the *generation registered facility* was at all relevant times operating under *AGC*; and M.3.~~4.2~~8.2 if the *generation registered facility* was not at all relevant times operating under *AGC*, provide the *dispatch instruction* relating to the highest *energy* output level (in MW) that is issued by the PSO to the *generation registered facility*. The *PSO* shall provide the aforementioned data within 3 *business days* of the *EMC's* request.	